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Vol. GC-09

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VOL. GC-09

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Name	Initials	Position	
Paul Bertetti	PB	Student	
MIKE ALMENDAREZ	MA	Student	

2/2/93 0900 MJP

Results of ICP analysis of zeolite and clay samples sent to Texas Tech on Nov. 17, 1992. See SC-04-252.

12/31/92 11:05 GEOSCIENCES → 5125225184 NO.143 P01

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TELEFAX

DATE: 12/31/92

TO: Bobby Pabalon
SRI
6220 Culebra Road
San Antonio, Texas, 78238-5166

FAX NUMBER: 210-522-5184

FROM: Melanie Barnes

Number of pages, including cover: 7

Bobby: Finally, your data has arrived. The three runs showed excellent correlation within and between runs. The only element which was somewhat questionable was Ba. Our internal standards were fine, but your standards, although quite reproducible, do not agree with the Geostandards Newsletter values. If you would like me to rerun the samples for Ba and bracket your samples more closely with our standards just let me know. A copy of the data, the invoice, and the samples will follow in the mail next week. HAPPY NEW YEAR!!!! - Melanie

SRI STANDARDS AND SAMPLES

Sample	#	SiO2	TiO2	Al2O3	Fe2O	Mn	MgO	CaO	Na2O	K2O	P2O	Total	Sr	Ba	Zr	Y	Rb
BLANK2	4638	0.00	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.04	0.03	0.16	1	5	7	0.7	
BLANK3	4608	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.08	1	5	7	0.2	
BLANK4	4526	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0	0	0	0.0	1
BLANK5	4508	0.11	0.00	0.06	0.00	0.00	0.02	0.03	0.00	0.00	0.01	0.23	2	4	19	0.9	
BLANK7	4818	0.07	0.00	0.02	0.00	0.00	0.03	0.02	0.00	0.05	0.02	0.21	1	5	12	0.7	2
	AVE	0.04	0.00	0.04	0.00	0.00	0.02	0.01	0.00	0.02	0.01	0.14	1	4	9	0.5	
NBS70	4527	68.21	0.00	17.71	0.09	0.00	0.03	0.12	2.48	11.84	0.00	100.50	64	115	2	1.6	567
NBS70	4543	65.77	0.00	16.73	0.09	0.00	0.04	0.12	2.46	11.37	0.00	96.57	62	113	0	2.1	565
NBS70	4548	67.91	0.00	17.74	0.09	0.00	0.03	0.12	2.49	11.89	0.01	100.28	62	113	1	1.1	568
NBS70	4581	65.18	0.00	17.09	0.06	0.00	0.07	0.12	2.35	11.51	0.01	96.38	64	117	8	2.7	567
NBS70	4601	67.20	0.00	17.73	0.05	0.00	0.06	0.12	2.41	12.29	0.02	99.87	65	119	7	1.7	
NBS70	4615	67.05	0.00	17.61	0.05	0.00	0.06	0.12	2.50	12.06	0.01	99.47	65	122	7	1.6	
NBS70	4633	66.55	0.00	17.20	0.06	0.00	0.06	0.12	2.43	11.59	0.00	98.02	65	115	8	2.3	
NBS70	4651	67.06	0.00	17.44	0.05	0.00	0.07	0.12	2.48	11.81	0.01	99.05	67	122	9	1.4	
NBS70	4664	66.71	0.00	17.31	0.06	0.00	0.06	0.13	2.44	11.92	0.02	98.65	65	119	7	1.9	
NBS70	4824	67.84	0.01	17.54	0.04	0.00	0.06	0.14	2.49	11.91	0.02	100.05	66	119	12	1.5	
	AVE	66.95	0.00	17.41	0.06	0.00	0.05	0.12	2.45	11.82	0.01	98.88	64	117	6	1.8	
NBS99	4536	64.48	0.01	20.14	0.13	0.00	0.02	2.06	6.17	5.22	0.03	98.25	432	2593	8	1.3	113
NBS99	4590	66.17	0.00	20.57	0.04	0.00	0.04	2.11	6.23	5.15	0.03	100.35	438	2608	13	1.9	115
NBS99	4610	66.31	0.00	20.83	0.04	0.00	0.05	2.19	6.24	5.23	0.03	100.92	444	2552	13	3.0	114
NBS99	4624	65.66	0.00	19.87	0.04	0.00	0.04	2.16	6.17	5.14	0.01	99.09	442	2550	13	2.7	115
NBS99	4643	65.78	0.00	20.73	0.05	0.00	0.05	2.13	6.28	5.13	0.02	100.17	447	2564	13	2.3	
NBS99	4660	67.82	0.00	20.94	0.04	0.00	0.05	2.18	6.36	5.19	0.03	102.60	447	2578	13	3.3	
NBS99	4826	64.99	0.01	19.94	0.03	0.00	0.04	2.10	6.20	5.11	0.03	98.45	434	2598	18	2.3	
	AVE	65.88	0.00	20.43	0.05	0.00	0.04	2.13	6.24	5.17	0.02	99.98	441	2578	13	2.4	
ACDTIIA-1	4540	53.84	0.00	23.49	0.02	0.00	0.00	0.00	14.86	0.02	0.02	92.27	2	1	0	0.0	27

SRI STANDARDS AND SAMPLES

Sample	#	SiO2	TiO2	Al2O3	Fe2O	Mn	MgO	CaO	Na2O	K2O	P2O	Total	Sr	Ba	Zr	Y	Rb
ACDTIIA-2	4539	54.00	0.00	23.96	0.04	0.00	0.00	0.03	14.55	0.04	0.00	92.63	5	7	0	0.0	26
API24-1	4537	59.51	0.57	14.68	4.32	0.11	3.58	1.45	2.24	2.63	0.13	89.22	201	665	190	22.0	116
API24-2	4531	59.65	0.57	14.44	4.43	0.12	3.53	1.39	2.20	2.55	0.12	89.00	199	690	152	24.2	117
API24NA-1	4529	49.19	1.02	16.80	9.38	0.11	5.03	0.18	2.09	4.37	0.08	88.23	45	412	100	21.2	281
API24NA-2	4542	50.01	1.03	17.10	9.51	0.11	5.15	0.18	2.20	4.52	0.07	89.89	46	406	115	21.3	285
ASE4-1	4544	54.63	0.00	23.76	0.09	0.00	0.01	0.00	15.18	0.01	0.00	93.69	2	4	2	0.9	25
ASE4-2	4547	54.99	0.00	24.03	0.09	0.00	0.00	0.00	15.03	0.01	0.01	94.16	2	3	5	0.0	25
ASH2003501	4500	54.34	0.00	23.95	0.00	0.00	0.02	0.03	14.48	0.00	0.00	92.82	7	6	20	0.7	26
ASH2003502	4503	55.08	0.00	24.39	0.00	0.00	0.03	0.03	14.95	0.00	0.01	94.49	6	6	21	1.4	26
CDVCAF-1	4640	65.91	0.06	11.01	0.38	0.00	0.23	5.68	0.00	0.43	0.02	83.70	95	159	89	9.1	27
CDVCAF-2	4641	66.02	0.06	11.11	0.39	0.00	0.23	5.69	0.00	0.44	0.00	83.92	96	158	89	9.1	27
CDVHF-1	4642	71.90	0.06	9.99	0.35	0.00	0.21	0.09	0.16	2.06	0.01	84.83	52	218	96	3.9	92
CDVHF-2	4644	72.27	0.07	9.85	0.35	0.00	0.22	0.09	0.16	2.07	0.01	85.08	52	218	93	4.8	92
CDVKF-1	4646	66.19	0.06	10.81	0.37	0.00	0.16	0.00	0.00	9.93	0.02	87.52	5	12	85	9.0	31
CDVKF-2	4647	65.92	0.06	10.56	0.39	0.00	0.17	0.00	0.00	10.33	0.02	87.41	5	12	87	8.9	32
CDVNAF-1	4648	67.43	0.06	10.73	0.37	0.00	0.18	0.00	6.37	0.62	0.00	85.76	9	133	88	9.1	37
CDVNAF-2	4650	67.33	0.06	10.68	0.36	0.00	0.18	0.01	6.25	0.60	0.02	85.48	9	134	90	9.2	37
CDVST-1	4652	62.97	0.00	19.33	0.06	0.00	0.05	2.01	6.07	4.83	0.03	95.34	435	2492	14	2.1	111
NACACL5-1	4583	68.46	0.06	11.25	0.36	0.00	0.18	1.32	5.00	0.61	0.02	87.26	10	130	90	9.3	38
NACACL5-5	4584	67.02	0.06	10.95	0.40	0.00	0.19	1.79	4.43	0.62	0.02	85.47	11	130	87	8.7	40
NACACL5-7	4586	66.13	0.06	10.57	0.36	0.00	0.18	2.14	3.79	0.61	0.03	83.87	13	126	84	8.7	39
NACACL5-11	4587	67.17	0.06	10.73	0.36	0.00	0.19	3.10	3.03	0.63	0.01	85.27	17	130	85	8.8	38
NACACL5-13	4589	67.32	0.06	10.74	0.36	0.00	0.18	3.60	2.47	0.63	0.02	85.38	21	130	88	8.1	38
NACACL5-25	4591	65.97	0.00	20.45	0.04	0.00	0.05	2.14	6.23	5.21	0.02	100.11	444	2595	15	2.5	113

SRI STANDARDS AND SAMPLES

Sample	#	SiO2	TiO2	Al2O3	Fe2O	Mn	MgO	CaO	Na2O	K2O	P2O	Total	Sr	Ba	Zr	Y	Rb
NACACLO5-1	4592	67.62	0.06	11.10	0.36	0.00	0.18	2.56	3.57	0.63	0.00	86.07	12	130	88	8.9	38
NACACLO5-5	4594	67.54	0.05	11.00	0.36	0.00	0.20	3.52	2.55	0.58	0.01	85.81	17	133	90	9.5	38
NACACLO5-9	4595	68.03	0.06	11.08	0.36	0.00	0.19	3.91	2.12	0.61	0.01	86.37	17	132	89	9.7	37
NACACLO5-11	4596	68.62	0.06	11.33	0.36	0.00	0.19	4.36	1.72	0.62	0.02	87.28	20	135	90	8.4	38
NACACLO5-19	4598	67.41	0.06	11.05	0.35	0.00	0.20	4.51	1.39	0.55	0.01	85.52	33	132	91	9.1	35
NACANO3-1	4599	69.09	0.06	11.30	0.36	0.00	0.19	1.21	5.10	0.62	0.01	87.94	11	134	91	10.1	40
NACANO3-7	4600	66.08	0.06	10.89	0.35	0.00	0.18	2.66	3.28	0.60	0.01	84.11	17	132	88	9.5	38
NACANO3-10	4602	65.74	0.06	10.86	0.38	0.00	0.18	3.46	2.55	0.62	0.02	83.86	22	129	83	9.1	38
NACANO3-14	4604	66.17	0.06	10.98	0.37	0.00	0.19	4.13	1.90	0.60	0.02	84.41	27	132	90	9.1	38
NACANO3-18	4606	65.44	0.06	10.78	0.35	0.00	0.19	4.92	1.02	0.55	0.01	83.33	48	130	88	8.5	37
NACANO3-25	4607	63.98	0.00	20.05	0.04	0.00	0.05	2.14	6.13	4.89	0.02	97.31	432	2523	14	2.9	115
NAKCL5-1	4609	67.81	0.06	11.17	0.36	0.00	0.17	0.00	1.91	7.52	0.02	89.00	7	111	87	9.1	54
NAKCL5-3	4611	66.95	0.06	10.98	0.36	0.00	0.17	0.00	1.23	8.55	0.02	88.31	5	58	88	8.6	45
NAKCL5-11	4612	65.82	0.06	10.75	0.35	0.00	0.16	0.01	0.55	9.29	0.02	87.01	5	25	87	8.3	38
NAKCL5-17	4616	67.80	0.06	10.91	0.34	0.00	0.17	0.00	0.81	9.34	0.01	89.43	5	43	87	8.8	45
NAKCL5-25	4618	66.78	0.00	17.12	0.05	0.00	0.06	0.12	2.48	12.00	0.01	98.61	65	121	6	1.9	577
NAKCLO5-1	4620	67.48	0.06	10.63	0.35	0.00	0.17	0.01	2.35	6.20	0.01	87.26	9	128	87	8.7	53
NAKCLO5-5	4622	67.58	0.04	10.55	0.25	0.00	0.25	0.00	0.55	8.43	0.00	87.67	13	136	106	11.4	48
NAKCLO5-9	4625	67.48	0.06	10.66	0.35	0.00	0.17	0.01	0.56	9.29	0.02	88.59	6	110	83	8.6	47
NAKCLO5-19	4627	67.34	0.06	10.58	0.35	0.00	0.17	0.00	0.32	9.64	0.01	88.48	6	93	87	9.1	42
NAKNO3-1	4628	68.00	0.06	10.78	0.35	0.00	0.17	0.00	4.83	2.66	0.02	86.86	9	131	86	9.1	44
NAKNO3-5	4630	68.00	0.06	10.77	0.38	0.00	0.18	0.00	2.24	6.71	0.01	88.36	9	132	84	8.6	51
NAKNO3-9	4631	67.30	0.06	10.79	0.35	0.00	0.17	0.00	1.52	7.59	0.01	87.79	8	128	83	9.5	50
NAKNO3-14	4632	66.76	0.06	10.49	0.35	0.00	0.17	0.01	0.78	8.70	0.01	87.34	7	114	85	8.6	45

SRI STANDARDS AND SAMPLES

Sample	#	SiO2	TiO2	Al2O3	Fe2O	Mn	MgO	CaO	Na2O	K2O	P2O	Total	Sr	Ba	Zr	Y	Rb
NAKNO3-16	4634	65.65	0.06	10.46	0.34	0.00	0.16	0.01	0.46	8.85	0.00	86.00	6	109	81	9.0	43
NAKNO3-19	4635	67.00	0.06	10.72	0.40	0.00	0.18	0.00	0.17	9.60	0.00	88.12	6	92	87	8.5	40
NAKNO3-25	4637	65.98	0.00	17.38	0.05	0.00	0.06	0.11	2.43	11.51	0.02	97.55	64	114	9	2.1	565
SAZ1-1	4653	53.43	0.20	15.14	1.39	0.08	5.21	2.53	0.04	0.17	0.02	78.21	296	296	269	34.6	6
SAZ1-2	4655	53.25	0.20	15.04	1.38	0.08	5.31	2.55	0.04	0.18	0.04	78.06	293	284	259	34.6	5
SAZ1-3	4656	54.11	0.20	15.30	1.39	0.09	5.39	2.65	0.04	0.19	0.03	79.38	294	306	255	37.5	5
SAZ111-25	4819	61.45	0.22	17.43	1.57	0.07	6.05	0.30	3.64	0.14	0.03	90.90	36	152	270	31.9	6
SAZ111-27	4820	62.26	0.29	17.65	1.56	0.04	5.98	0.06	3.99	0.09	0.03	91.95	9	80	276	21.3	5
SAZ111-29	4822	62.05	0.22	17.57	1.57	0.02	5.98	0.03	3.97	0.06	0.02	91.49	5	28	279	10.9	3
SAZ122-2	4823	62.13	0.22	17.50	1.58	0.06	5.88	0.05	3.96	0.12	0.03	91.53	8	124	295	27.9	5
SCA3-1	4658	52.97	0.14	14.89	1.07	0.03	6.66	0.71	0.92	0.13	0.03	77.55	102	99	168	23.8	6
SCA3-2	4659	53.35	0.17	15.05	1.10	0.03	6.79	0.71	0.96	0.14	0.02	78.32	101	84	194	14.9	4
SST1	4661	67.38	0.00	17.65	0.05	0.00	0.06	0.12	2.44	11.71	0.01	99.42	64	119	8	2.7	568
STX1-1	4663	58.63	0.19	12.56	0.57	0.02	2.80	1.41	0.22	0.08	0.04	76.52	93	56	157	45.7	4
STX1-2	4665	61.94	0.20	13.19	0.59	0.01	2.94	1.45	0.23	0.06	0.04	80.66	93	56	170	48.1	4

ICP LAB STANDARDS

Sample	#	SiO2	TiO2	Al2O3	Fe2O	Mn	MgO	CaO	Na2O	K2O	P2O	Total	Sr	Ba	Zr	Y	Rb
MHA	4821	61.18	0.83	17.23	6.09	0.10	3.09	6.04	4.32	1.15	0.18	100.21	546	300	143	17.0	
MHA	4825	61.04	0.82	17.34	6.14	0.10	3.11	6.18	4.29	1.17	0.18	100.37	546	299	141	17.3	
MHA	4829	61.11	0.83	17.34	6.16	0.10	3.11	5.98	4.28	1.14	0.19	100.24	544	298	146	17.4	
	AVE	60.84	0.83	17.44	6.17	0.10	3.10	6.09	4.26	1.18	0.19	100.20	550	300	144	17.1	
RGMT	4578	72.82	0.27	13.52	1.85	0.04	0.30	1.28	4.05	4.23	0.05	98.41	109	818	220	25.7	151
RGMT	4585	73.31	0.28	13.57	1.89	0.04	0.30	1.23	4.10	4.18	0.06	98.95	110	823	224	25.5	147
RGMT	4597	73.85	0.28	13.59	1.87	0.04	0.31	1.25	4.09	4.20	0.05	99.53	109	819	227	25.8	149
RGMT	4645	74.26	0.28	13.57	1.86	0.04	0.31	1.25	4.24	4.15	0.07	100.01	109	814	220	25.5	
	AVE	73.56	0.27	13.56	1.87	0.04	0.30	1.25	4.12	4.19	0.06	99.22	109	818	223	25.6	
TMS	4501	60.86	0.13	18.13	5.60	0.25	0.11	1.24	9.05	4.26	0.17	99.79	727	568	1172	51.6	
TMS	4504	59.09	0.13	18.17	5.58	0.25	0.11	1.22	9.05	4.15	0.17	97.90	725	574	1191	50.0	
	AVE	59.97	0.13	18.15	5.59	0.25	0.11	1.23	9.05	4.20	0.17	98.85	726	571	1181	50.8	
1.5TMS	4522	90.75	0.18	27.42	8.21	0.37	0.13	1.83	13.75	6.20	0.24	149.06	1092	841	1812	75.0	181
1.5TMS	4541	88.84	0.18	27.11	8.13	0.37	0.13	1.84	13.57	6.28	0.24	146.69	1088	840	1802	74.2	179
1.5TMS	4546	90.05	0.18	28.19	8.23	0.37	0.13	1.85	13.73	6.30	0.24	149.28	1099	843	1804	74.0	
1.5TMS	4588	89.98	0.18	27.38	8.14	0.36	0.16	1.88	13.62	6.27	0.25	148.22	1094	849	1834	74.1	
1.5TMS	4619	88.98	0.18	27.14	8.14	0.36	0.15	1.87	13.44	6.15	0.24	146.65	1082	838	1809	72.5	
1.5TMS	4649	88.46	0.18	27.05	8.10	0.37	0.15	1.83	13.44	6.10	0.25	145.95	1084	829	1825	74.4	
	AVE	89.51	0.18	27.38	8.16	0.37	0.14	1.85	13.59	6.22	0.24	147.64	1090	840	1814	74.0	
1633A	4626	49.63	1.42	27.07	13.92	0.03	0.75	1.61	0.17	2.11	0.41	97.13	813	1307	246	99.4	122
2GSP1	4636	0.00	1.33	30.13	8.54	0.09	1.90	4.03	5.55	10.98	0.57	63.12	465	2583	1062	54.2	

ICP LAB STANDARDS

Sample	#	SiO2	TiO2	Al2O3	Fe2O	Mn	MgO	CaO	Na2O	K2O	P2O	Total	Sr	Ba	Zr	Y	Rb
ABA	4499	45.92	2.06	14.24	12.21	0.19	11.35	10.59	3.03	1.38	0.45	101.42	531	388	153	29.7	28
ABA	4502	45.55	2.08	14.37	12.12	0.19	11.44	10.57	3.12	1.41	0.45	101.30	545	401	151	29.6	28
ABA	4580	45.00	2.04	14.26	12.34	0.19	11.27	10.13	3.03	1.34	0.43	100.04	533	389	154	28.9	28
ABA	4603	45.02	2.06	14.23	12.30	0.19	11.30	10.59	3.04	1.39	0.43	100.54	536	389	155	29.3	
ABA	4629	46.60	2.12	14.16	12.33	0.20	11.46	10.61	3.07	1.42	0.45	102.41	543	388	157	29.4	
ABA	4657	46.19	2.10	14.42	12.24	0.20	11.10	10.35	3.09	1.37	0.45	101.50	543	389	153	29.4	
ABA	4817	45.96	2.09	14.31	12.44	0.19	11.43	10.80	3.13	1.40	0.42	102.17	546	402	154	28.8	
ABA	4828	45.37	2.07	14.13	12.21	0.19	11.09	10.35	3.14	1.35	0.44	100.34	538	393	156	28.9	
	AVE	45.70	2.08	14.27	12.27	0.19	11.31	10.50	3.08	1.38	0.44	101.21	539	392	154	29.2	
BCM	4530	56.44	1.13	15.77	8.74	0.14	5.69	7.18	3.90	2.07	0.42	101.49	710	884	143	21.8	34
BCM	4545	56.97	1.11	15.70	8.69	0.14	5.68	7.31	3.99	2.15	0.45	102.18	732	888	171	21.6	34
BCM	4605	56.32	1.14	15.93	8.66	0.14	5.79	7.22	3.97	2.04	0.44	101.65	719	861	156	22.6	34
BCM	4662	56.21	1.13	15.49	8.73	0.15	5.68	7.22	3.95	2.08	0.45	101.07	725	848	149	21.8	
	AVE	56.48	1.13	15.72	8.71	0.14	5.71	7.23	3.95	2.08	0.44	101.60	721	870	155	22.0	
GSPT	4617	66.79	0.68	14.33	4.37	0.04	0.98	2.12	2.76	5.12	0.27	97.46	236	1297	562	30.6	
MHA	4507	61.05	0.87	17.92	6.23	0.10	3.18	6.16	4.38	1.22	0.19	101.30	579	313	144	17.0	19
MHA	4524	61.44	0.85	17.52	6.18	0.10	3.13	6.13	4.30	1.22	0.19	101.06	558	300	145	17.0	20
MHA	4538	61.09	0.83	17.53	6.20	0.10	3.12	6.14	4.29	1.18	0.18	100.65	548	298	145	17.2	19
MHA	4577	59.76	0.83	17.39	6.10	0.10	3.01	6.14	4.17	1.19	0.18	98.85	546	301	142	16.8	
MHA	4582	59.75	0.84	17.43	6.17	0.10	3.08	5.96	4.15	1.16	0.19	98.82	546	299	142	17.1	
MHA	4593	61.26	0.85	17.57	6.21	0.10	3.11	6.04	4.28	1.17	0.18	100.78	552	305	144	17.2	
MHA	4613	60.54	0.83	17.21	6.11	0.10	3.13	6.05	4.23	1.16	0.18	99.55	540	299	143	16.8	
MHA	4639	58.91	0.82	17.38	6.13	0.10	3.06	6.00	4.23	1.16	0.18	97.96	544	292	142	16.8	
MHA	4654	60.54	0.82	17.15	6.22	0.10	3.07	5.98	4.16	1.14	0.20	99.39	543	289	146	17.3	
MHA	4666	62.62	0.85	17.55	6.20	0.11	3.08	6.16	4.28	1.21	0.18	102.24	550	299	145	17.2	
MHA	4816	61.55	0.83	17.56	6.22	0.10	3.18	6.28	4.32	1.20	0.19	101.43	554	301	141	17.4	

2/4/93
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PB

LSA data analysis, Sr data manipulation NaSrCl 0.5N Isotherm experiment. (cont'd from p. 304 GC-04 CNWRA 020)

Determination of ^{90}Sr content.

① initial Sr-90

a. known weight of Sr-90 spike (#24A) is added to each reference solution. The wt. Sr-90 diluted w/ wt. of reference gives known activity per gram of each reference solution. Expected activity in dpm can then be determined.

b. initial Sr-90 activity can be verified by measurement of the reference solutions using LSA (Cerenkov counting)

- utilizing calibrated spike standards to determine efficiency of counting, etc, measured cpm of each reference can be corrected for background and efficiency to give activity (dpm). This activity divided by the mass of the reference measured gives activity per gram.

- because of the known accuracy of the calibration (spike) standards, the measured activity/g is used as the initial Sr-90 content for each reference.

c. Initial Sr-90 can be applied to exp. solutions in a similar fashion as applied w/non-radioactive Sr except that the expected activity of the exp. solution must take into account the mass of solution. (including mass as sampled and counted in LSA)

ex: activity (dpm) ref x wt. exp. sample = expected initial activity exp. solution

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PB

② final Sr-90 content

- measured cpm of experimental solutions is corrected for background and efficiency and converted to dpm. dpm can be corrected for weight of LSA sample to give activity/g.

③ Sr-90 ratio

- values for initial and final Sr-90 activity (dpm) of exp. solutions are used.

Determination of final $[Sr^{++}]$

recall: $$\text{Final } [Sr] = \frac{\text{initial } [Sr] \cdot \text{Sr-90 final dpm}}{\text{Sr-90 initial dpm}}$$

=) Now that initial and final exp. solution ~~of~~ Sr ppm values are known, they can be used to calculate ESr_z and ESr_s for the isotherm plot

8 Feb 93
PB

Calculation of ESr_s and ESr_z from Na^+ analysis data.

- Dilutions for Na ISE analysis were made by weight rather than volume. Dilution factor corrections must account for weight and density of solutions to be correct.

Using data as recorded during sampling and subsequent ISE analysis, the following data table depicts the corrected Na ppm concentrations of experimental solutions.

8 Feb 93

PB

Na ppm corrections for dilution

[NAISE.WQ1]

EXPERIMENTAL SOLUTIONS

solution	init dens	water de	wt samp	wt water	vol samp	vol water	dil factor	ise meas	corr ppm
1	1.029595	0.99821	1.0151	9.008	0.985922	9.024153	0.098493	1120	11371
2	1.029595	0.99821	1.0114	8.9994	0.982328	9.015538	0.098254	1075	10941
3	1.030266	0.99821	1.0154	9.0093	0.985571	9.025456	0.098449	1045	10615
4	1.031609	0.99821	1.0136	9.004	0.982543	9.020146	0.098228	994	10119
5	1.031609	0.99821	1.0139	9.0046	0.982834	9.020747	0.098248	905	9211
6	1.032952	0.99821	1.0133	9.0006	0.980975	9.01674	0.09812	844	8602
7	1.034297	0.99821	1.0152	9.0053	0.981536	9.021448	0.098124	775	7898
8	1.034297	0.99821	1.0244	9.0038	0.990431	9.019946	0.09894	712	7196
9	1.035641	0.99821	1.0251	9.006	0.989822	9.02215	0.098864	579	5857
10	1.036982	0.99821	1.0243	9.0086	0.98777	9.024754	0.098653	470	4764
11	1.038326	0.99821	1.0262	9.0008	0.988322	9.01694	0.09878	383	3877
12	1.03967	0.99821	1.0303	9.0034	0.990988	9.019545	0.098994	271	2738
13	1.041013	0.99821	1.0309	9.002	0.990285	9.018142	0.098945	203	2052
14	1.041013	0.99821	1.0307	9.0073	0.990093	9.023452	0.098875	166	1679
15	1.042356	0.99821	1.0325	9.0017	0.990544	9.017842	0.098971	116	1172
16	1.042356	0.99821	1.032	9.0088	0.990065	9.024955	0.098858	73.5	743
17	1.042356	0.99821	1.0327	9.0084	0.990736	9.024554	0.098922	50.2	507
18	1.042356	0.99821	1.0316	9.005	0.989681	9.021148	0.098861	28.4	287
19	1.042356	0.99821	1.0226	8.9974	0.981047	9.013534	0.098158	9.85	100

based on wt. $SrCl_2$ and NaCl added p. 233 GC-04

density of dd_2O @ 20°C

wt. sample p. 262 GC-04

p. 262 GC-04

measured p. 263 GC-04

corrected final Na ppm values used in isotherm calculations

17 Feb 93

PB

Compilation of Sr-90 data as measured using LSA.

- measured cpm of PB LSA runs from 1/10/93, 1/20/93, and 1/22/93 are corrected for background and averaged. Average values are converted to dpm using best fit derived from spiked eff. ref. data (92-93)
- explanation of columns, solutions, data found on following pages.

SREFFNEW.WQ1,17-Feb-93

LSA no.	Solution	01/10/93	01/20/93	01/22/93	corr 1/10	corr 1/20	corr 1/22	average	std dev	calc dpm	overall eff	eff 1	eff 2	eff 3	fit eff	fit dpm	absolute
Spike references																	
1	9A	8193.46	8223	8140.65	8180.06	8209.6	8127.25	8172	34.1	11395.3	0.717164	0.717845	0.720437	0.713211	0.717303	11393.09	-0.01936
2	9B	4130.24	4121.42	4085	4116.84	4108.02	4071.6	4099	19.6	5727.6	0.715626	0.718772	0.717232	0.710874	0.7172	5715.031	-0.21945
3	9C	2098.11	2098.16	2088.62	2084.71	2084.76	2075.22	2082	4.5	3133.5	0.664293	0.665298	0.665314	0.662269	0.716918	2903.489	-7.34037
4	9D	815.82	811.36	813.25	802.42	797.96	799.85	800	1.8	1120	0.714354	0.716446	0.712464	0.714152	0.715508	1118.194	-0.16122
5	9E	408.96	405.2	407.09	395.56	391.8	393.69	394	1.5	552.8	0.712162	0.715557	0.708755	0.712174	0.71202	552.9108	0.020052
6	9F	202.76	204.96	204.75	189.36	191.56	191.35	191	1.0	270.8	0.704419	0.699261	0.707386	0.70661	0.701754	271.8282	0.379694
7	9G	90.87	91.13	91.18	77.47	77.73	77.78	78	0.1	117.7	0.659813	0.658199	0.660408	0.660833	0.66079	117.5259	-0.14791
										Averages	0.698262	0.698768	0.698857	0.69716			
Reference solutions										wt dpm	wt eff	avg calc dpm			fit eff	fit dpm	
25	0.05	8359.29	8309.75	8324.95	8345.89	8296.35	8311.55	8318	20.7	11187.98	0.74347	11912			0.717305	11596	
26	0.1	8359.5	8283.23	8260.62	8346.1	8269.83	8247.22	8288	42.3	11244.43	0.737051	11869			0.717304	11554	
27	0.2	8368.62	8332.43	8371.76	8355.22	8319.03	8358.36	8344	17.8	11250.07	0.741702	11950			0.717305	11633	
28	0.3	8383.68	8386.37	8404.41	8370.28	8372.97	8391.01	8378	9.2	11289.59	0.742107	11998			0.717305	11680	
29	0.4	8323.7	8308.92	8360.13	8310.3	8295.52	8346.73	8318	21.5	11193.63	0.743058	11912			0.717305	11596	
30	0.5	8375.94	8293.58	8300.62	8362.54	8280.18	8287.22	8310	37.3	11244.43	0.739031	11901			0.717305	11585	
31	0.6	8266.53	8388.05	8405.25	8253.13	8374.65	8391.85	8340	61.7	11306.52	0.737616	11944			0.717305	11627	
32	0.7	8530.92	8490.25	8543.28	8517.52	8476.85	8529.88	8508	22.7	11323.46	0.751368	12185			0.717307	11861	
33	0.8	8368.06	8472.73	8383.26	8354.66	8459.33	8369.86	8395	46.2	11250.07	0.746183	12022			0.717305	11703	
34	0.9	8334.17	8400	8398.74	8320.77	8386.6	8385.34	8364	30.7	11204.92	0.746479	11979			0.717305	11661	
35	1	8419.75	8334.38	8350	8406.35	8320.98	8336.6	8355	37.1	11255.72	0.742258	11965			0.717305	11647	
Experimental solutions																	
13	1	129.4	128.14	128.22	116	114.74	114.82	115	0.6						0.684901	168	
14	2	666.14	659.59	664.69	652.74	646.19	651.29	650	2.8						0.714833	909	
15	3	589.99	585.41	587.76	576.59	572.01	574.36	574	1.9						0.714319	804	
16	4	496.96	498.08	493.47	483.56	484.68	480.07	483	2.0						0.71342	677	
17	5	815.58	810.76	820.59	802.18	797.36	807.19	802	4.0						0.715515	1121	
18	6	704.6	691.46	703.66	691.2	678.06	690.26	687	6.0						0.715031	960	
19	7	669.06	662.5	670.27	655.68	649.1	656.87	654	3.4						0.714855	915	
20	8	785.22	783.12	787.77	771.82	769.72	774.37	772	1.9						0.715406	1079	
21	9	816.49	814.21	816.2	803.09	800.81	802.8	802	1.0						0.715515	1121	
22	10	812.26	811.91	809.12	798.86	798.51	795.72	798	1.4						0.715499	1115	
23	11	805.36	799.02	804.56	791.96	785.62	791.16	790	2.8						0.715471	1104	
24	12	801.84	794.05	790.89	788.44	780.65	777.49	782	4.6						0.715444	1093	
37	13	761.82	760.88	774.29	748.42	747.48	760.89	752	6.1						0.715329	1052	
38	14	811.03	801.5	807.59	797.63	788.1	794.19	793	3.9						0.715484	1109	
39	15	766.8	759.58	765.15	753.4	746.18	751.75	750	3.1						0.715321	1049	
40	16	780.53	784.86	781.41	767.13	771.46	768.01	769	1.9						0.715394	1075	
41	17	807.88	801.82	802.02	794.48	788.42	788.62	791	2.8						0.715474	1105	
42	18	830.09	819.63	827.88	816.69	806.23	814.48	812	4.5						0.71555	1135	
43	19	839.52	841.45	842.88	826.12	828.05	829.48	828	1.4						0.7156	1157	
Blanks (non-spiked references)																	
49	b 0.05	13.07															
50	b 0.1	13.88															
51	b 0.2	13.09															
52	b 0.3	13.54															
53	b 0.4	13.48															
54	b 0.5	13.42															
55	b 0.6	13.28															
56	b 0.7	13.42															
57	b 0.8	13.69															
58	b 0.9	13.44															
59	b 1.0	13.1															

13.40 average of blanks

0.244 blank std deviation

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PD

Explanation of Sreff new data table:

SOLUTIONS

Spiked references: Sr-90 solutions from spike #9 used to determine counting efficiency of LSA Cerenkov method. (9A - 9G)

Reference solutions: Reference solutions ESr 0.05 - ESr 1.0 spiked with Sr-90 (#21A) and used as initial Sr concentration for experiment. (0.05 - 1)

Experimental solutions: Solutions using initial liquid from references mixed w/ zeolite. (1-1A)

Blanks (non spiked references): Reference solutions w/o added Sr-90 spike. Used for blank counting. Blank correction applied to measured samples is the average of these solutions' measured cpm. (b0.05 - b1.0)

COLUMNS

01/10/93, 01/20/93, 01/22/93 - measured cpm of solutions, see pp. 300-302 of GC-04.

corr 1/10, corr 1/20, corr 1/22 - solution cpm corrected for blank average (13.40)

average - avg cpm of corr 1/10, corr 1/20 and corr 1/22

std dev - population σ of corr 1/10, corr 1/20 and corr 1/22

calc dpm - expected dpm as calculated based on wt spike #9 added and activity of spike #9. See p 161 of radiochem notebook CNWRA 031.

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PD

Sr-90 data table cont'd.

COLUMNS

overall eff - efficiency as calculated by: $\frac{\text{average}}{\text{calc dpm}}$

eff 1, eff 2, eff 3 - efficiency of corr 1/10, corr 1/20 and corr 1/22 based on calc dpm

ex: $\text{eff1} = \frac{\text{corr } 1/10}{\text{calc dpm}}$

fit eff - efficiency of counting of average based on best fit of eff1, eff2, and eff 3 vs corr 1/10, corr 1/20 and corr 1/22

BEST FIT FUNCTION:

$$\text{EFF} = \frac{1}{a + b/x^{1.5}}$$

$$\text{EFF} = \left(\frac{1}{1.394 + \frac{81.673}{(\text{average})^{1.5}}} \right)$$

fit dpm - calculated dpm by applying fit eff to average

ex: $\text{fit dpm} = \frac{\text{average}}{\text{fit eff}}$

absolute - % difference in fit dpm value vs. calc dpm value

ex: $\text{absolute} = \frac{\text{fit dpm} - \text{calc dpm}}{\text{calc dpm}} * 100$

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PB

Explanation of Sr-90 table contd

Averages - average of eff1, eff2 and eff3 and overall eff.

wt. dpm - calculated dpm based on wt. of spike #24A added to reference solutions, see p 23a ~~GC-04~~ GC-04

wt. eff - efficiency calculated based on average and wt. dpm.

$$\text{wt eff} = \frac{\text{average}}{\text{wt. dpm}}$$

avg calc dpm - dpm calculated based on overall avg efficiency

$$\text{avg calc dpm} = \frac{\text{average}}{0.698262}$$

average of blanks - average cpm of solutions b0.05 - b1.0

blank std deviation - population σ of solutions b0.05 - b1.0

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PB

We can use the calculated dpm of the reference solutions and the weight of experimental ~~sto~~ PB solution sampled to calculate the expected initial dpm of the experimental solutions. The expected initial dpm can be then utilized with the measured dpm (final) to determine the change in dpm, this change is proportional to the change in Sr ppm of the samples.

18 Feb 93
PB

Calculation of initial dpm of experimental solutions, and dpm/g of references.

INITDPM.WQ1, 18-Feb-93

solution	spike/g	wt spike	sol wt	activity/g	LSA wt	vol activit	wt activit	wt dpm	vol dpm	fit dpm	corr fit/g
Reference solutions											
0.05	0.50854	0.1982	200.22	0.000503	10.1539	0.005034	0.005112	11347.68	11175.69	11596	1142.033
0.1	0.50854	0.1992	200.23	0.000506	10.2111	0.005059	0.005166	11468.61	11231.51	11554	1131.511
0.2	0.50854	0.1993	200.22	0.000506	10.2155	0.005062	0.005171	11479.89	11237.71	11633	1138.732
0.3	0.50854	0.2	200.32	0.000508	10.2384	0.005077	0.005198	11540.27	11271.55	11680	1140.798
0.4	0.50854	0.1983	200.23	0.000504	10.2582	0.005036	0.005166	11469.46	11180.77	11596	1130.365
0.5	0.50854	0.1992	200.23	0.000506	10.2813	0.005059	0.005202	11547.46	11231.51	11585	1126.804
0.6	0.50854	0.2003	202.7	0.000503	10.3248	0.005025	0.005188	11518.26	11155.92	11627	1126.093
0.7	0.50854	0.2006	200.21	0.00051	10.3078	0.005095	0.005252	11659.75	11311.58	11861	1150.697
0.8	0.50854	0.1993	200.22	0.000506	10.328	0.005062	0.005228	11606.31	11237.71	11703	1133.132
0.9	0.50854	0.1985	200.23	0.000504	10.3367	0.005041	0.005211	11568.88	11192.05	11661	1128.081
1.0	0.50854	0.1994	200.2	0.000507	10.2897	0.005065	0.005212	11570.23	11244.47	11647	1131.934
Experimental solutions											
1				0.000503	1.0109	0.000503	0.000509	1129.75	1117.569		1154.481
2				0.000503	1.0193	0.000503	0.000513	1139.138	1117.569		1164.074
3				0.000506	1.0157	0.000506	0.000514	1140.785	1123.151		1149.276
4				0.000506	1.0123	0.000506	0.000512	1137.594	1123.771		1152.738
5				0.000506	1.0178	0.000506	0.000515	1143.774	1123.771		1159.001
6				0.000508	1.0167	0.000508	0.000516	1145.979	1127.155		1159.849
7				0.000504	1.0184	0.000504	0.000513	1138.649	1118.077		1151.164
8				0.000504	1.0185	0.000504	0.000513	1138.761	1118.077		1151.277
9				0.000506	1.0215	0.000506	0.000517	1147.299	1123.151		1151.03
10				0.000503	1.0208	0.000503	0.000513	1138.796	1115.592		1149.515
11				0.00051	1.0244	0.00051	0.000522	1158.758	1131.158		1178.774
12				0.000506	1.0255	0.000506	0.000519	1152.427	1123.771		1162.027
13				0.000504	1.0304	0.000504	0.000519	1153.228	1119.205		1162.375
14				0.000504	1.0221	0.000504	0.000515	1143.939	1119.205		1153.012
15				0.000507	1.0249	0.000507	0.000519	1152.446	1124.447		1160.12
16				0.000507	1.0261	0.000507	0.00052	1153.796	1124.447		1161.478
17				0.000507	1.0261	0.000507	0.00052	1153.796	1124.447		1161.478
18				0.000507	1.0262	0.000507	0.00052	1153.908	1124.447		1161.591
19				0.000507	1.03	0.000507	0.000522	1158.181	1124.447		1165.893

18 Feb 93
PD

Explanation of INITDPM.WQ1

solutions : same as before

spike/g : activity in microcuries of spike 24A /g SEE Radiochemistry Notebook pp. 139-140 CNWRA 031

wt. spike : weight in grams of 24A added to reference solutions. p. 239 GC-04

solution wt. : weight in grams of reference solution mixed w/ spike. p. 239 GC-04

activity/g : activity in microcuries/g of reference solutions → initial activity ⇒ based on wt. and 24A calculations

LSA wt. : weight of solution sampled for LSA analysis

vol activity : activity of LSA sample based on volume

wt activity : activity of LSA sample based on weight

wt dpm : calculated dpm of LSA sample based on wt. activity
vol dpm : calculated dpm of LSA sample based on vol. activity

fit dpm : calculated dpm of LSA sample based on efficiency cal stds (9A-9a). see p. 11 of this notebook.

corr fit/g : activity/g in dpm of reference solutions based on fit dpm and LSA wt. For experimental solutions: this equals the total expected activity of the LSA sample based on LSA wt and initial act./g (from reference corr fit/g)

ex:

exp #1 corr fit/g = Ref corr/g * g LSA = 1142.033 dpm/g * 1.0109 g

= 1154.481 dpm ⇒ initial dpm of exp solution

18 Feb 93
PD

Once initial and final dpm of all solutions are known, final ppm can be calculated (for Sr).

SRWORK.WQ1, 18-Feb-93

	solution	avg cpm	std dev	final dpm final dp	init dpm initial dp	delta	init ppm	final pp
REFERENCE SOLUTIONS	0.05	8318	20.7	11596	11596	0	1096	1096
	0.1	8288	42.3	11554	11554	0	2190	2190
	0.2	8344	17.8	11633	11633	0	4381	4381
	0.3	8378	9.2	11680	11680	0	6571	6571
	0.4	8318	21.5	11596	11596	0	8762	8762
	0.5	8310	37.3	11585	11585	0	10953	10953
	0.6	8340	61.7	11627	11627	0	13143	13143
	0.7	8508	22.7	11861	11861	0	15333	15333
	0.8	8395	46.2	11703	11703	0	17524	17524
	0.9	8364	30.7	11661	11661	0	19714	19714
	1.0	8355	37.1	11647	11647	0	21905	21905
EXPERIMENTAL SOLUTIONS	1	115	0.6	168	1154	986	1096	160
	2	650	2.8	909	1164	255	1096	856
	3	574	1.9	804	1149	345	2190	1532
	4	483	2.0	677	1153	476	4381	2572
	5	802	4.0	1121	1159	38	4381	4238
	6	687	6.0	960	1160	200	6571	5440
	7	654	3.4	915	1151	236	8762	6962
	8	772	1.9	1079	1151	72	8762	8213
	9	802	1.0	1121	1151	30	10953	10669
	10	798	1.4	1115	1150	35	13143	12747
	11	790	2.8	1104	1179	75	15333	14355
	12	782	4.6	1093	1162	69	17524	16488
	13	752	6.1	1052	1162	111	19714	17836
	14	793	3.9	1109	1153	44	19714	18958
	15	750	3.1	1049	1160	111	21905	19809
	16	769	1.9	1075	1161	87	21905	20269
	17	791	2.8	1105	1161	57	21905	20837
	18	812	4.5	1135	1162	26	21905	21412
	19	828	1.4	1157	1166	9	21905	21736
		from Sreffnew.wq1 p. 11 GC-09			INITDPM p. 15 GC-09	init-final	wt. $SrCl_2$ added p 220 GC-04	calculated SEE p. 9 GC-09

22 Feb 93
PD

Prepared 0.05 N ~~or~~ solutions of NaCl - SrCl for 0.05N isotherm expt. 0.05 N and 0.005 N solutions made previously (Oct 92) will not be used because of age. An exception will be 0.05N E_{Sr} 1.0 solution. It has a high initial $[Sr^{++}]$, ~ 2190 ppm so changes due to evaporation/ sorption to container should not affect the solution conc. of Sr significantly. Also the 0.5 N E_{Sr} 1.0 solution does not have enough vol. remaining to make the required amount of 0.05N E_{Sr} 1.0 solution.

0.05N $NaCl-SrCl_2$ references, diluted from 0.5N $NaCl-SrCl_2$ references IAW procedure p. 236-237 GC-04 (CRWRA 020)

TEMP = 22.4 °C

reference solution	vol. 0.5N sol. taken	wt. 0.5N sol. (g)	diluted to w/n H_2O (ml)
0.1	50	-	500
0.2	50	51.06	500
0.3	50	51.07	500
0.4	50	51.16	500
0.5	50	51.26	500
0.6	50	51.29	500
0.7	50	51.37	500
0.8	50	51.44	500
0.9	PD ~~50~~ 100	102.90	1000
1.0	N/A	N/A	NA

23 Feb 93
PD

Volume of reference solutions (0.05N) made are smaller than stated in GC-04 procedure p.236-237 to minimize amount of 0.5N solution required. Also, spiked solution volume for 0.05N and 0.005N solutions will be as small as possible to minimize radioactive material generation.

Prepared 0.005N $NaCl-SrCl_2$ reference solutions by dilution from 0.05N $NaCl-SrCl_2$ ref. solutions.

reference solution	vol. 0.05N sol. taken (ml)	wt. 0.05N sol (g)	diluted to w/n H_2O (ml)
0.1	100	100.03	1000
0.2	100	99.98	1000
0.3	100	100.02	1000
0.4	100	100.00	1000
0.5	100	100.01	1000
0.6	100	100.08	1000
0.7	100	100.02	1000
0.8	100	100.02	1000
0.9	100	100.02	1000
1.0	200	200.01	2000

TEMP = 18.5 °C

24 Feb 93
PD

Prepared ref solutions for spiking w/ ^{90}Sr. Spike # 24A will be used as the spike for each solution. Spike is weighed into weigh boat, transferred to pre-weighed and labeled poly bottle, and diluted to a given weight using the desired reference solution.

24 Feb 93
PB

Addition of spike #24A to 0.05N reference solutions NaCl - $SrCl_2$.

reference solution (ESr)	(*) weight spike #24A	wt. bottle + spike + solution	wt. bottle	spike + solution wt.	mR/hr @ contact
0.1	0.1989	230.60	30.41	200.19	0.07
0.2	0.1010	173.30	30.53	102.77	0.07
0.3	0.1002	130.60	30.47	100.13	0.07
0.4	0.0995	130.41	30.28	100.13	0.06
0.5	0.1006	130.51	30.41	100.1	0.07
0.6	0.0997	130.31	30.25	100.06	0.07
0.7	0.0998	130.42	30.30	100.12	0.06
0.8	0.1000	130.51	30.38	100.13	0.07
0.9	0.2477	280.68	30.44	250.24	0.12
1.0	0.4937	~~155.07~~ PB 2/24/93 555.07	54.48	500.59	0.09

25 Feb 93
PB

reference solution (ESr)	(*) weight spike #24A	wt. bottle + spike + solution	wt. bottle	spike + solution wt.	mR/hr @ contact
0.1	0.1964	230.58	30.38	200.20	0.7
0.2	0.3902	454.79	54.24	400.55	0.7
0.3	0.1969	231.96	30.36	201.60 2/25/93	0.7
0.4	0.3869	454.36	53.90	400.~~60~~ PB 46	0.6
0.5	0.1962	230.42	30.23	200.19	0.6
0.6	0.1964	230.43	30.25	200.18	0.7
0.7	0.1932	230.87	30.68	200.19	0.6
0.8	0.2489	280.53	30.24	250.29	0.7
0.9	0.4983	555.35	54.81	500.54	0.7
1.0	0.9909	1007.50	100.07	907.43	0.5

(*) spike added using Eppendorf pipettor w/ disposable tips

26 Feb 93
PB

Calculation of activity/gram of each reference solution

	reference solution	activity/gram µci/g	dpm/g
0.05N			
	0.1	0.0005053	1121.68
	0.2	0.0004998	1109.51
	0.3	0.0005089	1129.75
	0.4	0.0005053	1121.86
	0.5	0.0005111	1134.60
	0.6	0.0005067	1124.90 2/26/93
	0.7	0.0005069	~~1125.90~~ PB 35 1125.35
	0.8	0.0005079	1127.49
	0.9	0.0005034	1117.50
	1.0	0.0005015	1113.42
0.005N	~~0~~ PB		
	0.1	0.0004989	1107.53
	0.2	0.0004954	1099.79
	0.3	0.0004967	1102.64
	0.4	0.0004913	1090.73
	0.5	0.0004984	1106.46
	0.6	0.0004989	1107.64
	0.7	0.0004908	1089.54
	0.8	0.0005057	1122.69
	0.9	0.0005063	1123.91
	1.0	0.0005553	1232.81

2.22×10^{12} dpm = 1 ci

SAMPLE CALCULATION:

ACT/g = (wt. spike added * activity of spike #24A) / wt of solution

FOR 0.05N ESr 0.1 solution = (0.1989 g * 0.50854 µci/g) / 200.19 g

ACT ESr 0.1 0.05N = 0.0005053 µCi/g

26 Feb 93
PB

pH of each reference solution, with and without spike (^{22}Na - ^{90}Sr) added, will be measured.

reference solution (Esr)	pH ~~before~~ without spike (2/26/93 PB)	pH ~~after~~ with spike (PB 2/26/93)
0.05N		
** 0.1	5.28	5.16
0.2	5.40	5.22
** 0.3	5.48	5.27
0.4	5.45	5.21
0.5	5.46	5.26
0.6	5.36	5.26
0.7	5.44	5.22
0.8	5.50	5.30
0.9	5.47	5.30
1.0	5.50	5.31
0.005N		
0.1	5.58	5.22
0.2	5.56	5.30
0.3	5.68	5.26
0.4	5.62	5.31
0.5	5.62	5.26
0.6	5.62	5.26
0.7	5.62	5.28
0.8	5.63	5.25
0.9	5.59	5.31
1.0	5.61	5.31

measured using Orion 920A (001606)
comb. electrode + ATC
**cal from 4, 7, 10
** slope = 100.6 % iso = 7.00
* slope = 99.4 % cal 7 and 4

1 Mar 93
PB

Preparation of experimental batch solutions for 0.05N NaCl - $^{90}SrCl_2$ isotherm expt.

Overview: 0.05N experimental batch solutions will be prepared by adding a given volume of spiked NaCl - $SrCl_2$ to a given wt of sodium form clinoptilolite. Solutions will be contained in capped polypropylene bottles and placed in a water-shaker bath @ 25°C for 10 days. After 10 days solutions will be sampled for Na and Sr analysis to determine the change in Na and Sr concentration in solution.

1. Label and weigh PP bottles to be used.

2. Weigh out an appropriate amount (as listed in the table p. 24) of Na form clinoptilolite into pre-labeled PP bottle.

3. To each PP bottle containing zeolite, add the volume of spiked 0.05N NaSr Cl reference solution listed on the following table. Record total wt. of solution + clinoptilolite + bottle.

   - volume of spiked solutions will be added using ~~an~~ PB 3/1/93 Oxford macro pipettors (10 and 5 ml tip sizes)

4. Place solutions into shaker-water bath @ 25°C and 40 rpm.

   - label bath and surrounding area with radioactive material labels

1 Mar 93 PD

TABLE: NaSr Isotherm expt 0.05N

solution #	wt of bottle (g)	wt. zeolite to be added (g)	actual wt. zeol. added (g)	volume solution	ref used	total weight sol + zeol + bottle
1	7.7624	0.3104	0.3102	25	0.1	33.0234
2	7.9369	0.16622	0.1659	25	0.1	33.0046
3	7.8592	0.1032	0.1032	25	0.1	32.8127
4	8.0359	0.2323	0.2321	25	0.2	32.9475
5	7.7123	0.1518	0.1519	25	0.2	32.7800
6	8.0275	0.1940	0.1941	25	0.3	32.1341
7	7.9569	0.2186	0.2186	25	0.4	33.0560 3/1/93
8	7.8382	0.2653	0.2658	25	0.5	32.~~455~~ 9255
9	7.8939	0.2811	0.2809	25	0.6	33.0241
10	7.8665	0.3183	0.3182	25	0.7	33.0259
11	7.9625	0.2752	0.2756	25	0.8	33.1021
12	7.9058	0.3041	0.3035	25	0.9	33.1464
13	8.0122	0.2867	0.2867	25	1.0	33.2375
14	7.8207	0.2006	0.2005	25	1.0	32.7831
15	11.2023	0.3086	0.3088	50	1.0	61.0603
16	11.3352 3/1/93	0.2407	0.2407	50	1.0	60.9720
17	11.5603	0.1887	0.1893	50	1.0	61.1985
18	11.4846 PD 5	0.1265	0.1269	50	1.0	61.0901
19	18.8910	0.1358	0.1361	100	1.0	117.7675
20	19.0609	0.0836	0.0840	100	1.0	117.7026
	AE 240		AE 240			AE 240

BOTTLES TARED, THEN ABSOLUTE ADDED

NOT USED -

1 Mar 93

PD 1655 - Placed 0.05N NaCl-$^{90}SrCl_2$ solutions into versa-bath (mod. 236) at 25°C and 40 rpm

3 Mar 93 PD

Preparation of 0.005 N NaCl-$^{90}SrCl_2$ experimental solutions

- Solutions are prepared following the procedure outlined on p. 23.

TABLE: NaSr ISOTHERM EXPT. 0.005N

solution no.	wt. of PP bottle 3/2/93	wt. zeolite to be added	actual wt. zeol added	volume 0.005N sol.	reference used	total wt. sol + zeol + bottle	
1	~~11.4983~~ ~~11.5086~~ 11.4272	0.0961	0.0957	50	0.1	61.2202	
2	19.1330	0.1023	0.1023	100	0.1	118.3009	
3	19.2873	0.1616	0.1621	100	0.2	118.4854	
4	18.9778	0.1066	0.1061	100	0.2	117.9004	
5	19.0763	0.1367	0.1363	100	0.3	118.0163	
6	19.0610	0.1519	0.1520	100	0.4	117.8709	
7	18.9669	0.1741	0.1746	100	0.5	117.7371	
8	19.1663	0.1528	0.1532	100	3/3/93 ~~0.6~~ 0.5A	118.9593	* 3/3/93
9	18.9157	0.1632	0.1628	100	3/3/93 ~~0.7~~ 0.6	117.8533	
10	19.0046	0.1725	0.1727	100	3/3/93 ~~0.8~~ 0.7	117.6960	
11	18.9870	0.1835	0.1831	100	3/3/93 ~~0.9~~ 0.8	117.7561	
12	18.9887	0.1824	0.1821	100	3/3/93 ~~1.0~~ 0.9	117.9274	
13	18.8923	0.1710	0.1704	100	1.0 A	118.9006	* ✓
14	18.8363	0.1476	0.1478	100	1.0 A	118.8737	* ✓
15	18.9737	0.1277	0.1280	100	1.0 A	118.9111	* ✓
16	19.1403	0.1011	0.1011	100	1.0 A	119.0267	* ✓
17	18.8048	0.0730	0.0729	100	1.0	118.1~~274~~ 324 PD 3/3/93	*
18	30.6045	0.1119	0.1124	250	1.0	280.31	* +
19	30.4866	0.0576	0.0574	250	1.0	279.93	* +
20	30.2307	0.0296	0.0303	250	1.0	279.33	* +
	AE 240		AE 240	OXFORD MACRO PIPETTORS			SEE NOTES p. 26

1335 - solutions ~~1-8~~ PD 1-7 and 9-12 placed in to water bath @ 25°C and 40 rpm

* solutions which require additional spiked reference solution to be made

4 Mar 93
PB

0.05N and 0.005N isotherm expts had previously been redesigned to take advantage of the ^{90}Sr counting capabilitres and to maximize $\Delta[Sr]$ PB 3/4/93 so that error is minimized. As such, there is insufficient quantity of 0.5 and 1.0 XSr spiked reference solutions to prepare all exp. solutions.

Spiked XSr solutions 1.0A and 0.5A will be prepared from the same 0.005N stock references (1.0 and 0.5) as the spiked XSr 0.5 and XSr 1.0 made 25 Feb 93.

spike is added w/ disposable Eppendorf tips

reference solution (ESr)	spike sol label	weight spike 24A (g)	wt. bottle + spike + solution (g)	wt. bottle (g)	spike + solution wt. (g)	mR/hr @ contact
0.5	0.5A	0.1987	230.47	30.2803	200.19	0.07 mR
1.0	1.0A	0.5012	555.05	54.5558	500.49	0.08 mR
		AE 240	PM 4600	AE 240		

Prepared * exp solutions. data entered p. 25.

4 Mar 93
1100

Placed solutions # 8 and # 13-20 in water bath @ 40 rpm and 25°C

- Swipe and frisk of work area and equipment shows no activity above background

NOTES: * - solutions prepared 4 Mar 93 vice 3 Mar 93
✓ - ref spike added using volumetric pipette (100 ml) instead of oxford macro pipettor
+ - ref spike added using volumetric pipette (100 ml ×2) plus oxford pipettor (10 ml × 5)

4 Mar 93
PB

pH of spiked solutions 0.5A ESr and 1.0A ESr

Sol	pH
0.5	5.25
1.0	5.30

Orion 920A (00 1606)
comb. pH elec + ATC
* cal 4 and 7 pH
slope 99.6%

19 Mar 93
PB
0900

Removed 0.05N and 0.005N Na-Sr experimental solutions from shaker bath. Checked all caps for tightness and dried outside of each poly bottle. Exp. solutions were then placed in acrylic storage boxes.

19 Mar 93
PB

Sampling of 0.05N and 0.005N Na-Sr experimental solutions and reference solutions for analysis of ^{90}Sr using LSC.

BRAND:

- The concentration of Sr in solution will be determined by using the initial to final ^{90}Sr ratio as done previously with the 0.5N experiment.

- initial [Sr] can be calculated using wt. $SrCl_2 \cdot 6H_2O$ added to reference solutions and accounting for dilution of those solutions to their 0.05N and 0.005N counterparts.

- [^{90}Sr] can be measured using LSC. 1.0 ml aliquots of experimental solutions and 10 ml aliquots of reference solutions are counted (Cerenkov radiation counting). The ratio of initial to final ^{90}Sr is equivalent to the ratio of initial to final non-radioactive Sr => final Sr can be calculated based on this relationship.

19 Mar 93
RD

- ^{90}Sr (^{90}Y) counting efficiency is determined by counting a known amount of ^{90}Sr spike in varying concentrations. This "calibration curve" can then be applied to exp. samples to correct for efficiency.

PROCEDURE

① Remove experimental solutions from shaker bath, dry outside, place in ~~p~~ protective shield box.

② Remove a 1.0 ml aliquot (using an eppendorf pipettor w/ disposable tips) from each experimental solution and place into a pre-weighed and labeled plastic LSA vial (20 ml). Weigh vial + solution (aliquot) and record weight.

③ To each vial, add ~9.0 ml of nH_2O using an Oxford macro pipettor. Weigh vial + aliquot + nH_2O and record weight.

④ For each spiked reference solution, remove a 10 ml aliquot and place into a pre-labeled and weighed plastic LSC vial. (Use oxford macro pipettor 5/19/93 w/ disposable tips) (use 20 ml LSC vial). Weigh vial + aliquot and record weight.

⑤ From each non-spiked reference solution, remove a 10 ml sample aliquot (using OXFORD macro pipettor w/ disposable tips) and place into a pre-weighed 5/19/93 and labeled plastic LSC vial (20 ml). Weigh vial + aliquot and record weight.

⑥ Labeled and sealed LSC vials are now ready for counting.

SR005SAM.XLS 3/19/93

0.005N Na-Sr Experimental Solutions

Sample No.	LSA vial wt (g)	vial + solution aliquot (g)	vial + solution + H2O (g)	wt sample aliquot (g)	sol + H2O weight (g)	weight of exp solution following sampling (g)
1	6.8681	7.8543	16.8180	0.9862	9.9499	60.22
2	7.0368	8.0156	17.0019	0.9788	9.9651	117.30
3	6.9337	7.9160	16.9053	0.9823	9.9716	117.50
4	6.9828	7.9714	16.9674	0.9886	9.9846	116.89
5	6.9086	7.8989	16.7724	0.9903	9.8638	117.01
6	6.8857	7.8701	16.8468	0.9844	9.9611	116.85
7	6.8211	7.8057	16.7948	0.9846	9.9737	116.73
8	6.9030	7.8908	16.8891	0.9878	9.9861	117.95
9	6.9962	7.9787	16.9640	0.9825	9.9678	116.87
10	6.9604	7.9481	16.9127	0.9877	9.9523	116.71
11	7.0039	7.9888	16.9683	0.9849	9.9644	116.74
12	6.8623	7.8558	16.8416	0.9935	9.9793	116.87
13	7.0141	7.9990	16.9805	0.9849	9.9664	117.89
14	6.9369	7.9313	16.9278	0.9944	9.9909	117.87
15	6.9032	7.8971	16.8715	0.9939	9.9683	117.91
16	6.9173	7.9156	16.8922	0.9983	9.9749	118.00
17	6.8539	7.8481	16.7758	0.9942	9.9219	117.11
18	6.9689	16.9466	16.9466	9.9777	9.9777	270.28
19	6.8828	16.9392	16.9392	10.0564	10.0564	269.86
20	6.9263	16.9570	16.9570	10.0307	10.0307	269.29
ESr 0.1	7.0416	17.0980	17.0980	10.0564	10.0564	
ESr 0.2	6.8978	16.9518	16.9518	10.0540	10.0540	
ESr 0.3	6.8881	16.8952	16.8952	10.0071	10.0071	
ESr 0.4	6.8416	16.8740	16.8740	10.0324	10.0324	
ESr 0.5	6.9549	16.9823	16.9823	10.0274	10.0274	
ESr 0.5A	6.9752	17.0179	17.0179	10.0427	10.0427	
ESr 0.6	6.8835	16.9326	16.9326	10.0491	10.0491	
ESr 0.7	6.8764	16.9172	16.9172	10.0408	10.0408	
ESr 0.8	6.8845	16.9250	16.9250	10.0405	10.0405	
ESr 0.9	6.9168	16.9497	16.9497	10.0329	10.0329	
ESr 1.0	6.9287	16.9680	16.9680	10.0393	10.0393	
ESr 1.0A	6.9490	16.9922	16.9922	10.0432	10.0432	
ESr 0.1b	6.9518	16.7958	16.7958	9.8440	9.8440	
ESr 0.2b	6.8431	16.7600	16.7600	9.9169	9.9169	
ESr 0.3b	6.8863	16.7958	16.7958	9.9095	9.9095	
ESr 0.4b	6.9115	16.7621	16.7621	9.8506	9.8506	
ESr 0.5b	6.8997	16.8001	16.8001	9.9004	9.9004	
ESr 0.6b	6.8794	16.7959	16.7959	9.9165	9.9165	
ESr 0.7b	6.8945	16.8095	16.8095	9.9150	9.9150	
ESr 0.8b	6.8786	16.7720	16.7720	9.8934	9.8934	
ESr 0.9b	6.9093	16.8339	16.8339	9.9246	9.9246	
ESr 1.0b	6.8406	16.6535	16.6535	9.8129	9.8129	
Spike 9AA	6.9129	7.1625	17.2320	0.2496	10.3191	} SEE NOTE P. 31
Spike 9BB	6.9861	7.1851	17.2298	0.1990	10.2437	

EXPERIMENTAL SOLUTIONS →

← NON SPIKED REFERENCES → ← SPIKED REFERENCES →

* NOTE: NO H_2O ADDED

0.05N Na-Sr Experimental Solutions

Sample No.	LSA vial wt (g)	vial + sol (g)	vial + sol+ H2O (g)	wt sample	sol + H2O	exp sol wt	exp sol wt
1	6.9056	7.9043	16.9524	0.9987	10.0468	32.08	31.08
2	6.8638	7.8652	16.8919	1.0014	10.0281	32.03	31.04
3	6.8902	7.8896	16.9031	0.9994	10.0129	31.98	30.98
4	6.8628	7.8485	16.8469	0.9857	9.9841	32.02	31.02
5	6.8594	7.8526	16.8514	0.9932	9.9920	31.82	30.82
6	7.0057	7.9949	17.0097	0.9892	10.0040	32.24	31.24
7	6.9824	7.9749	16.9838	0.9925	10.0014		32.14
8	6.8891	7.8824	16.8873	0.9933	9.9982		31.96
9	6.9037	7.9012	16.9028	0.9975	9.9991		32.08
10	6.8968	7.8994	16.9064	1.0026	10.0096		32.04
11	6.9289	7.9213	16.9226	0.9924	9.9937		32.15
12	6.9105	7.8909	16.8562	0.9804	9.9457		32.30
13	6.8496	7.8305	16.8164	0.9809	9.9668		32.35
14	6.9499	7.9423	16.9274	0.9924	9.9775		31.87
15	6.9744	7.9697	16.9514	0.9953	9.9770		60.04
16	6.8907	7.8839	16.8736	0.9932	9.9829		59.94
17	6.8516	7.8464	16.8545	0.9948	10.0029		60.17
18	6.8410	7.8283	16.8175	0.9873	9.9765		60.09
19	6.8228	7.8145	16.7873	0.9917	9.9645		116.77
20	6.9679	7.9591	16.9550	0.9912	9.9871		116.70
ESr 0.1	6.8333	16.9008	16.9008	10.0675	10.0675		
ESr 0.2	6.9393	16.9921	16.9921	10.0528	10.0528		
ESr 0.3	6.8353	16.9091	16.9091	10.0738	10.0738		
ESr 0.4	6.8942	16.9471	16.9471	10.0529	10.0529		
ESr 0.5	6.8592	16.9505	16.9505	10.0913	10.0913		
ESr 0.6	7.0412	17.1168	17.1168	10.0756	10.0756		
ESr 0.7	6.8799	16.9305	16.9305	10.0506	10.0506		
ESr 0.8	6.9516	17.0311	17.0311	10.0795	10.0795		
ESr 0.9	6.8523	16.8791	16.8791	10.0268	10.0268		
ESr 1.0	6.8792	16.6999	16.6999	9.8207	9.8207		
ESr 0.1b	6.9105	16.9199	16.9199	10.0094	10.0094		
ESr 0.2b	6.9907	16.9516	16.9516	9.9609	9.9609		
ESr 0.3b	6.8730	16.8120	16.8120	9.9390	9.9390		
ESr 0.4b	6.8948	16.8769	16.8769	9.9821	9.9821		
ESr 0.5b	6.9081	16.8391	16.8391	9.9310	9.9310		
ESr 0.6b	7.0133	17.0125	17.0125	9.9992	9.9992		
ESr 0.7b	6.9352	16.9526	16.9526	10.0174	10.0174		
ESr 0.8b	6.9684	17.0263	17.0263	10.0579	10.0579		
ESr 0.9b	6.8474	16.8208	16.8208	9.9734	9.9734		
ESr 1.0b	6.9000	16.8864	16.8864	9.9864	9.9864		
1r	6.9996	7.9849	17.0365	0.9853	10.0369		
2r	6.8802	7.8757	16.8966	0.9955	10.0164		
3r	6.9142	7.9110	16.8453	0.9968	9.9311		
4r	6.8794	7.8670	16.8676	0.9876	9.9882		
5r	6.8670	7.8594	16.8442	0.9924	9.9772		
6r	7.0383	8.0228	17.0122	0.9845	9.9739		

After 1r-6r sampling

EXPERIMENTAL SOLUTIONS →

NON SPIKED REFERENCES → | ← SPIKED REFERENCES → |

See note p. 29 GC-09 →

19 Mar 93 PP

Results of sampling 0.05N and 0.005N Na-Sr exp/ref solutions for ^{90}Sr analysis can be found on p. 30 and p. 29 GC-09 respectively.

Notes:

0.05N - The procedure for sampling (withdrawal of solution) using epperdorf pipettors includes "wetting" the tip by filling and discharging the tip contents 2-3 times prior to actual transfer. However, after sampling solutions 1-6 I noted that discharge of the tip agitated the solution enough to suspend zeolite particles. These particles could then be withdrawn with the sample. Solutions 1-6 were resampled and the questionable aliquots labeled 1r through 6r. 1r-6r will be counted to see if zeolite carryover can be detected during counting.

Solutions 1-6 reflect after sampling weights of 1r-6r and proper sampling.

Further sampling of solutions did not include the wetting process. No zeolite carryover was observed.

0.005N - Solutions 18-20 were sampled using 10 ml aliquots so that the difference in final vs. initial [^{90}Sr] is emphasized. Expected change is small so a larger aliquot should provide better statistical constraint.

- SPIKE 9AA and 9BB were made to provide better constraint on the counting efficiency curve. Recall spike 9C ~ (2000 cpm) was anomalously low in efficiency. Spikes 9AA (~2000) and 9BB should verify that the efficiency curve is correct. Expected cpm from 9AA and 9BB are shown on next page. *added 23 Mar 93: 9AA and 9BB were made up to 10 ml using 0.05N Esr 1.0 reference solution

19 Mar 93
PD

Calculation of spike 9AA and 9BB activity.

On 1/7/93, spike 9 activity = 5.00 nCi/g
(SEE RADIOCHEM NOTEBOOK p. 157)

we know $A = A_0 e^{-\lambda t}$

where: λ = decay constant = $2.4236 \times 10^{-2}\ y^{-1}$ for ^{90}Sr

A_0 = initial activity = 5.00 nCi/g
A = final activity
t = time elapsed = 61 days = $\frac{61}{365}$ = 0.1671 years

$$A = (5.00\ nCi/g)\, e^{-(2.4236 \times 10^{-2}\, y^{-1} \cdot 0.1671\, y)}$$

$$A = 4.9798\ nCi/g$$

1 nCi = 2220 dpm

SPIKE	wt. SPIKE 9 (g)	EXPECTED ACTIVITY (dpm)
9AA	0.2496	2759.4 dpm
9BB	0.1990	2200 dpm

* NOTE: corrected activity values will also be used to determine expected dpm for 9A-9G when counted.

22 Mar 93
PD

Placed all Sr-Na 0.05N and 0.005N solutions into LSA for counting. Reset protocol #7 parameters to count for 10 min/sample. Previous Y ingrowth study shows samples will not be ready for final counting for ~ 14 days

22 Mar 93
PD

Placed ~ 50 g $CaCl_2 \cdot 2H_2O$ into convection oven @ 75°C to thoroughly dry prior to making 0.05N Na-$CaCl_2$ reference solutions.

23 Mar 93
PD

Removed $CaCl_2 \cdot 2H_2O$ from oven, placed in desiccator to cool.

- Count of Na-Sr exp solutions from previous day is complete. Spike 9AA and 9BB fit well into the expected efficiency curve, confirming previous fit.

→ Need to make additional spike 9 solutions at low concentrations to verify shape of curve vs. count rate. As of now, only #9G defines the sharp bend in the curve. other solutions of similar count rate are needed to verify this.

24 Mar 93
PD

Sampling of 0.05N and 0.005N Na-Sr-Cl experimental and reference solutions for Na analysis.

Overview: Reference and experimental solutions are analyzed for Na concentration using ion selective electrode and a 920A Orion ISE meter. Initial (ref) and final (exp.) solution concentrations are used to develop an isotherm independent of Sr data. Differences in concentration and measurement methods require that separate samples be taken for the Na analyses. A sample aliquot is taken and diluted as necessary depending* upon initial solution volume and expected Na concentration. ISA is added to all solution samples and standards. Solutions are analyzed w/ ISE.

24 Mar 93
PB

PROCEDURE:

① From each non-spiked reference solution, remove an ~10 ml aliquot using Oxford macro pipettor and disposable tips. Place aliquot into a clean, pre-weighed and labeled 15 ml PP bottle. Cap, re-weigh and record weight of bottle + aliquot.

* ~~MAX PB~~ 3/24/93 initial (ref) [Na^+] ranges from 1090 ppm to 0 ppm (0.05N → 0.005N). Since this concentration is well within typical ISE range, no dilution is necessary. Additionally, an exact volume is not required (no change due to dilution). Residual reference solution volumes are more than adequate enough to support 10 ml withdrawals.

② From each experimental solution whose volume is 50 ml or more, remove an ~10 ml aliquot using an Oxford macro pipettor and disposable tip. Place aliquot into a clean, pre-weighed and labeled 15 ml PP bottle. Cap, and record weight of bottle + aliquot. Label each bottle as radioactive material containing ^{90}Sr.

③ From each experimental solution whose volume is less than 50 ml, remove a 5 ml aliquot using a 5 ml class A vol. pipette. Be careful not to incorporate zeolite particles into the aliquot. Dispense aliquot into a pre-weighed and labeled 15 ml PP bottle. Cap and record weight of bottle + aliquot.

- Using a 5 ml class A vol. pipette, add 3/24/93 5 ml of n H_2O to each of the *~~less than 50 ml~~ aliquots. Cap and record weight of aliquot + nH_2O + bottle, label as radioactive material containing ^{90}Sr.

* (5 ml aliquots)

24 Mar 93
PB

④ To all solutions, add 1.0 ml of ionic strength adjustor for Na analysis. Record volume ISA added.

⑤ Weigh and record weight of each experimental solution following removal of sample aliquot.

24 Mar 93
PB

0.005N DATA TABLE

0.005N NaSr solutions							
Na sampling and analysis							
		3/24/93	3/24/93	3/24/93	3/24/93		3/30/93
solution #	aliquot	wt bottle	wt bottle +	H2O added	total wt	dil factor	ISA added
	(ml)	(g)	aliquot (g)	(ml)	(g)		(ml)
1	10	7.0709	17.1310	0	17.1310	1	1
2	10	7.0428	17.0898		17.0898	1	1
3	10	7.1387	17.1861		17.1861	1	1
4	10	7.0667	17.1387		17.1387	1	1
5	10	7.0602	17.1511		17.1511	1	1
6	10	7.1013	17.1812		17.1812	1	1
7	10	7.0096	17.0989		17.0989	1	1
8	10	7.2257	17.2749		17.2749	1	1
9	10	7.1068	17.2106		17.2106	1	1
10	10	7.0967	17.1811		17.1811	1	1
11	10	7.1838	17.2403		17.2403	1	1
12	10	7.2133	17.2735		17.2735	1	1
13	10	6.9328	16.9432		16.9432	1	1
14	10	6.9935	17.0779		17.0779	1	1
15	10	7.0843	17.1461		17.1461	1	1
16	10	7.0678	17.1048		17.1048	1	1
17	10	6.9480	16.9925		16.9925	1	1
18	10	6.8862	16.9252		16.9252	1	1
19	10	7.0813	17.1398	3/24/93	17.1398	1	1
20	10	7.1158	17.2139		17.2139	1	1
ESr 0.1	10	7.1587	17.2280		17.2280	1	1
ESr 0.2	10	7.1476	17.2126		17.2126	1	1
ESr 0.3	10	7.0308	17.1099		17.1099	1	1
ESr 0.4	10	6.9264	17.0009		17.0009	1	1
ESr 0.5	10	7.2348	17.3004		17.3004	1	1
ESr 0.6	10	7.1066	17.1793		17.1793	1	1
ESr 0.7	10	7.1754	17.2221		17.2221	1	1
ESr 0.8	10	6.9375	16.9915		16.9915	1	1
ESr 0.9	10	7.1484	17.2137		17.2137	1	1
ESr 1.0	10	7.0933	17.1534		17.1534	1	1

AE 240 AE 240

24 Mar 93
PB

0.05N DATA TABLE

0.05N NaSr solutions							
Na sampling and analysis							
		3/24/93	3/24/93	3/25/93	3/25/93		3/30/93
solution #	aliquot	wt bottle	wt bottle +	H2O added	total wt	dil factor	ISA added
	(ml)	(g)	aliquot (g)	(ml)	(g)		(ml)
1	5	7.1066	12.0850	5	17.0668	2	1
2	5	7.0372	12.0320	5	17.0182	2	1
3	5	7.0522	12.0422	5	17.0254	2	1
4	5	7.2353	12.2237	5	17.1999	2	1
5	5	7.0303	12.0268	5	17.0136	2	1
6	5	6.9246	11.9251	5	16.9070	2	1
7	5	6.9235 PB 3/24	11.9135	5	16.8909	2	1
8	5	7.0794	12.0790	5	17.0603	2	1
9	5	6.9664	11.9646	5	16.9393	2	1
10	5	7.0175	12.0068	5	16.9909	2	1
11	5	6.9403	11.9275	5	16.9102	2	1
12	5	6.8557	11.8531	5	16.7263	2	1
13	5	7.1554	12.1472	5	17.1294	2	1
14	5	6.9497	11.9435	5	16.9201	2	1
15	3/24/93 10 ~~5~~ PB	7.0671	17.1948	0	17.1948	3/24/93 1 ~~2~~ PB	1
16	10 ~~5~~ PB	6.9367	17.0633	↓	17.0633	1 ~~2~~ PB	1
17	10 ~~5~~ PB	6.9541	16.7844	↓	16.7844	1 ~~2~~ PB	1
18	10 ~~5~~ PB	~~9.6~~ 6.9669	17.0654	↓	17.0654	1 ~~2~~ PB	1
19	10	7.1498	17.2267	↓	17.2267	1	1
20	10	7.0594	17.1574	↓	17.1574	1	1
ESr 0.1	10	7.0188	17.0808	↓	17.0808	1	1
ESr 0.2	10	7.0428	17.1026	↓	17.1026	1	1
ESr 0.3	10	7.2161	17.2819	↓	17.2819	1	1
ESr 0.4	10	6.9345	16.9805	↓	16.9805	1	1
ESr 0.5	10	7.1316	17.2083	↓	17.2083	1	1
ESr 0.6	10	7.1052	17.1879	↓	17.1879	1	1
ESr 0.7	10	7.1257 PB 3/24	17.2083	↓	17.2083	1	1
ESr 0.8	10	7.2501	17.3074	↓	17.3074	1	1
ESr 0.9	10	7.0522	17.1013	↓	17.1013	1	1
ESr 1.0	10	7.1143	17.1618	↓	17.1618	1	1
		AE 240	AE 240		AE 240		

24 Mar 93
PB

0.05N and 0.005N exp. solution weights.

SOLUTION #	0.05N (g)	0.005N (g)
1	26.0044	50.1054
2	25.9745	107.2703
3	25.7588	107.4429
4	25.9478	106.8246
5	25.7283	106.9210
6	26.1281	106.7756
7	27.0491	106.6350
8	26.9112	107.8832
9	26.9993	106.7515
10	26.9594	106.6106
11	27.0815	106.6611
12	27.1335	106.8205
13	27.2112	107.8823
14	27.7822	107.7639
15	49.9164	107.8462
16	49.7597	107.9558
17	50.3629	107.0586
18	49.9935	* 260.23
19	106.6890	* 259.79
20	106.6270	* 259.18

- weights by AE 240 except -
* PM4600

25 Mar 93
PB

Added 5ml nH_2O to #1 – #14 0.05N exp. solutions.
Added radioactive material labels to all bottles.

26 Mar 93
PP

Conduct redesigned KCl - $CaCl_2 \cdot 2H_2O$ isotherm experiment at total normality of 0.05.

- preliminary data from previous 0.05N K-Ca expt. shows isotherm shape to be similar to that given by 0.5N Na-Sr data. Initial solution concentration zeolite wt. and solution / zeolite ratios will be optimized to mimic the 0.5N NaSr curve.

- based on the optimization spreadsheet, exp and reference solutions will be prepared by
  1. weighing KCl and $CaCl_2 \cdot 2H_2O$ to make ref solutions of 0.05 TN ranging from ECa = 0.1 to ECa = 1.0 in 0.1 increments.
  2. adding given vol reference to a specified wt of K form clinoptilolite
  3. equilibrating for at least 10 days in water shaker bath @ 40 rpm and 25°C.

- Fresh reference solutions will be prepared as given in the procedure p. 232 GC-04 except that ECa 0.1 to ECa 0.9 solutions will be 500 ml and $CaCl_2 \cdot 2H_2O$ (pre-dried and in desiccator) will be added to beaker containing ~10-15 ml nH_2O. This should minimize change in wt. of $CaCl_2 \cdot 2H_2O$ during weighing process.

- sol/vol ratio is optimized to minimize the effect of Ca and K analytical error. (seeking a large change in K or Ca concentration for each solution).

26 Mar 93
PP

K-Ca-Cl 0.05N experiment.

Procedure as found p. 232 of GC-04.

Overview:

- KCl and $CaCl_2 \cdot 2H_2O$ are weighed and mixed w/ nH_2O to make reference solutions of 0.05 TN w/ ECa from 0.1 to 1.0.

- Reference solutions are dispensed into pre-weighed and labeled PP bottles, each containing a specified amount of K-form clinoptilolite, in selected volumes.

- solutions w/ zeolite (exp. solutions) are placed in shaker baths @ 40 rpm and 25°C for ~10-15 days.

- Solutions are removed from shaker bath, sampled for Ca and K. References are sampled for Ca and K.

- Initial and final Ca and K concentrations are used to develop isotherms.

① K-Ca, weighing of KCl - $CaCl_2 \cdot 2H_2O$ for reference solutions.

KCl - Lot # Fisher 885967
$CaCl_2 \cdot 2H_2O$ - Lot # Mallinckrodt 4160 KENN

26 Mar 93
PB

EiCa (0.05N)	weight (g) CaCl2·2H2O	weight (g) KCl	solution volume (ml)	wt. CaCl2·2H2O used (g)	wt. KCl used(g)
0.1	0.1838	1.6774	500	0.1852	1.6813
0.2	0.3675	1.4910	500	0.3662	1.4918
0.3	0.5513	1.3046	500	0.5523	1.3045
0.4	0.7351	1.1183	500	0.7373	1.1183
0.5	0.9189	0.9319	500	0.9219	0.9316
0.6	1.1026	0.7455	500	1.1027	0.7462
0.7	1.2864	0.5591	500	1.2857	0.5594
0.8	1.4702	0.3728	500	1.4704	0.3721
0.9	1.6539	0.1864	500	1.6518	0 ~~0~~.1866
1.0	3.6754	0.0000	1000	3.6758	~~PB~~ 0

Total N	0.05	AE 240	AE 240
wt CaCl2·2H2O	147.0164	3/26/93	3/26/93
wt KCl	74.5513		

- all solutions above stored in 1000 ml poly propylene bottles.

29 Mar 93
PB

② Prepared experimental solutions for KCa 0.05N experiment.

K form zeolite : CDV * 100/200 * UC * WA * HL * CPT * Kf

used in all solutions. A pre-weighed PP bottle is tared and Kf clinoptilolite is dispensed into the bottle until the weight specified on the following table is reached. Actual wt zeol. is recorded. Reference solution is added and the bottle reweighed. Solution wt. is calculated by subtracting ~~total~~ ~~wt~~ wt. bottle and wt. zeol. used from total wt. 3/29/93

29 Mar 93
PB

KCA05EXP.XLS 3/29/93

KCaCl 0.05N Experimental solutions							
			3/29/93	3/29/93	3/29/93	3/29/93	3/29/93
Mixture #	Ei Ca to use	Wt zeol (g)	Wt bottle (g)	Wt zeolite used (g)	Vol soln (ml)	Total wt. (g)	Soln wt. (g)
1	0.1	0.4087	7.0536	0.4085	10	17.4591	9.9970
2	0.1	0.1401	7.0583	0.1399	10	17.1974	~~10.7765~~ PB 9.9992 3/29/93
3	0.2	0.1929	7.1251	0.1928	10	17.3363	10.0184
4	0.3	0.1911	7.0741	0.1909	10	17.2684	10.0034
5	0.4	0.1781	7.~~7~~61362 PB	0.1782	10	17.2116	9.8972
6	0.5	0.1852	7.1208	0.1852	10	17.1998	9.8938
7	0.6	0.1859	7.1208	0.1857	10	17.2934	9.9869
8	0.7	0.1975	7.2139	0.1972	10	17.3861	9.9750
9	0.8	0.1675	7.0441	0.1676	10	17.1890	9.9773
10	0.9	0.1546	7.0727	0.1545	10	17.2201	9.9929
11	0.9	0.1064	7.0619	0.1066	10	17.1626	9.9941
12	1	0.1021	7.1989	0.1023	10	17.2849	9.9807
13	1	0.1799	7.9746	0.1801	25	33.1562	25.0015
14	1	0.1242	8.0213	0.1240	25	33.1579	25.0126
15	1	0.0859	7.9442	0.0860	25	PB ~~33~~.0533	25.0231
16	1	0.1176	11.4794	0.1174	50	61.5183	49.9215
17	1	0.0786	11.4494	0.0785	50	61.4178	49.8899
18	1	0.0834	18.9346	0.0835 PB	100	118.7880	99.7699
19	1	0.0614	30.4293	0.0618	250 *	279.89	249.3989
		TARGET	AE 240	AE 240		AE 240	CALCULATED

* PM 4600

29 Mar 93
PB
1405

Solutions placed into Fisher Versa-Bath Model 236 S @ 25°C and 40 rpm for equilibration (~ 10-15 days)

1530

started 2nd counting run for 0.05N and 0.005N NaSr [Sr] samples and blanks.

~~29~~ 30 Mar 93
PB

2nd counting run complete.

3/30/93 PB — Added 1.0 ml Na ISA to each 0.05N and 0.005N NaSr experimental and reference Na sample solution. Recorded on pp. 35 and 36.

3/30/93 PB — Analysis of 0.05N and 0.005N NaSr solutions for [Na^+] using ion selective electrode.

Equipment: Orion meter mode 920 A, SN 002230
Orion combination Na^+ electrode model 86-11
w/ fill solution 90-00-10

Standards and ISA:

10 ppm	- orion	13-641-948	
100 ppm	- orion	13-641-909	
1000 ppm	- orion	13-641-747	
ISA	- orion	13-641-748	(used to make rinse solution 1ml to 100 ml)

Procedure:

- Add ISA to all samples and standards (1ml ISA to 10ml sample)
- Prepare electrode IAW manual:
  - recondition for 30 sec w/ reconditioning solution PB
  - rinse w/ Na rinse solution
  - fill reference portion of electrode
  - store in storage solution at least 2hrs.

  - discharge fill solution to clean junction, refill electrode
  - rinse
  - calibrate, determine slope.

-Calibration: 3 point calibration is best as it provides wide range of coverage and allows for automatic blank correction (when using 920A)

3/30/93 PB
- using disposable 20 ml poly beakers, dispense 10ml of each standard into beakers. PB. Add 1 ml ISA and stir bar.

- calibrate 920 A IAW manual, slope of electrode should be between 54-60 mV.

* calibration should be repeated @ least every 2 hrs to compensate for electrode drift. However, calibration may need to be repeated more often because of lab temp. variation. ATC is not employed during direct concentration measurement unless a corrected isopotential point is entered => If necessary, based on drift, I will recal. every 10 samples.

- ~~Single~~ 3/30/93 Na^+ electrode (combination) does not require an additional reference electrode (built-in). Thus measurement of solutions in 15 ml PP bottles is possible. This should reduce the possibility of spills. (important for ^{90}Sr solutions)

Measurement:

- Once calibrated the electrode can be used to measure the conc. of Na in each sample.

- Place a small stir bar into 15 ml PP sample bottle. Place bottle on stir plate and insert PB electrode. 3/30/93 read Na ppm value.

- carefully remove electrode and rinse quickly over waste container. Take care not to drip radioactive sample.

- Remove stir bar. Use stir bar retriever to lift bar out of solution, remove w/ tweezers. Rinse tweezers over waste container

3/30/93 PD

- repeat measurement for each sample

- upon completion of 10 samples, re-read calibration standards (if numbers vary by more than 2%, recal. is required, or if temp change is significant)

- record all values

3/31/93 PD

Na ISE was prepped on 3/30/93. Calibration and measurement of 0.05N and 0.005N NaSr references follow. (Note: No radioactive solutions).

3/31/93 PD

Started 3rd count run of NaSr solutions

3/31/93 PD

0.005N and 0.05N NaSr ISE analysis worksheet								
	3/31/93							
cal standards		Lot #	ORION					
	10 ppm	13-641-	948					
	100 ppm	13-641-	904					
	1000 ppm	13-641-	747					
ISA added:								
cal stds	✓							
unknowns	✓							
Solution	Na ppm	cal info	Solution	Na ppm	cal info	Solution	Na ppm	cal info
10 ppm	8.32	9.99						
100 ppm	86.3	99.9						
1000 ppm	943	999						
	slope	58.4						
005N E0.7	34.8							
" E 0.2	92.3							
" E 0.1	104							
" E 0.8	23.0							
" E 0.9	11.4							
" E 0.6	46.0							
" E 0.3 PD	57.3							
" E 0.3 PD	80.3							
" ~~E 0~~ 0.4	69.1							
" E 1.0	0							
10 cal	10.0							
100 cal	99.1							
1000 cal PD	987							
05N E0.6	467							
" E0.1	1050							
" E0.2	934							
" E0.7	351							
" E0.3	817							
" E0.8	236							
" E0.9	117							
" E0.4	700							
" E1.0	0							
" E0.5	584							
1000 cal	991							
100 cal	101							
10 cal	10.4							

NO FURTHER ENTRIES

4/1/93 RB ~~Removed~~ RB NaSr count 3rd run completed.

4/1/93 Analyzed 0.05N | 0.005N NaSr Na samples w/ISE.

0.005N and 0.05N NaSr ISE analysis worksheet								
4/1/93								
cal standards		Lot #	orion					
	10 ppm	13-641-948						
	100 ppm	13-641-909						
	1000 ppm	13-641-747						
ISA added:								
cal stds	✓							
unknowns	✓							
Solution	Na ppm	cal info	Solution	Na ppm	cal info	Solution	Na ppm	cal info
10 ppm	11.5	9.99	CALIB.	slope	58.2			
100 ppm	104	99.9	1105					
1000 ppm	1000	999						
			005N #19	9.60				
0950	slope	57.6	" #6	112				
			" #2	117				
05N #2	568		" #7	110				
" #12	258		" #9	99.9				
" #13	197		" #3	116				
" #9	393		" #10	93.7				
" #10	362		" #15	48.9				
" #15	229		" #13	62.9				
" #4	548		" #4	115				
" #8	436		10 cal	9.99				
" #20	34.9		1000 cal	995				
" #17	147		100 cal	102				
10 cal	9.38		CALIB.	slope	58.2			
100 cal	97.5		1142					
1000 cal	983							
CALIB.	slope	58.0	005N #8	106				
1030			" #20	4.59				
05N #11	295		" #17	29.1				
" #19	57.4		" #11	87.1				
" #1	577		" #1	118				
" #6	501		" #12	77.5				
" #18	104		" #18	17.9				
" #7	464		" #5	114				
" #5	535		" #16	39.0				
" #3	561		" #14	55.9				
" #14	146		10 cal	9.81				
" #16	189		100 cal	99.5				
10 cal	9.86		1000 cal	999				
100 cal	99.1							
1000 cal	999							

reanalyzed 5 May 93: reading = 5.20 ppm using 10 ppm and 5ppm stds slope 57.9 mV

NO FURTHER ENTRIES RB

4/1/93 RB Calculation of ^{90}Sr discharged into sanitary sewer following analysis of exp. NaSr solutions.

Discharge can be estimated by:

- assuming ~ 0.1 ml rinsed off electrode in waste container following each sample
- assuming ~ 70% efficiency of counting for exp. samples in LSC.
- assuming LSC count of samples on 3/29/93 represents reasonable approximation of exp. solution activity.
- knowing that 2.22 dpm = 1 pCi

For 0.005N samples, LSC values are for 1g => 0.1 times LSC count on 3/29/93 gives dpm rinsed into waste container (corrected for efficiency)

For 0.05N samples, LSC values are for 1g => 0.1 times LSC count on 3/29/93 gives dpm rinsed into waste container. Except that #1 - #14 Na samples contain only 5 ml => divide dpm by 2

Sum of all activity in container is 1867 dpm

1867 dpm = 841 pCi total

container diluted w/ 2000 ml => 0.4205 pCi/ml discharged (limit 10 pCi/ml)

After discharge ~ 50 L H_2O flushed down sink.

4/2/93 PD — started run #4 LSC for NaSr solutions

4/5/93 PD — NaSr LSC run #4 complete

4/5/93 PD — As noted on p. 33, the trend of the efficiency curve (LSC Cerenkov of ^{90}Sr) used to convert ^{90}Sr sample counts could be inaccurate if sample 9G was an anomalous sample and produced ~~[illegible]~~ PD 4/5/93 low count rates (as with 9C). To confirm the shape of the curve I will make two additional spike #9 solutions. 9CC will contain the same wt. of ^{90}Sr as 9C, and 9DD which will contain somewhat less.

spike #9 solution	wt. LSC vial	wt vial + spike 9	wt. spike 9	wt. vial + spike + ~~[illegible]~~ 10ml ESr 0.9 0.05N PD 4/5/93
9CC	6.9374 g	6.9481 g	0.0107 g	17.1311 g
9DD	6.8678 g	6.8700 g	0.0022 g	16.9936 g

	total wt solution (spike + ESr 0.9)	wt of ESr 0.9
9CC	10.1937 g	10.1830
9DD	10.1258 g	10.1236

expected activity of 9CC and 9DD based on spike 9 activity as of 19 Mar 93.

	wt spike 9	expected dpm
9CC	0.0107 g	118.3
9DD	0.0022 g	~~22~~ PD 24.3 4/5/93

4/5/93 PD — started run #5 for NaSr LSC

4/8/93 PD — collected run #5 data, started run #6 (still @ 10 min/sample)

4/9/93 PD — Run #6 complete

4/11/93 PD — edited protocol 7 (Cerenkov Sr-90) to count to 2% 2S in region A. Bret L. started counting run #1 of 3 2% 2S runs. The 3 2% 2S runs will be used to determine [Sr] concentration

4/15/93 PD 2

```
Protocol #: 7        Name:CERENKOV Sr-90            11-Apr-93    10:59
Region A: LL-UL= 0.0-30.0  Lcr=   0  Bkg= 0.00  %2 Sigma=2.00
Region B: LL-UL=30.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.50
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =999.99      QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode
```

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
	1A 1	1.22	8245.80	1.99	38.52	8284.43	30.958	
	2	2.47	4052.23	2.00	26.32	4078.54	31.102	
	3	4.77	2096.86	2.00	16.35	2113.00	31.342	
	4	12.41	805.88	2.00	12.09	817.97	32.865	
	5	24.54	407.50	2.00	10.47	418.01	34.631	
	6	49.83	200.70	2.00	8.27	208.99	37.501	
SPIKE 9	9G 7	111.85	89.41	2.00	8.11	97.52	45.263	
	1AA 8	5.07	1973.37	2.00	17.36	1990.73	31.787	
	9	6.38	1570.06	2.00	18.18	1588.09	32.142	
	10	106.73	93.69	2.00	8.63	102.32	45.529	
	1DD 11	343.12	29.16	2.00	7.59	36.75	68.947	
	(1 missing vial)							
	05N 13	754.79	13.25	2.00	7.53	20.77	98.138	
	05N 14	763.97	13.09	2.00	7.79	20.88	100.88	
	(2 missing vials)							
2SN FED	1R 17	85.60	116.82	2.00	8.05	124.87	38.308	
	18	18.02	554.99	2.00	9.32	564.32	28.731	
	19	32.28	309.85	2.00	9.82	319.64	35.949	
	20	30.70	325.90	2.00	7.72	333.62	30.712	
	21	24.63	406.17	2.00	8.53	414.70	31.986	
	2R 22	21.77	459.35	2.00	8.54	467.89	30.669	
	(2 missing vials)							
2SN EXPS	#1 25	628.76	15.91	2.00	7.74	23.65	92.348	
	26	320.27	31.23	2.00	7.81	39.04	67.945	
	27	411.56	24.30	2.00	7.79	32.09	76.132	
	28	143.06	69.91	2.00	8.05	77.97	50.208	
	29	157.43	63.52	2.00	8.26	71.78	52.447	
	30	126.73	78.92	2.00	8.87	87.79	48.504	
	31	97.59	102.48	2.00	8.72	111.19	44.561	
	32	61.39	162.91	2.00	9.90	172.81	41.278	
	33	48.54	206.04	2.00	9.50	215.53	39.118	
	#10 34	43.79	228.36	2.00	9.09	237.45	37.848	
	(2 missing vials)							
2SN EXPS	#11 37	38.18	261.94	2.00	9.53	271.45	36.899	
	38	32.29	309.69	2.00	10.81	320.50	36.828	
	39	27.01	370.46	2.00	10.11	380.53	36.030	
	40	23.58	424.09	2.00	10.77	434.86	35.518	
	41	20.95	477.33	2.00	10.60	487.92	35.014	
	42	18.58	538.32	2.00	12.00	550.32	35.295	
	43	14.84	674.26	2.00	11.93	686.19	33.980	
	44	1.38	7268.84	2.00	60.87	7329.71	32.903	
	45	1.25	8056.00	1.99	56.00	8112.80	32.653	
	#20 46	1.19	8447.90	1.99	68.91	8516.81	32.605	
	(2 missing vials)							
2SN EXPS	49	1.27	7912.60	2.00	57.48	7970.08	32.177	
	50	1.30	7703.08	2.00	60.00	7763.08	32.617	
	51	1.28	7846.88	2.00	63.28	7910.16	32.507	
	0.452	1.30	7701.54	2.00	70.77	7772.31	32.907	

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

4/15/93
PB

2%25 run #1 | 11 Apr cont'd

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
0.5	53	1.28	7816.41	2.00	68.75	7885.16	32.701	
	54	1.28	7858.59	1.99	58.59	7917.19	32.484	
	55	1.28	7838.28	2.00	56.25	7894.53	32.477	
	56	1.26	7950.79	2.00	66.67	8016.67	32.727	
	57	1.24	8082.26	2.00	67.74	8150.00	32.492	
1.0	58	1.14	8798.25	2.00	85.09	8882.46	32.793	
0.5A	59	1.24	8108.87	1.99	83.06	8191.94	32.777	
1.0A	60	1.23	8148.78	2.00	70.73	8218.70	32.799	
	(2 missing vials)							
	#1 63	140.40	71.23	2.00	8.12	79.34	49.305	
	64	69.63	143.63	2.00	8.32	151.95	40.850	
	65	32.87	304.23	2.00	9.89	314.12	36.963	
	66	52.15	191.83	2.00	10.07	201.88	39.954	
	67	28.46	351.48	2.00	10.33	361.81	36.289	
	68	27.23	367.24	2.00	11.24	378.48	36.781	
	69	24.42	409.54	2.00	10.69	420.23	35.439	
	70	24.49	408.37	2.00	10.33	418.70	35.351	
	71	22.78	439.03	2.00	9.48	448.51	35.355	
	#10 72	22.74	439.89	2.00	10.55	450.44	35.275	
	(2 missing vials)							
	#11 75	19.48	513.60	2.00	11.34	524.95	35.190	
	76	20.16	496.18	2.00	11.26	507.44	35.012	
	77	19.33	517.54	2.00	11.54	529.07	34.769	
	78	16.64	601.02	2.00	11.72	612.74	34.595	
	79	15.40	649.87	2.00	11.95	661.82	34.379	
	80	14.72	679.69	2.00	12.16	691.85	34.115	
	81	14.45	692.32	2.00	13.56	705.95	34.296	
	82	13.51	740.93	2.00	13.25	754.18	34.588	
	83	13.14	761.03	2.00	13.55	774.66	34.153	
	#20 84	13.08	764.83	2.00	14.22	779.05	34.090	
	(2 missing vials)							
	87	1.23	8156.91	2.00	65.04	8221.95	32.520	
	88	1.24	8079.03	2.00	70.16	8149.19	32.277	
	89	1.24	8126.61	1.99	64.52	8191.13	31.774	
	90	1.25	8053.60	1.99	54.40	8108.00	32.477	
	91	1.24	8094.35	2.00	65.32	8159.68	32.441	
	92	1.24	8079.84	2.00	68.55	8148.39	32.128	
	93	1.24	8096.77	2.00	53.23	8150.00	32.369	
	94	1.23	8153.66	2.00	63.41	8217.07	32.892	
	95	1.27	7928.35	1.99	76.38	8004.72	32.655	
1.0	96	1.29	7782.95	2.00	71.32	7854.26	32.529	

4/15/93
PB

Removed 0.05N K-Ca-Cl experimental solutions from water bath. Dried each bottle, swirled by hand for 15-20 sec. (each)

Each reference and exp. solution will be sampled for subsequent analysis for Ca and K.

Because some exp. solution volumes are small, 1 or 2 ml aliquots will be taken. These will be diluted to 10 ml using vol flasks and nH_2O. All samples will be placed into clean, pre-labeled PP containers.

4/15/93
PB

Data table for K-Ca-Cl 0.05N Sampling.

0.05N K-Ca-Cl Sampling worksheet

Solution	K aliquot (ml)	4/15/93 nH2O added to K (ml)	4/15/93 dil. factor	ISA added (ml)	Ca aliquot (ml)	4/15/93 nH2O added to Ca (ml)	4/15/93 dil. factor	ISA added (ml)	4/16/93 final solution weight (g)
References									
ECa 0.1	10	1	1		10	1	1		1
0.2	10	1	1		10	1	1		1
0.3	10	1	1		10	1	1		1
0.4	10	1	1		10	1	1		1
0.5	10	1	1		10	1	1		1
0.6	10	1	1		10	1	1		1
0.7	10	1	1		10	1	1		1
0.8	10	1	1		10	1	1		1
0.9	10	1	1		10	1	1		1
1.0	10	1	1		10	1	1		1
Experimental 4/16/93		4/16/93	4/16/93		4/16/93	4/16/93	4/16/93		
1	1	9	10		1	9	10		15.4058
2	1	9	10		1	9	10		15.1671
3	1	9	10		1	9	10		15.2833
4	1	9	10		1	9	10		15.2179
5	1	9	10		1	9	10		~~15.1515~~ 15.1706
6	1	9	10		1	9	10		15.1444
7	1	9	10		1	9	10		15.2538
8	1	9	10		1	9	10		15.3494
9	1	9	10		1	9	10		15.1345
10	1	9	10		1	9	10		15.1803
11	1	9	10		1	9	10		15.1141
12	1	9	10		1	9	10		15.2408
13	2	8	5		2	8	5		29.1283
14	2	8	5		2	8	5		29.1037
15	2	8	5		2	8	5		28.9947
16	1	1	1		1	1	1		41.4251
17	1	1	1		1	1	1		41.3005
18	1	1	1		1	1	1		98.6311
19	1	1	1		1	1	1		259.74

ORIGINAL EXPERIMENTAL SOLUTIONS
Ca 240 cycle * (Ppm Ca)

4/20/93 PD

Calculation of spike 9 activity to be used in Cerenkov efficiency calculations (activity as of 7 Apr 93).

Activity of spike #9 on 2/7/92 = 5.11 nCi/g

since $A = A_0 e^{-\lambda t}$, where A = activity at elapsed time t
A_0 = initial activity
λ = decay constant
t = elapsed time

and

$$\lambda = \frac{\ln 2}{t_{1/2}}$$ where $t_{1/2}$ = nuclide half-life (28.6 years for ^{90}Sr)

$$\lambda = \frac{\ln 2}{28.6\,y} = 2.4236 \times 10^{-2}\ y^{-1}$$

we can calculate the activity of spike #9 on 4/7/93. If we assume 1 year = 365.25 days, then:

$$A_{(4/7/93)} = (5.11\ nCi/g)\, e^{-(2.4236 \times 10^{-2}\, y^{-1})\left(\frac{425}{365.25}\right)}$$

$$A = (5.11\ nCi/g)\, e^{-(0.0282)}$$

$$A = 4.9679\ nCi/g$$

$1\ Ci = 3.7 \times 10^{10}$ dps $= 2.22 \times 10^{12}$ dpm
$\Rightarrow 1\ nCi = 2.22 \times 10^{3}$ or 2220 dpm

$\therefore$ Spike #9 should give $(4.9679\ nCi/g)\left(\frac{2220\ dpm}{nCi}\right) =$

11,028.738 or 11,028.74 dpm/g

4/20/93

For each spike #9 solution, we can calculate an expected dpm

solution	wt. spike #9 (g)	calculated dpm
9A	1.0266	11,322.1
9B	0.5160	5690.8
9C	0.2823	3113.4
9D	0.1009	1112.8
9E	0.0498	549.2
9F	0.0244	269.1
9G	0.0106	116.9
9AA	0.2496	2752.8
9BB	0.1990	2194.7
9CC	~~0.90~~ 0.0107	118.0
9DD	0.0022	24.3

5 May 93 PD

Calculation of Sr concentration using LSC data, 0.05N and 0.005N NaSr-Cl solutions.

Overview:

LSC data is used to determine final Sr ppm by using the relationship:

$$Sr_f\ ppm = \frac{Sr_f\ dpm \cdot Sr_i\ ppm}{Sr_i\ dpm}$$

Initial and final dpm values are corrected for Cerenkov counting efficiency (using spike #9 calibration) and wt of ^{90}Sr added to each solution. Three LSA counting runs are performed at the 2% 2σ level and averaged (after bkgnd correction) to provide LSC data that is corrected for efficiency.

The following pages contain LSC output for ~~run 1~~ runs #2 and #3, efficiency calculation curves, and ppm calculation summary tables.

5 may 93
PD

LSC count data from 21 Apr 93

Protocol #: 7 Name:CERENKOV Sr-90 21-Apr-93 13:14
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
	#A 1	1.24	8074.19	2.00	40.32	8114.52	30.314	
	2	2.48	4034.27	2.00	20.16	4054.44	30.654	
	3	4.83	2072.67	2.00	15.53	2087.99	31.210	
	4	12.36	809.55	2.00	11.89	821.44	32.429	
	5	24.70	404.90	2.00	9.07	413.97	33.887	
	6	49.16	203.44	2.00	8.20	211.64	37.243	
	7	110.98	90.12	2.00	8.20	98.32	45.580	
	8	5.09	1966.21	2.00	20.04	1986.05	31.786	
	9	6.30	1589.21	2.00	17.14	1606.35	32.300	
	10	107.28	93.21	2.00	8.31	101.54	44.702	
	11	339.84	29.43	2.00	7.68	37.11	69.234	
	(1 missing vial)							
Blank	13	774.97	12.90	2.00	7.35	20.25	96.935	
	(3 missing vials)							
	17	86.90	115.09	2.00	8.35	123.44	38.380	
	18	18.49	540.83	2.00	8.17	548.95	27.628	
	19	32.35	309.15	2.00	9.52	318.67	35.007	
	20	30.17	331.52	2.00	8.05	339.58	29.578	
	21	24.96	400.84	2.00	8.49	409.33	31.134	
	22	21.95	455.72	2.00	8.97	464.69	31.135	
	(2 missing vials)							
	#1 25	632.32	15.81	2.00	7.64	23.45	90.043	
	26	322.09	31.05	2.00	7.72	38.78	66.485	
	27	412.06	24.27	2.00	7.52	31.79	73.615	
	28	143.68	69.60	2.00	7.76	77.37	49.225	
	29	158.48	63.10	2.00	8.13	71.23	51.200	
	30	125.56	79.65	2.00	8.14	87.79	47.220	
	31	101.38	98.65	2.00	8.51	107.16	44.242	
	32	61.61	162.33	2.00	8.16	170.49	38.784	
	33	49.28	202.96	2.00	9.70	212.68	38.077	
	#10 34	44.64	224.01	2.00	8.83	232.84	37.450	
	(2 missing vials)							
	#11 37	38.10	262.49	2.00	8.37	270.87	35.295	
	38	31.99	312.63	2.00	9.50	322.13	35.787	
	39	26.61	375.80	2.00	8.94	384.78	34.803	
	40	23.04	434.03	2.00	10.29	444.31	34.309	
	41	21.07	474.70	2.00	9.87	484.58	33.660	
	42	18.37	544.42	2.00	9.64	554.00	33.005	
	43	14.99	667.11	2.00	10.07	677.18	32.828	
	44	1.36	7366.91	2.00	40.44	7407.35	31.537	
	45	1.22	8247.54	1.99	53.28	8300.00	31.370	
	#20 46	1.18	8530.51	1.99	50.00	8581.36	31.866	
	(2 missing vials)							
	49	1.25	8036.80	2.00	29.60	8066.40	31.048	
	50	1.28	7818.75	2.00	39.84	7858.59	30.936	
	51	1.30	7723.08	2.00	35.38	7758.46	31.010	
	52	1.26	7952.38	2.00	51.59	8003.97	31.285	
	53	1.29	7794.57	1.99	46.51	7841.09	31.557	

SPIKE 9
OS REPS
OS EXPS
OS EXPS
OS REPS

5 may 93
PD

21 Apr 93 data, cont'd

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
OS REPS	54	1.28	7850.00	2.00	57.81	7907.81	31.278	
	55	1.28	7835.94	2.00	46.09	7882.03	31.075	
	56	1.24	8108.06	1.99	47.58	8155.65	31.237	
	57	1.27	7926.77	1.99	44.09	7970.87	31.222	
	58	1.13	8897.34	1.99	46.02	8943.36	31.456	
	59	1.23	8165.85	2.00	52.03	8217.89	31.294	
	60	1.25	8005.60	2.00	60.00	8065.60	31.370	
	(2 missing vials)							
OS EXPS	#1 63	139.68	71.59	2.00	7.87	79.46	48.031	
	64	67.94	147.19	2.00	8.33	155.52	39.339	
	65	32.99	303.12	2.00	9.21	312.34	35.624	
	66	51.96	192.47	2.00	9.06	201.54	38.065	
	67	28.69	348.66	2.00	8.89	357.55	34.345	
	68	26.40	378.86	2.00	10.19	389.09	35.181	
	69	24.20	413.51	2.00	9.67	423.18	34.436	
	70	24.47	408.79	2.00	10.34	419.17	34.469	
	71	23.04	434.11	2.00	9.20	443.32	33.707	
	#10 72	22.78	439.03	2.00	9.53	448.55	34.160	
	(2 missing vials)							
OS EXPS	#11 75	19.26	518.67	2.00	10.84	529.56	33.919	
	76	20.13	496.82	2.00	10.18	507.00	33.522	
	77	19.22	520.29	2.00	10.15	530.44	34.005	
	78	16.57	603.50	2.00	10.56	614.12	33.371	
	79	15.28	654.71	2.00	10.67	665.31	33.203	
	80	14.65	682.73	2.00	11.40	694.13	33.222	
	81	14.27	701.26	2.00	10.51	711.77	33.175	
	82	13.61	735.05	2.00	10.95	746.00	33.141	
	83	13.21	757.15	2.00	11.58	768.74	32.995	
	#20 84	12.89	775.80	2.00	11.09	786.89	33.228	
	(2 missing vials)							
OS REPS	87	1.23	8133.33	2.00	44.72	8178.05	30.907	
	88	1.24	8064.52	2.00	49.19	8113.71	30.494	
	89	1.25	8044.00	1.99	40.80	8084.80	31.030	
	90	1.25	8061.60	1.99	48.00	8109.60	31.386	
	91	1.23	8134.96	2.00	49.59	8184.55	31.683	
	92	1.23	8160.98	2.00	51.22	8212.20	31.083	
	93	1.26	7972.22	2.00	53.97	8026.19	31.595	
	94	1.23	8158.54	2.00	52.85	8211.38	31.419	
	95	1.27	7896.06	2.00	43.31	7938.58	31.273	
	96	1.28	7855.47	1.99	43.75	7899.22	31.370	

* system normalization performed but does not appear on these pages.

region of interest = CPM A

blank = background

5 May 93
PD

Usc data from 26 Apr 93

Protocol #: 7 Name:CERENKOV Sr-90 26-Apr-93 10:30
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
	9A 1	1.25	8020.00	2.00	39.20	8059.20	30.870	
	2	2.51	3992.03	2.00	35.86	4027.49	31.237	
	3	4.86	2061.11	2.00	16.26	2077.37	31.405	
	4	12.44	803.94	2.00	11.01	814.95	32.390	
	5	24.84	402.58	2.00	9.30	411.88	34.045	
	6	50.04	199.84	2.00	8.25	208.09	37.805	
	9A 7	111.05	90.05	2.00	7.56	97.60	44.453	
	9AA 8	5.09	1965.62	2.00	21.81	1987.43	32.518	
	9	6.53	1532.92	2.00	16.08	1549.16	32.129	
	10	106.05	94.30	2.00	8.44	102.74	45.734	
	10DD 11	342.32	29.21	2.00	7.67	36.89	70.220	
	(1 missing vial)							
BLANK	13	761.41	13.13	2.00	7.44	20.57	97.448	
	(3 missing vials)							
	1R 17	86.67	115.38	2.00	7.68	123.05	37.963	
	18	18.24	548.36	2.00	9.54	557.89	28.605	
	19	32.39	308.77	2.00	9.20	317.97	35.146	
	20	30.25	330.58	2.00	8.73	339.34	30.756	
	21	24.25	412.49	2.00	8.74	421.24	31.738	
	6R 22	21.91	456.55	2.00	10.27	466.86	31.960	
	(2 missing vials)							
	25	640.43	15.61	2.00	7.68	23.30	92.474	
	26	322.32	31.03	2.00	8.09	39.12	68.286	
	27	413.90	24.16	2.00	7.73	31.89	75.081	
	28	143.10	69.89	2.00	8.20	78.09	50.503	
	29	162.24	61.64	2.00	7.94	69.58	51.573	
	30	127.26	78.59	2.00	7.97	86.56	47.032	
	31	97.05	103.05	2.00	8.81	111.85	44.235	
	32	61.40	162.87	2.00	9.10	171.97	40.767	
	33	49.15	203.46	2.00	9.30	212.76	38.750	
	B10 34	44.40	225.23	2.00	9.28	234.50	37.769	
	(2 missing vials)							
	37	38.45	260.10	2.00	9.34	269.44	36.327	
	38	33.24	300.90	2.00	9.42	310.32	36.086	
	39	26.91	371.61	2.00	10.11	381.72	35.572	
	40	23.82	419.82	2.00	9.87	429.68	35.006	
	41	21.02	475.74	2.00	10.89	486.58	35.102	
	42	18.70	534.92	2.00	10.59	545.51	34.672	
	43	14.98	667.89	2.00	11.62	679.44	33.392	
	44	1.38	7280.43	2.00	50.72	7331.16	31.774	
	45	1.24	8115.32	1.99	61.29	8175.81	32.644	
	B20 46	1.18	8500.00	2.00	66.10	8566.95	32.492	
	(2 missing vials)							
	49	1.26	7940.48	2.00	53.97	7994.44	31.799	
	50	1.26	7946.03	2.00	66.67	8012.70	31.794	
	51	1.27	7918.11	1.99	62.20	7980.31	31.979	
	52	1.30	7710.00	2.00	44.62	7754.62	31.928	
	53	1.27	7926.77	1.99	55.91	7981.89	32.342	

5 May 93
PD

Data from 26 Apr 93, cont'd

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
	54	1.26	7957.94	2.00	65.87	8023.81	32.277	
	55	1.29	7813.18	1.99	52.71	7865.12	32.247	
	56	1.26	7948.41	2.00	60.32	8008.73	32.144	
	57	1.26	7963.49	2.00	58.73	8021.43	32.146	
	58	1.15	8728.70	2.00	71.30	8800.00	32.005	
	59	1.23	8134.15	2.00	50.41	8184.55	32.256	
	60	1.22	8223.77	2.00	52.46	8276.23	31.959	
	(2 missing vials)							
	B1 63	140.86	70.99	2.00	8.01	79.00	49.418	
	64	68.79	145.43	2.00	8.17	153.60	40.567	
	65	33.36	299.82	2.00	8.87	308.66	36.485	
	66	51.57	193.95	2.00	9.09	203.04	38.435	
	67	28.60	349.72	2.00	10.10	359.83	35.405	
	68	26.64	375.38	2.00	9.80	385.17	35.319	
	69	23.84	419.63	2.00	11.28	430.91	35.234	
	70	24.61	406.58	2.00	9.91	416.50	35.432	
	71	23.23	430.56	2.00	10.46	441.02	34.660	
	B10 72	22.74	439.75	2.00	10.03	449.78	34.796	
	(2 missing vials)							
	B11 75	19.94	501.55	2.00	10.48	512.04	35.211	
	76	20.35	491.89	2.00	10.32	502.21	34.659	
	77	19.24	519.75	2.00	9.72	529.47	34.320	
	78	16.84	594.42	2.00	12.77	607.19	34.868	
	79	15.36	651.24	2.00	11.52	662.76	33.455	
	80	14.81	675.49	2.00	10.87	686.29	33.961	
	81	14.01	714.42	2.00	10.56	724.98	33.558	
	82	13.90	719.86	2.00	12.37	732.23	33.160	
	83	13.39	747.05	2.00	11.80	758.85	33.615	
	B20 84	13.02	768.20	2.00	12.29	780.49	33.503	
	(2 missing vials)							
	87	1.26	8000.00	1.99	67.46	8067.46	32.169	
	88	1.27	7934.65	1.99	62.20	7996.85	31.872	
	89	1.25	8060.00	1.99	57.60	8117.60	31.864	
	90	1.23	8194.31	1.99	60.98	8254.47	32.126	
	91	1.23	8184.55	1.99	56.91	8241.46	31.721	
	92	1.24	8067.74	2.00	73.39	8141.13	32.324	
	93	1.26	7991.27	1.99	58.73	8050.00	32.298	
	94	1.24	8127.42	1.99	54.84	8182.26	32.086	
	95	1.27	7892.91	2.00	56.69	7949.61	32.327	
	96	1.30	7722.31	2.00	63.85	7786.15	31.696	

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

region of interest = CPMA

blank = background

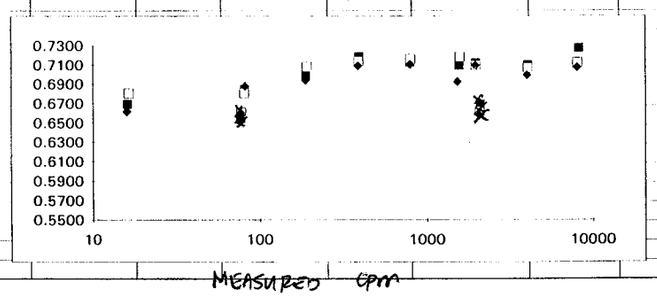
5 May 93
PD

Efficiency of counting vs. measured count rate (spike #9)

05EFF.XLS 5/5/93

0.05N and 0.005N Sr-90 Efficiency data

	Solution	2% 2S 4/11/93	corr 4/11/93	2% 2S 4/21/93	corr 4/21/93	2% 2S 4/26/93	corr 4/26/93	calc dpm	eff 4/11/93	eff 4/21/93	eff 4/26/93
	9A	8245.90	8233	8074.19	8061.29	8020.00	8006.87	11322.1	0.7272	0.7120	0.7072
	9B	4052.23	4039.33	4034.27	4021.37	3992.03	3978.90	5690.8	0.7098	0.7066	0.6992
x	9C	2096.86	2083.96	2072.67	2059.77	2061.11	2047.98	3113.4	0.6694	0.6616	0.6578
	9D	805.88	792.98	809.55	796.65	803.94	790.81	1112.8	0.7126	0.7159	0.7106
	9E	407.50	394.6	404.90	392	402.58	389.45	549.2	0.7185	0.7138	0.7091
	9F	200.70	187.8	203.44	190.54	199.84	186.71	269.1	0.6979	0.7081	0.6938
x	9G	89.41	76.51	90.12	77.22	90.05	76.92	116.9	0.6545	0.6606	0.6580
	9AA	1973.37	1960.47	1966.21	1953.31	1965.62	1952.49	2752.8	0.7122	0.7096	0.7093
	9BB	1570.06	1557.16	1589.21	1576.31	1532.92	1519.79	2194.7	0.7095	0.7182	0.6925
	9CC	93.69	80.79	93.21	80.31	94.30	81.17	118	0.6847	0.6806	0.6879
	9DD	29.16	16.26	29.43	16.53	29.21	16.08	24.3	0.6691	0.6802	0.6617
	avg bkgnd	13.2		12.9		13.1					



x - not used in efficiency calculations

5 May 93
PD

because efficiency varies w/ cpm, the efficiency data is fit using Tablecurve. The resulting equations provide a means to convert measured cpm values for exp. solutions to dpm.

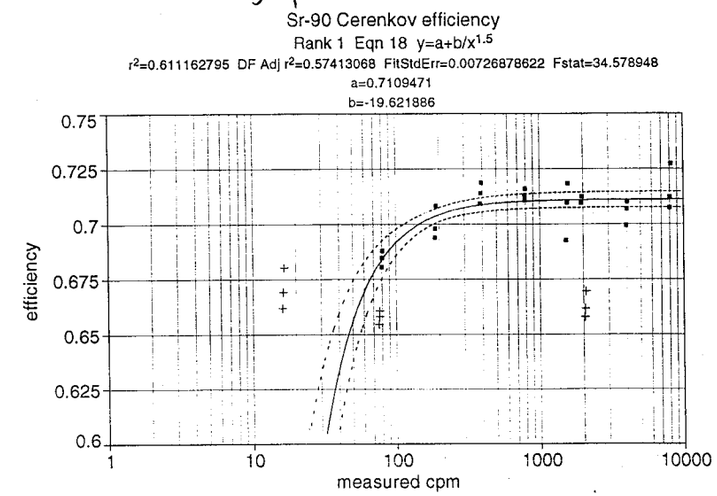
Fit of data is broken down into 2 segments, a high range and a low range, to better mimic the data trend.

The high and low fits are shown, followed by a summary plot.

5 May 93
PD

Fit for high cpm region

c:\tblcurve\sreffhrg.prn



Rank 1 Eqn 18 $y=a+b/x^{1.5}$

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.6111627952	0.5741306805	0.0072687862	34.578948025

Parm	Value	Std Error	t-value	95% Confidence Limits	
a	0.710947096	0.001696422	419.0863465	0.707427636	0.714466556
b	-19.6218861	3.336835999	-5.88038672	-26.5446116	-12.6991606

4 May 93 -
Fit used to calculate efficiency of counting at 100 cpm corrected and above.

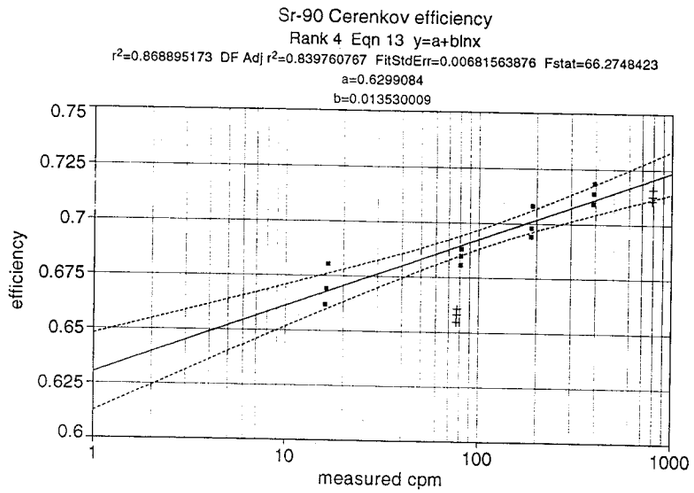
+ = indicates not used in computing fit

dashed lines are 95% confidence limits

5 May 93
PD

Fit for low cpm region

~~sreffig.prn~~ PD c:\tblcurve\sreffsm.prn



Rank 4 Eqn 13 y=a+blnx

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.8688951731	0.8397607671	0.0068156388	66.274842327

Parm	Value	Std Error	t-value	95% Confidence Limits	
a	0.629908401	0.007890757	79.82864220	0.612282394	0.647534408
b	0.013530009	0.001661972	8.140936207	0.009817573	0.017242445

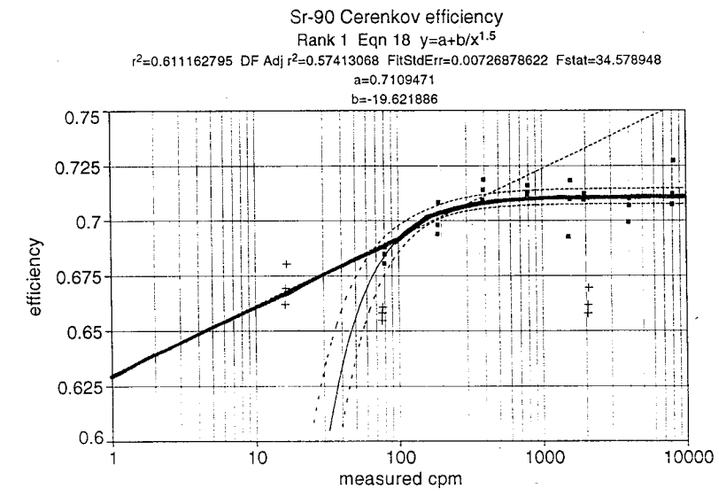
4 May 93 -

Fit used to calculate efficiency of counting below 100 cpm corrected.

+ = indicates not used in fit
dashed lines indicate 95% confidence limit

5 May 93
PD

Combination of high and low fits



Rank 1 Eqn 18 $y=a+b/x^{1.5}$

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.6111627952	0.5741306805	0.0072687862	34.578948025

Parm	Value	Std Error	t-value	95% Confidence Limits	
a	0.710947096	0.001696422	419.0863465	0.707427636	0.714466556
b	-19.6218861	3.336835999	-5.88038672	-26.5446116	-12.6991606

4 May 93 - Efficiency determination

TEST USED TO CALCULATE EFFICIENCY

≥100 cpm (bkgnd corrected)
$= y = a + b/x^{1.5}$ $a = 0.711$
$b = -19.622$

< 100 cpm (bkgnd corrected)
$= y = a + b\ln x$ $a = 0.630$
$b = 0.0135$

combination curve shown in green

12 May 93
PB

0.05N NaSr : Sr concentration calculation table

SR05PPM.XLS 5/5/93

0.05N Sr concentration calculations

Date	4/11/93 measured cpm	bkgnd correction	4/21/93 measured cpm	bkgnd correction	4/26/93 measured cpm	bkgnd correction	avg corr cpm	P.61 GC-09 eff corr dpm	samp wt (g)	final dpm per gram	ref used	initial dpm per gram	initial ppm	final ppm
solution	cpm	correction	cpm	correction	cpm	correction								
bkgnd	13.09		12.90		13.13									
experimental														
1	71.23	58.14	71.59	58.69	70.99	57.86	58.23	85.02351	0.9987	85.13418	0.1	1129.369	219	16.50868
2	143.63	130.54	147.19	134.29	145.43	132.30	132.38	189.6197	1.0014	189.3546	0.1	1129.369	219	36.71843
3	304.23	291.14	303.12	290.22	299.02	286.69	289.35	409.2568	0.9994	409.5025	0.1	1129.369	219	79.40811
4	191.83	178.74	192.47	179.57	193.95	180.82	179.71	255.6857	0.9857	259.395	0.2	1121.132	438	101.3396
5	351.48	338.39	348.66	335.76	349.72	336.59	336.91	475.9826	0.9932	479.2414	0.2	1121.132	438	187.2284
6	367.24	354.15	378.86	365.96	375.38	362.25	360.79	509.4873	0.9892	515.0499	0.3	1125.887	657	300.552
7	409.54	396.45	413.51	400.61	419.63	406.50	401.19	566.2015	0.9925	570.4801	0.4	1131.908	876	441.5029
8	408.37	395.28	408.79	395.89	406.58	393.45	394.87	557.3376	0.9933	561.097	0.5	1132.448	1095	542.5424
9	439.03	425.94	434.11	421.21	430.56	417.43	421.53	594.7611	0.9975	596.2518	0.6	1129.313	1314	693.7621
10	439.89	426.80	439.03	426.13	439.75	426.62	426.52	601.7682	1.0026	600.2076	0.7	1120.54	1533	821.138
11	513.60	500.51	518.67	505.77	501.55	488.42	498.23	702.4934	0.9924	707.8732	0.8	1134.972	1752	1092.709
12	496.18	483.09	496.82	483.92	491.89	478.76	481.92	679.5834	0.9804	693.1695	0.9	1107.166	1971	1233.995
13	517.54	504.45	520.29	507.39	519.75	506.62	506.15	713.6188	0.9809	727.5144	1.0	1113.378	2191	1431.664
14	601.02	587.93	603.50	590.60	594.42	581.29	586.61	826.6503	0.9924	832.9809	1.0	1113.378	2191	1639.21
15	649.87	636.78	654.71	641.81	651.24	638.11	638.90	900.1318	0.9953	904.3824	1.0	1113.378	2191	1779.72
16	679.69	666.60	682.73	669.83	675.49	662.36	666.26	938.5854	0.9932	945.0115	1.0	1113.378	2191	1859.674
17	692.32	679.23	701.26	688.35	714.42	701.29	689.63	971.4194	0.9948	976.4972	1.0	1113.378	2191	1921.634
18	740.93	727.84	755.05	722.15	719.86	706.73	718.91	1012.57	0.9973	1015.312	1.0	1113.378	2191	1998.016
19	761.03	747.94	757.15	744.25	747.05	733.92	742.04	1045.079	0.9917	1053.826	1.0	1113.378	2191	2073.808
20	764.83	751.74	775.80	762.90	768.20	755.07	756.57	1065.506	0.9912	1074.966	1.0	1113.378	2191	2115.408
references														
0.1	8156.91	8143.82	8133.33	8120.43	8000.00	7986.87	8083.71	11369.92	10.0675	1129.369			219	
0.2	8079.03	8065.94	8064.52	8051.62	7934.65	7921.52	8013.03	11270.51	10.0528	1121.132			438	
0.3	8126.61	8113.52	8044.00	8031.10	8060.00	8046.87	8063.83	11341.97	10.0738	1125.887			657	
0.4	8053.6	8040.51	8061.60	8048.70	8194.31	8181.18	8090.13	11378.95	10.0529	1131.908			876	
0.5	8094.35	8081.26	8134.96	8122.06	8184.55	8171.42	8124.91	11427.88	10.0913	1132.448			1095	
0.6	8079.84	8066.75	8160.98	8148.08	8067.74	8054.61	8089.81	11378.51	10.0756	1129.313			1314	
0.7	8096.77	8083.68	7972.22	7959.32	7991.27	7978.14	8007.05	11262.1	10.0506	1120.54			1533	
0.8	8153.66	8140.57	8158.54	8145.64	8127.42	8114.29	8133.50	11439.95	10.0795	1134.972			1752	
0.9	7928.35	7915.26	7896.06	7883.16	7892.91	7879.78	7892.73	11101.33	10.0288	1107.166			1971	
1	7782.95	7769.86	7855.47	7842.57	7722.31	7709.18	7773.87	10934.15	9.8207	1113.378			2191	
red exps														
1r	116.62													
2r	524.99													
3r	309.85													
4r	325.90													
5r	406.17													
6r	459.35													

NOT USED IN THIS EXP.

FROM WT. $SrCl_2 \cdot 6H_2O$

12 May 93
PB

0.005N NaSr : Sr concentration calculation table

SR005PPM.XLS 5/5/93

0.005N Sr concentration calculations

Date	4/11/93 measured cpm	bkgnd correction	4/21/93 measured cpm	bkgnd correction	4/26/93 measured cpm	bkgnd correction	avg corr cpm	P.61 GC-09 eff corr dpm	samp wt (g)	final dpm per gram	ref used	initial dpm per gram	initial ppm	final ppm
solution	cpm	correction	cpm	correction	cpm	correction								
bkgnd	13.25		12.90		13.13									
experimental														
1	15.91	2.66	15.81	2.91	15.61	2.48	2.68	4.171036	0.9862	4.229402	0.1	1111.944	22	0.083679
2	31.23	17.98	31.05	18.15	31.03	17.90	18.01	26.91967	0.9788	27.50273	0.1	1111.944	22	0.544146
3	24.30	11.05	24.27	11.37	24.16	11.03	11.15	16.82881	0.9823	17.13204	0.2	1092.531	44	0.689967
4	69.91	56.66	69.60	56.70	69.89	56.76	56.71	82.84253	0.9886	83.79782	0.2	1092.531	44	3.374829
5	63.52	50.27	63.10	50.20	61.64	48.51	49.66	72.73844	0.9903	73.45091	0.3	1098.598	66	4.41268
6	78.92	65.67	79.65	66.75	78.59	65.46	65.96	96.07427	0.9844	97.59678	0.4	1090.026	88	7.879188
7	102.48	89.23	98.65	85.75	103.05	89.92	88.30	127.8802	0.9846	129.8804	0.5	1098.696	110	13.00345
8	162.91	149.66	162.33	149.43	162.87	149.74	149.61	213.6439	0.9878	216.2826	0.5A	1137.688	110	20.91178
9	206.04	192.79	202.96	190.06	203.46	190.33	191.06	271.5579	0.9825	276.3948	0.6	1102.332	131	32.84648
10	228.36	215.11	224.01	211.11	225.23	212.10	212.77	301.9441	0.9877	305.7043	0.7	1094.879	153	42.71956
11	261.94	248.69	262.49	249.59	260.10	246.97	248.42	351.8707	0.9849	357.2654	0.8	1119.185	175	55.86336
12	309.69	296.44	312.63	299.73	300.90	287.77	294.65	416.6853	0.9935	419.4115	0.9	1118.41	197	73.87637
13	370.46	357.21	375.80	362.90	371.61	358.48	359.53	507.7235	0.9849	515.5076	1.0A	1136.198	219	99.36316
14	424.09	410.84	434.03	421.13	419.82	406.69	412.89	582.6292	0.9944	585.9103	1.0A	1136.198	219	112.9331
15	477.33	464.08	474.70	461.80	475.74	462.61	462.83	652.7656	0.9939	656.772	1.0A	1136.198	219	126.5916
16	538.32	525.07	544.42	531.52	534.92	521.79	526.13	741.6774	0.9983	742.9404	1.0A	1136.198	219	143.2004
17	674.26	661.01	667.11	654.21	667.89	654.76	656.66	925.0896	0.9942	930.4865	1.0	1232.19	219	165.3776
18	7268.84	7255.59	7366.91	7354.01	7280.43	7267.30	7292.30	10256.85	9.9777	1027.978	1.0	1232.19	219	182.705
19	8056.00	8042.75	8247.54	8234.64	8115.32	8102.19	8126.53	11430.14	10.0564	1136.604	1.0	1232.19	219	202.0114
20	8447.90	8434.65	8530.51	8517.61	8500.00	8486.87	8479.71	11926.88	10.0307	1189.037	1.0	1232.19	219	211.3305
references														
0.1	7912.6	7899.35	8036.80	8023.90	7940.48	7927.35	7950.20	11182.15	10.0564	1111.944			22	
0.2	7703.08	7689.83	7818.75	7805.85	7946.03	7932.90	7809.53	10984.3	10.054	1092.531			44	
0.3	7846.88	7833.63	7723.08	7710.18	7918.11	7904.98	7816.26	10993.78	10.0071	1098.598			66	
0.4	7701.54	7688.29	7952.38	7939.48	7910.00	7696.87	7774.88	10935.57	10.0324	1090.026			88	
0.5	7816.41	7803.16	7794.57	7781.67	7926.77	7913.64	7832.82	11017.07	10.0274	1098.696			110	
0.6	7858.59	7845.34	7850.00	7837.10	7957.94	7944.81	7875.75	11077.44	10.0491	1102.332			131	
0.7	7838.28	7825.03	7835.94	7823.04	7813.18	7800.05	7816.04	10993.46	10.0408	1094.879			153	
0.8	7950.79	7937.54	8108.06	8095.16	7948.41	7935.28	7989.33	11237.18	10.0405	1119.185			175	
0.9	8082.26	8069.01	7926.77	7913.87	7963.49	7950.36	7977.75	11220.89	10.0329	1118.41			197	
1	8796.25	8785.00	8897.34	8884.44	8728.70	8715.57	8795.00	12370.32	10.0393	1232.19			219	
0.5A	8108.87	8095.62	8165.85	8152.95	8134.15	8121.02	8123.20	11425.46	10.0427	1137.688			110	
1.0A	8148.78	8135.53	8005.60	7992.70	8223.77	8210.64	8112.96	11411.06	10.0432	1136.198			219	

FROM WT. $SrCl_2 \cdot 6H_2O$

12 May 93
RD

Summary of all LSC data for 0.05N NaSr samples

0.05N NaSr LSC data									
	10 min	10 min	10 min	10 min	10 min	10 min	2% 2S	2% 2S	2% 2S
Solution	3/22/93	3/29/93	3/31/93	4/2/93	4/5/93	4/8/93	4/11/93	4/21/93	4/26/93
	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA
Blanks									
0.1	12.6	14.7	14.6	14.4	14.6	12.3			
0.2	11.9	12.0	14.1	13.1	12.5	14.9			
0.3	14.4	14.5	13.5	14.5	12.4	13.2			
0.4	15.2	13.6	12.6	14.3	15.0	15.4			
0.5	13.1	12.2	15.5	13.2	14.0	14.0			
0.6	12.8	12.7	14.2	12.0	13.0	11.7			
0.7	11.5	13.4	12.0	15.0	11.7	14.7			
0.8	14.1	14.6	13.0	14.1	13.0	13.9			
0.9	15.7	13.4	13.7	14.2	14.5	15.7			
1	13.5	14.2	11.8	14.1	11.9	14.4	13.09	12.90	13.13
Average	13.5	13.5	13.5	13.9	13.3	14.0	13.09	12.90	13.13
References									
0.1	8064.3	8110.6	8090.9	8079.3	8094.7	8057.7	8156.91	8133.33	8000.00
0.2	7965.5	7955.9	7937.9	7952.4	7974.3	7967.1	8079.03	8064.52	7934.65
0.3	8076.1	8162.1	8092.0	8155.7	8123.1	8225.8	8126.61	8044.00	8060.00
0.4	8071.0	8108.4	8073.0	8028.7	8015.9	8040.5	8053.60	8061.60	8194.31
0.5	8140.7	8200.3	8216.2	8169.7	8162.3	8142.4	8094.35	8134.96	8184.55
0.6	8071.0	8133.6	8102.3	8110.5	8136.5	8053.2	8079.84	8160.98	8067.74
0.7	8092.0	8076.5	8066.5	8042.4	8099.4	8081.1	8096.77	7972.22	7991.27
0.8	8122.2	8161.2	8171.3	8114.0	8151.6	8123.9	8153.66	8158.54	8127.42
0.9	7986.7	8059.7	7976.1	8029.0	7992.8	7924.9	7928.35	7896.06	7892.91
1	7757.7	7808.4	7833.3	7850.3	7869.3	7847.2	7782.95	7855.47	7722.31
Experimental									
1	56.4	65.5	72.6	67.8	70.0	71.0	71.23	71.59	70.99
2	105.2	153.1	143.2	147.1	148.9	146.4	143.63	147.19	145.43
3	229.5	291.6	297.3	294.6	296.9	303.7	304.23	303.12	299.82
4	135.4	180.1	185.6	186.8	190.0	197.4	191.83	192.47	193.95
5	269.4	334.8	337.2	343.5	345.1	350.8	351.48	348.66	349.72
6	291.4	362.7	364.0	372.3	364.9	380.1	367.24	378.86	375.38
7	334.2	398.3	416.7	412.2	418.3	405.5	409.54	413.51	419.63
8	328.2	406.2	394.5	404.3	414.9	402.8	408.37	408.79	406.58
9	357.7	423.1	436.7	425.4	427.9	433.8	439.03	434.11	430.56
10	351.1	424.6	440.2	428.3	438.2	439.6	439.89	439.03	439.75
11	443.6	490.5	506.8	516.4	507.9	513.3	513.60	518.67	501.55
12	410.5	475.2	490.9	489.0	495.3	496.1	496.18	496.82	491.89
13	442.3	520.8	514.7	520.7	517.8	528.2	517.54	520.29	519.75
14	553.3	596.0	600.3	595.8	596.4	596.7	601.02	603.50	594.42
15	582.8	656.2	648.1	629.2	633.2	656.9	649.87	654.71	651.24
16	643.1	664.3	680.3	677.9	670.1	669.6	679.69	682.73	675.49
17	667.3	697.0	694.2	696.6	707.6	698.8	692.32	701.26	714.42
18	712.4	713.2	725.3	720.9	731.7	731.5	740.93	735.05	719.86
19	742.5	747.3	756.1	748.1	761.0	762.0	761.03	757.15	747.05
20	756.4	774.3	765.3	781.4	784.1	776.0	764.83	775.80	768.20
Red Exps									
1R	93.4	110.2	117.3	114.1	111.2	118.6	116.82	115.09	115.38
2R	538.6	548.6	551.3	539.8	552.1	549.7	554.99	540.83	548.36
3R	253.3	297.4	303.2	303.5	299.4	305.8	309.85	309.15	308.77
4R	278.1	318.7	326.1	331.2	335.2	322.5	325.90	331.52	330.58
5R	341.5	404.3	394.5	395.9	391.3	413.5	406.17	400.84	412.49
6R	387.4	446.1	449.5	450.6	452.4	466.9	459.35	455.72	456.55
Spike 9									
9A	8061.7	8120.6	8101.4	8156.2	8105.3	8130.5	8245.90	8074.19	8020.00
9B	4101.8	4092.0	4082.5	4099.9	4048.7	4071.7	4052.23	4034.27	3992.03
9C	2108.8	2073.6	2076.0	2103.0	2065.0	2093.8	2096.86	2072.67	2061.11
9D	802.5	814.0	820.3	808.8	798.1	816.3	805.88	809.55	803.94
9E	404.5	396.0	398.1	398.7	402.4	393.3	407.50	404.90	402.58
9F	203.9	207.3	194.9	201.9	204.6	201.5	200.70	203.44	199.84
9G	91.9	89.6	89.5	92.7	93.9	92.1	89.41	90.12	90.05
9AA	1966.2	1972.6	1979.3	1982.8	1955.2	1993.2	1973.37	1966.21	1965.62
9BB	1571.4	1584.5	1570.5	1590.3	1581.6	1579.3	1570.06	1589.21	1532.92
9CC					90.4	95.6	93.69	93.21	94.30
9DD					32.6	28.1	29.16	29.43	29.21

USED FOR Sr (ppm) DETERMINATION

SR05LSC.XLS

12 May 93
RD

Summary of all LSC data for 0.005N NaSr samples

0.005N NaSr LSC data									
	10 min	10 min	10 min	10 min	10 min	10 min	2% 2S	2% 2S	2% 2S
Solution	3/22/93	3/29/93	3/31/93	4/2/93	4/5/93	4/8/93	4/11/93	4/21/93	4/26/93
	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA
Blanks									
0.1	11.7	14.3	13.7	13.7	13.8	15.0			
0.2	14.0	14.0	14.1	11.1	16.0	14.3			
0.3	12.3	13.4	12.3	15.2	12.4	12.2			
0.4	12.9	14.4	14.3	11.9	14.0	15.1			
0.5	12.2	14.2	15.4	13.1	12.1	13.1			
0.6	12.8	14.3	13.4	13.8	13.4	11.2			
0.7	10.2	12.9	12.9	14.0	12.9	12.2			
0.8	14.5	12.3	13.4	13.4	12.4	13.0			
0.9	12.9	12.1	13.2	11.3	14.0	14.3			
1	13.2	12.9	15.6	12.7	13.1	12.6	13.25	12.90	13.13
Average	12.7	13.5	13.8	13.0	13.4	13.3	13.25	12.90	13.13
References									
0.1	7893.0	7974.5	7942.5	7901.0	7947.9	7992.1	7912.60	8036.80	7940.48
0.2	7681.6	7852.4	7900.4	7918.2	7903.9	7880.0	7703.08	7818.75	7946.03
0.3	7785.4	7890.7	7941.9	7914.6	7861.0	7834.3	7846.88	7723.08	7918.11
0.4	7822.8	7794.4	7848.4	7884.9	7842.7	7862.6	7701.54	7952.38	7710.00
0.5	7943.8	7937.3	7984.6	7903.3	7902.1	7928.4	7816.41	7794.57	7926.77
0.6	7759.8	7924.3	7939.5	7907.3	7922.6	7987.2	7858.59	7850.00	7957.94
0.7	7787.2	7836.3	7776.7	7810.8	7789.4	7807.1	7838.28	7835.94	7813.18
0.8	7974.4	8074.6	8047.0	8086.2	8081.8	8054.3	7950.79	8108.06	7948.41
0.9	8001.3	8057.4	8015.5	8054.2	8034.6	8097.0	8082.26	7926.77	7963.49
1	8766.7	8834.4	8829.3	8885.4	8809.5	8875.8	8798.25	8897.34	8728.70
0.5A	8023.6	8038.7	8068.3	8013.0	8035.7	8041.0	8108.87	8165.85	8134.15
1.0A	8043.0	8125.3	8103.5	8141.5	8112.0	8138.7	8148.78	8005.60	8223.77
Experimental									
1	15.4	15.8	15.6	17.0	15.7	17.5	15.91	15.81	15.61
2	24.3	30.8	30.0	30.8	31.6	28.8	31.23	31.05	31.03
3	20.8	21.6	26.0	25.4	22.1	23.4	24.30	24.27	24.16
4	49.6	65.7	68.4	70.0	74.7	70.2	69.91	69.60	69.89
5	49.9	61.5	67.1	61.8	66.1	60.9	63.52	63.10	61.64
6	54.1	72.0	79.3	76.6	76.6	71.4	78.92	79.65	78.59
7	80.7	100.1	97.3	99.3	101.9	104.3	102.48	98.65	103.05
8	126.3	160.9	154.0	158.9	161.8	155.3	162.91	162.33	162.87
9	140.7	193.3	192.4	204.3	202.6	198.4	206.04	202.96	203.46
10	169.7	220.7	218.6	218.8	234.6	243.4	228.36	224.01	225.23
11	178.6	240.3	249.7	254.1	262.1	261.0	261.94	262.49	260.10
12	202.4	298.7	293.5	304.6	311.0	303.0	309.69	312.63	300.90
13	264.9	348.5	362.4	357.5	368.9	374.0	370.46	375.80	371.61
14	287.5	412.4	412.6	427.5	425.6	423.6	424.09	434.03	419.82
15	352.6	456.4	468.9	481.1	476.8	478.6	477.33	474.70	475.74
16	449.6	528.3	545.0	535.7	544.2	552.6	538.32	544.42	534.92
17	541.3	640.8	656.7	662.3	661.9	652.9	674.26	667.11	667.89
18	6747.9	7313.2	7318.4	7362.2	7390.7	7313.1	7268.84	7366.91	7280.43
19	7739.0	8050.9	8092.6	8121.0	8108.5	8103.8	8056.00	8247.54	8115.32
20	8210.6	8467.2	8404.8	8407.0	8446.6	8450.0	8447.90	8530.51	8500.00
Spike 9									
9A	8061.7	8120.6	8101.4	8156.2	8105.3	8130.5	8245.90	8074.19	8020.00
9B	4101.8	4092.0	4082.5	4099.9	4048.7	4071.7	4052.23	4034.27	3992.03
9C	2108.8	2073.6	2076.0	2103.0	2065.0	2093.8	2096.86	2072.67	2061.11
9D	802.5	814.0	820.3	808.8	798.1	816.3	805.88	809.55	803.94
9E	404.5	396.0	398.1	398.7	402.4	393.3	407.50	404.90	402.58
9F	203.9	207.3	194.9	201.9	204.6	201.5	200.70	203.44	199.84
9G	91.9	89.6	89.5	92.7	93.9	92.1	89.41	90.12	90.05
9AA	1966.2	1972.6	1979.3	1982.8	1955.2	1993.2	1973.37	1966.21	1965.62
9BB	1571.4	1584.5	1570.5	1590.3	1581.6	1579.3	1570.06	1589.21	1532.92
9CC					90.4	95.6	93.69	93.21	94.30
9DD					32.6	28.1	29.16	29.43	29.21

USED FOR Sr (ppm) DETERMINATION

SR005LSC.XLS

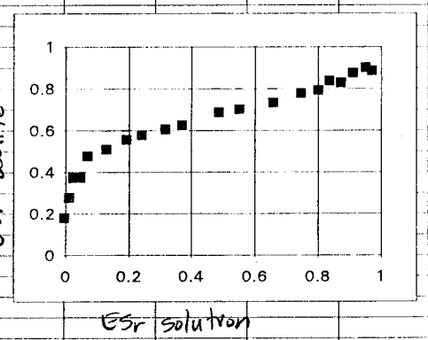
12 May 93
PB

Summary tables for ESr calculation from Na data (0.05N and 0.005N isotherms)

05NATHM.XLS

0.05N NaSr Isotherm data

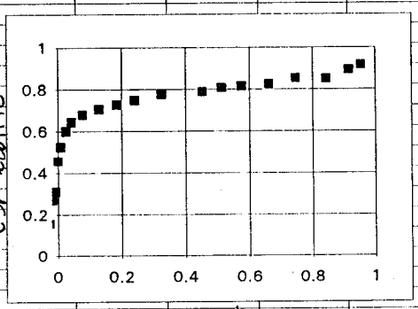
Exp solution	vol soln	wt zeolite	ref used	Na initial	Na final	ESr Z fm Na	ESr S fm Na
1	25	0.3102	0.1	1050	1154	0.17871558	-0.0039147
2	25	0.1659	0.1	1050	1136	0.27632675	0.01174424
3	25	0.1032	0.1	1050	1122	0.37189785	0.02392344
4	25	0.2321	0.2	934	1096	0.37205808	0.04654197
5	25	0.1519	0.2	934	1070	0.47725667	0.0691605
6	25	0.1941	0.3	817	1002	0.50806241	0.12831666
7	25	0.2186	0.4	700	928	0.55597538	0.19269247
8	25	0.2658	0.5	584	872	0.57757499	0.24140931
9	25	0.2809	0.6	467	786	0.60535455	0.31622445
10	25	0.3182	0.7	351	724	0.6248554	0.37016094
11	25	0.2756	0.8	236	590	0.68469147	0.48673336
12	25	0.3035	0.9	117	516	0.70078544	0.55110918
13	25	0.2867	1.0	0	394	0.73255359	0.65724228
14	25	0.2005	1.0	0	292	0.77631744	0.74597651
15	50	0.3088	1.0	0	229	0.79060409	0.80078295
16	50	0.2407	1.0	0	189	0.83711781	0.83558069
17	50	0.1893	1.0	0	147	0.82788037	0.87211831
18	50	0.1269	1.0	0	104	0.87372062	0.90952588
19	100	0.1361	1.0	0	57.4	0.89925866	0.95006525
20	100	0.0840	1.0	0	34.9	0.88588429	0.96963897



005NATHM.XLS

0.005N NaSr Isotherm data

Exp solution	vol soln	wt zeolite	ref used	Na initial	Na final	ESr Z fm Na	ESr S fm Na
1	50	0.0957	0.1	104	118	0.15596134	-0.026533275
2	100	0.1023	0.1	104	117	0.27095588	-0.017833841
3	100	0.1621	0.2	92.3	116	0.31174263	-0.009134406
4	100	0.1061	0.2	92.3	115	0.45618535	-0.000434972
5	100	0.1363	0.3	80.3	114	0.52718726	0.008264463
6	100	0.1520	0.4	69.1	112	0.60178944	0.025663332
7	100	0.1746	0.5	57.3	110	0.64357214	0.043062201
8	100	0.1532	0.5	57.3	106	0.67779921	0.077859939
9	100	0.1628	0.6	46	99.9	0.70593583	0.13092649
10	100	0.1727	0.7	34.8	93.7	0.72719991	0.184862984
11	100	0.1831	0.8	23	87.1	0.7464497	0.242279252
12	100	0.1821	0.9	11.4	77.5	0.77396688	0.325793823
13	100	0.1704	1.0	0	62.9	0.78706739	0.452805568
14	100	0.1478	1.0	0	55.9	0.8064329	0.513701609
15	100	0.1280	1.0	0	48.9	0.81457251	0.574597651
16	100	0.1011	1.0	0	39	0.82251592	0.660722053
17	100	0.0729	1.0	0	29.1	0.85113083	0.746846455
18	250	0.1124	1.0	0	17.9	0.84890206	0.844280122
19	250	0.0574	1.0	0	9.6	0.89151819	0.916485428
20	250	0.0303	1.0	0	5.2	0.91481144	0.95476294



reanalyzed sample 20 on 5 May 93 using 10 and 5 ppm Na stds. PB charge is 0.6 ppm from previous reading of 4.6 ppm.

12 May 93
PB

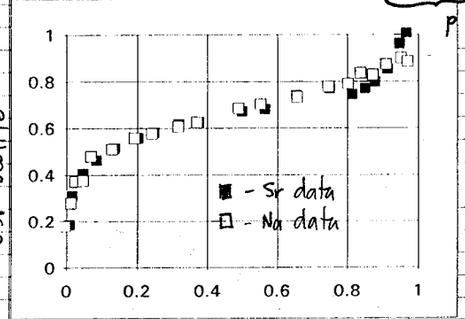
Summary table for ESr calculation from Sr data (0.05N isotherm), Na data from p. 66 is also plotted.

05SRTHM.XLS

0.05N NaSr Isotherm data for Sr

Exp solution	vol soln	wt zeolite	ref used	Sr initial	Sr final	ESr Z fm Sr	ESr S fm Sr	ESr Z fm Na	ESr S fm Na
1	25	0.3102	0.1	219	16.5	0.1826002	0.00753649	0.17871558	-0.00391475
2	25	0.1659	0.1	219	36.7	0.3073498	0.01676258	0.27632675	0.01174424
3	25	0.1032	0.1	219	79.4	0.3783703	0.03625113	0.37189785	0.02392344
4	25	0.2321	0.2	438	101.3	0.4057453	0.04626322	0.37205808	0.04654197
5	25	0.1519	0.2	438	187.2	0.4618034	0.08547292	0.47725667	0.0691605
6	25	0.1941	0.3	657	300.6	0.5136972	0.13720704	0.50806241	0.12831666
7	25	0.2186	0.4	876	441.5	0.5559981	0.2015535	0.55597538	0.19269247
8	25	0.2658	0.5	1095	542.5	0.5814074	0.24767969	0.57757499	0.24140931
9	25	0.2809	0.6	1314	693.8	0.617651	0.31671404	0.60535455	0.31622445
10	25	0.3182	0.7	1533	821.1	0.6257952	0.37486329	0.6248554	0.37016094
11	25	0.2756	0.8	1752	1092.7	0.6691674	0.49883982	0.68469147	0.48673336
12	25	0.3035	0.9	1971	1234.0	0.679279	0.56333953	0.70078544	0.55110918
13	25	0.2867	1.0	2191	1431.7	0.7408711	0.65357883	0.73255359	0.65724228
14	25	0.2005	1.0	2191	1639.2	0.7698315	0.74832709	0.77631744	0.74597651
15	50	0.3088	1.0	2191	1779.7	0.7451206	0.81247219	0.79060409	0.80078295
16	50	0.2407	1.0	2191	1859.7	0.7700987	0.84897225	0.83711781	0.83558069
17	50	0.1893	1.0	2191	1921.6	0.796084	0.87725811	0.82788037	0.87211831
18	50	0.1269	1.0	2191	1998.0	0.8507969	0.9121279	0.87372062	0.90952588
19	100	0.1361	1.0	2191	2073.8	0.963469	0.94672798	0.89925866	0.95006525
20	100	0.0840	1.0	2191	2115.4	1.006911	0.96571941	0.88588429	0.96963897

p. 62 — see p. 66

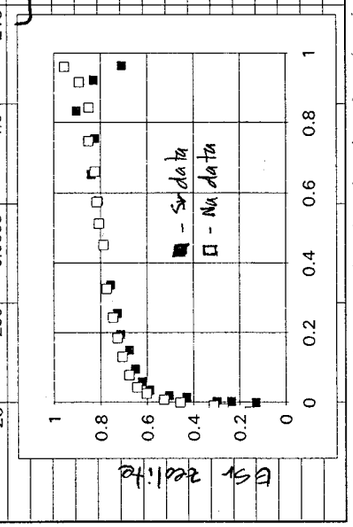


12 May 93
PB

Summary table for ESr calculation from Sr data (0.005N isotherm), Na data also plotted

0.005N NaSr Isotherm data for Sr

Exp solution	vol soln	wt zeolite	ref used	Sr initial	Sr final	ESr Z fm Sr	ESr S fm Sr	ESr Z fm N	ESr S fm Na
1	50	0.0957	0.1	22	0.1	0.128121581	0.000382011	0.155961	-0.026533
2	100	0.1023	0.1	22	0.5	0.234674957	0.002484119	0.270956	-0.017834
3	100	0.1621	0.2	44	0.7	0.298952425	0.003149815	0.311743	-0.009134
4	100	0.1061	0.2	44	3.4	0.428426567	0.015406662	0.456185	-0.000435
5	100	0.1363	0.3	66	4.4	0.505582496	0.020144625	0.527187	0.008264
6	100	0.1520	0.4	88	7.9	0.589791264	0.035969813	0.601789	0.025663
7	100	0.1746	0.5	110	13.0	0.621596616	0.059362917	0.643572	0.043062
8	100	0.1532	0.5a	110	20.9	0.650665987	0.095465775	0.677799	0.07786
9	100	0.1628	0.6	131	32.8	0.674602643	0.149949712	0.705936	0.130926
10	100	0.1727	0.7	153	42.7	0.714500817	0.195021961	0.7272	0.184863
11	100	0.1831	0.8	175	55.9	0.728037243	0.255025593	0.74645	0.242279
12	100	0.1821	0.9	197	73.9	0.756533275	0.337258037	0.773967	0.325794
13	100	0.1704	1.0a	219	99.4	0.785582741	0.453609481	0.787067	0.452806
14	100	0.1478	1.0a	219	112.9	0.80297476	0.51555869	0.806433	0.513702
15	100	0.1280	1.0a	219	126.6	0.80778928	0.577911868	0.814573	0.574598
16	100	0.1011	1.0a	219	143.2	0.838904195	0.653733828	0.822516	0.660722
17	100	0.0729	1.0	219	165.4	0.823029396	0.754976462	0.851131	0.746846
18	250	0.1124	1.0	219	182.7	0.903269916	0.834078799	0.848902	0.84428
19	250	0.0574	1.0	219	202.0	0.827910319	0.922215752	0.891518	0.916485
20	250	0.0303	1.0	219	211.3	0.708048193	0.964759042	0.954763	0.96007



p.63

SEE p.66

OOSSRTHM.XLS

13 May 93
PB

ISE Analysis of 0.05 kCa experimental solutions.

K - analysis

New combination electrodes (K^+ and Ca^{2+} ISE) (pHoenix via Cole-Parmer) were obtained primarily as a result of the success of the combination Na^+ ISE.

Because the reference is built-in, a smaller sample container can be used during analysis, and there is less ~~likelyhood of~~ chance of a reference elec malfunction.
5/13/93

Preparation:

Both electrodes were prepared for use by filling with the appropriate fill solutions provided, and placing each electrode in dilute standard for intermediate storage and membrane revitalization. The K^+ and Ca^{2+} were checked for proper slope law the manuals supplied. Both electrodes performed satisfactorily.

For analysis of K^+, 3 standard calibration solutions were prepared. Concentrations were 1000, 100, and 10 ppm K^+. The 1000 ppm solution was a purchased standard (lot EE31 pHoenix). The 100 and 10 ppm were made from serial dilution of the 1000 ppm std.

0.2 ml ISA for K^+ (5 M NaCl) was added to all standards and samples to be analyzed. (Vol of std and samples = 10 ml)

Results of analysis of experimental solutions (#1 - #19) are shown on the following page.

13 May 93
PB

1st calibration:

cal std	10	, entered as	9.99	, read	9.24
(ppm)	100		99.9		88.7
	1000		999		883

slope 56.1

to tighten up readings a 2nd calibration was performed.

std	9.99	-	9.35		
	99.9	-	95.1	slope	56.1
	999	-	1000		

Solution#	reading	correction $y = (1.0485)x + 0.1864$
1	170	
10	38.1	
11	32.5	
2	166	
17	61.9	
16	81.4	
3	149	
4	133	
12	19.7	
18	38.3	
6	96.7	
9	50.8	
13	30.6	
14	24.5	
8	65.2	
5	109	
19	13.8	
7	78.8	
15	18.5	
99.9	95.1	

13 May 93
PB

1st reference analysis

cal std	3910	-	read	3500
	391	-		352

slope 53.5

solution	ppm reading	corrected
Eva ~~Est~~ PB 0.1	1570	1758
0.5	896	999
0.2	1390	1556
0.6	725	~~1384~~ PB 808
0.3	1240	1384 5/13/93
0.7	532	592
0.4	1060	1182
0.8	350	399
~~0.5~~ 0.9	168	185
391	340	
3910	3430	

slope is linear but readings are low. Values are corrected by fitting actual readings vs. expected.

3430 vs 3910 for example.

Fit provides the correction equation $y = mx+b$

$y = (1.1179)x - 2.4341$

14 May 93
PD

Ca^{2+} analysis w/ ISE combination

Cal 100 - 92.6
1000 - 921

slope = 27.8

solution (refs)	ppm
0.1	69.4
0.6	491
0.2	144
0.7	533
0.3	218
0.8	656
0.4	301
0.9	718
0.5	367
1.0	743
100	86.1
1000	906

correction $y = (1.0977)x + 5.49$

14 May 93
PD

Ca^{2+} analysis (exps) w/ ISE

cal stds 10 - 8.65
100 - 96.7
1000 - 999

slope = 28.7

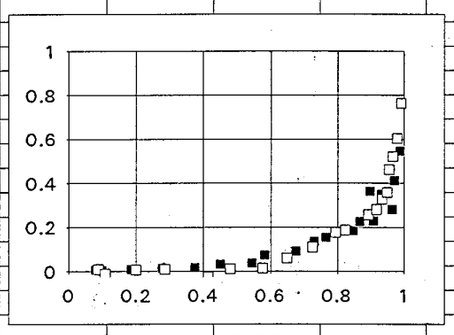
	solution	ppm
exp	1	8.10
	11	76.8
	2	9.76
	12	84.9
	3	18.6
	13	174
	4	28.0
	14	182
	5	37.6
	15	180
	6	45.3
	16	935
	7	54.6
	17	966
	8	58.5
	18	974
	9	67.8
	19	991
	10	73.3

correction $y = (1.0221)x + 1.1584$

28 May 93 / PD

0.05N KCa - Calcium isotherm

Exp solns	volume	weight zeol	ref used	initial ppm	final ppm	ECaZ fm C	ECaS fm C	UECaZ fm	UECaS fm	ECaZ fm K	ECaS fm K	UECaZ fm	UECaS fm K
1	10	0.4085	0.1	100.2	81	0.005748	0.080838	0.001545	0.005829	0.00798	0.087421	0.015375	0.006304
2	10	0.1399	0.1	100.2	98	0.001923	0.097804	0.004901	0.007053	-0.01434	0.108906	-0.04436	0.007853
3	10	0.1928	0.2	200.4	186	0.009135	0.185629	0.006939	0.013386	0.005202	0.199959	0.028693	0.014419
4	10	0.1909	0.3	300.6	280	0.013198	0.279441	0.010529	0.020151	0.007881	0.285897	0.025821	0.020616
5	10	0.1782	0.4	400.8	376	0.017021	0.37525	0.015089	0.02706	-0.02674	0.414804	-0.02315	0.029912
6	10	0.1852	0.5	501	453	0.031699	0.452096	0.017848	0.032601	0.010832	0.480792	0.019283	0.03467
7	10	0.1857	0.6	601.2	546	0.036355	0.54491	0.021401	0.039294	0.013503	0.576449	0.015623	0.041568
8	10	0.1972	0.7	701.4	585	0.072192	0.583832	0.022681	0.042101	0.059128	0.649598	0.011543	0.046843
9	10	0.1676	0.8	801.6	678	0.090196	0.676647	0.030672	0.048794	0.109218	0.726329	0.010017	0.052376
10	10	0.1545	0.9	901.8	733	0.133624	0.731537	0.036847	0.052752	0.175283	0.794874	0.007585	0.057319
11	10	0.1066	0.9	901.8	768	0.153512	0.766467	0.054404	0.055271	0.18583	0.824543	0.009538	0.059459
12	10	0.1023	1	1002	849	0.182919	0.847305	0.062859	0.0611	0.254919	0.893601	0.006249	0.064438
13	25	0.1801	1	1002	870	0.2241	0.868263	0.090171	0.062611	0.2802	0.917643	0.006865	0.066172
14	25	0.124	1	1002	910	0.226855	0.908184	0.133543	0.06549	0.326079	0.934012	0.007992	0.067353
15	25	0.086	1	1002	900	0.362647	0.898204	0.191611	0.06477	0.357177	0.94987	0.008759	0.068496
16	50	0.1174	1	1002	935	0.348995	0.933134	0.28559	0.067289	0.459215	0.956008	0.011255	0.068939
17	50	0.0785	1	1002	966	0.280443	0.964072	0.433714	0.06952	0.519074	0.96675	0.012732	0.069713
18	100	0.0835	1	1002	974	0.410123	0.972056	0.818733	0.070096	0.600605	0.979539	0.014729	0.070636
19	250	0.0618	1	1002	991	0.544235	0.989022	2.789037	0.071319	0.760778	0.992327	0.018676	0.071558



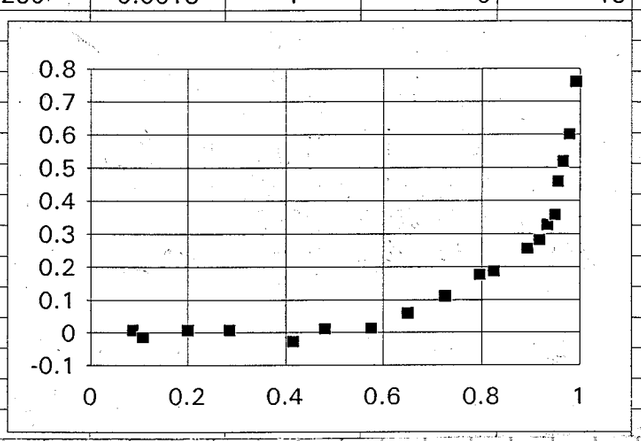
■ - Ca data
□ - K data

05 Ca thm. xls 5/28/93

28 May 93 PD

0.05N KCa - Potassium isotherm

Exp solns	volume	weight zeol	ref used	initial ppm	final ppm	ECaZ fm K	ECaS fm K	UECaZ fm	UECaS fm K
1	10	0.4085	0.1	1758	1784	0.00798	0.087421	0.015375	0.005864
2	10	0.1399	0.1	1758	1742	-0.01434	0.108906	-0.04436	0.007306
3	10	0.1928	0.2	1556	1564	0.005202	0.199959	0.028693	0.013414
4	10	0.1909	0.3	1384	1396	0.007881	0.285897	0.025821	0.019179
5	10	0.1782	0.4	1182	1144	-0.02674	0.414804	-0.02315	0.027826
6	10	0.1852	0.5	999	1015	0.010832	0.480792	0.019283	0.032252
7	10	0.1857	0.6	808	828	0.013503	0.576449	0.015623	0.038669
8	10	0.1972	0.7	592	685	0.059128	0.649598	0.011543	0.043576
9	10	0.1676	0.8	389	535	0.109218	0.726329	0.010017	0.048724
10	10	0.1545	0.9	185	401	0.175283	0.794874	0.007585	0.053322
11	10	0.1066	0.9	185	343	0.18583	0.824543	0.009538	0.055312
12	10	0.1023	1	0	208	0.254919	0.893601	0.006249	0.059945
13	25	0.1801	1	0	161	0.2802	0.917643	0.006865	0.061557
14	25	0.124	1	0	129	0.326079	0.934012	0.007992	0.062655
15	25	0.086	1	0	98	0.357177	0.94987	0.008759	0.063719
16	50	0.1174	1	0	86	0.459215	0.956008	0.011255	0.064131
17	50	0.0785	1	0	65	0.519074	0.96675	0.012732	0.064852
18	100	0.0835	1	0	40	0.600605	0.979539	0.014729	0.065709
19	250	0.0618	1	0	15	0.760778	0.992327	0.018676	0.066567



■ - K data

05 K thmA. xls 5/28/93

2 Jun 93
PD

Reanalysis of K experimental and reference solutions.

K ppm values were not as accurate as one would have liked. Solutions will reanalyzed using five point calibration curves.

New standard solutions required :

(*) 20 ppm K : $\frac{100 \text{ ppm} \times 20 \text{ ml}}{100 \text{ ml}}$ NOT USED!

50 ppm K : $\frac{1000 \text{ ppm} \times 5 \text{ ml}}{100 \text{ ml}}$

150 ppm K : $\frac{1000 \text{ ppm} \times 15 \text{ ml}}{100 \text{ ml}}$

200 ppm K : $\frac{1000 \text{ ppm} \times 20 \text{ ml}}{100 \text{ ml}}$

1955 ppm K : $\frac{3910 \text{ ppm} \times 50 \text{ ml}}{100 \text{ ml}}$

7 Jun 93
PD

Reanalysis of K exp. and ref solns cont'd

The Orion 920A has not been responding as expected, call in to Orion Tech. Support

- decided to test 920A for consistency and drift while using 5-point calibration
- note avg. slope for calibration may be low due to averaging of slope over entire range normal slope values as listed in Phoenix tech manual is 58 ± 2 mV.

7 Jun 93
PD

calibration for low values 0-200 ppm

* 1	10	-	7.48	slope = 54.4
2	50	-	40.3	
3	100	-	82.2	
4	150	-	127	
5	200	-	164	

check

stds 50 : 40.1
100 : 82.2
150 : 125
10 : 7.45
200 : 168
100 : 81.5
50 : 39.4
200 : 167
150 : 125
10 : 7.39

* drift is minor, readings are consistent

- disconnected power to meter and recalibrated

7 Jun 93
PD

cal stds 1 - 10 :
2 - 50 :
3 - 100 :
4 - 150 :
5 - 200 : 200 (value read 200 after entry)

avg. slope : 56.9

Solution	ppm as read	Solution	ppm as read
exp # 1	179	5	126
6	109	10	39.9
2	179	11	34.8
7	92.2	6/7/93 PD ~~20~~	
3	163	12	21.4
8	73.5	19	15.8
4	139	13	34.3
9	56.4	18	42.2

7 Jun 93 — solution (cont'd)

14 : 27.5
17 : 27.5 → meter or fritz! [meter locked up @ 27.5 ppm]
15 :
16 :
100 std :
50 std :

wash and test using other standards did not help.

- disconnected meter, reinput lot info on channel 2

7 Jun 93 — calibration (high)

avg. slope : 54.5

1 : 200
2 : 391
3 : 1000
4 : 1955
5 : 3910

slope only fair but readings were accurate and consistent

solution

1000 std :	991
0.1	1730
0.6	806
0.2	1560
0.7	603
0.3	1380
0.8	401
0.4	1190
0.9	200
0.5	1000

391 std :	391
1000 std :	991
1955 std :	1940

remeasure ppm

14 :	26.4	10 std :	9.91
17 :	64.3	50 std :	49.5
15 :	20.6	100 std :	99.5
16 :	84.5		
13 :	32.7		
18 :	40.8		

cal for above

1	10	avg slope: ~~56.0~~ N/A
2	50	56.6
3	100	
* ~~4~~	~~150~~ N/A	
~~5~~	~~200~~ N/A	

* meter failed during calibration check.

- during re cal for low end exp. solutions, meter "timer" went off, required power disconnect.

- after 5 point cal - received cal std. error msg. E-22, would not clear, disconnected, recalibrate using 3 stds.

- numbers good, good performance on reread of stds.

7 Jun 93 — Talked to Don Ivey, tech rep from Orion (ext. 860). He outlined some items to watch for and/or do during analysis w/ ISE. Will take action next analysis.

In general -

- do not use hold function (ever!)
- if readings are inconsistent, check mV values vs. display
- make sure meter is connected through a surge protector.

8 Jun 93 PB

Preparation for repeat of 0.5N NaSrA ion exchange experiment.

The previous 0.5N NaSr exp. was not optimized wrt the errors of analysis. As a result, error bars did not properly constrain the isotherm. The exp. will be rerun with better control of uncertainty.

To prepare exp. solutions, the same 0.5N references will be used. (high concentrations should keep the solutions fairly constant wrt evaporation / surface losses). However, more ESr 1.0 solution is required. This solution must also be spiked w/ ^{90}Sr.

$SrCl_2 \cdot 6H_2O$
Fisher lot # 804315

For 1.0 ESr =)

0.5 N = 0.5 eq/L for Sr^{2+}, 2eq/mole

∴ 0.5N (1.0 ESr) = 0.25 moles Sr^{2+}/L

I will make 250 ml, so 0.25 moles/L × 0.25 L = 0.0625 moles

$$0.0625 \text{ moles } Sr^{2+} \cdot \frac{1 \text{ mol } SrCl_2 \cdot 6H_2O}{1 \text{ mol } Sr^{2+}} \times 266.62 \text{ g/mol } SrCl_2 \cdot 6H_2O =$$

16.6638 g $SrCl_2 \cdot 6H_2O$ needed.

Tared a 100 ml beaker on the AE 240, and weighed

16.6644 g $SrCl_2 \cdot 6H_2O$.

$$16.6644 \text{ g } SrCl_2 \cdot 6H_2O \cdot \frac{87.62 \text{ g Sr}}{266.62 \text{ g } SrCl_2 \cdot 6H_2O} = 5.4765 \text{ g Sr}$$

5.4765 g Sr / x250 ml = 0.02191 g/ml = 21906 ppm Sr^{2+} in solution

Solution is labeled 0.5N ESr 1.0A

8 Jun 93 PB

The ESr 1.0A solution will be spiked using the same procedure and methods employed in previous NaSr experiments. 0.1 ml of spike #24A will be added for each 100 ml of solution. This ratio has proven to be adequate for analyses using LSA.

approx. 0.2000 g ^{90}Sr will be added to 200 g of ESr 1.0A.

spike #24A is dispensed into a tared weighing boat, the wt. is recorded ASAP, the spike is transferred to ~~the~~ PB 6/9/93 a 250 ml polypropylene bottle that has been pre-weighed. A wash bottle containing ESr 1.0A solution is used to wash the weighing boat contents into the poly bottle. ESr 1.0A solution is added so that the final wt. gives 200 g of solution.

solution	wt. spike #24A	wt. bottle + spike + solution	wt. bottle	spike + solution wt.	mR/hr @ contact
ESr 1.0A	0.1994 g	230.62 g	30.41 g	200.21 g	0.08 w/44-6

Experimental solutions are prepared in accordance w/ procedure on p. 23 of this notebook. Wt. zeolite, reference solution used, volume and solution number are found on the following page.

Na-form clinoptilolite 100-200 mesh will be used, same batch as used for 0.05N and 0.005N NaSr experiments.

Batch label: CDV * 100/200 * UC * WA * HL * CPT * Naf (1)
366.02 g as of 3/3/93 PB

8 Jun 93
PB

Experimental solution preparation 0.5N NaSr

solution #	wt. of bottle (g)	wt zeolite to be added (g)	actual wt. zeolite added (g)	vol soln (ml)	ref used (E_{Sr})	total wt. zeol + soln + bottle
1	7.0384	1.6261	1.6259	10 ✓	0.05	19.0076
2	7.0548	1.4013	1.4012	10 ✓	0.1	18.7624
3	7.0940	1.9292	1.9293	10 ✓	0.2	19.3462
4	7.1023	0.8026	0.8024	10 ✓	0.2	18.2094
5	7.0882	0.9151	0.9146	10 ✓	0.3	18.3362
6	7.1533	1.1066	1.1063	10 ✓	0.4	18.6024
7	7.0375	0.5311	0.5315	10 ✓	0.4	17.9354
8	7.0849	0.7592	0.7589	10 ✓	0.5	18.1993
9	7.0455	0.6071	0.6069	10 ✓	0.6	18.0022
10	7.0471	0.5761	0.5759	10 ✓	0.7	17.9869
11	7.0072	0.6164	0.6163	10 ✓	0.8	17.9760
12	7.0927	6/3/93 PB ~~0.7198~~ 0.6096	0.6093	10 ✓	0.9	18.0764
13	7.0491	6/9/93 PB ~~0.4964~~ 0.7198	0.7200	10 ✓	1.0	18.1323
14	7.0510	6/9/93 PB ~~0.8592~~ 0.4969	0.4967	10 ✓	1.0	17.9514
15	7.9444	0.8592	0.8588	25 ✓	1.0	34.7355
16	7.9036	0.5880	0.5877	25 ✓	1.0A	34.1521
17	8.0174	0.3931	0.3931	25 ✓	1.0A	34.3043
18	11.4946	0.4169	0.4170	50 ✓	1.0A *	63.5060
19	18.9943	0.2456	0.2460	100 ✓	1.0A	122.4563
	AE 240		AE 240	oxford macro pipettor		AE 240

* 40 ml 1.0A and 10 ml 1.0

9 Jun 93
1630

Exp. solns placed in water bath at ~~40°C and~~ PB 40 rpm and 25°C

9 Jun 93
PB

Reanalysis of Ca from KCa 0.05N ion exchange

To include multi point calibrations for ~~Sr~~ Ca^{2+}, additional standards will be made.

Use Orion Calcium std lot # 13-641-811
0.1M or 4000.8 ppm Ca^{2+}

and phoenix Calcium std. lot # EE31
1000 ppm Ca^{2+}

$$400.8 \text{ ppm Ca} = \frac{4000.8 \text{ ppm} \times 20 \text{ ml}}{200 \text{ ml}}$$ ✓

$$40.08 \text{ ppm Ca} = \frac{400.8 \text{ ppm} \times 10 \text{ ml}}{100 \text{ ml}}$$ ✓

$$200.4 \text{ ppm Ca} = \frac{400.8 \text{ ppm} \times 50 \text{ ml}}{100 \text{ ml}}$$ ✓

$$700 \text{ ppm Ca} = \frac{1000 \text{ ppm} \times 35 \text{ ml}}{50 \text{ ml}} \quad (25 \text{ ml} + 10 \text{ ml})$$ ✓

$$4.008 \text{ ppm Ca} = \frac{40.08 \text{ ppm} \times 10 \text{ ml}}{100 \text{ ml}}$$ ✓

9 Jun 93
PB

Analysis of Ca^{2+}

cal stds :

1 - 4 ppm :
2 - 10 ppm :
3 - 40.1 ppm :
4 - 100 ppm :
5 - 200 ppm :

avg. slope : 28.3 mV

```
CALIBRATION
CH1-CA++
P1 CONC =4.00
16.2mV 22.0C
P2 CONC =10.0
27.5mV 22.1C
P3 CONC =40.1
43.8mV 22.1C
P4 CONC =99.9
55.5mV 22.1C
P5 CONC =200
64.1mV 22.1C

SLP=28.3mV/D
```

	solution		ppm as read
exp#	1	:	8.34
	6	:	45.8
	2	:	9.21
	7	:	53.5
	3	:	18.2
	8	:	60.6
	4	:	26.8
	9	:	68.7
	5	:	37.2
	10	:	76.6
	13	:	174
ref	Eca 0.1	:	86.1
exp #	15	:	179
	11	:	81.6
	12	:	86.8
	14	:	182
std	10 ppm	:	~~10.5~~ PB 10.4
std	40.1 ppm	:	41.0
std	100 ppm	:	102

9 Jun 93
PB

Analysis of Ca^{2+} (high conc.)

cal stds:

1 - 100 ppm
2 - 200 ppm
3 - 400.8 ppm
4 - 700 ppm
5 - 1000 ppm

avg slope: 27.6 mV

```
CALIBRATION
CH1-CA++
P1 CONC =100
55.6mV 22.3C
P2 CONC =200
64.3mV 22.4C
P3 CONC =401
72.4mV 22.4C
P4 CONC =700
79.5mV 22.4C
P5 CONC =1000
83.4mV 22.4C

SLP=27.6mV/D
```

	solutions		ppm as read
	ECa 0.2	:	165
	0.6	:	528
	0.3	:	252
	0.7	:	632
	0.4	:	350
	0.8	:	726
	0.5	:	441
	0.9	:	825
	1.0	:	947
exp#	13	:	READ ON PREVIOUS PG.
	14	:	
	15	:	
	19	:	921
	16	:	888
	17	:	904
	18	:	913
std	200	:	194
std	400	:	391
std	1000	:	1000

15 Jun 93
PB

Ca^{2+} ISE seemed to work w/in experimental and design limits, but the reference values were still low relative to exp. solns. One possible reason is that the ionic strength differences between the two types (exp + ref) is too great even with ISA added.

A way to test this is to resample the reference solutions using a 1/10 dilution. This would change ionic strength and allow all solutions to be measured in the same calibration range.

15 Jun 93
PB

Conduct KCl - $SrCl_2 \cdot 6H_2O$ ion-exchange experiment using K form clinoptilolite at 0.05N.

Overview:

- Reference solutions consisting of varying equivalent mole fractions of K^+ and Sr^{2+} (E_{Sr} 0.1 to E_{Sr} 1.0) by weighing KCl and $SrCl_2 \cdot 6H_2O$ into nH_2O.

- Reference solutions are spiked with ^{90}Sr.

- Experimental solutions are prepared by weighing K form zeolite into polypropylene bottles and adding a given volume of spiked reference solution. Exp. solns. are then placed in a constant temperature bath for ~2 weeks at 40 rpm and 25°C.

- Exp. and reference solutions are then analyzed for K^+ and Sr^{2+} using ISE and LSA respectively.

15 Jun 93
PP

Preparation of K-Sr 0.05N reference solutions

1. KCl and $SrCl_2 \cdot 6H_2O$ are weighed into separate, tared, weigh boats.

2. Contents of weigh boat are washed w/ nH_2O into 150 or 250 ml beakers. Teflon coated stir bar is added along w/ ~100 ml nH_2O.

3. For each ref. solution, contents of beaker is transferred to class A vol. flask, mixed, and made up to mark.

4. Each ref solution is transferred to a PP container and capped and labeled.

5. Weight KCl and $SrCl_2 \cdot 6H_2O$ added listed in the table at right.

0.05N KSr reference solutions

SrCl2·6H2O = 266.62 g/mole   LOT # 884315   FISHER
KCl = 74.55 g/mole   LOT # 885967   FISHER

Reference ESr	vol soln (ml)	[Sr] expected (ppm)	[K] expected (ppm)	wt SrCl2·6H2O (g)	wt SrCl2·6H2O added (g)	wt KCl (g)	wt KCl added (g)	calc [Sr] (ppm)	calc [K] (ppm)
0.1	250 ✓	219	1759	0.1666	0.1673	0.8387	0.8389	220	1760
0.2	250 ✓	438	1564	0.3333	0.3338	0.7455	0.7452	439	1563
0.4	250 ✓	876	1173	0.6666	0.6660	0.5591	0.5594	875	1174
0.5	250 ✓	1095	977	0.8332	0.8330	0.4659	0.4660	1096	978
0.6	250 ✓	1314	782	0.9998	0.9993	0.3728	0.3723	1314	781
0.7	250 ✓	1533	586	1.1665	1.1669	0.2796	0.2795	1534	586
0.8	250 ✓	1752	391	1.3331	1.3333	0.1864	0.1865	1753	391
0.9	500 ✓	1971	195	2.9995	2.9996	0.1864	0.1863	1972	195
1.0	1000 ✓	2191	0	6.6655	6.6650	0.0000	0	2190	0

AE 240

AE 240

16 Jun 93 PB

Addition of ^{90}Sr spike to 0.05N K-Sr solutions (reference)

reference solution (ESr)		weight spike #24A	wt. bottle + spike + soln	wt. bottle	spike + solution wt.	mR/hr @ contact
0.1	(0.1)	0.0996	119.14	19.03	100.11	0.06
0.2	(0.1)	0.1008	119.26	19.15	100.11	0.07
(*) 0.4	(0.1)	0.1002	119.35	19.26	100.09	0.08
0.5	(0.1)	0.1004	119.26	19.17	100.09	0.08
0.6	(0.1)	0.1005	119.26	~~19.16~~ 6/16/93 OK	100.10	0.07
0.7	(0.1)	0.1005	119.43	19.32	100.11	0.08
0.8	(0.1)	0.0995	119.04	18.95	100.09	0.08
0.9	(0.3)	0.2482	304.76	54.49	250.27	0.08
1.0	(1.0)	0.9876	1055.8	101.45	954.35	0.09
	↑ approx spike wt needed	AE 240	PM 4600	PM 4600		(44-6)

(*) No ESr 0.3 required for this experiment.

remaining non-spiked reference solution ~~s~~ was ~~were~~ transferred to 60 ml polypropylene containers and labeled. Non-spiked references used to measure initial ~~the~~ K content.

16 Jun 93 PB

Preparation of experimental solutions

Experimental solutions (#1 - #20) will be prepared by weighing a given amount of K-form clinoptilolite into a tared, labeled, poly bottle. An amount of spiked reference solution is added to the poly bottle, the bottle is capped reweighed and placed into a constant temperature shaker bath. Spiked solution will be added using 10 ml Oxford macro pippetor (disposable tips) (#1 - #9) and 50 and 100 ml class A volumetric pipettes (#10 - #20).

16 Jun 93 PB

Table for preparation of 0.05N KSr solutions (experimental)

solution #	wt. of bottle (g)	wt. zeolite to be added (g)	actual wt. zeolite (g) (1)	vol soln (ml)		ref used (ESr)	total wt. zeol. + soln + bottle (g)
1	11.5638	0.3981	0.3984	50	✓	0.1	62.5061
2	11.3862	0.6710	0.6713	50	✓	0.2	62.5582
3	11.3953	1.1843	1.1839	50	✓	0.4	63.1057
4	11.6712	0.6220	0.6228	50	✓	0.5	62.6871
5	11.5353	0.9765	0.9764	50	✓	0.6	62.8088
6	11.5249	0.8682	0.8678	50	✓	0.7	62.5041
7	11.4830	0.8894	0.8892	50	✓	0.8	62.8135
8	11.5040	0.9644	0.9647	50	✓	* 0.9	62.4874
9	11.4425	0.6522	0.6526	50	✓	* 0.9	62.1269
10	11.4136	0.4424	0.4423	50	✓	* 0.9	61.8820
11	11.6410	0.2971	0.2974	50	✓	* 0.9	61.9354
12	11.5938	0.4857	0.4861	50	✓	* 1.0	62.0514
13	11.4193	0.3855	0.3854	50	✓	* 1.0	61.7615
14	11.6362	0.3086	0.3085	50	✓	* 1.0	61.9703
15	11.4778	0.2482	0.2486	50	✓	* 1.0	61.6608
16	11.3190	0.1997	0.1992	50	✓	* 1.0	61.4357
17	11.4898	0.1260	0.1256	50	✓	* 1.0	61.5319
18	19.1248	0.1941	0.1939	100	✓	* 1.0	119.3370
19	30.5269	0.1624	0.1631	250	✓	* 1.0	* 280.57
20	30.7393	0.0924	0.0925	250	✓	* 1.0	* 280.76
	AE 240		AE 240			oxford * vol. pipette	AE 240 * PM 4600

(1) zeolite used: K form clinoptilolite, CDV * 100/200 * UC * WA * UL * CPT * K-f
initial wt = 83.54 g (including container, para film)
final wt = 73.30 g " "

16 Jun 93 PB

1530, Placed experimental solutions into constant temp. water shaker bath at 25°C and 40 rpm. Direct frisk of bench tops showed no evidence of contamination.

21 Jun 93
PB

- Resampled 0.05N KCa reference solutions for Ca^{2+} analyses. Dilution factor of 1/10 should be similar to that for experimental conditions.

- Each reference 0.1 to 1.0 E_{Sr} is sampled using 1.0 ml class A volumetric pipettes and diluted with nH_2O into 10 ml vol. flasks.

- Diluted samples were transferred to 15 ml polypropylene containers. Ca ISA (0.2 ml) was added to each Poly. container, using 0.1 ml eppendorf.

Orion 920A meter w/ Ca^{2+} ISE was prepped for analysis. Meter start up checks ran satisfactorily. Initial Ca^{2+} electrode slope (w/ 10 and 100 ppm) was 28 mV (w/in range).

Solution concentration values are expected to be between 0 and 200 ppm. 5 cal stds will be used. 4 ppm, 10.0 ppm, 40.1 ppm, 100 ppm and 200.4 ppm.

cal stds:

4 - 12.4 mV, 4.00
10 - 24.1 mV, 10.0
40 - 41.1 mV, 40.1
100 - 52.7 mV, 100
200 - 61.5 mV, 200

slope : 29.0 mV

solution	ppm	solution	ppm
E_{Ca} 0.1	9.62	0.4	39.8
0.6	55.8	0.9	84.8
0.2	19.7	0.5	48.8
0.7	67.4	1.0	96.1
0.3	28.9	std 40.1	41.7
0.8	~~75.4~~ 76.5	std 100	102

21 Jun 93
PB

Preparation of low level ^{90}Sr efficiency solutions.

The degradation / loss of counting efficiency for ^{90}Sr solutions (Cerenkov method) during LSC_x is a nagging problem. Lower cpm rates show a decrease in counting efficiency that is difficult to characterize. For measurements near background, there is much uncertainty as to ~~which~~ what value of eff. correction to use. Now that I've said the same thing 3 times, ...

I will use a 10 µl syringe to measure very small aliquots of spike #9 (^{90}Sr). These aliquots will be diluted using 0.05N E_{Sr} 0.9 reference solution to about 10.0 ml volume in plastic LSC vials. The low activities of these aliquots should provide more information as to the trend of counting efficiency as cpm decreases. Also, it is hoped that I will get a better "feel" for the limit of detection of ^{90}Sr in solution.

We know from calculations (20 Apr 93) (p. 52) that spike #9 should have an activity of 11,028.74 dpm/g as of 7 Apr 93. ∴ we can calculate an expected ~~dpm/g~~ dpm for each solution made. If solutions containing from 1.0 µl to 10 µl in 1.0 µl increments are diluted to 10 ml :

SPIKE 9 vol	weight	~~actual~~ activity (dpm)	act/g
1.0 ~~0.1~~ µl	0.0010 g	11.03	1.10
2.0 ~~0.2~~ µl	0.0020 g	22.06	2.21
3.0 ~~0.3~~ µl	0.0030 g	33.09	3.31
4.0 ~~0.4~~ µl	0.0040 g	44.16	4.42
5.0 ~~0.5~~ µl	0.0050 g	55.14	5.51
6.0 ~~0.6~~ µl	0.0060 g	66.17	6.62
7.0 ~~0.7~~ µl	0.0070 g	77.20	7.72
8.0 ~~0.8~~ µl	0.0080 g	88.23	8.82
9.0 ~~0.9~~ µl	0.0090 g	99.26	9.93
10 ~~1.0~~ µl	0.0100 g	110.29	11.03

PB 6/21/93

21 Jun 93 PB

The activity of spike #9 has decreased somewhat since 7 Apr 93. (I will recalculate later) The lowest level solutions (1.0 and 2.0 µl) should bracket the typical background activity of 13 ~~dpm~~ cpm. (Assuming 60-70% counting efficiency) Hopefully, a trend will be seen that provides more information of the change in efficiency w/ low count rates.

SOLUTION	vol spike #9 added (µl)	22 Jun 93 wt. spike #9 added (g)	diluted to w/ 0.9 E_{Sr} 0.05N	22 Jun 93 wt vial before (g)	22 Jun 93 wt vial + spike + E_{Sr} 0.9 (g)
9EE	1.0	0.00096	10 ml	6.93754	17.07144
9FF	2.0	0.00190	10 ml	6.87388	16.98650
9GG	3.0	0.00292	10 ml	6.96737	17.07149
9HH	4.0	0.00401	10 ml	6.89946	16.98492
9II	5.0	0.00493	10 ml	6.85170	16.94646
9JJ	6.0	0.00719	10 ml	6.85646	16.99157
9KK	7.0	0.00614	10 ml	6.97178	17.04167
9LL	8.0	0.00759	10 ml	6.94140	17.00235
9MM	9.0	0.00880	10 ml	6.93428	17.01904
9NN	10.0	0.00966	10 ml	6.88974	17.04475
		AE 240		AE 240	AE 240

Procedure:

- obtain and label 10 20 ml plastic LSC vials
- weigh vials, or tare vial + lid on AE 240 (use 40g scale to provide 0.00000 resolution)
- Using 10 µl syringe, withdraw 1.0 µl from spike #9 container and dispense into LSC vial, read wt. immediately.
- Cap and place LSC vial aside

21 Jun 93 PB

- repeat addition of spike #9 to subsequent LSC vials
- Add 10.0 ml 0.05N E_{Sr} 0.9 ref. soln. (non-spiked) to each LSC vial using 10 ml Oxford macro pipettor.
- ~~re~~ cap and record weight of vial + spike + reference soln.
- count solutions in LSC to equivalent %2σ values.

22 Jun 93 PB

Added spike #9 solution to LSC vials as described. wt/vol listed in Table p. 92.

22 Jun 93 PB

Calculation of spike #9 activity as of 22 Jun 93. This value will be used in determining Cerenkov counting efficiency for ^{90}Sr samples (0.05N KSr and 0.5N NaSr), and spike #9 calibrator solutions 9A - 9G ; 9AA - 9NN.

Activity of spike #9 on 2/7/92 = 5.11 nCi/g

Since $A = A_0 e^{-\lambda t}$, where A = activity at time calculated
A_0 = initial activity
λ = decay constant
t = elapsed time

and $\lambda = \frac{\ln 2}{t_{1/2}}$ where $t_{1/2}$ = nuclide half-life (28.6 years for ^{90}Sr)

$$\Rightarrow \lambda = \frac{\ln 2}{28.6y} = 2.4236 \times 10^{-2}\ y^{-1},$$

we can calculate activity of spike #9 on 6/22/93. If we assume 1 year = 365.25 days,

2/7/92 → 6/22/93 = 501 days

22 Jun 93
PB

$$A_{(6/22/93)} = (5.11\ nCi/g)\, e^{-(2.4236 \times 10^{-2}\ y^{-1})(501/365.25)}$$

$$= (5.11\ nCi/g)\, e^{-(0.0332)}$$

$$A_{(6/22/93)} = 4.9429\ nCi/g = 4.943\ nCi/g$$

$$1\ nCi = 2220\ dpm$$

$$\therefore \text{spike } \#9 = (4.943\ nCi/g)\left(\frac{2220\ dpm}{nCi}\right) = 10{,}973.46\ dpm/g$$

23 Jun 93
PB

Results from counting spike #9 samples show higher than expected count rates. Possibly due to short period of time for sample to "decay" energy from light exposure. Also of note is that the LSC did not count to the desired %2s / time allotment. Samples will be re-run after a longer rest period.

```
Protocol #: 3        Name:CERENKOV Sr-90            22-Jun-93   22:18
Region A: LL-UL= 0.0-30.0  Lcr=   0  Bkg= 0.00  %2 Sigma=5.00
Region B: LL-UL=30.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.50
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time =150.00      QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode
```

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK	1	122.21	13.09	5.00	7.54	20.63	94.929	B
9A	2	0.21	7753.57	4.96	63.89	7817.47	31.356	
	3	0.41	3945.44	4.98	19.29	3964.74	30.745	
	4	0.78	2062.55	5.00	1.44	2063.99	30.277	
	5	2.05	768.37	5.08	4.66	773.03	31.875	
	6	3.92	395.33	5.17	0.37	395.70	30.829	
	7	8.02	186.53	5.36	0.69	187.23	30.841	
9G	8	18.22	74.72	5.94	0.00	74.10	29.721	
9AA	9	0.80	1995.66	5.02	12.46	2006.87	31.931	
	10	1.09	1516.27	4.94	3.47	1519.74	30.521	
	11	16.52	84.00	5.82	1.18	85.18	35.825	
9DD	12	56.13	15.41	10.18	0.00	15.11	28.582	
(2 missing vials)								
9EE	15	72.60	8.95	14.33	0.03	8.97	37.382	
	16	50.95	18.31	9.29	0.35	18.68	31.736	
	17	44.41	22.98	8.34	0.19	23.17	34.053	
	18	34.06	33.88	7.20	0.04	33.89	31.541	
	19	28.71	42.64	6.71	0.86	43.50	35.985	
	20	22.79	57.11	6.25	0.27	57.39	32.897	
	21	25.62	49.36	6.46	0.27	49.63	33.362	
	22	20.97	63.30	6.12	0.05	63.35	31.761	
	23	19.10	70.68	6.00	0.06	70.73	31.287	
9NN	24	17.05	81.04	5.85	0.44	81.48	31.158	

BACKGROUND CORRECTION APPLIED

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

23 Jun 93
PB

Calculated activities for spike #9 solutions (22 Jun 93)

solution	wt. spike #9 (g)	activity (dpm)	~~activity PB 6/23/93~~
9A	1.0266	11265.35	
9B	0.5160	5662.31	calculated from
9C	0.2823	3097.81	
9D	0.1009	1107.22	act/g (p.94).
9E	0.0498	546.48	
9F	0.0244	267.75	
9G	0.0106	116.32	
9AA	0.2496	2738.98	
9BB	0.1990	2183.72	
9CC	0.0107	117.42	
9DD	0.0022	24.14	
9EE	0.00096	10.53	
9FF	0.00190	20.85	
9GG	0.00292	32.04	
9HH	0.00401	44.00	
9II	0.00493	54.10	
9JJ	0.00719	78.90	
9KK	0.00614	67.38	
9LL	0.00756	82.96	
9MM	0.00880	96.57	
9NN	0.00966	106.00	

24 Jun 93
PB

Sample 0.5N NaSr experimental solutions for Sr analysis (^{90}Sr via LSC)

- ~~Sam~~ 6/24/93 PB Exp. solutions containers removed from water-shaker bath and dried, then sampled IAW outline and procedure listed on p 27-28 of this notebook.

24 Jun 93
PB

Sampling of 0.5N NaSr exp/ref solutions (from 8 Jun 93)

Sample no.	LSA vial wt. (g)	vial + samp (g)	vial + samp + H_2O (g)	wt. samp (g)	wt. H_2O + sample (g)	exp solution final wt (g)
Exp # 1	6.9218	7.9379	16.9202	1.0161	9.9984	17.9787
2	6.9834	7.9927	16.7745	1.0093	9.7911	17.7485
3	6.9647	7.9771	16.8761	1.0124	9.9114	18.3319
4	6.9498	7.9602	16.8742	1.0104	9.9244	17.1909
5	6.8829	7.8958	16.8125	1.0129	9.9296	17.3178
6	6.8758	7.8830	16.7787	1.0072	9.9029	17.5941
7	6.8577	7.8663	16.7754	1.0086	9.9177	16.9263
8	6.9073	7.9166	16.8267	1.0093	9.9194	17.1801
9	6.8963	7.8956	16.8054	0.9993	9.9091	16.9974
10	6.9588	7.9621	16.8534	1.0033	9.8946	16.9783
11	6.8690	7.8785	16.7952	1.0095	9.9262	16.9595
12	6.8722	7.8817	16.7835	1.0095	9.9113	17.0644
13	6.8830	7.8982	16.7651	1.0152	9.8821	17.1013
14	6.9774	7.9904	16.9144	1.0130	9.9370	16.9376
15	6.8693	7.8834	16.7791	1.0141	9.9098	33.7214
16	6.8705	7.8867	16.7839	1.0162	9.9134	33.1348
17	6.9739	7.9828	16.8320	1.0089	9.8581	33.2815
18	6.9650	7.9721	16.8848	1.0071	9.9198	62.4981
19	6.8821	7.8954	16.8227	1.0133	9.9406	121.4340
E_{sr} 0.1	6.9459	17.2942	-	~~10.3681~~ PB 6/24/93	-	-
0.2	6.8494	17.1858	-	10.3483	-	-
0.3	6.8922	17.2219	-	10.3364	-	-
0.4	6.8653	17.2129	-	10.3297	-	-
0.5	6.8327	17.1811	-	10.3476	-	-
0.6	6.8895	17.2477	-	10.3484	-	-
0.7	6.8528	17.2253	-	10.3582	-	-
0.8	6.9570	17.3502	-	10.3725	-	-
0.9	6.9121	17.2713	-	10.3932 10.3592	-	-
1.0	6.9996	17.4080	-	10.4084	-	-
0.05	6.9381	17.3062	-	10.3681	-	-
	AE 240	AE 240	AE 240	calculated	calculated	

29 Jun 93
PB

Sampling of 0.5N NaSr experimental and reference solutions for Na^+ ISE analysis.

Samples are taken IAW procedure written on p. 33-35 of this notebook. Exceptions are that 1 ml aliquots of both exp. and reference (non-spiked) solution will be taken, added to a 10 ml vol flask and made up to the mark with n H_2O.

Sample no.	aliquot vol (ml)	diluted to (ml)	dilution factor	exp. solution final wt.
Exp # 1	1.0	10.0	10	16.9677
2	1.0	10.0	10	16.7411
3	1.0	10.0	10	17.3175
4	1.0	10.0	10	16.1787
5	1.0	10.0	10	16.3041
6	1.0	10.0	10	16.5799
7	1.0	10.0	10	15.9043
8	1.0	10.0	10	16.1676
9	1.0	10.0	10	15.9831
10	1.0	10.0	10	15.9581
11	1.0	10.0	10	15.9405
12	1.0	10.0	10	16.0449
13	1.0	10.0	10	~~16.0736~~ PB 16.0740
14	1.0	10.0	10	15.9073
15	1.0	10.0	10	32.6958
16	1.0	10.0	10	32.1083
17	1.0	10.0	10	32.2513
18	1.0	10.0	10	61.4704
19	1.0	10.0	10	120.4013
~~2~~ PB 6/29/93	~~volumetric~~ ~~pipette~~ PB eppendorf tip	vol flask n H_2O		AE 240

Reference sampling continued on next page.

29 Jun 93
PB

Sample no.	aliquot vol (ml)	diluted to (ml)	dilution factor
E_{Sr} 0.05			
0.1	1.0	10.0	10
0.2	1.0	10.0	10
0.3	1.0	10.0	10
0.4	1.0	10.0	10
0.5	1.0	10.0	10
0.6	1.0	10.0	10
0.7	1.0	10.0	10
0.8	1.0	10.0	10
0.9	1.0	10.0	10
1.0	N/A	N/A	N/A
	eppendorf ~~volumetric~~ pipette	vol flask w H_2O	

- all solutions were transferred to labeled 15 ml PP containers
- rad containing solutions were labeled w/ sticky tabs

29 Jun 93
PB

Calculation of ^{90}Sr disposed of during Nat sampling:

① each reference solution contains 0.001 g spike #24A per gram of solution.

② Activity of spike #24A is 0.5009 μCi/gm (28 May 93)

③ As a conservative estimate, we can assume no ^{90}Sr was exchanged onto the zeolite during the experiment and that all ^{90}Sr remains in solution.

- Each solution has 1 gm withdrawn and diluted to 10 ml (~ 10g) => ~~0.05009 μCi/ml~~ PB 6/29/93 in each vol. flask (0.05009 x10^{-3} μCi/ml)

- about 0.2 ml of the diluted solution (~~0.05009 μCi/ml~~ PB 6/29/93 (0.05009 x10^{-3} μCi/ml)

29 Jun 93
PB

remains in each vol flask following transfer to PP containers.

0.2 x 0.05009 x10^{-3} μCi/ml = 0.0100 x10^{-3} μCi in each flask

= 1 x10^{-5} μCi in each flask

19 x 1.0 x10^{-5} μCi = 19 x10^{-5} μCi disposed of.

Solutions were diluted directly into 1 liter => 1.9 x10^{-7} μCi/ml and followed by ~ 50 L of H_2O. => 3.8 x10^{-9} μCi/ml
- work area frisked for β-contamination, no levels above background found.

1 Jul 93
PB

Collected preliminary data for 1st count of 0.5M NaSr solutions including 2nd count of expanded efficiency test (spike #9) The last counts seemed high based on what I expected (declining efficiency at low count rate). However, these numbers confirm that efficiency remains rather constant even at low count rates, and that the spread is fairly consistent. Errors are highlighted due to the low numbers involved. This indicates to me that the average eff. at high count rates (~ 72%) should be applied as a constant to all samples counted in the future. This does not greatly influence previous counts because the relative impact on low count numbers is small and the functions used ~~are~~ PB exhibit linear behavior at the high end (>100 cpm) see p. 61.

Results of counting run and efficiency chart (w/ partial data) are shown on the following page.

Expanded eff. test solutions will be counted again to verify results and application.

1 Jul 93
PD

Cerenkov counting of 0.5N NaSr exp/ref and spike #9 28-30 Jun 93.

* Note change in %2S constraint for #9FF - 9NN.

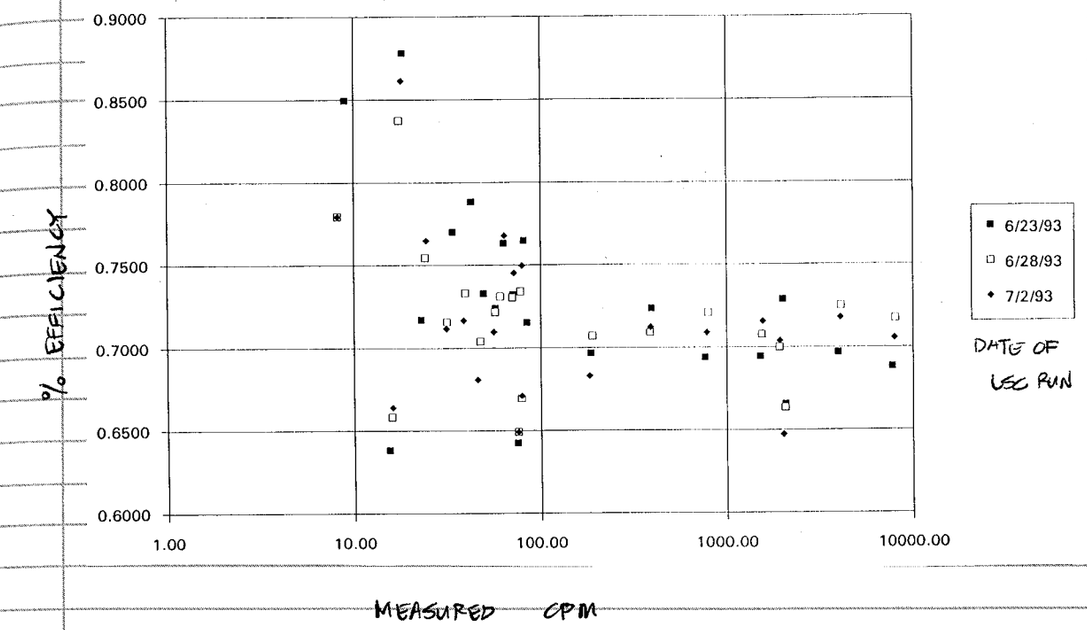
Protocol #: 7 Name:CERENKOV Sr-90 28-Jun-93 23:29
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK #1	1	760.43	13.15	2.00	7.48	20.63	97.647	
	2	90.38	110.64	2.00	7.77	118.40	42.348	
	3	52.05	192.14	2.00	8.41	200.56	37.683	
	4	49.27	202.96	2.00	8.99	211.97	37.439	
	5	22.48	445.06	2.00	9.25	454.36	33.856	
	6	20.54	487.34	2.00	10.37	497.71	34.010	
	7	21.65	462.03	2.00	8.87	470.90	33.634	
	8	16.13	620.21	2.00	10.11	630.32	32.629	
	9	16.83	594.30	2.00	10.40	604.69	33.387	
	10	16.27	614.75	2.00	9.71	624.46	33.013	
	11	15.18	659.22	2.00	12.78	672.00	33.239	
	12	15.19	658.66	2.00	9.61	668.33	32.584	
	13	15.16	659.89	2.00	11.74	671.64	33.179	
	14	15.26	655.31	2.00	9.70	665.01	32.453	
	15	14.46	692.19	2.00	10.37	702.56	33.182	
	16	13.64	733.21	2.00	13.42	746.70	33.392	
	17	13.30	751.95	2.00	10.53	762.41	32.350	
	18	13.01	769.25	2.00	10.91	780.17	32.882	
	19	12.35	810.36	2.00	11.17	821.54	32.770	
#19	20	12.23	818.23	2.00	12.10	830.34	32.621	
	(1 missing vial)							
0.05	22	1.20	8400.00	1.99	55.00	8455.00	31.055	
	23	1.21	8269.42	2.00	56.20	8326.45	31.408	
	24	1.20	8333.33	2.00	55.83	8389.17	31.072	
	25	1.20	8337.50	2.00	33.33	8370.83	30.920	
	26	1.21	8274.38	2.00	43.80	8318.18	31.072	
	27	1.20	8347.50	2.00	56.67	8405.00	30.579	
	28	1.20	8370.83	2.00	45.00	8415.00	30.587	
	29	1.20	8400.83	1.99	40.00	8440.83	30.815	
	30	1.20	8399.17	1.99	53.33	8451.67	31.015	
1.0	32	1.20	8373.33	2.00	45.00	8419.17	31.163	
	(5 missing vials)							
9D	38	1.24	8093.55	2.00	37.90	8131.45	30.473	
	39	2.43	4117.70	2.00	27.16	4144.86	30.724	
	40	4.84	2068.59	2.00	15.91	2084.50	31.127	
	41	12.33	811.44	2.00	12.00	823.44	32.743	
	42	24.96	400.68	2.00	9.62	410.30	34.126	
	43	49.39	202.49	2.00	8.48	210.97	37.546	
	44	112.82	88.65	2.00	7.81	96.47	44.904	
	45	5.18	1930.50	2.00	15.06	1945.75	30.918	
	46	6.42	1558.88	2.00	14.02	1572.90	31.185	
	47	108.96	91.78	2.00	7.89	99.67	44.774	
9DD	48	344.30	29.04	2.00	7.78	36.83	68.995	
	(2 missing vials)							
9EE	51	468.27	21.36	2.00	7.50	28.86	78.374	

Protocol #: 7 Name:CERENKOV Sr-90 30-Jun-93 08:17
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
9FF	52	311.27	30.61	2.05	7.47	38.08	66.677	
	53	119.07	37.32	3.00	7.26	44.59	60.700	
	54	99.54	44.65	3.00	7.84	52.48	56.765	
	55	84.18	52.80	3.00	7.76	60.57	53.323	
	56	63.45	70.07	3.00	7.36	77.43	47.569	
	57	73.35	60.59	3.00	8.25	68.83	52.027	
	58	60.23	73.78	3.00	7.77	81.54	47.323	
	59	53.13	83.66	3.00	7.89	91.57	46.258	
9NN	60	48.87	90.94	3.00	8.00	98.94	45.962	

% efficiency as a function of count rate



PD * chart pasted 6 Jul 93 - printer not available 1 Jul 93. Data include 2 Jul 93 LSC run.

- LSC at 2%, 3%, and 5% 2S but results remain consistent. To me, data indicate that above 100 cpm (corrected for background) a linear correction for efficiency is not only justified but will produce good results. Below 100 cpm, Efficiency varies due to the high sensitivity of the calculation to low cpm values. Still a similar linear correction should be usable. The error would be large in low cpm regions. Note that nearly all samples (reference and experimental) exhibit cpm values above 100 cpm.

2 Jul 93
PB

Removal and Sampling of KSr 0.05N solutions

Overview:

KSr 0.05N solutions have been equilibrating for ~ 15 days in a constant temp shaker bath. The experimental solutions will be removed, sampled for Sr and K analysis, and stored in acrylic boxes. Since all exp. sol volumes are above 50 ml, 10 ml aliquots of each solution will be taken. This will improve count rate (^{90}Sr) thus minimizing counting times for 2% 2s control and reduce the change in ionic strength factors that tend to complicate K^+ ISE analysis. Aliquots measured for ^{90}Sr will be taken immediately and analyzed so that ^{90}Y in-growth can be evaluated. K^+ analysis will be performed later.

Procedure:

1. Remove KSr 0.05N experimental solutions from water bath, check caps for tightness, dry each container.

2. Label and pre-weigh LSC vials (plastic 20 ml) to be used for ^{90}Sr analysis, record wt.

3. Label and pre-weigh 15 ml polypropylene containers to be used for K^+ ISE analysis, record wt.

4. Ensure precautions for handling radioactive materials have been taken.

5. From each exp. solution (# 1-19), remove a 10 ml aliquot using an oxford macro pipettor w/ 10 ml disposable tip and dispense into LSC vial. Cap vial and reweigh, record weight.

2 Jul 93
PB

6. From each spiked KSr 0.05N reference solution, remove a 10 ml aliquot using an oxford macropipettor w/ 10 ml disposable tip and dispense into LSC vial. Cap vial and reweigh, record weight.

7. From each 0.05N KSr exp. solution, remove a 10 ml aliquot using an oxford macro pipettor w/ disposable 10 ml tip and dispense into 15 ml PP container. Cap and reweigh, record wt.

8. From each non-spiked reference soln, remove a 10 ml aliquot using an oxford macropipettor w/ disposable 10 ml tip and dispense into 15 ml PP container. Cap and reweigh, record wt.

9. Weigh each experimental solution container to record wt. solution lost, record wt.

10. Dispense 10 ml of ESr 0.9 (0.05N KSr) non-spiked reference solution into a labeled LSC vial for use ~~of~~ as a blank in LSA.

11. Place LSC vials into LSA for subsequent analysis.

12. Place K^+ analysis and exp solns and spiked reference solutions in appropriate storage containers.

* When acquiring samples, especially from small volumes, make sure that no zeolite material is withdrawn with sample.

2 Jul 93
PD

Sampling of 0.05N KSr solutions for ^{90}Sr analysis
→ KSR05SAM.XLS

Sample no.	LSA vial wt. (g)	vial + samp (g)	vial + samp + H_2O (g)	wt. samp (g)	wt. H_2O + sample (g)
exp. #1	6.9024	17.0366		10.1342	
2	6.8427	16.7084		9.8657	
3	6.9476	17.0106		10.0630	
4	6.8625	16.8968		10.0343	
5	6.8780	16.9319		10.0539	
6	6.9841	17.0393		10.0552	
7	6.9748	16.9922		10.0174	
8	6.9245	16.9513		10.0268	
9	6.9716	16.9856		10.0140	
10	6.9606	16.9601		9.9995	
11	6.8823	16.8591		9.9768	
12	6.9751	16.9732		9.9981	
13	6.8702	16.8728		10.0026	
14	7.0001	16.9926		9.9925	
15	6.9079	16.9054		9.9975	
16	6.9204	16.9256		10.0052	
17	6.9590	16.9509		9.9919	
18	6.9568	16.9774		10.0206	
19	6.9118	16.9216		10.0098	
20	6.9429	16.9355		9.9926	
E_{Sr} 0.1	6.8366	16.7860		9.9494	
0.2	6.9484	16.9065		9.9581	
0.4	6.9827	16.9703		9.9876	
0.5	6.8420	16.8407		9.9987	
0.6	6.9198	16.9013		9.9815	
0.7	7.0533	17.0404		9.9871	
0.8	6.9743	16.9592		9.9849	
0.9	6.9810	16.9928		10.0118	
1.0	6.8905	16.8875		9.9970	
	AE 240	AE 240			

No H_2O Added

No H_2O Added

2 Jul 93
PD

Sampling of 0.05 KSr solutions for kt analysis
→ K05SAM.XLS

Sample no.	Poly container wt (g)	container + samp (g)	wt. samp (g)	dilution factor	wt exp. soln (g)
exp #1	7.3063	17.4428	10.1365	none	
2	7.0898	17.0919	10.0021	none	
3	7.1449	17.1885	10.0436	none	
4	7.0940	17.1502	10.0562	none	
5	7.1266	17.1591	10.0325	none	
6	7.0571	17.0826	10.0255	none	
7	7.0270	17.0473	10.0203	none	
8	7.0626	17.0830	10.0204	none	
9	7.0885	17.0915	10.0030	none	
10	7.1155	17.1079	9.9924	none	
11	7.0770	17.0704	9.9934	none	
12	7.1253	17.1164	9.9911	none	
13	7.1033	17.0812	9.9779	none	
14	7.1144	17.1055	9.9911	none	
15	6.9921	16.9867	9.9946	none	
16	7.0711	17.0679	9.9968	none	
17	7.2208	17.2141	9.9933	none	
18	7.1690	17.1578	9.9888	none	
19	7.1094	17.1043	9.9949	none	
20	7.0585	17.0498	9.9913	none	
E_{Sr} 0.1	7.1784	17.1153	9.9369	none	
0.2	7.1061	17.0650	9.9589	none	
N/A ~~0.3~~				none	
0.4	7.0230	16.9604	9.9374	none	
0.5	7.0660	17.0156	9.9496	none	
0.6	7.1059	17.0949	9.9890	none	
0.7	7.0953	17.0459	9.9506	none	
0.8	7.0913	17.0408	9.9495	none	
0.9	7.1095	17.0866	9.9771	none	
1.0	6.9778	16.9939	10.0161	none	
	AE 240	AE 240			

2 Jul 93
PB

I neglected to take an aliquot from the 0.5N NaSr E1.0a spiked reference. I did so today.

	wt vial	wt vial + samp	wt vial + samp + H_2O	wt samp + H_2O	wt samp
Esr 1.0a	7.0148	8.6971	17.0722	10.0574	1.6823

* there was little solution left, I sampled with two partially full eppendorf tops to obtain the wt given.

6 Jul 93
PB

Results of LSC from 2 Jul and 4 Jul are shown below and on following page. Ideally multiple counts during ^{90}Y in-growth will allow calculation of ^{90}Y present over time. This might lead to some information on the relative affinity of the zeolite (clinoptilolite) for Y over Sr.

2 Jul 93

Protocol #: 7 Name:CERENKOV Sr-90 02-Jul-93 01:48
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
Blank 1	341.09	13.03	3.00	7.57	20.50	100.15	
#1 2	39.52	112.45	3.00	7.49	119.94	41.812	
3	22.36	198.88	3.00	7.50	206.48	36.565	
4	20.36	218.27	3.00	8.29	227.60	37.734	
5	9.73	457.14	3.00	8.56	466.70	34.053	
6	8.95	496.65	3.00	9.27	506.03	33.405	
7	9.19	483.90	3.00	8.16	492.06	33.748	
8	7.18	619.36	3.00	11.00	630.36	33.315	
9	7.36	604.48	3.00	10.87	615.35	33.931	
10	5.85	548.91	3.00	10.66	559.56	33.534	
11	5.64	569.88	3.00	13.40	583.43	33.573	
12	5.77	556.72	3.00	10.49	567.21	33.148	
13	5.76	557.69	3.00	10.80	568.49	33.840	
14	5.63	570.89	3.00	11.46	582.35	33.209	
15	5.25	711.84	3.00	10.08	721.92	32.989	
16	5.00	741.50	3.00	11.17	752.67	32.785	
17	5.87	757.07	3.00	13.60	770.67	33.818	
18	5.59	796.42	3.00	10.38	806.98	33.058	
19	5.54	802.53	3.00	10.29	812.82	32.473	
#19 20	5.49	809.84	3.00	11.64	821.68	33.001	
(1 missing vial)							
0.05 22	0.52	8688.46	2.98	53.85	8742.31	31.545	
23	0.55	8140.00	2.99	58.18	8198.18	31.594	
24	0.54	8294.44	2.99	46.30	8340.74	30.668	
25	0.54	8233.33	3.00	51.85	8285.18	31.317	
26	0.54	8350.00	2.98	35.19	8385.18	31.240	
27	0.54	8383.33	2.97	51.85	8435.18	31.001	
28	0.53	8398.11	3.00	52.83	8450.94	31.507	
29	0.55	8214.54	2.98	36.36	8252.73	30.840	
30	0.52	8546.15	3.00	50.00	8596.15	31.620	
31	0.54	8294.44	2.99	55.56	8350.00	30.925	
1.0 32	0.53	8386.79	3.00	52.83	8439.62	31.365	
(5 missing vials)							
#A 38	0.56	7960.71	3.00	42.86	8003.57	30.704	
39	1.09	4078.90	3.00	31.19	4110.09	31.369	
40	2.21	2018.10	2.99	17.65	2035.75	31.050	
41	5.57	798.20	3.00	8.80	807.00	31.789	
42	11.06	402.35	3.00	9.49	411.84	34.739	
43	22.68	195.94	3.00	7.89	203.88	37.147	
44	50.20	88.53	3.00	7.99	96.51	45.012	
45	2.29	1941.48	3.00	17.03	1958.52	31.640	
46	2.82	1575.89	3.00	19.15	1595.04	32.134	
47	48.40	91.84	3.00	7.64	99.48	45.102	
Blank 48	152.95	29.06	3.00	7.59	36.65	69.796	
(2 missing vials)							
#B 51	209.29	21.24	3.00	7.23	28.46	78.696	
52	143.41	30.99	3.00	7.27	38.25	65.316	
#A 53	118.39	37.54	3.00	7.65	45.19	61.923	

0.05N Sr-90 Exps

Replicates

Spike #9

6 Jul 93
PB

LSC from 2 Jul 93 cont'd

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
#B 54	100.21	44.35	3.00	7.87	52.23	57.297	
55	85.79	51.80	3.00	7.84	59.63	54.022	
56	64.38	69.03	3.00	7.63	76.67	48.321	
57	75.50	58.90	3.00	7.85	66.75	51.474	
58	57.94	76.72	3.00	7.51	84.24	48.284	
59	52.31	84.97	3.00	7.70	92.68	45.556	
#A 60	48.06	92.49	3.00	8.80	101.31	46.659	

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

Spike #9

* The following count sheet also includes 1st 0.05N KSr data *

- LSC from 4 Jul 93

Protocol #: 7 Name:CERENKOV Sr-90 04-Jul-93 13:33
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
Blank 1	342.67	12.97	3.00	7.57	20.54	100.43	
#1 2	36.94	120.33	3.00	7.72	128.05	41.120	
3	21.76	204.32	3.00	8.87	213.19	37.873	
4	20.38	218.06	3.00	8.19	226.25	36.953	
5	9.49	468.49	3.00	10.33	478.82	34.454	
6	8.96	496.32	3.00	11.72	507.92	34.061	
7	9.08	489.54	3.00	7.93	497.47	32.882	
8	7.04	632.24	3.00	8.81	641.05	32.949	
9	7.22	616.07	3.00	11.77	627.84	33.679	
10	7.05	630.92	3.00	10.50	641.42	33.327	
11	6.65	668.42	3.00	10.83	679.25	32.651	
12	6.66	668.17	3.00	14.41	682.58	34.093	
13	6.60	673.48	3.00	13.94	687.42	33.461	
14	6.71	662.59	3.00	12.37	674.96	33.553	
15	6.10	728.52	3.00	11.31	740.00	32.904	
16	5.90	753.39	3.00	11.69	765.08	32.857	
17	5.56	800.54	3.00	12.05	812.59	32.614	
18	5.85	760.17	3.00	11.79	771.97	32.697	
19	5.53	803.62	3.00	10.85	814.29	32.903	
#19 20	5.50	808.00	3.00	9.64	817.64	32.035	
(1 missing vial)							
0.05 22	0.55	8150.91	2.99	36.36	8187.27	30.805	
23	0.53	8452.83	2.99	49.06	8500.00	31.076	
24	0.54	8351.85	2.98	37.04	8387.04	30.590	
25	0.54	8292.59	2.99	62.96	8355.56	31.300	
26	0.56	7953.57	3.00	62.50	8016.07	30.684	
27	0.54	8337.04	2.98	40.74	8377.78	30.921	
28	0.54	8266.67	2.99	40.74	8307.41	30.743	
29	0.53	8488.68	2.98	35.85	8524.53	30.304	
30	0.54	8312.96	2.99	53.70	8366.67	31.545	
31	0.54	8262.96	2.99	50.00	8312.96	31.039	
1.0 32	0.54	8353.70	2.98	46.30	8400.00	30.992	
1.0 33	3.28	1356.71	3.00	14.33	1371.04	32.319	
(3 missing vials)							
#A 37	0.55	8192.73	2.98	47.27	8241.82	30.645	
38	1.11	4027.93	2.99	17.12	4045.04	30.761	
39	2.22	2002.70	3.00	18.02	2020.72	31.478	
40	5.55	801.08	3.00	12.61	813.69	32.768	
41	11.03	402.99	3.00	9.79	412.78	34.371	
42	22.62	196.55	3.00	9.33	205.88	38.929	
43	48.71	91.23	3.00	8.01	99.24	45.530	
44	2.29	1943.23	3.00	15.72	1958.52	31.998	
45	2.82	1584.04	2.99	13.12	1597.16	31.679	
46	48.85	90.99	3.00	8.13	99.12	45.223	
#B 47	153.75	28.90	3.00	7.66	36.57	68.960	
(1 missing vial)							
Blank 49	300.34	14.80	3.00	7.36	22.16	90.282	
#1 50	0.74	6072.97	2.98	43.24	6114.86	30.699	

0.05N KSr Exps

Spike #9

Replicates

0.05N KSr Exps

6 Jul 93
PB

LSC from 4 Jul 93, cont'd

0.05N KSr BKGS

KSr REAS

SPIKE #9

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	BIS	FLAG
d2	51	0.83	5374.70	2.99	38.55	5413.25	31.056	
	52	0.89	5013.48	2.99	24.72	5038.20	31.280	
	53	0.75	5969.33	2.99	30.67	6000.00	31.108	
	54	0.80	5598.75	2.99	42.50	5641.25	31.151	
	55	0.80	5608.75	2.99	43.75	5652.50	30.850	
	56	0.81	5525.93	2.99	30.86	5556.79	30.894	
	57	0.84	5319.05	2.99	35.71	5354.76	31.245	
	58	0.75	5953.33	2.99	42.67	5996.00	30.563	
	59	0.79	6144.30	2.87	45.57	6191.14	31.294	
	60	0.68	6572.06	2.99	35.29	6607.35	30.762	
	61	0.71	6291.55	2.99	46.48	6338.03	30.993	
	62	0.70	6392.86	2.99	38.57	6431.43	31.496	
	63	0.66	6762.12	2.99	34.85	6796.97	30.761	
	64	0.65	6926.15	2.98	35.38	6961.54	31.040	
	65	0.63	7163.49	2.98	42.86	7206.35	31.051	
	66	0.59	7545.76	3.00	55.93	7601.70	31.203	
	67	0.56	7935.71	3.00	37.50	7973.21	31.635	
	68	0.55	8103.64	3.00	43.64	8147.27	31.817	
d2	69	0.56	7998.21	2.99	41.07	8039.29	31.136	
	(3 missing vials)							
0.1	73	0.58	7710.35	2.99	37.93	7750.00	31.300	
0.2	74	0.56	8014.29	2.99	50.00	8066.07	31.844	
0.4	75	0.56	7967.86	2.99	53.57	8021.43	31.219	
	76	0.55	8120.00	2.99	38.18	8158.18	31.125	
	77	0.56	7944.64	3.00	73.21	8017.86	31.370	
	78	0.56	7957.14	3.00	33.93	7991.07	30.937	
	79	0.55	8083.64	3.00	50.91	8134.55	31.321	
	80	0.56	8019.64	2.98	41.07	8060.71	30.993	
1.0	81	0.54	8305.56	2.99	37.04	8342.59	31.003	
	(5 missing vials)							
MEE	87	208.03	21.36	3.00	7.71	29.07	80.258	
	88	145.76	30.50	3.00	7.81	38.31	68.467	
	89	120.19	36.97	3.00	7.83	44.80	62.467	
	90	97.20	45.72	3.00	7.87	53.60	56.620	
	91	84.04	52.88	3.00	7.52	60.40	53.186	
	92	64.07	69.36	3.00	8.19	77.56	49.591	
	93	72.94	60.93	3.00	7.88	68.81	52.278	
	94	60.44	73.53	3.00	7.05	80.58	46.916	
	95	54.36	81.75	3.00	7.08	88.83	44.927	
JWN	96	49.29	90.18	3.00	8.07	98.26	45.715	

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

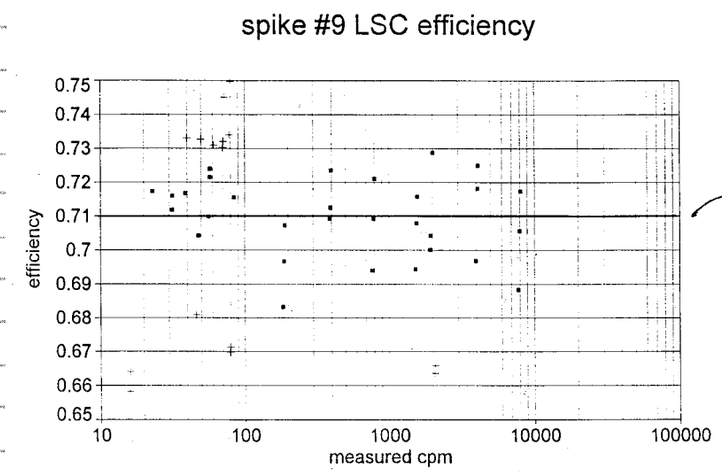
6 Jul 93
PB

Analysis of Spike #9 LSC runs shows no significant trend in efficiency for low count rate samples (below 100 cpm)

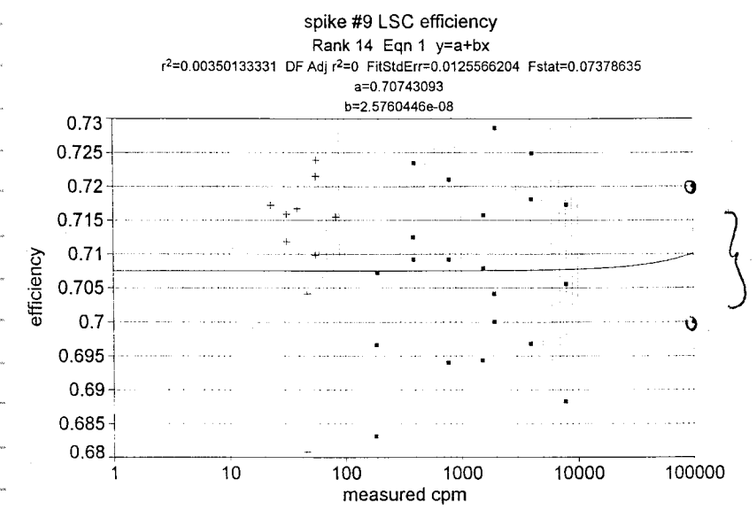
An efficiency of ~ 0.71 seems appropriately applied to all samples. Additionally, the efficiency can be derived from high cpm spike #9 samples and does not require counting of low cpm samples (which take a long time to process).

An example of eff. spread is shown in the 1st plot, next page, a nearly horizontal linear fit of only >100 cpm points is shown on the following page as well.

6 Jul 93
PB



hand drawn approximation.



these two pts artificially added to provide linear trend through ROI. TBLCURVE DID NOT WANT TO FIT A HORIZONTAL LINE THROUGH DATA!

Rank 14 Eqn 1 y=a+bx

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.0035013333	0.0000000000	0.0125566204	0.0737863500

Parm	Value	Std Error	t-value	95% Confidence Limits	
a	0.707430934	0.002814520	251.3504329	0.701575076	0.713286791
b	2.57604e-08	9.48343e-08	0.271636430	-1.7155e-07	2.23072e-07

Date	Time	File Source
Jul 6, 1993	3:21:43 PM	c:\tcwin\expeff.prn

8 Jul 93
PB

LSC results from 0.5 NaSr and 0.05N KSr 7 Jul 93

low cpm spike #9 samples will no longer be counted, they have ~~been~~ been removed from the loop.

- Protocol will be changed to 2% 2s for subsequent runs.

Protocol #: 7 Name:CERENKOV Sr-90 06-Jul-93 15:42
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
1	343.14	12.96	3.00	7.72	20.68	100.37	
2	36.70	121.17	3.00	8.45	129.62	42.791	
3	20.51	216.87	3.00	8.97	225.84	38.928	
4	19.82	224.27	3.00	8.88	233.10	37.474	
5	9.48	469.30	3.00	9.92	479.22	34.927	
6	8.95	497.65	3.00	10.28	507.93	34.502	
7	9.33	476.42	3.00	10.93	487.35	34.823	
8	6.93	642.28	3.00	9.09	651.37	33.375	
9	7.41	600.40	3.00	13.50	613.90	34.744	
10	6.84	650.29	3.00	12.72	663.01	34.055	
11	6.51	682.80	3.00	12.75	695.55	33.928	
12	6.59	674.66	3.00	13.81	688.47	34.310	
13	6.44	690.68	3.00	11.02	701.55	33.577	
14	6.47	687.64	3.00	11.44	699.07	33.949	
15	6.35	700.31	3.00	12.28	712.60	34.428	
16	6.08	731.25	3.00	12.99	744.24	33.626	
17	5.93	750.25	3.00	12.98	763.41	33.888	
18	5.88	755.78	3.00	11.56	767.35	33.591	
19	5.63	790.05	3.00	13.32	803.37	33.724	
20	5.61	792.16	3.00	12.83	804.99	33.631	
(1 missing vial)							
22	0.54	8337.04	2.98	31.48	8368.52	31.676	
23	0.56	8057.14	2.98	50.00	8108.93	32.074	
24	0.55	8130.91	2.99	69.09	8200.00	31.947	
25	0.54	8238.89	3.00	44.44	8283.33	31.587	
26	0.55	8227.27	2.97	49.09	8276.36	31.684	
27	0.53	8541.51	2.97	43.40	8584.91	31.093	
28	0.54	8324.07	2.98	48.15	8372.22	31.950	
29	0.54	8255.56	3.00	57.41	8312.96	31.522	
30	0.55	8150.91	2.99	78.18	8229.09	32.250	
31	0.54	8275.93	2.99	68.52	8344.44	32.021	
32	0.55	8149.09	2.99	60.00	8209.09	31.929	
33	3.37	1320.18	3.00	16.62	1337.09	32.772	
(3 missing vials)							
37	0.55	8105.45	3.00	58.18	8165.45	31.925	
38	1.10	4061.82	2.99	28.18	4090.00	31.603	
39	2.18	2041.28	3.00	22.94	2064.22	32.275	
40	5.53	804.88	3.00	11.93	817.00	32.659	
41	11.42	389.23	3.00	9.46	398.77	35.265	
42	22.35	198.84	3.00	8.59	207.43	38.697	
43	49.00	90.69	3.00	7.78	98.47	44.694	
44	2.27	1963.88	3.00	23.35	1987.22	32.590	
45	2.91	1533.68	2.99	15.81	1549.48	32.797	
46	47.21	94.15	3.00	8.66	102.82	45.643	
47	152.15	29.21	3.00	7.93	37.13	70.348	
(1 missing vial)							
49	303.12	14.66	3.00	7.45	22.11	91.173	
50	0.67	6640.30	3.00	43.28	6683.58	31.806	

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

8 Jul 93
PB

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
51	0.73	6116.44	2.99	39.73	6157.53	32.154	
52	0.77	5796.10	2.99	44.16	5840.26	32.434	
53	0.66	6769.70	2.99	37.88	6807.58	31.902	
54	0.72	6193.06	3.00	41.67	6234.72	31.791	
55	0.72	6186.11	3.00	31.94	6219.44	32.222	
56	0.78	5723.08	2.99	52.56	5775.64	32.344	
57	0.80	5578.75	2.99	36.25	5615.00	31.740	
58	0.71	6288.73	2.99	59.15	6346.48	31.924	
59	0.67	6704.48	2.98	55.22	6759.70	32.639	
60	0.64	6946.88	3.00	46.88	6995.31	31.750	
61	0.68	6585.29	2.99	51.47	6636.76	32.226	
62	0.67	6691.04	2.99	53.73	6744.78	32.589	
63	0.64	7021.88	2.98	56.25	7078.13	31.933	
64	0.63	7131.75	2.98	49.21	7182.54	31.925	
65	0.60	7423.33	3.00	40.00	7463.33	32.014	
66	0.61	7380.33	2.98	50.82	7429.51	31.917	
67	0.58	7748.28	2.98	46.55	7793.10	31.619	
68	0.56	8010.71	2.99	53.57	8066.07	32.358	
69	0.55	8183.64	2.98	58.18	8240.00	32.276	
(3 missing vials)							
73	0.58	7729.31	2.99	58.62	7787.93	31.848	
74	0.57	7857.90	2.99	54.39	7912.28	31.837	
75	0.56	8044.64	2.98	51.79	8098.21	32.139	
76	0.56	7985.71	2.99	53.57	8039.29	32.272	
77	0.56	7951.79	3.00	64.29	8017.86	32.009	
78	0.55	8138.18	2.99	54.55	8192.73	31.646	
79	0.57	7868.42	2.99	61.40	7931.58	31.853	
80	0.55	8083.64	3.00	56.36	8140.00	32.975	
81	0.56	7991.07	2.99	64.29	8055.36	32.001	

Protocol #: 7 Name:CERENKOV Sr-90 07-Jul-93 08:5
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time = 30.00 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
(5 missing vials)							
87	30.00	21.40	7.89	8.07	29.50	83.578	
88	30.00	30.00	6.67	8.00	38.00	71.599	
89	30.00	37.07	6.00	7.20	44.30	64.700	
90	30.00	45.00	5.44	7.20	52.20	55.549	
91	30.00	54.50	4.95	7.90	62.43	54.952	
92	30.00	68.23	4.42	7.47	75.70	49.575	
93	30.00	63.63	4.58	7.53	71.17	49.109	
94	30.00	77.73	4.14	8.47	86.20	49.994	
95	30.00	83.70	3.99	8.23	91.93	47.840	
96	30.00	92.70	3.79	8.87	101.57	47.130	

9 Jul 93
PB

1.0 ml Na^+ ISA added to all exp and ref solutions to be analyzed for Na^+.

9 Jul 93
PB

Analysis of 0.5N NaSr experimental and reference solutions for Na^+ concentration.

Equipment. Orion Ross model 86-11 combination Na^+ ISE
Orion model 920A pH/mv/ISE/T meter w/optional
Orion model 900A printer.

Solutions:
ISA - ionic strength adjustor, Na, lot # 13-641-748
standards
10 ppm Na Orion lot # 13-641-948
100 ppm Na Orion lot # 13-641-909
1000 ppm Na Orion lot # 13-641-747
others:
Na reconditioning solution lot # TR 1. Orion
Na electrode rinse: 1ml ISA : 100 ml nH_2O
Orion reference solution, 2 M NH_4Cl lot # WU 1
Orion elec. storage (Na) solution lot # WY 1

- refurbished Na^+ ISE, rinsed in reconditioning solution for 1 min, washed w/rinse. Replaced electrode ref solution and placed electrode in storage solution for ≈20 min.

- Performed prelimirary calibration and slope evaluation to check meter and electrode response

9 Jul 93
PB

Calibration: 10 ppm:
100 ppm:
1000 ppm:

slope: 60.1

CALIBRATION
Chl-NA+
P1 CONC =10.0
-129.5mV 25.0C
P2 CONC =100
-94.8mV 25.0C
P3 CONC =1000
-26.6mV 25.0C

SLP=60.1994
SLP=59.9mV/D
IS=1.00
10/21 07-09-93

	Solution	ppm as read	Solution	ppm as read
exp	# 1	1130	# 10	491
	# 11	398	E 0.05	1090
ref	E 0.1	1040	10 ppm	10.3
	# 2	1100	100 ppm	99.5
	# 12	294	1000 ppm	996
	E 0.2	936		
	# 3	1075		
	# 13	225		
	E 0.3	818		
	# 4	1000		
	# 14	165		
	E 0.4	699		
	# 5	929		
	# 15	118		
	E 0.5	586		
	# 6	857		
	# 16	83.7		
	E 0.6	480		
	# 7	793		
	# 17	56.2		
	E 0.7	354		
	# 8	725		
	# 18	28.0		
	E 0.8	239		
	# 9	602		
	# 19	7.59		
	E 0.9	120		

13 Jul 93

PB

results of LSC for 0.5N NaSr and 0.05 KSr samples

Protocol #: 7 Name:CERENKOV Sr-90 09-Jul-93 16:57
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK	1	766.90	13.04	2.00	7.55	20.60	98.259	
0.5N NaSr EXPTS	2	82.21	121.64	2.00	8.13	129.77	40.771	
	3	47.78	209.29	2.00	8.48	217.77	37.246	
	4	44.69	223.76	2.00	8.19	231.95	36.253	
	5	21.21	471.52	2.00	9.67	481.14	33.675	
	6	20.19	495.29	2.00	9.61	504.90	33.340	
	7	20.07	498.31	2.00	10.46	508.82	33.880	
	8	15.93	627.75	2.00	10.48	638.23	32.747	
	9	16.64	600.96	2.00	9.98	610.94	32.900	
	10	15.53	644.11	2.00	11.20	655.31	33.502	
	11	14.62	684.13	2.00	11.01	695.14	32.865	
	12	14.71	679.81	2.00	9.99	689.87	33.016	
	13	14.91	670.82	2.00	10.40	681.22	32.979	
	14	15.06	664.14	2.00	11.22	675.37	33.359	
	15	13.92	718.68	2.00	10.56	729.24	33.360	
	16	13.50	740.81	2.00	12.22	752.96	32.647	
	17	13.27	753.88	2.00	11.00	764.88	32.376	
	18	12.95	772.20	2.00	11.43	783.63	32.583	
	19	12.44	804.50	2.00	11.09	815.59	32.241	
	20	12.29	813.67	2.00	10.50	824.17	32.439	
	(1 missing vial)							
0.5N NaSr REPS	22	1.21	8287.60	2.00	47.93	8335.54	31.149	
	23	1.20	8411.67	1.99	41.67	8454.17	30.865	
	24	1.22	8233.61	2.00	47.54	8281.15	30.492	
	25	1.21	8305.79	2.00	42.15	8348.76	31.111	
	26	1.23	8165.04	2.00	37.40	8202.44	30.758	
	27	1.20	8352.50	2.00	41.67	8394.17	30.738	
	28	1.21	8266.94	2.00	38.02	8304.96	30.816	
	29	1.19	8455.46	1.99	42.02	8497.48	31.103	
	30	1.19	8452.10	1.99	48.74	8500.84	31.206	
	31	1.20	8367.50	2.00	51.67	8419.17	31.243	
	32	1.21	8329.75	1.99	57.85	8387.60	31.065	
	33	7.51	1331.56	2.00	16.11	1347.67	31.709	
	(3 missing vials)							
SPIKE #5	37	1.22	8222.13	2.00	44.26	8265.57	30.652	
	38	2.47	4055.87	2.00	20.65	4076.92	30.913	
	39	4.83	2070.60	2.00	18.43	2089.03	30.690	
	40	12.55	797.29	2.00	11.00	808.29	32.115	
	41	25.11	398.25	2.00	8.84	407.09	34.008	
	42	50.90	196.48	2.00	7.80	204.30	37.067	
	(1 missing vial)							
0.05M KSr EXPS	44	5.08	1972.64	2.00	16.73	1989.37	31.598	
	45	6.42	1557.79	2.00	15.73	1573.52	31.511	
	(4 missing vials)							
	50	1.42	7072.54	2.00	37.32	7109.16	30.639	
	51	1.50	6673.33	2.00	32.00	6705.33	31.188	
	52	1.57	6385.35	2.00	37.58	6422.93	30.908	
	53	1.43	6993.71	2.00	41.26	7035.66	31.131	

From 9 Jul 93

13 Jul 93

PB

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
KSr EXPTS	54	1.53	6535.95	2.00	35.29	6570.59	31.115	
	55	1.56	6454.49	1.99	42.31	6496.79	31.351	
	56	1.57	6394.90	2.00	39.49	6435.03	31.439	
	57	1.65	6061.21	2.00	36.36	6097.58	30.782	
	58	1.51	6668.87	1.99	37.75	6706.62	30.718	
	59	1.45	6915.86	2.00	46.90	6962.76	31.355	
	60	1.41	7100.00	2.00	42.55	7142.55	31.060	
	61	1.46	6865.07	2.00	40.41	6906.16	30.871	
	62	1.43	7034.27	1.99	46.85	7081.12	31.479	
	63	1.40	7192.14	1.99	37.86	7230.00	31.078	
	64	1.36	7391.91	1.99	44.12	7436.03	30.735	
	65	1.33	7547.37	2.00	44.36	7591.73	31.333	
	66	1.29	7763.57	2.00	47.29	7810.85	30.871	
	67	1.28	7853.13	1.99	43.75	7896.88	30.918	
	68	1.22	8203.28	2.00	33.61	8236.88	31.140	
	69	1.21	8333.06	1.99	34.71	8367.77	31.139	
	(3 missing vials)							
KSr REPS	73	1.28	7854.69	1.99	39.84	7894.53	31.040	
	74	1.24	8079.84	2.00	53.23	8132.26	31.087	
	75	1.26	7979.37	1.99	46.03	8025.40	30.574	
	76	1.22	8204.92	2.00	45.08	8250.00	30.685	
	77	1.27	7926.77	1.99	37.80	7964.57	30.702	
	78	1.22	8209.02	2.00	54.10	8263.11	31.233	
	79	1.26	7980.95	1.99	35.71	8016.67	31.074	
	80	1.26	7965.87	2.00	49.21	8014.29	31.347	
	81	1.20	8391.67	1.99	41.67	8433.33	30.650	

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

From 9 Jul 93 (cont'd)

13 Jul 93 results of LSC, 10 Jul 93 0.5N NaSr, 0.05N KSr

PD

Protocol #: 7 Name:CERENKOV Sr-90 10-Jul-93 18:07
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK 1	762.03	13.12	2.00	7.43	20.55	97.091	
#2	80.64	124.03	2.00	8.57	132.60	41.483	
3	47.39	211.01	2.00	8.82	219.84	37.553	
4	44.87	222.96	2.00	7.73	230.67	36.220	
5	21.42	467.09	2.00	9.99	477.08	34.202	
6	19.79	505.61	2.00	9.04	514.65	33.647	
7	20.42	489.81	2.00	10.09	499.95	33.865	
8	15.56	642.80	2.00	9.90	652.70	32.573	
9	16.59	602.77	2.00	10.13	612.90	33.382	
10	15.13	661.34	2.00	10.05	671.38	32.936	
11	14.76	677.71	2.00	11.11	688.89	33.268	
12	14.94	669.48	2.00	10.04	679.52	32.482	
13	14.67	682.14	2.00	11.11	693.18	32.849	
14	14.89	671.79	2.00	12.02	683.81	33.429	
15	14.03	712.76	2.00	11.12	723.88	33.347	
16	13.72	728.94	2.00	10.20	739.21	32.735	
17	13.15	760.91	2.00	12.17	773.16	32.794	
18	13.07	765.42	2.00	10.86	776.28	32.283	
19	12.58	795.71	2.00	13.75	809.46	32.492	
#20	12.33	811.11	2.00	10.30	821.41	32.245	
(1 missing vial)							
22	1.21	8288.43	2.00	42.15	8330.58	30.879	
23	1.20	8335.00	2.00	54.17	8389.17	31.149	
24	1.19	8453.78	1.99	37.82	8492.44	30.937	
25	1.20	8391.67	1.99	50.00	8441.67	31.356	
26	1.21	8271.07	2.00	39.67	8310.74	30.780	
27	1.21	8295.04	2.00	47.93	8343.80	30.898	
28	1.23	8199.19	1.99	44.72	8243.90	31.029	
29	1.20	8380.83	1.99	30.00	8410.83	30.687	
30	1.18	8505.93	2.00	50.00	8555.93	30.997	
31	1.21	8315.70	1.99	46.28	8361.98	30.872	
32	1.20	8348.33	2.00	55.83	8404.17	30.898	
33	7.31	1368.40	2.00	13.95	1382.35	31.997	
(3 missing vials)							
37	1.23	8131.71	2.00	40.65	8172.36	30.563	
38	2.49	4018.88	2.00	21.69	4040.56	30.575	
39	4.96	2019.56	2.00	21.98	2041.53	31.354	
40	12.60	793.65	2.00	10.71	804.37	32.188	
41	25.02	399.96	2.00	10.23	410.23	34.998	
42	49.82	200.72	2.00	8.35	209.07	37.607	
(1 missing vial)							
44	5.06	1976.48	2.00	14.62	1991.11	31.408	
45	6.40	1564.22	2.00	15.31	1579.53	31.680	
(4 missing vials)							
50	1.39	7205.04	2.00	46.04	7251.08	31.234	
51	1.47	6839.46	1.99	35.37	6874.83	31.290	
52	1.56	6440.38	2.00	43.59	6483.97	31.134	
53	1.40	7177.14	2.00	40.00	7217.86	30.908	

0.5M NaSr EXPS; 0.5M NaSr REPS; 0.05M KSr EXPS

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
#54	1.51	6623.18	2.00	39.74	6662.91	30.910	
55	1.52	6587.50	2.00	37.50	6625.00	31.096	
56	1.57	6389.81	2.00	35.67	6425.48	31.192	
57	1.63	6160.74	2.00	30.06	6190.80	30.949	
58	1.52	6609.21	2.00	39.47	6648.68	31.254	
59	1.45	6920.69	2.00	44.14	6964.83	31.446	
60	1.38	7255.07	2.00	36.96	7292.03	31.144	
61	1.45	6896.55	2.00	47.59	6944.83	31.114	
62	1.43	7013.29	2.00	50.35	7063.64	31.014	
63	1.38	7305.80	1.99	50.72	7355.80	31.226	
64	1.36	7391.18	1.99	37.50	7427.94	31.154	
65	1.34	7503.73	1.99	46.27	7550.00	31.166	
66	1.31	7648.09	2.00	51.15	7698.47	31.270	
67	1.28	7827.34	2.00	47.66	7875.00	31.096	
68	1.24	8075.81	2.00	49.19	8125.00	31.052	
#70 69	1.21	8300.83	2.00	50.41	8352.07	31.032	
(3 missing vials)							
73	1.29	7787.60	2.00	52.71	7840.31	31.439	
74	1.26	7982.54	1.99	44.44	8026.98	30.783	
75	1.25	8079.20	1.99	47.20	8126.40	30.707	
76	1.26	7975.40	2.00	42.06	8017.46	31.040	
77	1.25	8070.40	1.99	44.00	8114.40	30.897	
78	1.25	8024.00	2.00	43.20	8067.20	31.124	
79	1.28	7838.28	2.00	46.09	7884.38	30.942	
80	1.24	8115.32	1.99	55.65	8170.97	31.193	
81	1.18	8482.20	2.00	39.83	8522.88	30.764	

0.05M KSr EXPS; 0.05M KSr REPS

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

13 Jul 93 results of LSC, 11 Jul 93, 0.5 NaSr, 0.05 KSr

PD

Protocol #: 7 Name:CERENKOV Sr-90 11-Jul-93 19:08
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
1	757.73	13.20	2.00	7.58	20.78	98.546	
2	81.26	123.06	2.00	7.43	130.48	40.881	
3	47.54	210.37	2.00	8.10	218.47	36.901	
4	44.93	222.59	2.00	9.08	231.69	37.173	
5	20.84	480.04	2.00	9.84	489.88	34.063	
6	19.71	507.56	2.00	10.25	517.81	33.605	
7	20.11	497.51	2.00	9.95	507.46	33.909	
8	15.64	639.58	2.00	10.68	650.26	33.045	
9	16.48	606.92	2.00	10.98	617.90	33.285	
10	15.49	646.03	2.00	11.68	657.65	33.758	
11	14.70	680.61	2.00	11.02	691.63	33.583	
12	14.75	678.24	2.00	9.97	688.27	32.782	
13	14.70	680.61	2.00	11.29	691.90	33.166	
14	15.12	661.38	2.00	11.04	672.42	33.508	
15	13.93	718.16	2.00	12.56	730.73	33.519	
16	13.92	718.97	2.00	10.63	729.60	32.855	
17	13.34	749.93	2.00	10.34	760.27	32.133	
18	12.93	773.55	2.00	10.44	783.99	32.489	
19	12.57	795.94	2.00	10.10	805.97	32.114	
20	12.22	818.58	2.00	13.50	832.08	32.600	
(1 missing vial)							
22	1.21	8267.77	2.00	47.93	8315.70	31.224	
23	1.19	8425.21	2.00	60.50	8485.71	31.116	
24	1.20	8397.50	1.99	31.67	8429.17	30.560	
25	1.23	8203.25	1.99	50.41	8253.66	31.311	
26	1.21	8299.17	2.00	42.15	8341.32	30.994	
27	1.21	8281.82	2.00	47.11	8328.93	31.037	
28	1.21	8315.70	1.99	47.93	8363.64	31.114	
29	1.21	8323.97	1.99	58.68	8382.64	31.378	
30	1.19	8448.74	1.99	50.42	8499.16	31.356	
31	1.20	8370.83	2.00	44.17	8415.00	30.821	
32	1.20	8336.67	2.00	50.83	8386.67	31.100	
33	7.36	1359.78	2.00	14.67	1374.46	31.744	
(3 missing vials)							
37	1.24	8082.26	2.00	32.26	8114.52	30.563	
38	2.44	4104.10	2.00	25.00	4129.10	30.851	
39	4.91	2039.71	2.00	17.52	2057.23	31.239	
40	12.44	804.18	2.00	9.65	813.83	32.007	
41	24.64	405.84	2.00	9.82	415.67	34.632	
42	48.53	206.06	2.00	8.18	214.24	37.153	
(1 missing vial)							
44	5.06	1977.47	2.00	14.82	1992.49	31.274	
45	6.32	1582.91	2.00	16.61	1599.68	32.061	
(4 missing vials)							
50	1.39	7205.04	2.00	48.92	7253.96	31.178	
51	1.44	6990.97	1.99	37.50	7028.47	31.157	
52	1.54	6513.64	2.00	40.26	6553.90	31.474	
53	1.42	7052.11	2.00	45.07	7097.89	31.135	

sample numbers/id same as on previous page (116)

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
54	1.56	6662.82	1.96	30.77	6693.59	30.616	
55	1.50	6692.00	2.00	34.67	6726.67	31.076	
56	1.59	6308.18	2.00	37.74	6345.91	31.253	
57	1.60	6274.38	2.00	41.88	6316.25	30.957	
58	1.50	6675.33	2.00	40.67	6716.67	30.962	
59	1.45	6932.41	1.99	42.07	6974.48	31.464	
60	1.40	7172.14	2.00	50.00	7222.14	31.309	
61	1.43	6993.01	2.00	51.05	7044.06	31.047	
62	1.39	7208.63	2.00	33.09	7241.73	31.186	
63	1.35	7423.70	2.00	44.44	7468.15	31.262	
64	1.35	7434.81	2.00	48.89	7483.70	31.377	
65	1.30	7710.00	2.00	52.31	7761.54	31.498	
66	1.28	7832.03	2.00	35.94	7868.75	31.021	
67	1.27	7897.64	2.00	43.31	7940.94	31.087	
68	1.22	8231.97	2.00	51.64	8283.61	31.613	
69	1.22	8223.77	2.00	56.56	8279.51	31.320	
(3 missing vials)							
73	1.27	7909.45	2.00	42.52	7952.76	31.130	
74	1.23	8171.54	1.99	42.28	8213.82	30.953	
75	1.25	8035.20	2.00	54.40	8089.60	31.475	
76	1.24	8072.58	2.00	47.58	8120.16	31.186	
77	1.26	7985.71	1.99	49.21	8034.13	31.036	
78	1.25	8049.60	1.99	50.40	8100.80	31.573	
79	1.26	7992.06	1.99	48.41	8040.48	30.863	
80	1.26	7974.60	2.00	57.94	8032.54	31.488	
81	1.21	8288.43	2.00	45.45	8333.88	31.025	

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

13 Jul 93 LSC results from 12 Jul 93, 0.5N NaSr, 0.05 KSr
PD

Protocol #: 7 Name:CERENKOV Sr-90 12-Jul-93 20:22
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
1	772.23	12.95	2.00	7.46	20.41	98.733	
2	80.03	124.97	2.00	7.68	132.64	40.579	
3	48.17	207.64	2.00	8.08	215.72	36.887	
4	44.87	222.87	2.00	9.34	232.20	37.463	
5	21.21	471.52	2.00	10.84	482.37	34.433	
6	19.66	508.70	2.00	10.63	519.38	33.805	
7	20.07	498.41	2.00	9.77	508.17	33.551	
8	15.65	639.11	2.00	11.57	650.73	33.173	
9	16.66	600.30	2.00	10.32	610.62	33.153	
10	15.63	640.05	2.00	10.81	650.80	33.464	
11	14.64	683.67	2.00	10.04	693.72	32.565	
12	14.79	676.34	2.00	12.04	688.37	32.935	
13	14.66	682.54	2.00	10.98	693.52	33.072	
14	14.73	679.36	2.00	10.52	689.88	33.174	
15	13.88	720.68	2.00	10.81	731.48	32.675	
16	13.59	735.84	2.00	11.26	747.09	32.821	
17	13.24	755.82	2.00	12.16	767.98	32.515	
18	12.67	789.50	2.00	12.00	801.58	33.062	
19	12.62	792.71	2.00	10.78	803.49	32.528	
20	12.29	814.00	2.00	10.41	824.41	32.388	
(1 missing vial)							
22	1.22	8250.82	1.99	40.98	8290.98	30.932	
23	1.22	8254.92	1.99	59.02	8313.93	31.398	
24	1.22	8222.13	2.00	45.90	8268.03	30.721	
25	1.20	8398.33	1.99	43.33	8441.67	31.342	
26	1.20	8352.50	2.00	55.83	8408.33	31.441	
27	1.20	8345.83	2.00	42.50	8389.17	30.939	
28	1.24	8122.58	1.99	45.97	8168.55	31.150	
29	1.20	8353.33	2.00	38.33	8392.50	31.055	
30	1.20	8386.67	1.99	42.50	8429.17	31.308	
31	1.22	8209.84	2.00	48.36	8258.20	30.834	
32	1.21	8309.09	1.99	50.41	8358.68	31.395	
33	7.36	1358.83	2.00	14.67	1373.51	31.926	
(3 missing vials)							
37	1.23	8146.34	2.00	29.27	8175.61	31.054	
38	2.48	4047.18	2.00	23.79	4070.97	31.097	
39	4.82	2075.73	2.00	17.22	2092.95	31.240	
40	12.57	795.94	2.00	10.26	806.21	32.213	
41	24.83	402.78	2.00	8.94	411.68	33.725	
42	49.31	202.80	2.00	7.67	210.46	36.823	
(1 missing vial)							
44	5.09	1967.39	2.00	17.29	1984.68	31.559	
45	6.41	1562.56	2.00	16.38	1578.94	32.188	
(4 missing vials)							
50	1.36	7373.53	2.00	38.97	7412.50	31.209	
51	1.43	7024.48	2.00	42.66	7067.13	31.494	
52	1.51	6656.29	1.99	44.37	6701.32	31.370	
53	1.42	7081.69	1.99	41.55	7123.94	31.175	

Sample #'s/id same as on previous page (116)

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
54	1.47	6823.81	2.00	36.73	6860.54	30.936	
55	1.50	6666.67	2.00	34.67	6701.33	30.879	
56	1.53	6549.02	2.00	27.45	6576.47	31.319	
57	1.63	6169.33	1.99	23.93	6193.25	31.007	
58	1.51	6649.01	2.00	38.41	6687.42	30.886	
59	1.45	6928.28	2.00	44.14	6972.41	31.113	
60	1.39	7203.60	2.00	41.73	7245.32	31.423	
61	1.43	6993.71	2.00	39.16	7032.87	31.202	
62	1.40	7174.29	2.00	47.14	7220.71	31.427	
63	1.36	7398.53	1.99	51.47	7450.74	31.604	
64	1.35	7450.37	1.99	44.44	7494.81	31.156	
65	1.32	7591.67	2.00	43.94	7636.36	31.160	
66	1.29	7805.43	1.99	47.29	7853.49	31.199	
67	1.27	7892.91	2.00	53.54	7946.46	31.203	
68	1.24	8077.42	2.00	44.35	8121.77	31.382	
69	1.24	8084.68	2.00	54.84	8139.52	30.877	
(3 missing vials)							
73	1.28	7828.13	2.00	53.91	7882.03	31.108	
74	1.24	8129.84	1.99	54.84	8184.68	31.115	
75	1.25	8016.00	2.00	52.80	8068.80	31.150	
76	1.25	8042.40	1.99	44.00	8086.40	31.134	
77	1.24	8070.16	2.00	50.00	8120.16	30.970	
78	1.24	8075.00	2.00	43.55	8118.55	30.961	
79	1.24	8094.35	2.00	49.19	8144.35	30.903	
80	1.22	8226.23	2.00	54.10	8281.15	31.589	
81	1.19	8452.10	1.99	50.42	8502.52	31.294	

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

13 Jul 93 LSC results from 13 Jul 93, 0.5N NaSr, 0.05N KSr
PD

Protocol #: 7 Name:CERENKOV Sr-90 13-Jul-93 21:36
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
1	772.97	12.94	2.00	7.40	20.33	98.649	
2	81.44	122.79	2.00	7.67	130.46	40.479	
3	47.38	211.06	2.00	8.48	219.52	37.469	
4	44.42	225.12	2.00	7.95	233.07	36.211	
5	21.04	475.33	2.00	9.98	485.31	33.767	
6	19.97	500.95	2.00	9.21	510.12	33.591	
7	20.37	491.16	2.00	9.72	500.88	33.804	
8	15.70	637.01	2.00	10.19	647.20	33.169	
9	16.38	610.93	2.00	10.07	621.00	33.158	
10	15.34	652.28	2.00	10.23	662.58	33.740	
11	14.88	672.45	2.00	12.37	684.81	33.435	
12	15.00	666.93	2.00	10.40	677.33	33.167	
13	14.79	676.27	2.00	11.49	687.83	33.460	
14	14.91	671.36	2.00	10.53	681.96	33.269	
15	13.94	717.65	2.00	11.26	728.91	33.334	
16	13.45	743.57	2.00	12.42	755.91	33.000	
17	13.00	769.23	2.00	9.69	778.92	32.527	
18	13.21	757.31	2.00	11.66	768.96	33.243	
19	12.57	796.26	2.00	11.69	807.96	32.965	
20	12.44	804.26	2.00	11.50	815.68	32.747	
(1 missing vial)							
22	1.20	8351.67	2.00	61.67	8414.17	31.348	
23	1.19	8442.02	2.00	54.62	8496.64	31.348	
24	1.19	8442.02	2.00	47.90	8489.92	31.168	
25	1.21	8330.58	1.99	55.37	8386.78	31.198	
26	1.23	8133.33	2.00	52.03	8185.37	31.759	
27	1.21	8324.79	1.99	49.59	8374.38	31.135	
28	1.21	8290.91	2.00	46.28	8337.19	31.035	
29	1.19	8421.85	2.00	57.98	8480.67	30.841	
30	1.20	8360.00	2.00	42.50	8402.50	31.642	
31	1.21	8323.97	1.99	60.33	8384.30	31.272	
32	1.20	8394.17	1.99	44.17	8438.33	31.199	
33	7.34	1362.94	2.00	16.49	1379.56	32.000	
(3 missing vials)							
37	1.23	8136.59	2.00	43.09	8179.67	30.866	
38	2.46	4068.70	2.00	24.80	4093.90	31.102	
39	4.87	2054.00	2.00	16.43	2070.23	31.570	
40	12.47	801.92	2.00	10.34	812.35	32.438	
41	24.99	400.28	2.00	8.08	408.40	33.871	
42	50.26	199.01	2.00	8.73	207.74	37.796	
(1 missing vial)							
44	5.14	1948.05	2.00	14.40	1962.45	31.669	
45	6.46	1548.61	2.00	16.56	1565.17	31.932	
(4 missing vials)							
50	1.35	7451.11	1.99	33.33	7484.44	30.927	
51	1.42	7083.10	1.99	45.77	7128.87	31.317	
52	1.51	6634.44	2.00	36.42	6670.86	31.311	
53	1.40	7157.86	2.00	32.14	7190.00	31.273	

Sample #'s/id same as on p. ~~117~~ PD 116
6/15/93

S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
54	1.49	6731.54	2.00	38.26	6769.80	30.967	
55	1.48	6800.00	1.99	47.97	6847.30	31.381	
56	1.55	6458.06	2.00	41.29	6499.35	31.165	
57	1.61	6239.75	2.00	42.24	6281.99	31.503	
58	1.50	6687.33	2.00	40.67	6728.00	31.222	
59	1.42	7057.75	2.00	40.85	7098.59	31.218	
60	1.38	7284.06	1.99	45.65	7329.71	31.128	
61	1.43	7037.06	1.99	42.66	7079.72	31.251	
62	1.39	7227.34	2.00	47.48	7274.82	31.641	
63	1.39	7236.69	1.99	38.85	7275.54	31.607	
64	1.34	7498.51	2.00	41.79	7540.30	31.277	
65	1.34	7493.28	2.00	51.49	7544.78	31.770	
66	1.29	7789.15	2.00	47.29	7836.43	31.377	
67	1.24	8104.84	2.00	51.61	8156.45	31.558	
68	1.23	8169.11	2.00	44.72	8214.63	31.449	
69	1.20	8359.17	2.00	55.83	8415.00	31.302	
(3 missing vials)							
73	1.30	7748.46	1.99	48.46	7796.92	31.208	
74	1.26	7990.48	1.99	53.97	8044.44	31.353	
75	1.27	7909.45	2.00	53.54	7962.99	31.058	
76	1.23	8146.34	2.00	43.90	8190.24	31.201	
77	1.26	7946.83	2.00	42.06	7988.10	31.124	
78	1.24	8131.45	1.99	50.81	8183.06	31.215	
79	1.25	8032.80	2.00	51.20	8084.00	31.381	
80	1.25	8052.00	1.99	44.80	8097.60	31.771	
81	1.22	8231.97	2.00	50.82	8282.79	31.138	

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

15 Jul 93
PP

Analysis of 0.05 N KSr for K^+ concentration using K^+ ISE.

Equipment: Phoenix model 27505-38 K^+ comb ISE
Orion model 920A pH/ISE meter w/ 900A printer

solutions:

ISA : phoenix K ISA lot EE31
standards: phoenix K std 1000 ppm lot # EE31
Corning K std 3910 ppm lot # 0362322
391 ppm (from 3910 1:10 dil)
100 ppm (from 1000 ppm)
1955 ppm (from 3910 ppm), 10 ppm (from 100 ppm)
others:
phoenix K electrode ref. fill lot EE31
(0.1 m NaCl & Ag)
nanopure H_2O
K storage soln (100 ppm K std w/o ISA)

- refurbished K^+ ISE, replaced fill solution

- performed preliminary calibration and meter test check to evaluate probe and meter operation

initial calibration/slope:

10 ppm -180.3 mV
100 ppm -124.0 mV

slope -56.3 mV/D

15 Jul 93
PP

calibration:

10 ppm : -179.1 mV
100 ppm : -123.4 mV
391 ppm : -90.1 mV
1000 ppm : -67.9 mV
1955 ppm : -52.2 mV

slope : 54.8 mV/D

CALIBRATION
CH1-K+
P1 CONC =10.0
-179.1mV 25.0C
P2 CONC =100
-123.4mV 25.0C
P3 CONC =391
-90.1mV 25.0C
P4 CONC =1000
-67.9mV 25.0C
P5 CONC =1960
-52.2mV 25.0C

SLPNX=.2800
SLP=54.8mV/D
COR=1.00
14:15 07-15-93

Solution	ppm as read	Solution	ppm as read
exp # 10	431	~~#17~~	
# 20	27.3	E 0.2	1670
# 9	521	# 2	1690
# 19	44.5	# 12	313
ref E 0.9	220	E 0.1	1850
# 8	607	# 1	1860
# 18	104	# 11	377
E 0.8	435	391 ppm	398
# 7	722	1000 ppm	1010
# 17	128		
E 0.7	652		
# 6	885		
# 16	177		
E 0.6	862		
# 5	1050		
# 15	201		
E 0.5	1070		
# 4	1170		
# 14	233		
E 0.4	1280		
# 3	1400		
# 13	269		

printout of 391 and 1000 ppm results for drift evaluation.

← 391 ppm

← 1000 ppm

20 Jul 93
PB

The Packard 1900 TR LSA runs performance analysis checks automatically. Evidence that IPA is run is included w/most LSA result printouts. Detected problems should be "announced" by the 1900 TR during the system normalization/IPA printout. To provide a hardcopy of machine ~~ex~~ PB performance, the most recent performance parameters are included on the following pages.

```
 VIEW IPA                       IDLE                            20-Jul-93   10:23
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMM;
:            H3 FIGURE OF MERIT (E^2/B) TEST                3      227.56  19-Jul-93 :
:           H3 Counting Sensitivity Evaluation              3      233.41  14-Jul-93 :
:                                                           3      234.18  13-Jul-93 :
:     E^2/B >= Operator specified E^2/B threshold           3      236.04  12-Jul-93 :
:                                                           3      233.10  11-Jul-93 :
: This test allows automatic monitoring of the high         3      226.41  10-Jul-93 :
: performance counting of the system.  E^2/B is a           3      242.31  09-Jul-93 :
: very sensitive parameter to evaluate instrument           3      247.90  06-Jul-93 :
: performance which is often dependent on local             3      251.16  05-Jul-93 :
: environmental conditions.                                 3      231.70  04-Jul-93 :
:                                                           3      242.73  03-Jul-93 :
: When the system does not pass this test after             3      244.49  01-Jul-93 :
: cleaning the vials, and the efficiency and                3      223.49  28-Jun-93 :
: background are still within specifications, the           3      229.26  22-Jun-93 :
: integrity of the test standards - H3 and background       3      230.35  21-Jun-93 :
: should be evaluated.  Preventive maintenance by a         3      236.42  20-Jun-93 :
: qualified service engineer might be required.             3      238.20  17-Jun-93 :
:                                                           3      232.09  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                        :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
  F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
```

```
 VIEW IPA                       IDLE                            20-Jul-93   10:25
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMM;
:            H3 EFFICIENCY (E) TEST                         3       67.64  19-Jul-93 :
:       Sensitivity Test of Detection System                3       67.61  14-Jul-93 :
:                                                           3       67.38  13-Jul-93 :
:                    E >= 58%                               3       67.63  12-Jul-93 :
:                                                           3       67.54  11-Jul-93 :
: When the instrument fails to pass this test under         3       67.40  10-Jul-93 :
: the proper conditions, it should be checked by a          3       67.48  09-Jul-93 :
: qualified service engineer.                               3       67.58  06-Jul-93 :
:                                                           3       67.46  05-Jul-93 :
: When the E does not agree within +- 2% of the             3       67.29  04-Jul-93 :
: previous measurement of the SAME STANDARD, check          3       67.80  03-Jul-93 :
: for dirt or fingerprints on the standard.                 3       67.18  01-Jul-93 :
:                                                           3       67.57  28-Jun-93 :
: Verify the DPM entered for IPA calculations and           3       67.38  22-Jun-93 :
: check the quench level of the standard.  If               3       67.41  21-Jun-93 :
: tSIE <= 950, the standard is possibly expired.            3       67.24  20-Jun-93 :
: Re-establish H3 quench correction curves when the         3       67.33  17-Jun-93 :
: system issues a "re-run quench curves" warning.           3       67.39  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                        :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
  F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
```


20 Jul 93
PB

```
 VIEW IPA                       IDLE                            20-Jul-93   10:22
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMM;
:            H3 CHI-SQUARE (X^2) TEST                       3        9.05  19-Jul-93 :
:     Stability Test of Spectralyzer Threshold              3        7.23  14-Jul-93 :
:                                                           3       16.26  13-Jul-93 :
:            7.63 < X^2 <= 36.19                            3       26.26  12-Jul-93 :
:                                                           3       13.49  11-Jul-93 :
: When repeated observations persist in unlikely            3       18.75  10-Jul-93 :
: Chi-Square results, have the instrument examined          3       13.05  09-Jul-93 :
: for possible malfunctions.                                3       20.10  06-Jul-93 :
:                                                           3        9.28  05-Jul-93 :
: Use SpectraView (full scale = 25 KeV) to verify           3        9.17  04-Jul-93 :
: the integrity of the H3 spectrum in the low               3       19.35  03-Jul-93 :
: energy region.                                            3       11.88  01-Jul-93 :
:                                                           3       12.15  28-Jun-93 :
:                                                           3       16.25  22-Jun-93 :
:                                                           3       22.24  21-Jun-93 :
:                                                           3       13.56  20-Jun-93 :
:                                                           3       18.66  17-Jun-93 :
:                                                           3       12.54  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                        :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
  F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
```

```
 VIEW IPA                       IDLE                            20-Jul-93   10:28
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMM;
:            H3 BACKGROUND (B) TEST                         3       20.25  19-Jul-93 :
:       Assessment of Low Energy Background                 3       19.58  14-Jul-93 :
:                                                           3       19.62  13-Jul-93 :
:            B <= baseline value + 4 SD                     3       19.60  12-Jul-93 :
:                                                           3       19.77  11-Jul-93 :
: The most frequent causes for high background are          3       20.18  10-Jul-93 :
: contamination, increased environmental radiation,         3       19.08  09-Jul-93 :
: electrostatic discharge, light leaks and electric         3       18.68  06-Jul-93 :
: or electromechanical noise.                               3       18.33  05-Jul-93 :
:                                                           3       19.55  04-Jul-93 :
: Verify historical data for trends or random               3       18.98  03-Jul-93 :
: fluctuations.  Check for eventual correlation             3       18.77  01-Jul-93 :
: with environmental conditions.  Test with empty           3       20.75  28-Jun-93 :
: vial.  A high background result indicates possible        3       20.00  22-Jun-93 :
: contamination.                                            3       20.00  21-Jun-93 :
:                                                           3       19.33  20-Jun-93 :
: The SpectraView display can be used to further            3       19.28  17-Jun-93 :
: qualify the nature of the background interference.        3       19.65  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                        :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
  F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
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20 Jul 93

PD

```
VIEW IPA                      IDLE                              20-Jul-93   10:15
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMMMM;
:            C14 CHI-SQUARE (X^2) TEST                 3      30.03  19-Jul-93 :
:       Stabilty Test of Spectralyzer Gain             3      13.38  14-Jul-93 :
:                                                      3      22.50  13-Jul-93 :
:               7.63 < X^2 <= 36.19                    3      17.73  12-Jul-93 :
:                                                      3      26.47  11-Jul-93 :
: When repeated observations persist in out-of-range   3      23.19  10-Jul-93 :
: Chi-Square results, have the instrument examined     3      16.66  09-Jul-93 :
: for possible malfunctions.                           3      23.43  06-Jul-93 :
:                                                      3      16.78  05-Jul-93 :
: Use SpectraView (full scale = 250 KeV) to examine    3      23.92  04-Jul-93 :
: the high end of the C14 spectrum.                    3      17.66  03-Jul-93 :
:                                                      3      21.11  01-Jul-93 :
:                                                      3      13.18  28-Jun-93 :
:                                                      3      16.04  22-Jun-93 :
:                                                      3      11.77  21-Jun-93 :
:                                                      3      16.96  20-Jun-93 :
:                                                      3      23.38  17-Jun-93 :
:                                                      3      18.07  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                 :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
 F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
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VIEW IPA                      IDLE                              20-Jul-93   10:17
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMMMM;
:            C14 FIGURE OF MERIT (E^2/B) TEST          3     475.87  19-Jul-93 :
:           C14 Counting Sensitivity Evaluation        3     461.53  14-Jul-93 :
:                                                      3     482.51  13-Jul-93 :
:     E^2/B >= Operator specified E^2/B threshold      3     450.12  12-Jul-93 :
:                                                      3     456.43  11-Jul-93 :
: Automatic monitor of high counting performance       3     466.50  10-Jul-93 :
: for C14 measurements.  The baseline value depends    3     479.57  09-Jul-93 :
: on local environmental conditions.                   3     493.18  06-Jul-93 :
:                                                      3     491.95  05-Jul-93 :
: Check the quality of the SNC (C14) and background    3     478.00  04-Jul-93 :
: standards when the system fails to pass this test.   3     471.10  03-Jul-93 :
: Clean the standards and repeat the test.  Verify     3     481.93  01-Jul-93 :
: the C14 background and efficiency data to identify   3     451.29  28-Jun-93 :
: a possible cause.  Preventive instrument maintenance 3     473.06  22-Jun-93 :
: by a qualified service engineer might be required.   3     450.91  21-Jun-93 :
:                                                      3     476.86  20-Jun-93 :
:                                                      3     476.68  17-Jun-93 :
:                                                      3     456.46  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                 :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
 F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
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20 Jul 93

PB

```
VIEW IPA                      IDLE                              20-Jul-93   10:18
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMMMM;
:            C14 EFFICIENCY (E) TEST                   3      96.70  19-Jul-93 :
:     Integrity Check of Calibration Standard          3      96.40  14-Jul-93 :
:                                                      3      96.77  13-Jul-93 :
:                   E >= 90%                           3      96.46  12-Jul-93 :
:                                                      3      96.65  11-Jul-93 :
: When the instrument fails to pass this test, the     3      96.33  10-Jul-93 :
: calibration standard should be replaced or the       3      96.62  09-Jul-93 :
: instrument checked by a qualified service engineer.  3      96.63  06-Jul-93 :
:                                                      3      96.92  05-Jul-93 :
: This test should be cross-referenced with the        3      96.62  04-Jul-93 :
: H3 efficiency test to determine the appropriate      3      97.10  03-Jul-93 :
: action.  The DPM entered for the IPA calculation     3      96.94  01-Jul-93 :
: must be verified.                                    3      96.63  28-Jun-93 :
:                                                      3      96.63  22-Jun-93 :
:                                                      3      96.63  21-Jun-93 :
:                                                      3      96.76  20-Jun-93 :
:                                                      3      96.45  17-Jun-93 :
:                                                      3      96.60  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                 :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
 F1-IPA PAGE   F2-SCROLL DOWN   F3-SCROLL UP   F4-PAGE DOWN   F5-PAGE UP
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VIEW IPA                      IDLE                              20-Jul-93   10:20
IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMQMMMMMMMMMMMMMMMMMMMMMMM;
:            C14 BACKGROUND (B) TEST                   3      28.23  19-Jul-93 :
:          High Energy Background Test                 3      27.70  14-Jul-93 :
:                                                      3      27.47  13-Jul-93 :
:           B <= baseline value + 4 SD                 3      27.75  12-Jul-93 :
:                                                      3      27.60  11-Jul-93 :
: This background test should be cross-referenced      3      27.62  10-Jul-93 :
: with the H3 background results.                      3      26.65  09-Jul-93 :
:                                                      3      26.28  06-Jul-93 :
: An elevated C14 background and a normal H3           3      26.28  05-Jul-93 :
: background is usually caused by an increase in       3      27.00  04-Jul-93 :
: environmental radiation.  This background shows      3      26.95  03-Jul-93 :
: a strong dependency on sample volume.                3      26.82  01-Jul-93 :
:                                                      3      28.62  28-Jun-93 :
: Use SpectraView and refer to the H3 background       3      27.55  22-Jun-93 :
: data to further qualify the cause.                   3      27.80  21-Jun-93 :
:                                                      3      27.13  20-Jun-93 :
:                                                      3      26.93  17-Jun-93 :
:                                                      3      27.80  15-Jun-93 :
GDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD6
: Please select Scrolling command by pressing a function key.                 :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
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22 Jul 93
BD

LSC results of 0.05N KSr and 0.5N NaSr Samples.
Final set for both.

Protocol #: 7 Name:CERENKOV Sr-90 21-Jul-93 01:16
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK	1	775.45	12.90	2.00	7.71	20.61	100.98	
#1	2	79.99	125.04	2.00	8.03	133.08	41.450	
	3	48.52	206.10	2.00	8.62	214.72	37.539	
	4	44.23	226.09	2.00	9.00	235.09	37.110	
	5	21.18	472.29	2.00	10.15	482.44	34.233	
	6	19.84	504.28	2.00	11.39	515.73	34.607	
	7	20.32	492.42	2.00	10.53	502.95	34.372	
	8	15.61	640.94	2.00	12.24	653.17	33.798	
	9	16.68	599.70	2.00	12.17	611.87	34.428	
	10	15.28	654.52	2.00	9.62	664.14	32.891	
	11	14.88	672.11	2.00	13.58	685.69	34.047	
	12	14.81	675.49	2.00	11.01	686.56	33.645	
	13	14.76	678.05	2.00	10.77	688.82	33.409	
	14	14.55	687.56	2.00	11.34	698.90	33.064	
	15	14.10	709.57	2.00	12.84	722.41	33.686	
	16	13.73	728.55	2.00	11.51	740.06	33.164	
	17	13.08	764.68	2.00	11.47	776.22	33.295	
	18	12.95	772.36	2.00	11.74	784.02	32.443	
	19	12.51	799.36	2.00	11.59	810.95	33.327	
#19	20	12.21	819.49	2.00	12.61	832.02	33.019	
	(1 missing vial)							
0.05	22	1.22	8236.07	2.00	54.92	8290.98	31.239	
	23	1.22	8217.21	2.00	44.26	8261.48	31.699	
	24	1.19	8403.36	2.00	54.62	8457.98	31.192	
	25	1.22	8205.74	2.00	54.92	8260.66	31.369	
	26	1.21	8309.92	1.99	53.72	8363.64	31.515	
	27	1.21	8298.35	2.00	57.02	8355.37	31.437	
	28	1.21	8304.13	2.00	53.72	8357.85	31.189	
	29	1.20	8346.67	2.00	45.00	8391.67	31.655	
	30	1.20	8381.67	1.99	52.50	8434.17	31.658	
	31	1.21	8301.65	2.00	47.11	8347.93	31.407	
1.0	32	1.20	8366.67	2.00	61.67	8427.50	31.981	
1.0	33	7.38	1355.15	2.00	15.18	1370.33	32.410	
	(3 missing vials)							
	37	1.24	8112.90	1.99	54.03	8166.94	31.667	
	38	2.42	4141.32	2.00	25.21	4166.53	31.338	
	39	4.88	2051.43	2.00	17.83	2069.26	31.576	
	40	12.43	804.67	2.00	11.18	815.93	32.479	
	41	25.00	400.20	2.00	8.88	409.08	34.391	
	42	49.91	200.40	2.00	8.42	208.82	37.462	
	(1 missing vial)							
	44	5.16	1939.53	2.00	19.38	1958.91	32.205	
	45	6.37	1571.90	2.00	14.60	1586.50	32.454	
	(4 missing vials)							
	50	1.32	7597.73	2.00	47.73	7644.70	31.632	
	51	1.38	7281.16	2.00	43.48	7324.64	31.618	
	52	1.47	6830.61	2.00	42.86	6873.47	31.674	
	53	1.41	7119.15	2.00	52.48	7171.63	31.770	

0.5N NaSr EXPS
0.5N NaSr REPS
SPIKE #9
0.05N KSr EXPS

22 Jul 93
BD

21 Jul 93 - LSC results (cont'd)

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
# 5	54	1.47	6822.45	2.00	42.18	6864.63	31.510	
	55	1.46	6874.66	2.00	39.73	6915.07	31.245	
	56	1.50	6682.67	2.00	42.00	6724.67	31.761	
	57	1.56	6441.67	2.00	48.08	6489.74	31.609	
	58	1.47	6836.73	2.00	47.62	6884.35	31.463	
	59	1.42	7071.13	2.00	52.11	7123.24	31.659	
	60	1.37	7337.23	1.99	46.72	7384.67	31.583	
	61	1.41	7122.70	2.00	43.97	7166.67	31.723	
	62	1.38	7278.26	2.00	57.25	7335.51	31.730	
	63	1.36	7363.97	2.00	44.85	7409.56	31.636	
	64	1.33	7565.41	1.99	51.88	7618.04	31.264	
	65	1.30	7749.23	1.99	50.00	7799.23	31.477	
	66	1.28	7816.41	2.00	54.69	7871.09	31.773	
	67	1.26	8000.00	1.99	40.48	8041.27	31.812	
	68	1.21	8329.75	1.99	60.33	8390.08	31.402	
# 2	69	1.22	8198.36	2.00	45.08	8242.62	31.522	
	(3 missing vials)							
0.73		1.27	7915.75	1.99	42.52	7958.27	31.307	
0.74		1.24	8092.74	2.00	54.84	8147.58	31.643	
0.75		1.25	8004.00	2.00	52.00	8056.00	31.660	
	76	1.24	8107.26	1.99	47.58	8155.65	31.631	
	77	1.25	8015.20	2.00	47.20	8062.40	31.361	
	78	1.26	7989.68	1.99	48.41	8038.89	31.881	
	79	1.25	8004.80	2.00	48.00	8052.80	31.191	
	80	1.26	7957.94	2.00	57.14	8015.87	31.938	
1.0	81	1.19	8469.75	1.99	45.38	8515.13	31.138	

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

0.05N KSr EXPS
0.05N KSr REPS

27 Jul 93 — LSC results from 14 Jul 93, 0.05 KSr and 0.5 NaSr data

Protocol #: 7 Name:CERENKOV Sr-90 14-Jul-93 22:39
Region A: LL-UL= 0.0-30.0 Lcr= 0 Bkg= 0.00 %2 Sigma=2.00
Region B: LL-UL=30.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.50
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK	1	759.13	13.17	2.00	7.42	20.59	96.833	
#1	2	82.64	121.02	2.00	7.85	128.87	41.093	
	3	47.64	209.91	2.00	8.48	218.39	37.127	
	4	44.33	225.63	2.00	8.32	233.95	36.279	
	5	21.15	472.96	2.00	9.74	482.70	33.750	
	6	19.85	504.08	2.00	8.61	512.75	33.046	
	7	20.37	491.21	2.00	10.41	501.62	33.674	
	8	15.62	640.27	2.00	10.44	650.64	33.007	
	9	16.23	616.51	2.00	10.66	627.17	33.265	
	10	15.57	642.77	2.00	12.07	654.85	33.378	
	11	14.67	681.66	2.00	10.43	692.09	33.044	
	12	14.66	682.47	2.00	11.05	693.52	32.818	
	13	14.71	680.08	2.00	9.65	689.73	32.769	
	14	15.12	661.71	2.00	11.44	673.15	32.929	
	15	13.80	724.86	2.00	10.72	735.58	33.539	
	16	13.34	749.78	2.00	10.94	760.72	32.711	
	17	13.10	763.59	2.00	8.63	772.21	31.896	
	18	12.92	774.15	2.00	11.46	785.60	32.914	
	19	12.72	786.16	2.00	11.08	797.25	32.553	
#10	20	12.60	794.13	2.00	11.35	805.48	32.595	
	(1 missing vial)							
0.05	22	1.23	8149.59	2.00	53.66	8203.25	31.203	
0.1	23	1.20	8348.33	2.00	35.83	8384.17	31.132	
	24	1.21	8283.47	2.00	46.28	8330.58	31.245	
	25	1.22	8259.84	1.99	42.62	8302.46	31.118	
	26	1.20	8355.83	2.00	40.00	8396.67	31.251	
	27	1.20	8360.83	2.00	45.83	8406.67	30.901	
	28	1.21	8298.35	2.00	42.15	8340.50	30.857	
	29	1.23	8190.24	1.99	39.84	8230.08	31.327	
	30	1.19	8452.94	1.99	48.74	8501.68	31.176	
	31	1.36	8213.24	1.89	48.53	8261.03	30.855	
1.0	32	1.20	8350.83	2.00	62.50	8413.33	31.302	
1.0	33	7.40	1352.57	2.00	12.70	1365.27	32.062	
	(3 missing vials)							
#A	37	1.25	8041.60	1.99	40.80	8083.20	30.699	
	38	2.52	3982.14	2.00	22.62	4004.76	31.028	
	39	4.89	2046.22	2.00	16.77	2062.99	31.178	
	40	12.45	803.53	2.00	12.37	815.90	32.837	
	41	24.53	407.83	2.00	10.80	418.63	34.282	
#E	42	50.52	197.94	2.00	8.14	206.08	37.390	
	(1 missing vial)							
#A	44	5.11	1962.04	2.00	14.09	1976.13	31.414	
#B	45	6.43	1556.30	2.00	16.49	1572.94	32.117	
	(4 missing vials)							
#1	50	1.36	7358.82	2.00	52.94	7411.03	31.069	
	51	1.42	7073.24	2.00	35.92	7109.16	30.910	
	52	1.52	6611.18	2.00	36.84	6648.03	31.097	
#4	53	1.40	7147.86	2.00	37.14	7185.00	31.198	

0.5 NaSr Exps

0.5 NaSr 0.05 KSr Exps

0.5 NaSr 0.1 KSr Exps

0.05 KSr 0.5 NaSr Exps

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	F
#5	54	1.50	6715.33	1.99	40.00	6755.33	31.042	
	55	1.48	6782.43	2.00	52.03	6834.46	30.872	
	56	1.55	6489.68	1.99	40.00	6529.68	31.368	
	57	1.59	6319.50	2.00	39.62	6359.12	31.182	
	58	1.50	6698.00	2.00	36.00	6734.00	30.833	
	59	1.43	7037.06	1.99	39.16	7076.22	31.703	
	60	1.39	7212.95	2.00	42.45	7255.40	31.268	
	61	1.44	6968.75	2.00	33.33	7002.08	30.786	
	62	1.37	7304.38	2.00	46.72	7351.09	31.175	
	63	1.41	7133.33	1.99	43.97	7178.01	31.403	
	64	1.32	7593.18	2.00	44.70	7637.12	30.724	
	65	1.31	7685.50	1.99	41.22	7725.95	31.077	
	66	1.29	7782.17	2.00	52.71	7834.88	31.018	
	67	1.26	7973.02	2.00	55.56	8028.57	31.464	
	68	1.24	8095.16	2.00	53.23	8148.39	31.535	
#10	69	1.24	8073.39	2.00	41.94	8115.32	31.278	
	(3 missing vials)							
0.1	73	1.26	7980.16	1.99	38.89	8019.05	30.721	
0.2	74	1.23	8199.19	1.99	47.15	8246.34	30.975	
0.4	75	1.26	7973.02	2.00	47.62	8021.43	30.580	
	76	1.25	8045.60	1.99	40.80	8086.40	30.847	
	77	1.26	7982.54	1.99	43.65	8026.19	30.939	
	78	1.23	8147.97	2.00	60.16	8208.94	31.144	
	79	1.26	7994.44	1.99	39.68	8034.13	30.966	
	80	1.24	8114.52	1.99	41.94	8156.45	31.469	
1.0	81	1.20	8390.00	1.99	45.00	8435.00	31.203	

0.05 KSr 0.5 NaSr Exps

9 Aug 93 — Experiment to examine the reversibility of the Na-Sr exchange in clinoptilolite.

Overview:

By adding a solution with higher Na/Sr than the equilibrium Na/Sr of experimental solutions, we can shift solution equilibrium in a direction opposite that of the forward expt. If the exchange is reversible, the resulting solution equilibrium should "reverse" and also lie on the same isotherm as that generated by the forward expt.

- Added solutions must have the same normality as the original solutions so that the reverse expt is conducted at $TN_F = TN_R$.

- Not all expt. solns need be tested, selected solutions should provide the necessary data.

- The magnitude of the change in $E_{Sr_{eq}} \rightarrow E_{Sr_{rev}}$ should be sufficient to resolve w/in expt. analytical error

- Simplest solution to add would be a solution of $E_{Na} = 1.0$ or $E_{Sr} = 0.0$. For the 0.05 system this corresponds to a $[Na^+] = 1149.5$ ppm.

An "optimum" value of 1.0 E_{Na} solution to be added is calculated from known data and expected reversibility. Once the additional solutions are added, the solutions are allowed to equilibrate and then resampled for $[Na^+]$ and $[Sr^{++}]$ ($[Sr^{++}]$ via $[^{90}Sr]$). New (reverse) E_{Sr} and ~~#~~ E_{Sr} points are calculated and plotted to examine reversibility.

9 Aug 93
PB

Preparation: select several solutions from a forward isotherm expt. We choose six from the 0.05N NaSr expt. The six are chosen to allow for a spread of points along the isotherm, provide a notable change in E_{Sr} and have fairly coincident E_{Sr}/E_{Sr} points as calculated from Na and Sr. Since calculations of reverse points is based on data derived independently from Na and Sr, coincident points produce a better starting value.

- Make a 0.05 N NaCl solution ($E_{Na} = 1.0$ @ 0.05N). Add the solution in appropriate volumes to the eq. exp. solutions and place into water-shaker bath at 40 rpm and 25°C.

- You may need to sample the exp solutions for Sr^{2+} (^{90}Sr) prior to adding new solution to verify ^{90}Sr activity (Also may want to sample for $[Na^+]$).

10 Aug 93

Preparation of 1.0 E_{Na} (0.05N) NaCl solution

NaCl - formula wt = 58.44 g/mole
Fischer lot # 914193

0.05 N = 0.05 eq/liter, for Na^+ 0.05 mole = 0.05 equivalents

0.05 mol/liter · 58.44 g/mole = 2.9220 g NaCl/liter

Need ~ ~~[illegible]~~ 110 ml => will make 250 ml

2.9220 g/L · 0.250 L = 0.7305 g NaCl

10 Aug 93
PB

wt NaCl needed : 0.7305 g

wt NaCl + weigh dish = 2.7093
− wt. weigh dish = 1.9783 g
wt NaCl = 0.7310 g

0.05N NaSr exp solns #'s 18, 14, 13, 11, 10, and 9 were selected for the reverse experiment. To provide better control of initial Na and Sr concentrations, each solution was sampled for Na^+ and ^{90}Sr prior to adding 1.0 E_{Na} solution to initiate reverse expts. 1.0 ml of exp. soln was removed and placed into a pre-weighed LSC vial, the vial was reweighed. 9.0 ml of nH_2O

exp. Sample #	Vial wt	vial + sample	vial + sample + H_2O	exp sol wt after Sr + Na sampling
18	6.9852	7.9638	17.0012	47.9938
14	6.9062	7.8935	16.8725	24.7821
13	6.9822	7.9626	16.8864	25.1912
11	6.8430	7.8320	16.7256	25.0723
10	6.8800	7.8604	16.7732	24.9296
9	6.8688	7.8499	16.7961	24.8428

was added to each LSC vial and each vial reweighed. The ^{90}Sr activity will be determined by counting each vial. Additionally 1.0 ml of exp. soln was removed (2.0 ml total) and placed into a 10 ml vol flask. This flask was made up to the mark w/ nH_2O. Original exp soln $[Na^+]$ will be determined from these dilutions. Na sample ~~soln's~~ solns. were then transferred to ~~10~~ 15 ml PP containers, labeled and capped. Original exp. soln bottles were weighed in order to provide verification of volume of solution remaining.
PB 8/10/93

The quantity of 0.05 N 1.0 E_{Na} solution to be added to each exp soln. to initiate reverse experiments was determined using an Excel spreadsheet ~~05~~ PB.

E:/EXCEL/EXPTS/NASR/05REVEXP.XLS

10 Aug 93 PP

calculated amounts of 1.0 E Na to be added

exp	solution	wt. bottle	bot + XPR or bot+sol	sol added (1.0 E Na 0.05N)	final wt (start rev) 8/10/93
18		NA	47.9938	15	63.1177
14		NA	24.7821	6	30.7299
13		NA	25.1912	7	32.2170
11		NA	25.073	12	37.0418
10	PP	18.8680 / 11.4963 PP	NA	21	49.3688
9		11.4963	NA	48	83.5939

exp. sol. #	wt. bottle (g)	bot + XPR (g)	sol added (1.0 E Na 0.05N)	final wt (g) (start rev)
18 R	N/A	47.9938	15 ml	63.1177
14 R	N/A	24.7821	6 ml	30.7299
13 R	N/A	25.1912	7 ml	~~37.0418~~ PP 32.2170
11 R	N/A	25.0723	12 ml	37.0418
10 R	11.4963	N/A	21 ml	49.3688
9 R	18.8680	N/A	48 ml	83.5939

resulted in a total volume which ~~might~~ would PP 8/10/93 exceed the capacity of the original exp container volume for #9 and #10 0.05N exp solns.

Soln	calc total	orig container	container used (vol)
#9	65 ml	~~15~~ 25 ml	125 ml
#10	38 ml	25 ml	60 ml

Therefore, the solution and zeolite for #9 and #10 were transferred to larger containers. This was a difficult process. Simple washing did not remove all the zeolite and was ineffective. The method which seemed to work involved adding

10 Aug 93 PP

solution to the original PP bottle, tilting so that the zeolite was in a low spot, and "vacuuming" the zeolite into a 1.0 ml eppendorf pipette tip using the eppendorf pipettor. Repeated applications of this method removed nearly all zeolite from #9 and #10. (the zeolite was transferred to a new, larger container)

PP containers #9 and #10 were weighed prior to adding any zeolite or solution. Solns 18, 14, 13 and 11 were weighed prior to adding any solution (1.0 E Na). All containers weighed after adding 1.0 E Na solution (amount added given in table on p. 132)

1430 : After mixing all solutions (reverse) placed in water-shaker bath @ ~~40°C 40 rpm~~ 8/10/93 40 rpm and 25°C.

initial ^{90}Sr and $[Na^+]$ will be determined when final reverse experiment samples are taken.

(*) Work area frisked using β, γ probe after completion of work, no ^{90}Sr counts found. (no counts above background)

^{90}Sr solution disposed of into the sanitary sewer :

Approx 0.1 ml solution remained in vol flask after transfer to 15 ml PP container. ⇒ represents 0.01 ml of original solution

	sol activity /g	activity disposed
18	1015 dpm	10.2 dpm
14	833 dpm	8.3 "
13	728 dpm	7.3 "
11	707 dpm	7.1 "
10	600 dpm	6.0 "
9	596 dpm	6.0 "

total 44.9 dpm

2.22 dpm / pCi = 20.2 pCi disposed of

diluted by ~50 liters = 0.0004 ~~0.4~~ pCi/ml

30 Aug 93

0.05N NaSr reverse expt., sampling and solution analyses.

Overview: Each reverse exp. solution is removed from the shaker bath and sampled for ^{90}Sr and Na+ analysis. ^{90}Sr samples are removed with Eppendorf disposable pipettes while the Na samples are taken with 1.0 ml volumetric glass pipettes. ^{90}Sr aliquots are placed into LSC vials, weighed, and mixed with 9.0 ml nH_2O. Na aliquots are transferred to 10 ml vol flasks and diluted to the mark with nH_2O. ^{90}Sr analyzed via LSA, Na analyzed with ISE.

Materials:

- Eppendorf pipettor (1000 µl) with 1.0 ml (blue) disposable tips
- Class A vol pipets (1.0 ml)
- class A vol flasks (10.0 ml)
- Plastic LSC vials ~~(25 ml)~~ (25 ml)
- Oxford macro pipettor (5.0 ml) w/ disposable tips
- Analytical balance (AE 240)
- Polypropylene vials (15 ml)
- nano pure H_2O (nH_2O)

Procedure:

① Remove reverse exp. solns from constant temp shaker bath and dry each container. Ensure lid is tightly secured on each container. Swirl each container to mix solutions. Let rest for 30 min to confirm that all zeolite has settled.

② For each rev. exp solution:

a. withdraw 1.0 ml using eppendorf pipettor and ~~from~~ discharge into pre-weighed, pre labeled LSC vial.

30 Aug 93

② contd

b. cap LSC vial and ~~re~~ reweigh, record weight.

c. using 1.0 ml vol pipette, withdraw 1.0 ml of rev exp soln and discharge into 10 ml vol flask. Wash flask neck w/ nH_2O and dilute to mark.

d. Using oxford macro pipettor, add 9.0 ml of nH_2O to each LSC vial, reweigh, record weight.

* I have used 5.0 ml and 4.0 ml aliquots of nH_2O to make ~~9.0~~ 9.0 ml. 8/30/93

③ Transfer Na sample from vol flask to Poly containers.

④ Carefully rinse and discharge ^{90}Sr bearing solutions from vol pipettes and flasks.

30 Aug 93
1400

- Placed rev exp. initial and final LSC solns into LSA (will initiate counting @ 1700, though rest period is short, I hope to get better info on ^{90}Y in-growth.)

Blank = nH_2O (10.0 ml)
stds = 9A-9E, 9AA-9BB

modified protocol #7 for initial counting to 2% 2σ or 20 min, this should force a complete counting cycle ~ every 4-6 hours or so

⑤ capped PP containers are set aside for later Na+ analysis using Na ISE.

Work area frisked with β, γ probe. No contamination > bkgnd noted.

30 Aug 93
PD

Calculation of ^{90}Sr disposed of via sanitary sewer.

- approx 0.1 ml of solution remained in vol flask after transfer, approx 0.05 ml soln remained in pipette
=> 0.15 ml solution remained, disposed of.

N soln	activity / g	activity from flask	activity from pipette
9	600 dpm	6.0	60/2 = 30
10	600	6.0	60/2 = 30
11	700	7.0	70/2 = 35
13	730	7.3	73/2 = 35
14	830	8.3	83/2 = 40
18	1020	10.2	102/2 = 50
		45	220

265 dpm disposed 2.22 dpm / pCi => 120 pCi

120 pCi diluted with N 50 L = 0.0024 pCi/ml

limit = 10 pCi/ml or 1 μCi/day

0.05N NaSr REVERSE EXP SAMPLING (Sr info / Na info)

solution	vol samp for Sr	vol samp for Na	wt LSC vial	wt LSC vial + samp	wt sample	wt vial + H_2O + samp	Na dilut factor
9 R	1.0	1.0	6.9863	7.9836	0.9973	16.9125	10
10 R	1.0	1.0	6.9388	7.9318	0.9930	16.9647	10
11 R	1.0	1.0	6.9956	7.9880	0.9924	16.9279	10
13 R	1.0	1.0	7.0293	8.0258	0.9965	16.9748	10
14 R	1.0	1.0	6.9052	7.9043	0.9991	17.0045	10
18 R	1.0	1.0	6.9549	7.9424	0.9875	16.9322	10
	eppendorf	vol pipette	AE240	AE240	calc.	AE 240	vol flask

31 Aug 93
PD

LSC results for 0.05N NaSr reverse solns.

```
Protocol #: 7        Name:CERENKOV Sr-90            30-Aug-93   19:20
Region A: LL-UL= 0.0-30.0  Lcr=   0  Bkg= 0.00  %2 Sigma=2.00
Region B: LL-UL=30.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.50
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time = 20.00      QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode
```

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK	1	20.00	15.65	11.30	8.40	24.05	100.66	
(2 missing vials)								
SPIKE #9	4	1.24	8109.68	1.99	45.16	8154.03	30.969	
	5	2.51	3991.24	2.00	21.91	4013.15	31.076	
	6	4.81	2080.46	2.00	19.33	2100.00	31.797	
	7	12.45	803.29	2.00	11.57	814.86	32.794	
	8	20.00	406.35	2.22	10.00	416.35	34.939	
	9	20.00	202.30	3.14	8.60	210.90	38.210	
	10	5.12	1954.10	2.00	17.38	1971.48	32.246	
	11	6.46	1548.14	2.00	16.25	1564.40	32.212	
(1 missing vial)								
REVERSE SOLNS FINAL	13	20.00	429.25	2.16	10.90	440.20	35.438	
	14	20.00	255.70	2.80	8.95	264.65	36.305	
	15	20.00	201.55	3.15	9.35	210.85	37.627	
	16	20.00	187.60	3.27	7.65	195.25	37.734	
	17	20.00	91.70	4.67	8.40	100.05	44.109	
	18	20.00	68.75	5.39	8.95	77.70	51.462	
REVERSE SOLNS INITIAL	19	13.93	718.16	2.00	10.19	728.43	33.360	
	20	16.78	596.01	2.00	12.81	608.82	34.588	
	21	19.72	507.15	2.00	9.74	516.89	34.318	
	22	20.00	492.35	2.02	9.95	502.35	34.501	
	23	20.00	407.40	2.22	10.10	417.50	34.867	
	24	20.00	410.90	2.21	9.90	420.80	34.790	

```
Protocol #: 7        Name:CERENKOV Sr-90            31-Aug-93   01:06
Region A: LL-UL= 0.0-30.0  Lcr=   0  Bkg= 0.00  %2 Sigma=2.00
Region B: LL-UL=30.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.50
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time = 20.00      QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode
```

	S#	TIME	CPMA	A:2S%	CPMB	CPMC	SIS	FLAG
BLANK	1	20.00	13.35	12.24	7.90	21.25	100.77	
(2 missing vials)								
SPIKE #9	4	1.27	7877.17	2.00	45.67	7923.62	31.470	
	5	2.48	4032.26	2.00	29.03	4061.29	31.628	
	6	4.81	2082.95	2.00	16.22	2099.38	32.002	
	7	12.54	797.85	2.00	10.69	808.53	33.149	
	8	20.00	392.05	2.26	9.70	401.75	34.946	
	9	20.00	199.30	3.17	8.75	208.05	38.228	
	10	5.15	1944.27	2.00	18.64	1962.72	32.387	
	11	6.44	1554.04	2.00	15.68	1569.72	32.512	
(1 missing vial)								
REVERSE SOLNS FINAL	13	20.00	434.70	2.14	11.40	446.10	35.241	
	14	20.00	268.85	2.73	7.70	276.55	35.968	
	15	20.00	203.95	3.13	8.55	212.50	37.651	
	16	20.00	192.15	3.23	9.50	201.65	39.298	
	17	20.00	104.20	4.38	8.85	113.05	45.743	
	18	20.00	69.60	5.36	7.80	77.40	48.300	
REVERSE SOLNS INITIAL	19	14.41	694.03	2.00	13.19	707.22	33.905	
	20	17.06	586.52	2.00	12.02	598.53	34.492	
	21	19.85	503.88	2.00	11.13	515.06	34.597	
	22	20.00	487.90	2.02	11.15	499.05	35.239	
	23	20.00	406.05	2.22	10.70	416.75	35.072	
	24	20.00	415.90	2.19	9.90	425.80	34.642	

31 Aug 93 PB

LSC results 0.05N NaSr reverse expt.

```
Protocol #: 7        Name:CERENKOV Sr-90          31-Aug-93   06:52
Region A: LL-UL= 0.0-30.0  Lcr=   0  Bkg= 0.00  %2 Sigma=2.00
Region B: LL-UL=30.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.50
Region C: LL-UL= 0.0-2000  Lcr=   0  Bkg= 0.00  %2 Sigma=0.10
Time = 20.00      QIP = SIS
Sr-Na ion exchange experiment
High Sensitivity Count Mode

   S#   TIME     CPMA A:2S%    CPMB    CPMC    SIS FLAG
BLANK 1  20.00    12.85 12.48    6.80   19.65 94.482
(2 missing vials)
9A 4    1.27 7877.95  2.00   60.63 7939.37 31.797
   5    2.47 4057.08  2.00   33.20 4090.28 31.881
   6    4.88 2049.79  2.00   15.57 2065.16 32.162
   7   12.93  773.63  2.00   11.06  784.76 33.775
   8   20.00  397.80  2.24   10.65  408.45 35.550
9B 9   20.00  197.90  3.18    8.55  206.40 38.139
9A 10    5.20 1925.00  2.00   20.96 1945.96 32.616
9B 11    6.47 1546.06  2.00   14.99 1560.90 32.787

(1 missing vial)
18 13   20.00  433.70  2.15   10.25  443.95 35.364
   14   20.00  271.25  2.72    8.90  280.15 36.370
   15   20.00  220.15  3.01    8.70  228.85 37.125
   16   20.00  198.60  3.17   10.50  209.10 39.304
   17   20.00  113.05  4.21    6.85  119.90 40.978
9 18    20.00   72.75  5.24    8.50   81.25 49.149
18 19   13.91  719.12  2.00   12.37  731.49 33.784
   20   16.98  588.93  2.00   10.60  599.53 35.415
   21   19.88  503.17  2.00   11.67  514.84 35.295
   22   20.00  488.60  2.02   11.20  499.80 35.151
   23   20.00  411.75  2.20   10.50  422.25 35.491
9 24    20.00  414.70  2.20   10.55  425.30 34.900
```

SPIKE #9

REVERSE SOLNS FINAL

INITIAL

2 Sep 93 PB

Analysis of 0.05N NaSr reverse exp solns for Na^+ using ion selective electrode.

Materials:

- Orion 920A
- Na electrode reconditioning, storage, and rinse solutions
- Na standards, ISA
- Na combination ISE
- nH_2O

Procedure:

① Prepare Na ISE for use

a. break out electrode, remove end cap and port cover

2 Sep 93 PB

① cont'd

b. discharge electrode fill solution and replace with new reference fill solution

c. recondition electrode by washing electrode tip in Na ISE reconditioning solution for ~ 1 minute. Rinse with Na electrode rinse solution.

d. Soak electrode in Na storage solution for at least 15 min prior to use. (actual storage ~ 1 hour)

② Prepare calibration standards

a. range of expected Na ppm values for solutions to be measured is 10-200 ppm. Standards will therefore be: 10, 50, 100, 150, and 200 ppm.

10 and 100 ppm standards used are purchased directly from Orion.

50 ppm standard:

25 ml of 100 ppm standard diluted to 50 ml in vol. flask.

$$\frac{(25\ ml)(100\ ppm)}{50\ ml} = 50\ ppm$$

150 ppm standard:

15 ml of 1000 ppm standard (purchased) diluted to 100 ml.

$$\frac{(15\ ml)(1000\ ppm)}{100\ ml} = 150\ ppm$$

2 Sep 93
PB

② a. cont'd

200 ppm standard:

10 ml of 1000 ppm standard diluted to 50 ml.

$$\frac{(10\ ml)(1000\ ppm)}{50\ ml} = 200\ ppm$$

③ Add ISA to all solutions.

- 0.2 ml Na ISA added to all standards (10 ml aliquots) and all exp. solns (10 ml volume), Eppendorf pipettor with disposable tip.
- teflon coated magnetic stir bars added to all solution containers.

④ Meter check and calibration

a. install Na electrode into meter, setup for ISE direct concentration readout, perform performance check.

b. Calibrate meter to check slope

cal stds : 2 (10 ppm and 100 ppm)

slope = 58.2 mV/decade

c. Recalibrate meter using all 5 standards, use stirrer during all measurements, analyze samples.

2 Sep 93
PB

Analysis:

Calibration:

5 stds

slope : 58.9 mV/D

```
CALIBRATION
CH1-NA+
P1 CONC =10.0
161.1mV 25.0C
P2 CONC =50.0
201.7mV 25.0C
P3 CONC =100
219.0mV 25.0C
P4 CONC =150
229.6mV 25.0C
P5 CONC =200
237.1mV 25.0C

SLP=58.5mV/D
ISO=1.00
10:30 09-02-93
```

Solution	ppm as read	corrected for dilution
Initial		
9	82.8	828
18	11.4	114
10	79.6	796
14	33.5	335
11	68.3	683
13	48.1	481
final		
9R	122	1220
18R	48.2	482
10R	114	1140
14R	62.3	623
11R	100	1000
13R	75.8	758

std 10 ppm	12.9	- 30% drift!
" 100 ppm	127	
" 50 ppm	63.6	

- too much drift over 20 min. of analyses, will remeasure.

2 Sep 93
PB

Analysis : Na (rev exp)

Calibration:

5 stds

slope = 59.6 mV/Dec

```
CALIBRATION
CHI-NA+
P1 CONC =10.0
167.3mV 25.0C
P2 CONC =50.0
207.7mV 25.0C
P3 CONC =100
225.4mV 25.0C
P4 CONC =150
235.8mV 25.0C
P5 CONC =200
243.3mV 25.0C

BLANK=.5000
SLP=59.6mV/D
ISO=1.00
10:57 09-  -93
```

solution	ppm as read	corrected for dilution
initial	80.7	
9	10.9	807
18	75.8	109
10	32.2	758
14	65.0	322
11		650
13	46.0	460
final		
9R	116	1160
18R	46.0	460
10R	106	1060
14R	57.4	574
11R	90.7	907
13R	69.0	690

cal 10 ppm	11.9	] - 20% drift! - still not very good.
100 ppm	115	

- will soak electrodes for a day or so to see if improvement occurs. PB

13 Sep 93
PB

Calculation of $[Sr^{2+}]$ from ^{90}Sr.

Final Sr concentration is calculated by using the ratio of initial ^{90}Sr to final ^{90}Sr. initial/final Sr^{90} should be the same as initial/final non-radioactive Sr.

Factors to be included are:

1. Y-ingrowth stabilizes after ≈ 7 half-lives of ^{90}Y. Therefore the LSC values used should reflect the equilibrium value of ^{90}Y. (Especially since all counts from LSC using Cerenkov are due to ^{90}Y decay)

2. Initial Sr concentration is corrected for change in volume due to addition of 1.0 E Na

3. Efficiency of counting is applied as a "flat" rate throughout the range of samples. The efficiency is determined by averaging cal stds of spike #9 and converting to calculated dpm.

$$\text{Final } [Sr] = \frac{\text{Final } ^{90}Sr}{\text{Initial } ^{90}Sr} \left(\text{Initial } [Sr] \text{ corrected}\right)$$

17 Sep 93
PB

Re-analysis of [Na^+] in 0.05 NaSr reverse exp. solutions.

Na electrode previously exhibited a significant amount of drift when measuring final exp. solutions. Additionally, the ppm values for the final solutions were too high.

One problem might have been the variance in [Sr] from the standards to the exp. solutions. The electrode may have also been in need of further reconditioning.

The reverse experiment final solutions will be reanalyzed. Sr (~80 ppm) will be added to the standards by adding 0.4 ml of 1.0 ESr 0.05N reference solution (~2100 ppm). Standard concentrations will be corrected for the dilution effect of adding the Sr solution.

Calibration

initial check of meter was satisfactory.

check slope using 10 and 100 ppm stds was slightly low. Electrode was reconditioned and fill solution was replaced.

```
CALIBRATION
CHI-NA+
P1 CONC =9.50
53.2mV 25.0C
P2 CONC =95.0
105.4mV 25.0C

SLP=52.2mV/D
ISO=1.00
10:15 09-17-93
```

P1 = 10 ppm
P2 = 100 ppm

initial slope 52.2 mV/D.

17 Sep 93
PB

Electrode / meter recalibrated for analysis

Cal stds: 10 ppm entered as 9.5 (corrected for Sr addition)
50 ppm " 47
100 ppm " 95

Sr addition $\frac{0.4\ ml \times 2100\ ppm}{10.4\ ml} = 80.1\ ppm$

calibration slope 63.3 mV/D slightly high due to using 3 stds (slope may be off when using multiple stds)

P1 = 10 (9.5) ~~P2 = 100~~ PB (47) P2 = 50 P3 = 100 (95)

```
CALIBRATION
CHI-NA+
P1 CONC =9.50
60.2mV 25.0C
P2 CONC =47.0
94.4mV 25.0C
P3 CONC =95.0
112.2mV 25.0C

SLP=63.3mV/D
ISO=1.00
10:[illegible] 09-17-93
```

Analysis

Solution	ppm	corr
18R	39.3	393
9R	101	1010
14R	50.2	502
10R	94.7	947
13R	61.0	610
11R	82.7	827

printouts*

```
CHI-NA+
CONC =101
116.4mV 25.0C
10:44 09-17-93
```
9R PB

```
CHI-NA+
CONC =61.0
104.7mV 25.0C
10:43 09-17-93
```
13R PB

```
CHI-NA+
CONC =94.7
114.4mV 25.0C
10:38 09-17-93
```
10R PB

```
CHI-NA+
CONC =50.2
105.4mV 25.0C
10:40 09-17-93
```
14R PB

11R PB

* 18R printout not acquired (printouts taken on 2nd re-read as an afterthought, ran out of paper before 18R)

17 Sep 93
PB

Results of reverse exp. final solutions are w/in specifications for expected sol. concentrations. Numbers from Na now correlate well with numbers from Sr.

24 Sep 93
PB

Calculation of Cerenkov counting efficiency ($^{90}Sr/^{90}Y$)

Standards made from Spike #9 are used for calculation of the efficacy of counting $^{90}Sr/^{90}Y$ samples. Spike #9 standards contain a known weight of spike / gm solution and as such a cpm / dpm ratio can be calculated accurately.

We must know the activity of the spike near the count dates to determine expected dpm

$A = A_0 e^{-\lambda t}$ where $\lambda = 2.4236 \times 10^{-2}\ y^{-1}$

$A_0 = 5.11$ nCi/g on 2/7/92

2/7/92 to 9/7/93 = 578 days

$A = (5.11\ nCi/g)\, e^{(-2.4236 \times 10^{-2} y^{-1})(578/365.25)}$

~~A = 5.3098 nCi/g PB~~

A = 4.9177 nCi/g

24 Sep 93
PB

Spike Std.	wt spike #9	activity
9A	1.0266	11207.7
9B	0.5160	5633.3
9C	0.2823	3082.0
9D	0.1009	1101.6
9E	0.0498	543.7
9F	0.0244	266.4
9AA	0.2496	2725.0
9BB	0.1990	2172.5

Using these values, the average eff applied to the LSC data is 71%. Note: 9C = error in sample, value not used in eff. calculation.

SUMMARY WORKSHEET.

Spike #9 data sheet

	spike #9 initial activity=		5.11	nCi/g	present activity	4.9177	nCi/g
		date	2/7/92				
		today's date	9/7/93				
	calculated difference		578	days			

Spike std.	wt spike 9	activity(nCi)	activity(dpm)		avg cpm	avg efficiency	
9A	1.0266	5.0485	11207.8		8003.691	0.71	
9B	0.5160	2.5375	5633.4		4013.475	0.71	
9C	0.2823	1.3883	3082.0		2031.486	0.66	← NOT USED
9D	0.1009	0.4962	1101.6		785.3045	0.71	
9E	0.0498	0.2449	543.7		382.6559	0.70	
9F	0.0244	0.1200	266.4		187.1141	0.70	
9AA	0.2496	1.2275	2725.0		1928.933	0.71	
9BB	0.1990	0.9786	2172.6		1537.743	0.71	
					average	0.71	

corrected for background

24 Sep 93 PB

Summary of 0.05N NaSr reverse expt LSC data

0.05N NaSr Reverse Experiment																				
Sr analysis																				
LSC results																				
date / time	8/30/93 19:20	8/31/93 1:06	8/31/93 6:52	8/31/93 12:39	8/31/93 19:55	9/1/93 1:42	9/1/93 7:28	9/1/93 13:14	9/1/93 20:30	9/2/93 2:16	9/2/93 10:58	9/2/93 18:07	9/3/93 1:11	9/3/93 8:17	9/3/93 16:52	9/3/93 23:57	9/4/93 7:01	9/4/93 14:05	9/4/93 22:28	9/5/93 5:40
delta t	0	5.77	5.77	5.78	7.27	5.78	5.77	5.77	7.27	5.77	8.70	7.15	7.07	7.10	8.58	7.08	7.07	7.07	8.38	7.20
cumulative	0.09	0.18010417	0.27020833	0.360572917	0.474114583	0.5644792	0.6545833	0.7446875	0.85822917	0.9483333	1.08427083	1.19598958	1.3064063	1.4173437	1.55145833	1.66213542	1.77255208	1.88296875	2.01395833	2.12645833
%2s	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30	2%-30
solution	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA
blank	15.65	13.35	12.85	13.20	13.35	12.60	13.95	12.25	13.70	14.05	13.07	11.90	11.73	12.43	12.67	12.93	13.90	12.87	12.63	13.53
initial																				
18	718.16	694.03	719.12	714.71	703.45	712.32	706.29	706.57	719.05	715.74	710.36	709.72	712.83	710.80	711.31	707.50	714.43	713.11	705.64	723.14
14	596.01	586.52	588.93	585.54	593.59	592.42	592.48	583.21	584.18	586.63	581.91	583.89	573.24	594.53	583.56	588.99	581.63	580.50	587.54	576.21
13	507.15	503.88	503.17	505.05	503.37	507.71	506.68	514.56	519.48	499.75	508.23	519.10	502.11	511.04	510.99	505.30	501.50	505.76	495.44	499.85
11	492.35	487.90	488.60	484.75	486.35	485.80	473.70	475.20	485.50	499.80	481.05	486.19	488.86	491.69	482.91	481.70	476.11	485.20	488.34	484.59
10	407.40	406.05	411.75	409.75	412.10	404.95	410.75	409.35	405.50	403.85	400.44	414.85	412.54	403.06	403.51	399.80	411.06	405.43	414.59	404.37
9	410.90	415.90	414.70	410.40	419.10	407.60	411.30	414.45	413.40	410.45	407.12	414.29	409.14	413.22	405.76	412.54	408.50	418.63	416.58	411.73
final																				
18	429.25	434.70	433.70	441.50	443.25	450.70	454.80	456.50	462.75	456.35	474.17	468.43	473.13	477.88	480.36	487.57	486.19	495.84	490.49	496.52
14	255.70	268.85	271.25	288.45	306.05	306.45	319.15	327.75	341.35	336.85	343.59	363.14	364.06	369.62	379.15	381.68	387.26	392.66	404.00	415.54
13	201.55	203.95	220.15	226.85	239.40	243.60	253.65	257.25	277.65	277.75	288.37	299.10	302.80	308.63	315.80	313.60	326.83	335.38	333.69	334.36
11	187.60	192.15	198.60	207.40	211.20	224.10	221.55	231.05	236.10	240.95	248.47	250.60	256.47	258.63	265.13	267.93	270.63	278.30	277.73	273.30
10	91.70	104.20	113.05	119.60	122.20	133.55	135.80	141.35	147.20	149.65	156.93	158.70	163.10	171.17	171.50	175.87	186.73	179.20	186.00	187.77
9	68.75	69.60	72.75	76.35	83.90	89.20	95.85	91.05	102.20	104.00	102.43	113.30	109.07	112.33	110.53	117.83	120.90	122.33	125.47	127.40
spike 9																				
9a	8109.68	7877.17	7877.95	7945.24	7910.24	8072.58	7960.32	7859.38	7961.11	8005.60	7957.94	7923.62	7876.38	8047.20	7919.69	8004.80	8096.39	8050.40	7857.81	8184.55
9b	3991.24	4032.26	4057.08	4019.68	4031.33	4036.69	4057.89	4042.34	4012.80	4067.07	4000.40	4013.60	4000.00	4021.29	4115.16	3994.02	4032.66	4074.80	4033.87	3992.83
9c	2080.46	2082.95	2049.79	2047.85	2075.73	2048.67	2063.51	2051.23	2013.88	2073.71	2074.12	2079.25	2049.59	2026.40	2017.54	2027.73	2032.66	2046.22	2008.63	2064.95
9d	803.29	797.85	773.63	802.49	801.36	785.10	788.03	794.36	799.68	812.35	799.92	796.97	792.55	792.47	800.80	802.89	799.12	798.16	803.53	799.36
9e	406.35	392.05	397.80	402.20	397.60	399.90	397.75	400.85	395.85	395.50	398.25	400.04	402.94	397.65	396.94	397.18	396.75	399.08	395.61	401.44
9f	202.30	199.30	197.90	197.10	203.85	201.25	196.80	203.00	195.30	199.50	203.80	196.00	203.60	196.50	195.87	197.87	202.57	201.47	199.17	196.80
9aa	1954.10	1944.27	1925.00	1947.86	1941.47	1980.79	1926.54	1920.54	1934.94	1946.02	1948.05	1946.69	1975.15	1977.47	1961.37	1906.78	1917.62	1926.97	1966.01	1961.37
9bb	1548.14	1554.04	1546.06	1549.54	1537.02	1568.81	1550.54	1576.06	1559.19	1570.85	1527.79	1559.19	1534.97	1525.46	1551.63	1540.92	1527.48	1540.15	1569.44	1548.61
Background corrected																				
initial																				
18	702.51	680.68	706.27	701.51	690.10	699.72	692.34	694.32	705.35	701.69	697.29	697.82	701.10	698.37	698.84	694.57	700.53	700.24	693.01	709.61
14	580.36	573.17	576.08	572.34	580.24	579.82	578.53	570.96	570.48	572.58	568.84	571.99	561.51	582.10	570.89	576.06	567.73	567.63	574.91	562.68
13	491.50	490.53	490.32	491.85	490.02	495.11	492.73	502.31	505.78	485.70	495.16	507.20	490.38	498.61	498.32	492.37	487.60	492.89	482.61	486.32
11	476.70	474.55	475.75	471.55	473.00	473.20	459.75	462.95	471.80	485.75	467.98	474.29	477.13	479.26	470.24	468.77	462.21	472.33	475.71	471.06
10	391.75	392.70	398.90	396.55	398.75	392.35	396.80	397.10	391.80	389.80	387.37	402.95	400.81	390.63	390.84	386.87	397.16	392.56	401.96	390.84
9	395.25	402.55	401.85	397.20	405.75	395.00	397.35	402.20	399.70	396.40	394.05	402.39	397.41	400.79	393.09	399.61	394.60	405.76	403.95	398.20
final																				
18	413.60	421.35	420.85	428.30	429.90	438.10	440.85	444.25	449.05	442.30	461.10	456.53	461.40	465.45	467.69	474.64	472.29	482.97	477.86	482.99
14	240.05	255.50	258.40	275.25	292.70	293.85	305.20	315.50	327.65	322.80	330.52	351.24	352.35	357.19	366.48	368.75	373.36	379.79	391.37	402.01
13	185.90	190.60	207.30	213.65	226.05	231.00	239.70	245.00	263.95	263.70	275.30	287.20	291.07	296.20	303.13	300.67	312.93	322.51	321.06	320.83
11	171.95	178.80	185.75	194.20	197.85	211.50	207.60	218.80	222.40	226.90	235.40	238.90	244.74	246.20	252.46	255.00	256.73	265.43	265.10	259.77
10	76.05	90.85	100.20	106.40	108.85	120.95	121.85	129.10	133.50	135.60	143.86	146.80	151.37	158.74	158.83	162.94	172.83	166.33	173.37	174.24
9	53.10	56.25	59.90	63.15	70.55	76.60	81.90	78.80	88.50	89.95	89.36	101.40	97.34	99.90	97.86	104.90	107.00	109.46	112.84	113.87
spike 9																				
9a	8094.03	7863.82	7865.10	7932.04	7896.89	8059.98	7946.37	7847.13	7947.41	7991.55	7944.87	7911.72	7864.65	8034.77	7907.02	7991.87	8084.49	8037.53	7845.18	8171.02
9b	3975.59	4018.91	4044.23	4006.48	4017.98	4024.09	4043.94	4030.09	3999.10	4053.02	3987.33	4001.70	3988.27	4008.86	4102.49	3981.09	4018.76	4061.93	4021.24	3979.30
9c	2064.81	2069.60	2036.94	2034.65	2062.38	2036.07	2049.56	2038.98	2000.18	2059.66	2061.05	2067.35	2037.86	2015.97	2004.67	2014.80	2018.76	2033.35	1996.00	2051.42
9d	787.64	784.50	760.78	789.29	788.01	772.50	774.08	782.11	785.98	796.30	786.85	785.07	780.82	780.04	788.13	789.96	785.22	785.29	790.90	785.83
9e	390.70	378.70	384.95	389.00	384.25	387.30	383.80	388.60	382.15	381.45	385.18	388.14	391.21	385.22	384.27	384.25	382.85	386.21	382.98	387.91
9f	186.65	185.95	185.05	183.90	190.50	188.65	182.85	190.75	181.60	185.45	190.73	184.10	191.87	184.07	183.20	184.94	188.67	188.60	186.54	183.27
9aa	1938.45	1930.92	1912.15	1934.66	1928.12	1968.19	1912.59	1906.29	1921.24	1931.97	1934.96	1934.79	1963.42	1965.04	1948.70	1895.85	1903.72	1914.10	1953.38	1947.84
9bb	1532.49	1540.69	1533.21	1536.34	1523.67	1556.21	1536.59	1563.81	1545.49	1556.80	1514.72	1547.29	1523.24	1513.03	1538.96	1527.99	1513.58	1527.28	1556.81	1535.08

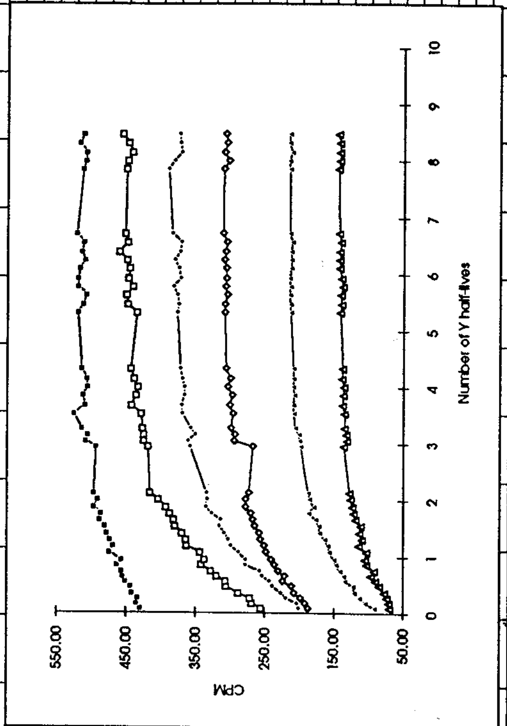
Data summary (cont'd)

24 Sep 93 PB

9/7/93 10:16	9/7/93 17:16	9/8/93 0:16	9/8/93 7:15	9/8/93 23:42	9/9/93 9:18	9/9/93 20:21	9/10/93 5:57	9/10/93 15:32	9/11/93 2:35	9/13/93 17:48	9/14/93 3:18	9/14/93 14:20	9/14/93 23:48	9/15/93 9:18	9/15/93 20:18	9/16/93 5:47	9/16/93 15:15	9/17/93 2:15	9/17/93 11:45
52.60	7.00	7.00	6.98	16.45	9.60	11.05	9.60	9.58	11.05	63.22	9.50	11.03	9.47	9.50	11.00	9.48	9.47	11.00	9.50
2.94833333	3.05770833	3.16708333	3.27619792	3.53322917	3.68322917	3.85588542	4.00588542	4.155625	4.32628125	5.316041667	5.464479167	5.636875	5.784791667	5.933229167	6.105104167	6.25328125	6.401197917	6.573072917	6.721510417
2%-30	2%-30	2%-30	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA	CPMA
12.77	13.43	12.83	12.70	12.90	13.50	12.81	13.25	12.72	12.93	12.80	13.02	12.97	13.45	13.22	12.47	13.03	13.23	12.56	13.42
713.62	711.96	718.02	705.72	714.94	708.14	705.29	716.85	706.93	704.23	709.43	721.57	719.57	714.43	710.87	709.50	710.01	694.93	710.23	712.83
587.20	584.45	580.78	583.90	586.97	585.25	575.82	583.21	581.23	566.69	584.69	578.82	586.17	585.71	585.94	588.12	594.83	582.41	596.31	585.48
508.65	498.65	510.93	501.55	507.56	499.30	504.34	502.01	507.61	510.83	508.59	506.84	510.83	497.81	502.11	513.87	512.45	503.63	500.25	505.97
478.02	485.58	493.15	477.84	477.88	492.47	481.10	489.48	484.74	484.73	486.14	478.12	484.26	486.85	481.94	488.43	481.98	486.67	479.30	488.67
405.35	398.57	407.25	406.17	415.02	401.44	404.16	412.20	407.54	406.83	402.17	410.38	411.31	404.69	408.12	411.39	404.73	395.81	411.18	409.71
405.60	405.35	411.48	406.34	415.67	413.48	408.49	418.59	413.39	411.10	408.29	402.45	413.74	419.51	412.75	413.91	410.89	413.44	413.74	410.17
493.44	507.87	505.30	513.87	524.99	508.91	512.08	505.51	506.12	513.61	518.94	512.08	507.46	518.99	518.83	516.15	509.27	513.60	510.88	520.56
418.54	424.58	424.62	426.65	428.99	442.91	436.43	433.16	439.17	443.79	435.06	447.67	449.69	441.08	447.47	445.24	449.28	459.70	448.32	451.97
358.68	360.69	350.74	357.91	369.25	370.10	366.97	366.64	369.41	372.55	377.19	375.41	376.62	382.38	372.58	374.85	380.95	372.97	371.61	383.92
268.10	294.20	293.63	299.37	296.21	300.66	297.24	303.67	299.88	306.81	308.83	308.20	305.19	307.41	306.65	306.50	309.31	307.85	305.50	311.62
198.13	200.53	201.30	206.70	208.51	209.95	207.83	209.14	209.62	209.31	213.65	214.31	214.87	214.24	215.52	213.72	212.88	213.63	211.75	215.35
135.90	130.90	132.17	134.43	135.06	137.06	136.80	135.76	138.37	137.89	140.90	138.95	140.71	137.84	139.78	141.86	141.74	142.05	140.50	143.18
8024.00	7939.68	8105.65	8066.13	8105.65	8106.87	8115.32	7955.56	7860.94	8064.52	7916.54	8022.40	8004.80	7947.62	7917.32	7947.62	8049.60	7938.89	7864.06	8043.20
3994.42	3939.76	4030.52	4037.10	4030.52	3998.01	4000.00	4024.90	4067.07	3989.24	4004.40	4039.52	4012.00	4014.80	4037.90	4014.80	4035.08	3968.38	4132.64	4029.32
2054.00	2013.08	2041.22	2056.26	2041.22	2041.84	2058.85	2076.76	2062.47	2043.47	2019.56	2023.23	2035.16	2050.72	2057.91	2050.72	2045.60	2012.68	2029.82	2028.34
784.25	786.48	797.21	790.60	797.21	804.42	794.91	806.61	799.12	795.15	793.02	805.23	794.60	804.59	790.83	804.59	793.81	799.12	792.55	800.96
396.71	395.22	392.36	399.48	392.36	400.40	398.25	401.52	402.66	397.06	396.87	397.02	348.49	397.73	401.28	397.73	395.07	394.71	399.76	395.34
203.83	196.53	197.10	201.27	197.10	200.10	199.70	196.91	200.82	201.59	199.04	201.61	203.71	201.15	199.66	201.15	202.94	196.33	203.11	198.89
1921.11	1944.85	1957.14	1949.90	1957.14	1954.88	1978.26	1904.18	1965.82	1935.98	1914.53	1957.34	1939.15	1957.53	1922.07	1957.53	1961.18	1916.28	1936.75	1949.81
1559.19	1555.21	1558.41	1586.69	1558.41	1532.31	1529.20	1572.37	1548.61	1543.30	1548.14	1565.41	1549.38	1543.45	1540.99	1543.45	1533.38	1546.37	1569.44	1581.39
700.85	698.53	705.19	693.02	702.04	694.64	692.48	703.60	694.21	691.30	696.63	706.55	706.60	700.98	697.65	697.03	696.98	681.70	697.67	699.41
574.43	571.02	567.95	571.20	574.07	571.75	563.01	569.96	568.51	553.76	571.89	565.80	573.20	572.26	572.72	575.65	581.80	569.18	583.75	572.06
495.88	485.22	498.10	488.85	494.66	485.80	491.53	488.76	494.89	497.90	495.79	493.82	497.86	484.36	488.89	501.40	499.42	490.40	487.69	492.55
465.25	472.15	480.32	465.14	464.96	478.97	468.29	476.23	472.02	471.80	473.34	465.10	471.29	473.40	468.72	475.96	468.95	473.44	466.74	475.25
392.58	385.14	394.42	393.47	402.12	387.94	391.35	398.95	394.82	393.90	389.37	397.36	398.34	391.24	394.90	398.92	391.70	382.58	398.62	398.29
392.83	391.92	396.65	393.64	402.77	399.98	395.68	405.34	400.67	398.17	395.49	389.43	400.77	406.06	399.53	401.44	397.86	400.21	401.18	396.75
480.67	494.44	492.47	501.17	512.09	495.41	499.27	492.26	493.40	500.68	506.14	499.06	494.49	505.54	505.61	503.68	496.24	500.37	498.32	507.14
405.77	411.15	411.79	413.95	416.09	429.41	423.62	419.91	426.45	430.86	422.26	434.65	436.72	427.63	434.25	432.77	436.25	446.47	435.76	438.55
345.91	347.26	337.91	345.21	356.35	356.60	354.16	353.39	356.69	359.62	364.39	362.39	363.65	368.93	359.36	362.38	367.92	359.74	359.05	370.50
255.33	260.77	280.80	286.67	283.31	287.16	284.43	290.42	287.16	293.88	296.03	295.18	292.22	293.96	293.43	294.03	296.28	294.62	292.94	298.20
185.36	187.10	188.47	194.00	195.61	196.45	195.02	195.89	196.90	196.38	200.85	201.29	201.90	200.79	202.30	201.25	199.85	200.40	199.19	201.93
123.13	117.47	119.34	121.73	122.16	123.58	123.99	122.51	125.65	124.96	128.10	125.93	127.74	124.39	126.56	129.39	128.71	128.82	127.94	129.76
8011.23	7926.25	8092.82	8053.43	8092.75	8095.37	8102.51	7942.31	7848.22	8051.59	7903.74	8009.38	7991.83	7934.17	7904.10	7935.15	8036.57	7925.86	7851.50	8029.78
3981.65	3926.33	4017.69	4024.40	4017.62	3984.51	3987.19	4011.65	4054.35	3976.31	3991.60	4026.50	3999.03	4001.35	4024.68	4002.33	4022.05	3955.15	4120.08	4015.90
2041.23	1999.65	2028.39	2043.56	2028.32	2028.34	2046.04	2063.51	2049.75	2030.54	2006.76	2010.21	2022.19	2037.27	2044.69	2038.25	2032.57	1999.45	2017.26	2014.92
771.48	773.05	784.38	777.90	784.31	790.92	782.10	793.36	786.40	782.22	780.22	792.21	781.63	791.14	777.61	792.12	780.78	785.89	779.99	787.54
383.94	381.79	379.53	386.78	379.46	386.90	385.44	386.27	389.94	384.13	384.07	384.00	335.52	384.28	388.06	385.26	382.04	381.48	387.20	381.92
191.06	183.10	184.27	188.57	184.20	186.60	186.89	183.66	188.10	188.66	186.24	188.59	190.74	187.70	186.44	188.68	189.91	183.10	190.55	185.47
1908.34	1931.42	1944.31	1937.20	1944.24	1941.38	1965.45	1890.93	1953.10	1923.05	1901.73	1944.32	1926.18	1944.06	1906.85	1945.06	1948.15	1903.05	1924.19	1936.39
1546.42	1541.78	1545.58	1573.99	1545.51	1518.81	1516.39	1559.12	1535.89	1530.37	1535.34	1552.39	1536.41	1530.00	1527.77	1530.98	1520.35	1533.14	1556.88	1567.97

spike #9 / initial avgs from this point onwards

Summary of 0.05N Reverse expt (NaSr) data from LSC (contd) 24 Sep 93 RB



Y ingrowth of final solutions

9/20/93 11:33	9/20/93 20:59	9/21/93 6:28	9/21/93 17:32	9/22/93 3:06			
71.80	9.43	9.48	11.07	9.57			
7.843385417	7.99078125	8.138958333	8.311875	8.461354167			
2%	2%	2%	2%	2%	column	corected	
CPMA	CPMA	CPMA	CPMA	CPMA	averages	averages	
12.57	13.01	13.29	12.71	13.05	12.98		
697.84	719.86	700.42	716.40	697.35	709.42	696.44	696.44
573.72	586.69	585.66	584.40	580.78	583.76	570.78	570.78
507.41	496.52	512.39	516.84	506.33	506.14	493.16	493.16
493.24	481.01	484.50	482.91	488.14	484.56	471.58	471.58
414.46	404.08	406.87	407.49	416.71	407.93	394.95	394.95
412.75	407.79	402.58	409.33	408.24	411.21	398.23	398.23
511.56	508.28	507.20	516.37	510.99	513.56	500.57	500.56
449.53	447.96	441.89	447.23	455.26	448.74	435.76	435.74
389.41	381.79	371.20	373.25	374.50	377.45	364.47	364.45
310.33	302.57	308.96	305.40	307.82	307.49	294.51	294.49
215.56	215.86	212.18	215.66	215.29	214.30	201.32	201.30
144.00	142.09	142.09	142.42	144.07	141.80	128.82	128.80
7986.51	8005.60	8043.20	8204.10	8198.37	8016.67	8003.69	8003.69
4020.48	4065.04	4048.58	4030.52	3981.75	4026.46	4013.47	4013.47
2049.18	2053.59	2074.90	2026.92	2039.10	2044.47	2031.49	2031.49
807.83	791.53	802.16	795.07	798.40	798.29	785.30	785.30
393.66	400.68	398.96	401.00	394.01	395.64	382.66	382.66
197.96	198.28	199.42	200.42	200.96	200.10	187.11	187.11
1907.62	1940.50	1947.67	1932.82	1935.20	1941.92	1928.93	1928.93
1556.77	1567.87	1568.81	1523.59	1506.63	1550.73	1537.74	1537.74
685.27	706.85	687.13	703.69	684.30	696.44		
561.15	573.68	572.37	571.69	567.73	570.78		
494.84	483.51	499.10	504.13	493.28	493.16		
480.67	468.00	471.21	470.20	475.09	471.58		
401.89	391.07	395.58	394.78	403.66	394.95		
400.18	394.78	389.29	396.62	395.19	398.23		
498.99	495.27	493.91	503.66	497.94	500.56		
436.96	434.95	428.60	434.52	442.21	435.74		
376.84	368.78	357.91	360.54	361.45	364.45		
297.76	289.56	295.67	292.69	294.77	294.49		
202.99	202.85	198.89	202.95	202.24	201.30		
131.43	129.08	128.80	129.71	131.02	128.80		
7973.94	7992.59	8029.91	8191.39	8185.32	8003.69		
4007.91	4052.03	4035.29	4017.81	3968.70	4013.47		
2036.61	2040.58	2061.61	2014.21	2026.05	2031.49		
795.26	778.52	788.87	782.36	785.35	785.30		
381.09	387.67	385.67	388.29	380.96	382.66		
185.39	185.27	186.13	187.71	187.91	187.11		
1895.05	1927.49	1934.38	1920.11	1922.15	1928.93		
1544.20	1554.86	1555.52	1510.88	1493.58	1537.74		

SAME column (comparison)

11-09-93 MA

Size Analysis by Sieving

Obtained sample of W510 and divided into fourths. Took half of the sample from two "fourths" which were diagonal to each other. Sample was weighed.

The sample was poured into the top of seven stacked sieves (11-9-93 MA: screens), with the coarsest at the top. From top to bottom these sieves were: ~~No. 40~~ (MA 11-9-93) No. 45, No. 60, No. 100, No. 140, No. 200, No. 230, No. 325, Pan.

The stack was then placed into the Ro-Tap and seived for 20 minutes.

The stacks were then emptied one at a time, onto a creased piece of paper. This pile of sand was then carefully poured onto a glazed piece of paper on the top balance scale. This process was repeated for each screen size. The weight of the sand ~~of~~ on each screen was recorded.

In total, five sieves were conducted. The results from the first three, may be skewed, somewhat, as moisture seemed to be a problem. (11-9-93) The sand in these tended to "clump", which is why extra sieves were conducted. The results of these sieves were as follows:

①

Mesh	Weight (g)	% Retained
45	1.08	2.22
60	9.49	19.49
100	23.36	47.97
140	11.37	23.35
200	2.81	5.77
230	.32	.66
325	.25	.51
pan	.02	.04

Total Wt: 48.7g
Initial Wt of Sample 50.12 g
LOSS: 1.42g

2)

Mesh	Weight (g)	% Retained
45	.99g	.02
60	9.29	19.25
100	23.27	48.23
140	11.25	23.32
200	2.93	6.07
230	.35	.73
325	.17	.35
pan	N/A	—

Tot. Wt: 48.25g
Initial Wt of Sample: 49.31g
Loss: 1.06 g

3)

Mesh	Weight (g)	% Retained
45	1.09	2.15
60	9.83	19.42
100	24.08	47.56
140	11.99	23.68
200	3.01	5.95
230	.39	.77
325	.24	.47
Pan	N/A	–

Tot. Wt: 50.63 g
Initial Wt. of Sample: 51.37 g
Loss: .74 g

④

Mesh	Weight	% Retained
45	1.42	3.0
60	10.64	22.55
100	22.95	48.63
140	9.64	20.43
200	2.11	4.47
230	.28	.59
325	.15	.32
Pan	–	

Tot. Wt: 47.19 g
Initial Wt. of Sample: 48.11 g
Loss: .92 g

⑤

Mesh	weight (g)	% Retained
45	1.80	3.52
60	11.28	22.05
100	24.27	47.44
140	10.85	21.21
200	2.56	5.0
230	.28	.55
325	.12	.23
Pan	N/A	

Total Wt: 51.16 g
Initial Wt. of Sample ~~51.68~~ g MA 11-9-93 51.68
Loss: .52 g

Once the sand had been sieved, and weighed, each fraction was put into its own separate container.

MA

11 Nov. 93 Sieving Analysis Continued:

MA

The separated fractions were combined. The sand was poured into the top seive screen, and seived for 20 minutes. The stack of screens were No. 45, No. 60, No. 100, No. 140, No. 200, No. 230, No 325, and a pan. When seiving was complete, the individual screens were emptied, and again, the sand was separated into individual fractions, and put into separate containers.

A large sample of sand was seived (using same screens) for 20 minutes. The procedure above was followed, and these fractions were ADDED to those previously obtained.

Each individual fraction was taken, and ONE gram was measured out, and placed into a small plastic vial. (Each fraction into its own labeled vial.). The vials were labeled "W510" with the fraction number, and characterized as "unwashed".

Continued and Finished 12 Nov 93

Next, a small aliquot was taken of W510, and crushed into a fine powder. This powder was then sieved for 20 minutes. The only screens used were No. 45, No. 325, and the pan. The powder in the pan was then poured into a clean vial and labeled: "W510", a fraction number, "XRD", and characterized as "unwashed". This procedure was followed for the following fractions: No. 45, No. 60, No. 100, No. 140, No. 200, No. 230, No. 325.

MA

16 Nov 93
MA

Ultrasonically Cleaning of Sieve Fractions

The separated, individual sieve fractions were placed in large (600 and 400ml) beakers, and partially filled with DI water. The beakers were then placed in the ultrasonic water bath for 7 minutes. The beakers were removed and observed for turbidity. The water was decanted, and this process was repeated until no turbidity could be observed.

The fractions used, again, were named according to the mesh size: NO. 45, NO. 60, NO. 100, NO. 140, NO. 200, NO. 230, NO. 325.

A sample of the original W510 was also "cleaned."

The cleaned ~~sam~~ 11-16-93 fraction samples were then placed in an oven (temp = 50°C) to dry.

16 Nov 93
MA

Sieving Analysis for Fractions top/100, 100/200, 200/pan

A large amount of the W510 sand was placed in the top screen (NO. 100) 11-16-93 and sieved for 20 minutes. The stack of sieve screens were in the following order: NO. 100, NO. 200, and the pan.

The sand MA 11-16-93 retained on NO. 100 was placed in a large, wide-mouth plastic container labeled, "top/100". Likewise, the sand caught on NO. 200 was put in a similar container and labeled "100/200". The remaining particles in the pan were placed in a smaller container labeled "200/pan".

The sieving process will continue until the 100/200 container has been filled.

MA

18-Nov 93
MA

Separating Fractions for XRD and SEM: From Clean Sample

After the cleaned W510 sand fractions had been dried, about one gram of each fraction was placed into a small plastic vial. Each vial was properly labeled according to the fraction it contained.

The vials were labeled: "W510 * Fraction * UC".

Next, a small amount of each sand fraction was crushed into a fine powder. The powder was sieved for 20 minutes with screen NO.'s 45, 325, and the pan. The powder which went through to the pan was poured into a clear vial and labeled.

The vials were labeled: "W510 * Fraction * UC * XRD.

23 Nov '93
MA

Sample Preparation and Mounting for XRD Analysis of Geological Materials: Sample W510.

Procedure followed as per TOP-004-02. One difference occurs in step(2): the specimen holder was placed in contact with cardboard, instead of the glass slide mentioned in the T.O.P.

The samples used in this procedure ~~was~~ were 11-23-93 MA the ultrasonically cleaned sieve fractions top/45, 45/60, 60/100, 100/140, 140/200, 200/230, 230/325 and the W510 itself.

30 Nov 93
MA

Sieving Analysis

Continuing the analysis from 11-16-93. A new sieve screen size was introduced: NO. 60 was placed on top of the NO. 100.

Sand retained on each screen was placed in individual containers. These were labeled as follows:

top/60, 60/100, 100/200, 200/pan

MA

12-07-93 MA

Combining Sieve Fractions

As a result of the sieving analysis from 16 Nov 93 and 30 Nov 93, the following fractions resulted:

16 Nov 93: top/100, 100/200, 200/pan

30 Nov 93: top/60, 60/100, 100/200, 200/pan

The top/100 and top/60 fractions were combined and put into one large plastic bucket and labeled "W510: top/60 and top/100". The bucket was then stored.

The 100/200 and the 60/100 fractions were set aside for ultrasonic cleaning.

MA ~~12-07-93~~

MA 9 Dec 93

Ultrasonic Cleaning of Sieve Fractions: 100/200, 60/100

The 100/200 sieve fraction of the W510 sand was split up and placed into 3 600 ml beakers and 2 400 ml beakers. The fraction was ultrasonically cleaned in the same manner done on 16 Nov 93.

The cleaned fraction (beakers) were placed in an oven to dry. The 60/100 fraction was similarly cleaned.

10 Dec 93 Sample Preparation and Mounting for XRD Analysis

Sample: W510, unwashed fractions

The crushed samples of the following sieve fractions were prepared and mounted as per TOP-004-02:

top/45	140/200
45/60	200/230
60/100	230/325
100/140	W510 Bulk sample

The same change in procedure done on 23 Nov 93 (p. 155) was also done here.

16 Dec 93 – 06 Jan '94

MA

Removal of Carbonates and Soluble Salts from Wedron Silica Sand (W510)

Objective: Removal of soluble impurities in W510 not previously removed through ultrasonic cleaning.

1) Prepared 1 N Sodium Acetate Buffer: pH = 5

a. Added 135.8 g of $NaC_2H_3O_2 \cdot 3H_2O$ to 600 ml of nanopure H_2O. (in a 1000 ml beaker)

b. The sodium acetate was dissolved using stirring plate. The solution was transferred to a 1000 ml volumetric flask and shaken several times. The solution was placed on a stirring plate, and acetic acid was added until pH = 5.0. (Buffer was poured into 8L plastic container)

c. 25.7 ml of acetic acid were added to get pH of 5.

D. Other portions of Sodium Acetate buffer were made, but were diluted to 2L (instead of 1L done in previous steps) (a 2000 ml beaker and volumetric were used.)

~~#~~ 12-16-93 MA	Diluted to:	$NaC_2H_3O_2 \cdot 3H_2O$ Added	Acetic Acid Added
1) 12/16/93	1000 ml	135.8 g	25.7 ml
2) 12/16/93	2000 ml	272.19 g	49.2 ml
3) 12/16/93	2000 ml	272.10 g	55.6 ml
12/17/93	2000 ml	271.96 g	54.4 ml
12/20/93	2000 ml	272.07 g	52.4 ml
12/20/93	2000 ml	272.03 g	51.3 ml
12/30/93	2000 ml	273.32 g	54.4 ml
12/30/93	2000 ml	272.19 g	61.3 ml
12/30/93	2000 ml	272.45 g	51.6 ml

(continued on page 160) MA

E. Once a pH of 5 was obtained, the buffer solution was transferred to a large, ~~wide-mouth~~ MA 12-16-93 PP container (8 L) and labeled "Sodium Acetate Buffer": pH = 5.0

2) Mixing of Buffer and W510 Sand

a. About MA 12-16-93 ~~50 g~~ 100 g of W510 * 100/200 * UC sand was placed in (Also W510 * 60/100 * UC)

16 Dec 93
MA
(cont)

a 600 ml beaker.
b.) 300 ml of Sodium Acetate buffer was added.
c) stirring bar was placed in beaker, and all were put on stirring plate.

3) Heat and Mix Solution
a Beakers placed in hot water bath @ 90°C for 30 min, with solution being stirred at 15 min intervals
b. After 30 minutes, the solution (buffer) was decanted, fresh buffer was added, and steps 2+3 were repeated 3 times.

4) After final Sodium Acetate treatment, the buffer was decanted, and the sand washed twice with nanopure water.

5) Filter Sand –
a. sand was rinsed onto P8 filter paper using nanopure water.
b. Sand retained on the filter paper was dried in convection oven overnight at about 80°C.

6) Transfer (dried) sand to container
a. Labels: W510*100/200 * UC * RC
W510*60/100 * UC * RC

11 Jan '94 7) From the large completed samples of W510 *60/100*UC *RC and W510 *100/200 * UC * RC, an aliquot of about 2 grams (each) was taken out and placed in separate, small containers.
These were labeled as follows:
W510 * 100/200 * UC * RC * Dissolution
W510 * 60/100 * UC * RC * Dissolution

20 Dec 93
MA

Separating W510:
The Wedron 510 sand was removed from the bag in which it came and was poured into 2 plastic buckets.
These buckets were labeled as follows:
Bulk Sample W510 #1
Bulk Sample W510 #2

21 Dec 93
MA
thru
28 Jan 94

Sieving Analysis

Large aliquots of the W510 sand was taken from Bulk Sample W510 #1 and sieved for 20 minutes.
Sieves used: #60, #100, #200, pan.
Sieve fractions are labeled: top/60, 60/100, 100/200, 200/pan

The sieve fractions 60/100 and 100/200 were put in separate, large-mouthed PP containers and labeled
W510 ~~#1~~ MA * 60/100 and W510 ~~#1~~ MA * 100/200

The top/60 and 200/pan are not fractions needed for further analysis. These fractions were put in their respectively labeled containers as per previous procedures followed on 11-16-93, p. 154 (for 200/pan fraction) and 12-07-93 p. 156 for the top/60 fraction.

MA

12/30/93 continued from TABLE ON p. 157

	Diluted To:	$NaC_2H_3O_2 \cdot 3H_2O$ Added	Acetic Acid Added
12/30/93	2000 ml	271.96 g	52.1 ml
1/03/94	2000 ml	272.24 g	51.6 ml
1/03/94	2000 ml	271.97 g	50.75 ml
1/03/94	2000 ml	272.30 g	52.30 ml
1/03/94	2000 ml	271.99 g	50.60 ml
1/04/94	2000 ml	272.02 g	50.90 ml
1/04/94	2000 ml	271.56 g	49.75 ml
1/04/94	2000 ml	272.07 g	50.40 ml
1/04/94	2000 ml	272.14 g	49.45 ml
1/06/94	2000 ml	272.00 g	49.7 ml

11 Jan 94
PB

Physical description of W510 sieve fractions.

Equipment: binocular scope w/ light source
weigh paper
small spatula

Overview: Wedron silica sand (510) sieved fractions are described. Visual identification of components is accomplished with the aid of a binocular microscope.

① W510 # TOP/45 # UC

Sample is primarily quartz (qtz), plutonic appearance (clear), a few quartz grains are 'smoky' gray.

- grains are rounded / sub-rounded, highly spherical
- lightly frosted → polished
  50/60 % 50/40 %

- ~ 2% grains have red/yellow coating (Fe-oxide)

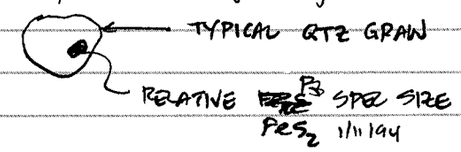
11 Jan 94
PB

① W510 * TOP/45 * UC (cont'd)

- ~ 10% of qtz grains have black specs, the specs appear to be another mineral phase (probably pyrite). The pyrite is included w/in some qtz grains and appears on the surface of others. Most pyrite does not appear highly oxidized (red/yellow) although most appears black-gold.

- rare grains (1-2 ~~seen~~ observed) have translucent (yellow/yellow brown) inclusions. Hard to tell if these are another mineral phase (topaz?, tourmaline?) or gold colored pyrite w/in qtz.

- size of the pyrite specs on qtz grains is small (~ 5% ?)



- smoked qtz usually lightly frosted, Fe-oxide coated/stained grains are usually polished (or clear)

② W510 # 45/60 # UC

- primarily quartz > 99%
- grains are spherical, subrounded / rounded
- polished → frosted
  50% 50%
- qtz appears to be plutonic (clear not milky)

- small ~ 2% of qtz grains show Fe-oxide coating/stain
- ~ 5% of grains (qtz) have the small pyrite inclusions/surface specs seen in the TOP/45 sample. (fewer grains show specs, specs are similar in relative size)

- trace amount of smoked qtz. (round)

11 Jan 94
PD

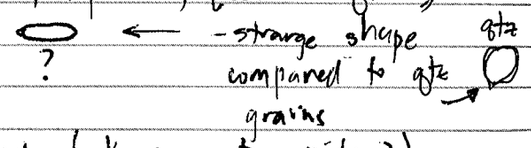
(3) W510 * 100/140 * UC

- primarily (>99%) qtz grains
- spherical, subrounded (trace ~~angular~~ subangular)
- polished (clear) → frosted (slightly)
  70/80 % 30/20 %

- 1-2% grains have Fe-oxide coatings (slight decrease from 45/60 fraction

- 2-3% grains have small pyrite specs in/on surface, first appearance of separate grains of pyrite (most subround) equal in size to sieve fraction. relative size of FeS_2 specs to host qtz grains is similar to TOP/45 fraction.

- several (trace amount for whole sample) darker mineral grains are evident. grains are yellow/yellow-brown, translucent but clear/polished, elongate (cigar shaped) and well rounded. Possibly same as darker mineral observed earlier (tourmaline, topaz ?) [colored qtz ?]



← - strange shape compared to qtz grains

- one grain, angular, reddish (K-spar, Fe-oxide ?)

(4) W510 * 60/100 * UC

- primarily quartz grains (> 99%)
- spherical, sub rounded
- ~ 2% grains show Fe-oxide coat/stain

- polished → frosted (very slight)
  50 % 50 %

11 Jan 94
PD

(4) W510 * 60/100 * UC (cont'd)

- trace amount of smoked quartz, well rounded (few grains)
- trace amount of individual grains of pyrite (rounded)
- ~ 30% (maybe less) grains have pyrite inclusions/on surface

- no other colored minerals seen in the sample

(5) W510 * 140/200 * UC

- primarily qtz (although there is a noticeable increase in the amount of dark mineral grains present).

- qtz is clear, with ~~tout~~ med. 1-11-94 sphericity and subangular to angular grains, smoky qtz more rounded

- most dark mineral grains are pyrite (individual grains vary from rounded to angular), the other dark minerals are qtz or impurities
  colored minerals (impurities) are brown/yellow-brown (most subround), translucent, and elongate (tourm.?)

maybe 1-2% of total grains are not qtz.

- few qtz grains have pyrite inclusions or surface specs.

(6) W510 * 200/230 * UC

- primarily qtz ~ 98-97 %
- qtz grains are clear (~ 85%), angular, ~~tout~~ medium sphericity 1-11-94

- 2-3% dark grains (~ 1/4 of these are smoky quartz now, more angular)

- more brown/yellow brown ~~colo~~ minerals (as seen before)

11 Jan 94
PD

(6) W510 * 200/230 * UC

are present. (tourm.?, topaz?, rutile, Fe-oxides?)

- ~ 2-3% of quartz grains have Fe-oxide coating/stain

- trace amount of qtz grains appear to have pyrite in/on (most pyrite seems to be separate)

(7) W510 * 230/325 * UC

- similar to 200/230 fraction, but the number of dark mineral grains have increased.
- many more dk brown grains are present, some appear to be k-spar, etc.

(8) W510 * UC (bulk fraction)

as expected, primarily qtz, <1% dark fraction
[MIXTURE OF ABOVE 7 SAMPLES]

(9) W510 * 60/100 * UC * RC

- similar to 60/100 * UC, but qtz grains appear to show less pyrite inclusions/surface specs.

(10) W510 * ~~60/100 *~~ 1/11/94 PD 100/200 * UC * RC

- similar to 100/140 and 140/200, but the number of dark grains seems high, heavily influenced by 140/200 fraction.

11 Jan 94
PD

Summary of description of W510 sieve fractions

1. Percent of dark minerals / pyrite (as discreet grains) increases with finer size fractions. Minerals other than qtz or pyrite ↑ with finer fractions.

2. A larger amount of pyrite is associated with qtz grains in the coarser size fractions. => Although discreet grains of FeS_2 may not be present, the presence of FeS_2 on the surfaces of qtz may influence the results of sorption expts.

3. Fe-oxide coatings/stains seem to be present in each fraction

4. 'smoky' qtz grains are present in trace amounts.

What to do:

A. - Process for free iron oxides (60/100 and 100/200 * UC * RC) to determine effect on coatings

B. - Heavy liquid separation may effectively cleanse 100/200 fraction of dark grains (that are not quartz).

C. - Grain mount thin sections will help to identify unknown mineral components. Chemical analysis will also help.

→ Note: Siegel reports a high Al content in his analysis of the 70/100 fraction. I don't know where this (Al) comes from unless there is a lack of UC of fine grained particles (like kaolinite in his samples)
- if sieve fractions have many fine particles → would expect elevated Al content

11 Jan 94 PB

additionally, Al values could come from accessory/impurities that occur in the Wedron samples. Tourmaline, Topaz, etc have high Al content compared to qtz or pyrite. The chem. analyses reported by Siegel ~~et. a~~ et al. show an increase in Fe as the size fraction ↓. This is likely due to the increased ratio of FeS_2 grains.

13 JAN 94 MA

thru 2 Feb 94

Removal of free IRON-OXIDES from W510 silica SAND

Objective: To remove free iron oxides from sand, which can have a significant effect on the sorption characteristics of the sand.

Equipment:

- 600 ml beakers
- temperature controlled water bath
- filter paper (P8) and filter assembly
- stirring rods
- analytical balance

Reagents:

- Nanopure H_2O
- .3 M sodium ~~bicarbonate~~ Citrate - Dihydrate MA 1-13-94
- 1.0 M sodium bicarbonate
- Sodium Dithionite
- W510 * 60/100 * UC * RC
- W510 * 100/200 * UC * RC

Procedure:

A reagent solution of .3 M Sodium Citrate · $2H_2O$ was prepared by adding ~ 88.24 grams of Sodium citrate · $2H_2O$ to 1 liter of nanopure water.

A 1.0 M sodium bicarbonate solution was prepared by adding 84 grams of Sodium bicarbonate to 1 liter of nanopure water.

1-13-94 MA

Procedure (cont)

400 ml of .3 M Sodium Citrate and 50 ml of Sodium Bicarbonate (1.0 M) was poured into a 600 ml beaker.

~ 100 g of W510 sand was added to each beaker.

(W510 * 60/100 * UC * RC and W510 * 100/200 * UC * RC were processed)

The mixtures ~~was~~ were MA 1-13-94 placed in a water bath and heated to 75°C - 80°C. At this point, 10 g of Sodium Dithionite ~~was~~ 1-13-94 MA was added to each beaker, and thoroughly stirred for 1 minute. The suspensions were heated @ 75°-80° C for 15 minutes, with continuous stirring.

After 15 minutes, the beakers were removed from the water bath, and the supernatant was decanted. The remaining sand was rinsed w/ nanopure H_2O three to four times.

The sand was then filtered through P8 filter paper, while rinsing with nanopure water.

The sand remaining on the filter paper was dried overnight in the oven at 80° C. The dry sand was transferred to large-mouthed PP containers and labeled as follows:

W510 * 60/100 * UC * RC * RFe
W510 * 100/200 * UC * RC * RFe

20 Jan 94 PB

W510 samples were sent to Mineral Optics Laboratory
P.O. Box 828, 29 "A" st.
Wilder, VT 05088 (802) 295-9373

for thin section preparation. All samples will be grain mounts, standard thickness, standard size, polished, clear epoxy resin impregnated, with no cover slips

Samples of sand from different size fractions, along with examples of sequentially cleaned 60/100 and 100/200 fractions (RC and RFe) are included.

20 Jan 94
PB

Samples were packed in plastic vials (each vial contained ~ 1-2 g of sand)

SAMPLES WERE LABELED:

#1 = W510 * UC
#2 = W510 * 100/200 * UC
#3 = W510 * 100/200 * UC * RC
#4 = W510 * 100/200 * UC * RC * RFe
#5 = W510 * 60/100 * UC
#6 = W510 * 60/100 * UC * RC
#7 = W510 * 60/100 * UC * RC * RFe
#8 = W510 * 100/140 * UC
#9 = W510 * 140/200 * UC
#10 = W510 * 200/230 * UC
#11 = W510 * 230/325 * UC
#12 = W510 * 45/60 * UC
#13 = W510 * Top/45 * UC

returned thin sections should be labeled #1, #2, #3, ...

28 JAN 94
MA

Crushing Samples for Chemical Analysis

About 2 grams of the sieve fraction samples were weighed out individually. The 2 gram samples ~~was~~ were then crushed and grinded into a fine powder. Gloves were worn to guard against sodium contamination. The crushed samples were then placed into small plastic vials and labeled with the extension * Chem: The samples crushed and their "new" labels are as follows:

W510 * UC → W510 * UC * Chem
W510 * Top/45 * UC → W510 * Top/45 * UC * Chem
W510 * 45/60 * UC → W510 * 45/60 * UC * chem
W510 * 60/100 * UC → W510 * 60/100 * UC * chem
W510 * 100/140 * UC → W510 * 100/140 * UC * Chem
W510 * 140/200 * UC → W510 * 140/200 * UC * chem
W510 * 200/230 * UC → W510 * 200/230 * UC * chem
W510 * 230/325 * UC → W510 * 230/325 * UC * Chem

28 JAN 94 (continued)
MA

W510 * 60/100 * UC * RC → W510 * 60/100 * UC * RC * chem
W510 * 100/200 * UC * RC → W510 * 100/200 * UC * RC * chem
W510 * 60/100 * UC * RC * RFe → W510 * 60/100 * UC * RC * RFe * chem
W510 * 100/200 * UC * RC * RFe → W510 * 100/200 * UC * RC * RFe * chem

NOTE: The 230/325 * UC and 200/230 * UC sieve fractions were not able to weigh out 2 grams. In fact, each had only about .5 grams. In order to ~~augment~~ increase the weight of the samples, the remaining powdered samples of each sieve fraction (which had previously been crushed for XRD analysis (p.155)) was added. Still, each sample weighed ~ 1 gram. MA 1-26-94

4 Feb 94
MA

Ultrasonic Cleaning of W510 * 60/100 and 100/200

The sieve fractions which were combined on ~~12-07-93~~ 12-21-93 MA 6C-09 p. ~~156~~ 159, were ultrasonically cleaned using ~~in~~ MA the procedure done on 16 Nov 94 (6C-09 p. 154).
SIEVE FRACTIONS: W510 * 60/100 AND W510 * 100/200

9 Feb '94
MA

Removal of Carbonates and Soluble Salts from Wedron W510 Silica Sand

Began processing 60/100 sieve fraction which was noted above and on p. 159. Procedure listed in 6C-09 p. 157-158 was followed.
60/100 sieve fraction completed: 2/23/94
100/200 sieve fraction processing started 2/24/94

2 Mar 94
MA

Completed processing W510 * 100/200 sieve fraction. (for carbonate and soluble salt removal.)

Sodium Acetate Buffer Solutions were prepared according to procedure on p. 157, the "results" being as follows:

BUFFER.XLS

				SODIUM ACETATE BUFFER	
DATE PREPARED		DILUTED TO:		SODIUM ACETATE ADDED:	ACETIC ACID ADDED:
2/9/94		2000 ml		271.6 g	51.6 ml
2/10/94		2000ml		271.59 g	49.6 ml
2/10/94		2000 ml		271.61 g	48.9 ml
2/10/94		2000 ml		271.59 g	50.5 ml
2/10/94		2000 ml		271.66 g	50.8 ml
2/11/94		2000 ml		271.63 g	50.3 ml
2/11/94		2000 ml		271.63 g	50.1 ml
2/11/94		2000 ml		271.61 g	49.4 ml
2/14/94		2000 ml		271.58 g	49.4 ml
2/14/94		2000 ml		271.66 g	46.6 ml
2/14/94		2000 ml		271.58 g	51.8 ml
2/14/94		2000 ml		271.61 g	47.4 ml
2/18/94		2000 ml		271.69 g	49.4 ml
2/18/94		2000 ml		271.58 g	49.6 ml
2/21/94		2000 ml		271.62 g	49.3 ml
2/21/94		2000 ml		271.62 g	49.8 ml
2/21/94		2000 ml		271.43 g	50.0 ml
2/21/94		2000 ml		271.68 g	49.5 ml
2/23/94		2000 ml		271.62 g	49.2 ml
2/23/94		2000 ml		271.66 g	49.4 ml
2/24/94		2000 ml		271.57 g	46.6 ml
2/24/94		2000 ml		271.59 g	46.8 ml

MA

3 Mar 94

MA Removal of Free Iron Oxides from ~~W~~ MA 3-3-94 W510 Silica Sand

Began processing 60/100 sieve fraction (W510*60/100*UC*RC) following the procedure on pp 166-167.

18 Mar 94 Completed 60/100 sieve fraction.

MA Began processing 100/200 sieve fraction for Free Iron oxide removal. Followed same procedure as noted above.

29 Mar 94

MA Completed processing of 100/200 sieve fraction for Free Iron oxide removal. Completed samples are in separate, wide mouth, Nalgene PP containers (4L) and labeled:

W510 * 60/100 * UC * RC * RFe

W510 * 100/200 * UC * RC * RFe

30 Mar 94

MA Heavy Liquid Separation: 60/100 and 100/200 sieve fractions

Objective: To remove non-quartz grains from sand samples

~~Eq~~ MA 3-30-94

Equipment:

- Funnel and tubing (and assembly)
- coffee filter
- 250 ml roundbottom flasks
- 1 L PP (narrow mouth bottle)
- 1 L wide Mouth bottle
- stirring rods

Reagents

- Sodium PolyTungstate, Density = 2.89
- W510 * 60/100 * UC * RC * RFe
- W510 * 100/200 * UC * RC * RFe

30 Mar '94 (continued)

Procedure (SPT)

The Sodium Polytungstate was extremely viscous, so in order to get the heavy grains to sink down faster, the density was lowered. 250 ml of SPT was poured into a 600 ml beaker. Then, 4 ml of NanoPure H_2O was added, and mixed. Next, .5 ml of the SPT was weighed out: 1.32g. Density ~~?~~ MA 3-30-94 about 2.64

The SPT was poured into a medium-sized funnel resting in an assembly ring, and tubing connected. The tubing was clipped to prevent flow. Then about 50-60 grams of the 60/100 sieve fraction was added, and stirred. The mixture was allowed to settle. It was obviously clear that most of the dark grains were sinking, while the quartz floated on top. ~~of the~~ MA 3-30-94 After several stirrings, and allowing time to settle, there was an observable separation between the quartz at the top, and the dark, heavy grains which had sunk down into the tubing and stem of the funnel.

The clip was released slowly, and a slow flow of SPT and the dark heavy grains were emptied into a MA 3-30-94 250 ml round bottom flask with a funnel and filter paper to catch the grains. The "pure" SPT in the flask was transferred to the 1 L wide-mouthed bottle and labeled "Pure SPT". (This SPT could and would be used again.)

Another 250 ml round bottom flask, funnel and coffee filter were set up under the tubing. Again, the clip was opened slowly, and the remaining SPT and quartz grains were emptied onto the coffee filter. The filtered SPT solution was emptied into the 1L bottle labeled "Pure SPT". The quartz still in the funnel was washed with NanoPure H_2O through the same filter, but into a separate flask, labelled "SPT Wash". Once the sand was out of the funnel, the filter papers were put in the oven to dry, and the SPT Wash was emptied into the 1L PP bottle labeled SPT Wash. (This solution will later be heated to allow the H_2O to evaporate, and retain the SPT.)

When the quartz dried, the procedure was

30 Mar '94

repeated 2 more times.

This procedure will also be followed to separate heavy grains from the 100/200 sieve fraction.

A total of about 250 g of each sieve fraction will be separated at this time.

6 Apr 94 MA

Heavy Liquid Separation (cont)

Began separating heavy grains from the 100/200 sieve fraction. It was quite ~~noticeable~~ MA 4-6-94 evident how much "dirtier" this fraction is compared to the 60/100 fraction. That is, it has a lot more darker, heavier grains falling into the funnel stem and tubing, as well as darker grains suspended below the quartz which accumulates at the top. The heavier grains in the stem and tubing will be "drained out". The suspended grains will be filtered out with the quartz, dried, and re-processed 2-3 more times.

8-April 94 MA

Heavy Liquid Separation (cont) ~~to~~ MA 4-8-94 100/200 Sieve Fraction

After the quartz had dried, the process described above and on p. 172 (GC-09) was repeated. There were still heavy dark grains noticeable, but they were not "falling" like they had before.

To make the heavy liquid less dense (in order to speed up the separation) about 1.5 ml of water (NanoPure) was added and stirred.

The heavy liquid solution now became "less dense" so much so that the quartz began to move to the bottom / stem area of the funnel.

Now the density must be increased - this will be done by ① adding SPT and ② by evaporating off the excess water of the portion of this solution being used.

12 Apr 94 MA

Recovery of SPT

The heavy liquid solution used on 8-April-94 was poured into an evaporating dish, and placed on a hot plate in the hood. The "SPT Wash" was also put in an evaporating dish, and likewise heated. The water

12 Apr '94
MA

(continued)
was driven off, and the density of both solutions was checked periodically during the process until their densities were about 2.8.

13 Apr '94
MA

Continued Heavy Liquid Separation of 100/200 Sieve Fraction

With the heavy liquid back at a density of 2.8, the 100/200 sieve fraction was processed for the 2nd time. Separation was slow, but periodic stirring facilitated the process. (procedure from p. 172-173 was followed.)

The solution of heavy liquid and W510 * 100/200 * UC * RC * RFe sample was stirred and allowed to settle. A small amount of dark, heavy grains ~~were~~ 4-13-94 was MA drained out, then stirring and allowing solution to settle followed. The dark, heavy grains were again drained out, and this continued until mostly quartz was evident at the stem of the funnel.

A separate funnel and flask was used to collect the remaining quartz. This was dried, and will be processed again.

The dark heavy grains were washed w/ nanopure H_2O, dried and put into a small plastic vial labeled: "W510 * 100/200 separated heavy"

19 April '94
MA

Ultrasonic Cleaning of Sieve Fractions: 60/100, ~~100/200~~ MA

After the heavy grains had been separated and removed from the sieve fraction samples, the (quartz) sand was split into 2 portions of about 70g and placed into 600 ml beakers. The (quartz) sand was ultrasonically cleaned, following the procedure on p. 154 (6C-09).

20 April '94
MA

Ultrasonic Cleaning of Sieve Fraction: 100/200

Procedure from 4-19-94 was followed for the 100/200 sieve fraction.

* Objective of U.C. cleaning was to remove any SPT that may have still been "stuck" to the quartz.

21 April 94
MA

Continued Ultrasonic Cleaning

- Continuing procedure began on 4-20-94 for 100/200 sieve fraction.

  NOTE: The ultrasonic cleaning pertains to the quartz. The heavy grains which have been separated from both sieve fractions will be "cleaned" in the future.

- The 60/100 "cleaned" quartz was removed from the oven and placed in a glass container and labeled:

  W510 * 60/100 * UC * RC * RFe * Separated * UC

- The 100/200 "cleaned" quartz was removed from the oven and placed in a glass container and labeled:

  W510 * 100/200 * UC * RC * RFe * Separated * UC

27 April '94

NOTE: Sieve fractions 60/100 and 100/200 which went through heavy liquid separation process will now be labeled:

W510 * 60/100 * UC * RC * RFe * HL
W510 * 100/200 * UC * RC * RFe * HL

the labels mentioned on this page (4-21-94) will be disregarded.

MA

4 May 94
MA

U Sorption on Wedron Silica
Sorption (Q1) and Kinetics (Q1-K) Experiments

WRITTEN BY: F.P. Bertetti — DATE WRITTEN: May 2, 1994
REVISION NO.: 0 — DATE REVISED: N/A

CONDITIONS:

1.) ΣU= 50 ppb
2.) 0.1 m $NaNO_3$ matrix, equilibrium with atmospheric CO_2(g); $pCO_2=10^{-3.5}$
3.) pH range 2-9
4.) initial solution volume = 50 ml, initial quartz sand mass = 0.1 g

OBJECTIVES:

- To investigate the characteristics of U sorption on quartz sand as a function of solution pH. Experimental data will be correlated with uranium aqueous speciation and compared with results of U sorption on clinoptilolite and α-alumina.
- To investigate the reproducibility and reversibility of U sorption reactions.
- To investigate the effects of using experimental containers of differing composition (in this case polycarbonate versus FEP as used in previous U sorption experiments).

EQUIPMENT:

Gyratory shaker
Packard liquid scintillation counter
Orion pH/mV/ISE/°C meter
Combination pH electrode
ATC probe
Analytical balances (Mettler 4600 and 240AE)
α, β and γ survey instruments

SUPPLIES:

47	2 oz. polycarbonate bottles (acid washed and dried)
1	2000-ml FEP bottle (acid cleaned and dried)
1	500-ml FEP bottle (acid cleaned and dried)
1	Repipettor for transfer of scintillation cocktail
various	Eppendorf micropipettors for solution transfer
	Eppendorf pipet tips
	pH buffer solutions
	Ultima-Gold liquid scintillation cocktail

PROCEDURE:

Special considerations:

- Experimental solutions and sample containers/vials should be weighed at each step. Do not add or subtract contents without weighing before and after each process. Always record weight of solutions.
- When measuring pH, minimize the amount of time the glass electrode is in contact with the U bearing solution. Make sure to rinse the electrode thoroughly before measuring another solution. Take care not to introduce lint particles or other foreign objects into the experimental or sample containers.
- Liquid scintillation analysis (LSA) should be performed within two days of each sampling interval so that results can be reviewed during the experiment. Sample vials should "rest" in the absence of light for at least 24 hours prior to initial analysis to allow for decay of incident radiation pulses.
- Following each sampling period, swipes and frisks of the work area should be performed. If contamination is found, follow the radiological procedures for clean-up, and inform the division radiation safety point of contact (RSPOC). Radioactive solutions may not be disposed of without following all radiation safety guidelines. Do not dispose of any solutions without prior approval of the division RSPOC.

4 May 94
MA

Q1 and Q1-K experiments were started today following the procedures below.
For the preparation of the 50 ppb U solutions, an additional 1000 ml of .1 m $NaNO_3$ was needed.
This was prepared by adding 8.4984 g of $NaNO_3$ to 1000 g of nanopure H_2O.

2.) Prepare separate 50 ppb U solutions for sorption and kinetic experiments.

a.) On the Mettler 4600 balance, weigh 200 g of 500 ppb U stock solution into a tared 2000 ml FEP bottle. 200.0 g
b.) Dilute to a total of 2000 g using 0.1 m $NaNO_3$ stock solution.
c.) Cap and label the bottle accordingly (sorption solution).
d.) On the Mettler 4600 balance, weigh ~~40~~ g of 500 ppb U stock solution into a tared 500 ml FEP bottle. 40.19 g
e.) Dilute to a total of ~~400~~ g using 0.1 m $NaNO_3$ stock solution. 400.03 g
f.) Cap and label the bottle accordingly (kinetics solution).

3.) Add 50 ppb U solution to each experiment container.

Kinetics:

a.) Label three 2 oz. polycarbonate containers Q1-K*pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
b.) Add 50 g of the 50 ppb U (from the 500 ml FEP bottle) solution to each container. Record weight.
c.) Label three 2 oz. polycarbonate containers Q1-KC*pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
d.) Add 50 g of the 50 ppb U solution to each container. Record weight.
e.) Transfer 50 g of the remaining 50 ppb U solution into a pre-weighed 2 oz. polycarbonate bottle labeled Q1-K*IU. Add 100 µl of 50% HNO3 solution to the bottle and mix thoroughly. Record weight.

Sorption:

a.) Label twenty-nine 2 oz. polycarbonate containers Q1-pHi (where *i* is the approximate pH of each solution, ~~see Table 1~~) and pre-weigh. Record weight.
b.) Add 50 g of the 50 ppb U (from the 2000 ml FEP bottle) solution to each container. Record weight.
c.) Label ten 2 oz. polycarbonate containers Q1-C*pH*i* (where *i* is the approximate pH of each solution, ~~see Table 1~~) and pre-weigh. Record weight.

d.) Add 50 g of the 50 ppb U solution to each container. Record weight.
e.) Transfer the remaining (~50 g) 50 ppb U solution into a pre-weighed 2 oz. polycarbonate bottle labeled Q1-IU. Add 100 µl of 50% HNO3 solution to the bottle and mix thoroughly. Record weight.

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

4.) For Q1-pHi, Q1-C*pH*i*, Q1-K*pH*i* and Q1-KC*pH*i* solutions, add HNO_3 or $NaHCO_3$ to adjust pH to desired value.

a.) Adjust pH by adding HNO_3 or $NaHCO_3$ using an Eppendorf micropipet. The amount to be added to each solution is given in Table 1. Record the amount and concentration actually added to each container. Mix well by swirling the solutions.
b.) Re-weigh each container. Record weight.
c.) Replace screw caps, but **do not tighten!** Solutions must be open to atmosphere.
d.) Place bottles on a gyratory shaker at ~120 rpm. Allow at least 10 days for pH equilibration.

4 May 94
MA

STEPS 3 and 4 FOR the Kinetics exp. WERE followed, with the RESULTS AS FOLLOWS:

Sample NAME	Empty wt of bottle	wt of bottle + U sol'n (g)	wt. of U sol'n (g)
Q1-K* pH 5.5	20.3278 g	70.4074	50.0796
Q1-K* pH 6	20.0894 g	70.0115	49.9221
Q1-K* pH 6.5	20.2430 g	70.2630	50.0200
Q1-KC* pH 5.5	20.3063 g	70.3539	50.0476
Q1-KC* pH 6	20.0697 g	70.1639	50.0942
Q1-KC* pH 6.5	20.3873 g	70.4028	50.0155
Q1-K* IU	20.0965 g	70.1529	50.0564

STEP 4 required Addition of $NaHCO_3$ for pH Adjustment:

Sample NAME	Vol of $NaHCO_3$ MA ~~needed~~ ADDED, ml	Molarity of $NaHCO_3$	wt of bottle, U sol'n, and $NaHCO_3$ (g)
Q1-K* pH 5.5	.390	.01	70.7981
Q1-K* pH 6	.430	.01	70.4348
Q1-K* pH 6.5	.100	.05	70.3634
Q1-KC* pH 5.5	.390	.01	70.7421
Q1-KC* pH 6	.430	.01	70.5894
Q1-KC* pH 6.5	.100	.05	70.4982

100 ul of 50% HNO_3 was added to Q1-K* IU.
Final weight of bottle and solution was 70.2765g

STEP 3 for the Sorption EXP. WAS FOLLOWED, with the RESULTS listed ON NEXT page.

4 May 94
MA

SAMPLE NAME	WT. OF BOTTLE, g	WT OF BOTTLE & U SOL'N, g	WT OF U SOL'N, g
Q1-pH 2	20.2046	70.2116	50.0070
Q1-pH 2.25	20.2288	70.2811	50.0523
Q1-pH 2.5	20.1521	70.2637	50.1116
Q1-pH 2.75	20.2826	70.3287	50.0461
Q1-pH 3	20.1586	70.0830	49.9244
Q1-C* pH 3	20.2599	70.3778 ✓	50.1179
Q1-pH 3.25	20.2463	70.1790	49.9327
Q1-pH 3.5	20.1930	70.2975	50.1045
Q1-pH 3.75	20.1051	70.1951	50.0900
Q1-pH 4	20.1528	70.1882	50.0354
Q1-C* pH 4	20.2294	70.2445 ✓	50.0151
Q1-pH 4.25	20.4401	70.4892	50.0491
Q1-pH 4.5	20.2387	70.2378	49.9991
Q1-pH 4.75	20.1180	70.0256	49.9076
Q1-pH 5	20.1203	70.2123	50.0920
Q1-C* pH 5	20.0365	70.1042 ✓	50.0677
Q1-pH 5.25	20.1434	70.1805	50.0371
Q1-pH 5.5	20.2437	70.1833	49.9396
Q1-C* pH 5.5	20.2189	70.1746 ✓	49.9557
Q1-pH 5.75	20.2530	70.3655	50.1125
Q1-pH 6	20.4164	70.4325	50.0161
Q1-C* pH 6	20.1433	70.0860 ✓	49.9427
Q1-pH 6.25	20.1742	70.2425	50.0683
Q1-pH 6.5	20.1047	70.0703	49.9656
Q1-C* pH 6.5	20.3522	70.4103 ✓	50.0581
Q1-pH 6.75	20.2375	70.2550	50.0175
Q1-pH 7	20.4094	70.3859	49.9765
Q1-C*pH 7	20.2267	70.2277 ✓	50.0010
Q1-pH 7.25	20.1023	70.0440	49.9417
Q1-pH 7.5	20.4852	70.4261	49.9409
Q1-C*pH 7.5	20.3726	70.3650 ✓	49.9924
Q1-pH 7.75	20.1137	70.1775	50.0638
Q1-pH 8	20.0289	70.0287	49.9397
Q1-C*pH 8	20.1691	70.1909 ✓	50.0218
Q1-pH 8.25	20.1460	70.0994	49.9534
Q1-pH 8.5	20.0298	69.9766	49.9468
Q1-pH 8.75	20.4482	70.5106	50.0624
Q1-pH 9	20.1347	70.0650	49.9303
Q1-C*pH 9	20.1869	70.3174 ✓	50.1305
Q1-IU	20.1624	69.2004	49.0380

AE 240 AE 240

STEP 4 WAS then FOLLOWED FOR the Sorption Exp. PH WAS Adjusted by Adding either HNO_3 or $NaHCO_3$, AND the bottles were then weighed. Results ARE listed ON the NEXT page.

4-May 94
MA

SAMPLE	VOL. OF HNO_3 ADDED, ml	MOLARITY		WT, g
Q1-pH 2	.600	1		70.8445
Q1-pH 2.25	.335	1		70.6385
Q1-pH 2.5	.185	1		70.4569
Q1-pH 2.75	.100	1		70.4310
Q1-pH 3	.560	.1		70.6402
Q1-C*pH3	.560	.1	✓	70.4332
Q1-pH 3.25	.300	.1		70.4751
Q1-pH 3.5	.150	.1		70.4470
Q1-pH 3.75	.070	.1		70.2522
Q1-pH 4	.100	.02		70.2852
Q1-C*pH4	.100	.02	✓	70.3438

SAMPLE	VOL OF $NaHCO_3$ ADDED, ml	MOLARITY		WT. g
Q1-pH 4.25	.120	.005		70.6042
Q1-pH 4.5	.420	.005		70.6563
Q1-pH 4.75	.295	.01		70.3148
Q1-pH 5	.340	.01		70.5416
Q1-C*pH5	.340	.01	✓	70.4481
Q1-pH 5.25	.370	.01		70.5503
Q1-pH 5.5	.390	.01		70.5675
Q1-C*pH5.5	.390	.01	✓	70.5592
Q1-pH 5.75	.410	.01		70.7844
Q1-pH 6	.430	.01		70.8532
Q1-C*pH6	.430	.01	✓	70.5107
Q1-pH 6.25	.460	.01		70.7083
Q1-pH 6.5	.100	.05		70.1676
Q1-C*pH6.5	.100	.05	✓	70.5082
Q1-pH 6.75	.120	.05		70.3711
Q1-pH 7	.150	.05		70.5245
Q1-C*pH7	.150	.05	✓	70.3639
Q1-pH 7.25	.210	.05		70.2518
Q1-pH 7.5	.310	.05		70.7286
Q1-C*pH7.5	.310	.05	✓	70.6823
Q1-pH 7.75	.240	.1		70.4225
Q1-pH 8	.400	.1		70.4306
Q1-C*pH8	.400	.1	✓	70.5899
Q1-pH 8.25	.140	.5		70.2434
Q1-pH 8.5	.250	.5		70.2402
Q1-pH 8.75	.230	1.0		70.7489
Q1-pH 9	.435	1.0		70.5130
Q1-C*pH9	.435	1.0	✓	70.7734
~~Q1~~				
~~Q1~~				
Q-IU	.100 ml of 50% HNO_3 Added			69.3261

Page 1

240 AE

Q1 and Q1-K Sorption

5 May 94
MA

5.) Sample Q1-IU and Q1-K*IU to determine initial U concentration for experimental solutions.

a.) Label (e.g., Q1-K*IUa and Q1-K*IUb) and pre-weigh 2 liquid scintillation vials each containing 0.5 ml 0.02 M HNO_3.
b.) Using an Eppendorf pipet, withdraw two 0.5 ml samples from Q1-IU and Q1-K*IU and transfer to liquid scintillation vials. Re-weigh vials and record weight.
c.) Add 5 ml of Ultima-Gold cocktail to each vial. Homogenize sample and set aside for LSA.

Results of step 5 are as follows:

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-IU*a	7.7828	8.2145	.4317
Q1-IU*b	7.7736	8.3443	.5707
Q1-K*IUa	7.7913	8.2906	.4993
Q1-K*IUb	7.7487	8.2489	.5002

Samples weighed on Mettler 240 AE balance.

11 May '94 MA Results of initial LSA were imprecise due to a possible error in measurement of the sample. This step was repeated:

~~Samp~~

Sample Bottle:	wt. (g)
Q1-K*IU	69.1552
Q1-IU	68.2181

LSA vials were labeled and weighed:

	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample
Q1-K*IUa	7.8266	8.3287	.5021 g
Q1-K*IUb	7.7726	8.2735	.5009 g
Q1-IUa	7.8267	8.3265	.4998 g
Q1-IUb	7.7731	8.2733	.5002 g

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12 May 92 Q2 Sorption Exp. began today.
MA

U Sorption on Wedron Silica
Sorption (Q2) Experiment

WRITTEN BY: F.P. Bertetti
REVISION NO.: 0

DATE WRITTEN: May 9, 1994
DATE REVISED: N/A

CONDITIONS:

1.) ΣU= 50 ppb
2.) 0.1 m $NaNO_3$ matrix, equilibrium with atmospheric CO_2(g); $pCO_2=10^{-3.5}$
3.) pH range 2-9
4.) initial solution volume = 50 ml, initial quartz sand mass = 1.0 g

OBJECTIVES:

- To investigate the characteristics of U sorption on quartz sand as a function of solution pH and as a function of solution volume to solid mass ratio. Experimental data will be correlated with uranium aqueous speciation and compared with results of U sorption on clinoptilolite and α-alumina.
- To investigate the reproducibility and reversibility of U sorption reactions.

EQUIPMENT:

Gyratory shaker
Packard liquid scintillation counter
Orion pH/mV/ISE/°C meter
Combination pH electrode
ATC probe
Analytical balances (Mettler 4600 and 240AE)
α, β and γ survey instruments

SUPPLIES:

40	2 oz. polycarbonate bottles (acid washed and dried)
1	2000-ml FEP bottle (acid cleaned and dried)
1	Repipettor for transfer of scintillation cocktail
various	Eppendorf micropipettors for solution transfer
	Eppendorf pipet tips
	pH buffer solutions
	Ultima-Gold liquid scintillation cocktail
	7 ml scintillation vials
	weighing paper
	Wedron silica sand (W510*60/100*UC*RC*RFe*HL)
	reagent grade $NaHCO_3$

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500 ppb U stock solution (spike 23A)
ultrapure water
2L 0.1 m $NaNO_3$ stock solution
stock solution of 1.0 M HNO_3
stock solution of 0.1 M HNO_3
stock solution of 0.02 M HNO_3
stock solution of 1.0 M $NaHCO_3$
stock solution of 0.5 M $NaHCO_3$
stock solution of 0.1 M $NaHCO_3$
stock solution of 0.05 M $NaHCO_3$
stock solution of 0.01 M $NaHCO_3$

PROCEDURE:

Special considerations:

- Experimental solutions and sample containers/vials should be weighed at each step. Do not add or subtract contents without weighing before and after each process. Always record weight of solutions.

- When measuring pH, minimize the amount of time the glass electrode is in contact with the U bearing solution. Make sure to rinse the electrode thoroughly before measuring another solution. Take care not to introduce lint particles or other foreign objects into the experimental or sample containers.

- Sample vials should "rest" in the absence of light for at least 24 hours prior to initial analysis to allow for decay of incident radiation pulses.

- Following each sampling period, swipes and frisks of the work area should be performed. If contamination is found, follow the radiological procedures for clean-up, and inform the division radiation safety point of contact (RSPOC). Radioactive solutions may not be disposed of without following all radiation safety guidelines. Do not dispose of any solutions without prior approval of the division RSPOC.

1.) Stock solution preparation

1000 ml stock solution of 1.0 M HNO_3
1000 ml stock solution of 0.1 M HNO_3
1000 ml stock solution of 0.02 M HNO_3
500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml H_2O)
500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 g in 500 ml H_2O)
500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml H_2O)
500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml H_2O)
500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml H_2O)

The NaHCO3 solutions should be prepared with *degassed* ultrapure water and stored in tightly capped glass reagent bottles.

2000 ml 0.1 m $NaNO_3$ stock solution (16.999 g in 2000 g H_2O)

2.) Prepare 50 ppb U solution.

a.) On the Mettler 4600 balance, weigh 200 g of 500 ppb U stock solution into a tared 2000 ml FEP bottle.
b.) Dilute to a total of 2000 g using 0.1 m $NaNO_3$ stock solution.
c.) Cap and label the bottle accordingly (sorption solution).

3.) Add 50 ppb U solution to each experiment container.

a.) Label twenty-nine 2 oz. polycarbonate containers Q2-pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
b.) Add 50 g of the 50 ppb U (from the 2000 ml FEP bottle) solution to each container. Record weight.
c.) Label ten 2 oz. polycarbonate containers Q2-C*pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
d.) Add 50 g of the 50 ppb U solution to each container. Record weight.
e.) Transfer the remaining (~50 g) 50 ppb U solution into a pre-weighed 2 oz. polycarbonate bottle labeled Q2-IU. Add 100 µl of 50% HNO3 solution to the bottle and mix thoroughly. Record weight.

1) Stock Solution Prep

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MA

Made 1000 ml solution of .1 m $NaNO_3$ by diluting 8.4982 g of $NaNO_3$ in 1000 g of nanopure H_2O.

2) Prepared 50 ppb solution (Uranium) by weighing 200.23 g of U stock solution (Spike 23A) and diluting with ~~NANO~~ .1 m $NaNO_3$ to a total of 2000 g.

3) Labeled and weighed containers, added 50 g of 50 ppb U and weighed again. Results are as follows:

☆ Weighed on Mettler AE 240 Balance

Sample Name	wt. of Bottle (g)	wt. of Bottle + U sol'n (g)	wt. of U sol'n (g)
Q2-pH2	20.3442	70.3659	50.0217
Q2-pH 2.25	20.1100	70.1556	50.0456
Q2-pH 2.5	20.2039	70.2779	50.0740
Q2-pH 2.75	20.1836	70.2009	50.0173
Q2-pH 3	20.0203	70.0651	50.0448
Q2-C*pH 3	20.1670	70.2415	50.0745
Q2-pH 3.25	20.2143	70.1868	49.9725
Q2-pH 3.5	20.3386	70.3761	50.0375
Q2-pH 3.75	20.2456	70.2075	49.9619
Q2-pH 4	20.1008	70.1552	50.0544
Q2-C*pH 4	20.2668	70.2158	49.9490
Q2-pH 4.25	20.0669	70.1099	50.0430
Q2-pH 4.5	20.1298	70.0873	49.9575
Q2-pH 4.75	20.0549	70.1257	50.0708
Q2-pH 5	20.0483	70.0604	50.0121
Q2-C* pH 5	20.1114	70.2155	50.1041
Q2-pH 5.25	20.2418	70.3629	50.1211
Q2-pH 5.5	20.2050	70.3187	50.1137
Q2-C*pH 5.5	20.1264	70.1857	50.0593
Q2-pH 5.75	20.2133	70.1881	49.9748
Q2-pH 6	20.1519	70.1026	49.9507
Q2-C*pH 6	20.2263	70.2533	50.0270
Q2-pH 6.25	20.1514	70.1736	50.0222
Q2-pH 6.5	19.8764	69.8773	50.0009
Q2-C*pH 6.5	20.1516	70.1063	49.9547

12 May '94
MA
(cont)

SAMPLE NAME	WT OF Bottle (g)	WT. OF bottle + U sol'n (g)	Wt. OF U sol'n (g)	13 May 94
Q2-pH 6.75	20.1358	70.2654	50.1296	MA
Q2-pH 7	20.0321	69.9993	49.9672	
Q2-C*pH 7	20.1956	70.1372	49.9416	
Q2-pH 7.25	20.2272	70.1797	49.9525	
Q2-pH 7.5	20.1502	70.2706	50.1204	
Q2-C* pH 7.5	20.0673	70.0458	49.9785	
Q2-pH 7.75	20.0528	70.0667	50.0139	
Q2-pH 8	20.1483	70.1006	49.9523	
Q2-C*pH 8	20.1548	70.0724	49.9176	
Q2-pH 8.25	20.1898	70.1776	49.9878	
Q2-pH 8.5	20.0971	70.1564	50.0593	
Q2-pH 8.75	20.1575	70.2215	50.0640	
Q2-pH 9	20.1273	70.0794	49.9521	
Q2-C*pH 9	20.0694	70.0722	50.0028	
* Q2-IU	20.3070	69.0125	48.7055	

* 100 µl of 50% HNO_3 was added to Q2-IU.
WT. Q2-IU + 50% HNO_3 : ~~69.1488~~ g 69.1488 g
MA 5-12-94

13 May 1994 Proceeded with pH adjustments:
MA

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

4.) For Q2-pH*i* and Q2-C*pH*i*, add HNO_3 or $NaHCO_3$ to adjust pH to desired value.

a.) Adjust pH by adding HNO_3 or $NaHCO_3$ using an Eppendorf micropipet. The amount to be added to each solution is given in Table 1. Record the amount and concentration actually added to each container. Mix well by swirling the solutions.
b.) Re-weigh each container. Record weight.
c.) Replace screw caps, but **do not tighten!** Solutions must be open to atmosphere.
d.) Place bottles on a gyratory shaker at ~120 rpm. Allow at least 10 days for pH equilibration.

5.) Sample Q2-IU to determine initial U concentration for experimental solutions.

a.) Label (e.g., Q2-IUa and Q2-IUb) and pre-weigh 2 liquid scintillation vials each containing 0.5 ml 0.02 M HNO_3.
b.) Using an Eppendorf pipet, withdraw two 0.5 ml samples from Q2-IU and transfer to liquid scintillation vials. Re-weigh vials and record weight.

c.) Add 5 ml of Ultima-Gold cocktail to each vial. Homogenize sample and set aside for LSA.

Table 1. Polycarbonate bottle labels, estimated solution pH, and volume of HNO_3 or $NaHCO_3$ solutions needed for adjustment of pH in 0.1m $NaNO_3$ solutions with 50 ppb U. Amount of reagent needed for pH adjustment was calculated using EQ3 v7.2.

Sample Label	Estimated solution pH	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
Q2-pH2	2	0.602	1
Q2-pH2.25	2.25	0.336	1
Q2-pH2.5	2.5	0.187	1
Q2-pH2.75	2.75	0.103	1
Q2-pH3 Q2-C*pH3	3	0.563	0.1
Q2-pH3.25	3.25	0.299	0.1
Q2-pH3.5	3.5	0.151	0.1
Q2-pH3.75	3.75	0.067	0.1
Q2-pH4 Q2-C*pH4	4	0.102	0.02
Sample Label	**Estimated solution pH**	**Volume of $NaHCO_3$ needed, ml**	**Molarity of $NaHCO_3$ to use**
Q2-pH4.25	4.25	0.12	0.005
Q2-pH4.5	4.5	0.417	0.005
Q2-pH4.75	4.75	0.293	0.01
Q2-pH5 Q2-C*pH5	5	0.342	0.01
Q2-pH5.25	5.25	0.371	0.01
Q2-pH5.5 Q2-C*pH5.5	5.5	0.391	0.01
Q2-pH5.75	5.75	0.409	0.01
Q2-pH6 Q2-C*pH6	6	0.429	0.01
Q2-pH6.25	6.25	0.46	0.01
Q2-pH6.5 Q2-C*pH6.5	6.5	0.102	0.05
Q2-pH6.75	6.75	0.12	0.05
Q2-pH7 Q2-C*pH7	7	0.151	0.05
Q2-pH7.25	7.25	0.207	0.05
Sample Label	**Estimated solution pH**	**Volume of $NaHCO_3$ needed, ml**	**Molarity of $NaHCO_3$ to use**
Q2-pH7.5 Q2-C*pH7.5	7.5	0.306	0.05
Q2-pH7.75	7.75	0.242	0.1
Q2-pH8 Q2-C*pH8	8	0.403	0.1
Q2-pH8.25	8.25	0.139	0.5
Q2-pH8.5	8.5	0.248	0.5
Q2-pH8.75	8.75	0.228	1
Q2-pH9 Q2-C*pH9	9	0.436	1

When adjusting pH, the volumes of HNO_3 and $NaHCO_3$ were sometimes "rounded off". The actual amount added, and the weight of the bottles AFTER these additions are listed on the next page.

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Sample	Vol. of HNO_3 Added (ml)	Molarity	Wt. of bottle (after addition) (g)
Q2-pH 2	.600	1.0	70.9904
Q2-pH 2.25	.335	1.0	70.5006
Q2-pH 2.5	.185	1.0	70.4743
Q2-pH 2.75	.100	1.0	~~70.3094~~ MA 5-13-94 70.3054
Q2-pH 3	.565	5-13-94 MA ~~1.0~~ 0.1	70.6303
Q2-C*pH 3	.565	MA ~~1.0~~ 0.1	70.8069
Q2-pH 3.25	.300	0.1	70.4804
Q2-pH 3.5	.150	0.1	70.5192
Q2-pH 3.75	.065	0.1	70.2724
Q2-pH 4	.100	0.02	70.2609
Q2-C*pH 4	.100	0.02	70.3038

Sample	Vol. of $NaHCO_3$ Added (ml)	Molarity	Wt. of bottle after addition (g) AE 240
Q2-pH 4.25	.120	.005	70.2225
Q2-pH 4.5	.420	.005	70.5119
Q2-pH 4.75	.295	.01	70.4148
Q2-pH 5	.340	.01	70.3821
QC-C*pH 5	.340	.01	70.5476
Q2-pH 5.25	.370	.01	70.7176
Q2-pH 5.5	.390	.01	70.7062
Q2-C*pH 5.5	.390	.01	70.5742
Q2-pH 5.75	.410	.01	70.5934
Q2-pH 6	.430	.01	70.5292
Q2-C*pH 6	.430	.01	70.6808
Q2-pH 6.25	.460	.01	70.6280
Q2-pH 6.5	.100	.05	69.9801
Q2-C*pH 6.5	.100	.05	70.1961
Q2-pH 6.75	.120	.05	70.3779
Q2-pH 7	.150	.05	70.1496
Q2-C*pH 7	.150	.05	70.2850
Q2-pH 7.25	.210	.05	70.3904
Q2-pH 7.5	.305	.05	70.5723
Q2-C*pH 7.5	.305	.05	70.3543

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Sample	Vol of $NaHCO_3$ Added (ml)	Molarity	Wt. of bottle (g) (after addition)
Q2-pH 7.75	.240	.1	70.3164
Q2-pH 8	.405	.1	70.4754
Q2-C*pH 8	.405	.1 5-13-94	70.5034
Q2-pH 8.25	.140	~~.1~~ MA .5	70.3222
Q2-pH 8.5	.250	.5	70.4209
Q2-pH 8.75	.230	1	70.4660
Q2-pH 9	.435	1	70.5422
Q2-C*pH 9	.435	1	70.5420

STEP 5) Sampling Q2-IU

Q2-IU wt: 69.1488 g (from p.186)

LSA vials were labeled and weighed:

	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q2-IUa	7.8123	8.3138	.5015
Q2-IUb	7.8097	8.3127	.5030

After the 2 .5 ml samples were taken, the Q2-IU bottle was weighed:

Q2-IU wt: 68.1430 g

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MA
Step 6
(cont. from p. 181)

Q1- and Q1-K Experiments

6.) Measure equilibration pH and U concentration of experimental solutions.

a.) Weigh each solution container, Record weight.
b.) From each solution, withdraw two 0.5 ml samples and transfer into labeled, pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Re-weigh vials and record. Add 5.0 ml of cocktail. Homogenize samples, and set aside for LSA.
c.) Measure and record the pH of each solution. Re-weigh and record weight.

7.) Add 0.1 g quartz sand to Q1-pHi and Q1-K*pH*i* solutions.

a.) Tare aliquots of Wedron silica sand weighing 0.1 ± 0.001 g onto weighing paper.

b.) Carefully transfer silica to each Q1-K*pH*i* solution (not the Q1-KC*pH*i* or Q1-C*pH*i* solutions). Swirl each bottle. Replace cover loosely. Re-weigh and record. Replace bottles on gyratory shaker at ~120 rpm.

8.) Sample kinetic and kinetic control solutions for U concentration and pH over various time intervals.

a.) At intervals of 2 hours, 4 hours, 1 day, 2 days, 4 days, 8 days, 12 days, 16 days, and 21 days, sample the solutions (Q1-K*pH*i* and Q1-KC*pH*i*) for pH and U concentration.
b.) Sample solutions by:
- weighing and recording weight of container
- withdrawing two 0.5 ml aliquots and transferring into labeled, pre-weighed scintillation vials containing 0.5 ml 0.02 M HNO3, re-weighing vials, add 5.0 ml scintillation cocktail, homogenizing, and setting aside vials for LSA.
- measuring pH of each solution, Q1-K*pH*i* and Q1-KC*pH*i*, re-weighing solution containers and replacing bottles on gyratory shaker.

9.) Sample sorption and sorption control solutions for U concentration and pH.

a.) If the preliminary kinetic experimental results so indicate, sample the sorption solutions (Q1-pHi and Q1-C*pH*i*) after 21 days.
b.) Sample solutions by:
- weighing and recording weight of container
- withdrawing two 0.5 ml aliquots and transferring into labeled, pre-weighed scintillation vials containing 0.5 ml 0.02 M HNO3, re-weighing vials, add 5.0 ml scintillation cocktail, homogenizing, and setting aside vials for LSA.
- measuring pH of each solution, Q1-K*pH*i* and Q1-KC*pH*i*, re-weighing solution containers and replacing bottles on gyratory shaker.

10.) Determine the U concentration of solutions by analyzing sample vials using LSA.

If analytical results are deemed satisfactory, reversibility and reproducibility tests will be performed. The procedure for reversibility and reproducibility experiments will be provided at a later date.

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6(a) Solution bottles were weighed: ~~(Q1 and Q1-K)~~ MA Q1-K (on AE 240)

Sample	Wt. (g)
Q1-K*pH 5.5	70.6413
Q1-KC*pH 5.5	70.5453
Q1-K*pH 6	70.2075
Q1-KC*pH 6.5	70.3388
Q1-K*pH 6.5	70.1913
Q1-KC*pH 6.5	70.2853
Q1-K*IU	68.0743

6(b) Two .5 ml samples were taken from Q1-K*pHi solutions.

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-K*pH 5.5 a	7.7011	8.2105	.5094
Q1-K*pH 5.5 b	7.7795	8.2835	.5040
Q1-KC*pH 5.5a	7.7980	8.2993	.5013
Q1-KC*pH 5.5 b	7.7966	8.2974	.5008
Q1-K*pH 6 a	7.7505	8.2546	.5041
Q1-K*pH 6 b	7.7316	8.2324	.5008
Q1-KC*pH 6a	7.8474	8.3475	.5001
Q1-KC*pH 6b	7.8351	8.3352	.5001
Q1-K*pH 6.5 a	7.7999	8.3002	.5003
Q1-K*pH 6.5 b	7.7918	8.2912	.4994
Q1-K*IU (a)	7.7450	8.2464	.5014
Q1-K*IU (b)	7.7272	8.2271	.4999
Q1-KC*pH 6.5 a	7.7676	8.2706	.5030
Q1-KC*pH 6.5 b	7.7475	8.2493	.5018

6(c) pH measurements were as follows:
Meter calibrated with buffers pH 2, pH 4, pH 7, pH 10

Sample	pH	Temp (°C)	Sample	pH	Temp (°C)
Q1-K*pH 5.5	5.27	21.2°	Q1-K*pH 6.5	5.77	21.3°
Q1-KC*pH 5.5	5.35	21.3°	Q1-KC*pH 6.5	5.84	21.3°
Q1-K*pH 6	5.41	21.3°	Q1-K*IU	2.09	21.3°
Q1-KC*pH 6	5.39	21.3°			

6(C) Solution Bottles were weighed:

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Sample	wt. (g)
Q1-K*pH5.5	69.6136
Q1-KC*pH 5.5	69.5294
Q1-K*pH 6	69.1539
Q1-KC*pH 6	69.3307
Q1-K*pH 6.5	69.1738
Q1-KC*pH 6.5	69.2572
Q1-K*IU	67.0364

Since the pH readings from the previous page are not as close to the desired value as anticipated, the sample bottles for Q1 and QK-1 were placed on the gyratory shaker for 3 more days. The bottle caps were gently placed on the bottles but were not screwed on at all.

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MA

LSA results are posted on next page.

S# 37 Q1-K*IUa
38 Q1-K*IUb
39 Q1-IUa
40 Q1-IUb

were samples weighed out on 5-11-94 p. 181 for Q1 and Q1-K experiments

S# 41 Q2-IUa
42 Q2-IUb

were samples weighed out on 5-13-94 p. 189 for Q2 exp.

S# 55 thru 68 were samples taken from Q1-K*pHi samples


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

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.06	1.45	3.173	3.55	28.48	1.19	141.62	B
2	12.65	1.18	216.4	348.368	3.03	350.41	3.13	710.39	
3	12.82	0.99	255.3	343.551	3.03	345.07	3.13	710.27	
4	12.47	0.00	0.00	353.443	3.03	353.07	3.13	716.60	
5	12.33	0.89	287.6	357.492	3.03	357.65	3.13	711.54	
6	13.00	1.63	155.6	338.981	3.03	339.29	3.14	707.41	
7	12.70	2.59	101.3	346.827	3.03	349.86	3.12	707.98	
8	12.49	1.03	246.6	352.952	3.03	354.46	3.13	714.06	
9	12.75	0.00	0.00	345.690	3.03	345.24	3.14	713.00	
10	15.14	0.89	261.0	290.684	3.03	292.39	3.15	710.08	
11	15.14	0.49	467.7	290.618	3.03	291.40	3.16	705.31	
12	24.99	0.03	6740.	174.698	3.05	174.64	3.27	714.63	
13	24.86	0.00	0.00	175.588	3.06	175.22	3.27	714.31	
14	17.51	1.78	123.3	250.853	3.04	252.96	3.17	707.52	
15	17.06	1.92	116.2	257.319	3.04	259.21	3.17	706.60	
16	13.56	0.41	591.8	324.851	3.03	326.16	3.14	711.76	
17	13.94	1.53	160.2	315.837	3.03	319.37	3.13	708.69	
18	338.34	0.30	183.7	9.968	4.11	10.07	7.49	679.82	
19	496.00	0.39	122.5	5.795	5.03	6.49	9.69	667.88	
20	777.03	0.17	246.9	2.547	8.06	3.00	17.52	680.13	
21	578.39	0.24	194.6	4.510	5.69	4.89	12.00	690.23	
22	360.42	0.56	97.27	9.157	4.22	10.14	7.26	683.42	
23	733.74	0.48	89.65	2.886	7.41	3.61	14.91	628.22	
24	158.49	0.32	238.5	24.867	3.41	25.79	4.72	719.77	
25	573.06	0.17	277.7	4.585	5.64	4.85	12.13	714.00	
26	545.38	0.00	0.00	4.981	5.41	5.19	11.56	726.76	
27	451.53	0.00	0.00	6.676	4.74	7.04	9.30	754.59	
28	495.26	0.11	435.6	5.800	5.03	6.10	10.29	716.12	
29	476.81	0.00	0.00	6.149	4.90	6.09	10.43	755.89	
30	91.78	0.00	0.00	45.247	3.22	45.91	3.99	728.80	
31	23.56	1.52	124.0	185.494	3.05	188.33	3.23	726.19	
32	12.30	0.94	273.3	358.209	3.03	360.70	3.12	731.59	
33	178.47	1.03	70.72	21.727	3.48	23.01	4.89	700.57	
34	49.07	1.09	119.9	87.391	3.11	88.60	3.51	724.36	
35	20.77	1.83	110.4	210.789	3.05	212.92	3.21	724.16	
(1 missing vial)									
37	8.43	6.92	50.91	523.992	3.02	534.15	3.06	727.00	
38	8.52	2.89	111.6	518.541	3.02	523.86	3.07	729.49	
39	8.11	2.64	124.4	545.039	3.02	550.06	3.07	732.51	
40	8.00	5.44	64.55	552.952	3.02	558.89	3.07	725.59	
41	8.22	6.00	58.39	537.460	3.02	545.48	3.06	725.32	
42	8.16	4.71	72.67	541.435	3.02	547.01	3.07	725.20	
(12 missing vials)									
55	8.86	0.80	374.4	498.520	3.02	502.22	3.08	731.91	
56	8.79	3.01	105.7	502.629	3.02	507.35	3.08	726.85	
57	9.37	2.60	117.3	471.747	3.02	476.53	3.08	729.77	
58	8.92	6.05	55.65	495.706	3.02	502.12	3.07	721.38	
59	9.25	2.67	115.3	477.476	3.02	481.25	3.09	722.35	
60	9.13	2.63	117.9	483.902	3.02	486.63	3.09	724.37	
S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
61	8.95	0.00	0.00	493.363	3.02	494.20	3.09	729.59	
62	8.99	0.40	730.4	491.821	3.02	492.54	3.09	726.80	
63	9.51	4.28	73.45	464.650	3.02	469.52	3.08	723.79	
64	9.23	2.17	140.1	478.300	3.02	481.70	3.09	722.60	
65	8.51	0.68	449.7	519.389	3.02	522.16	3.08	726.19	
66	8.42	3.62	90.94	524.618	3.02	529.24	3.08	720.69	
67	9.13	2.84	109.3	484.012	3.02	488.38	3.08	724.55	
68	9.35	1.26	235.1	472.121	3.02	473.87	3.09	729.46	

```
SYSTEM NORMALIZED
C14 IPA DATA PROCESSED
C14 CHI SQUARE IPA DATA PROCESSED
H3 IPA DATA PROCESSED
H3 CHI SQUARE IPA DATA PROCESSED
BKG IPA DATA PROCESSED
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SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
Q1-K*IUa	37	523.99	1043.597	1.2068E+14	2.0036E-10	46.6927
Q1-K*IU B	38	518.54	1035.217	1.1971E+14	1.9875E-10	46.3178
Q1-IUa	39	545.04	1090.516	1.2610E+14	2.0937E-10	48.7920
Q1-IUb	40	552.95	1105.458	1.2783E+14	2.1224E-10	49.4605

Q1 and QK-1 Experiments

*Calculations verified in GC-11 pp. 143-144.

Q2 Sorption Exp

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
Q2-IUa	41	537.460	1071.705	1.2393E+14	2.0576E-10	47.9503
Q2-IUb	42	541.435	1076.412	1.2447E+14	2.0666E-10	48.1609

Results of the First sampling of Kinetics Experiment QK-1 are as follows: (Samples taken 5-16-94, and recorded on pp 190-192 of this notebook.)

Q1-KLSA1

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
Q1-K*pH5.5a	55	498.520	978.642	1.1317E+14	1.8789E-10	43.7865
Q1-K*pH 5.5b	56	502.629	997.280	1.1532E+14	1.9147E-10	44.6204
Q1-KC*pH 5.5a	57	471.747	941.047	1.0882E+14	1.8067E-10	42.1044
Q1-KC*pH 5.5b	58	495.706	989.828	1.1446E+14	1.9004E-10	44.2870
Q1-K*pH 6a	59	477.476	947.185	1.0953E+14	1.8185E-10	42.3790
Q1-K*pH 6b	60	483.902	966.258	1.1174E+14	1.8552E-10	43.2324
Q1-KC*pH 6a	61	493.363	986.529	1.1408E+14	1.8941E-10	44.1394
Q1-KC*pH 6b	62	491.821	983.445	1.1372E+14	1.8882E-10	44.0014
Q1-K*pH 6.5a	63	464.650	928.743	1.0740E+14	1.7831E-10	41.5539
Q1-K*pH 6.5b	64	478.300	957.749	1.1075E+14	1.8388E-10	42.8517
Q1-K*IUa	65	519.389	1035.878	1.1979E+14	1.9888E-10	46.3473
Q1-K*IUb	66	524.618	1049.446	1.2136E+14	2.0149E-10	46.9544
Q1-KC*pH 6.5a	67	484.012	962.250	1.1127E+14	1.8475E-10	43.0531
Q1-KC*pH 6.5b	68	472.121	940.855	1.0880E+14	1.8064E-10	42.0958

MA Calculations verified in GC-11 pp. 143-144.

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Repeated Equilibration pH and U concentration measurement of experimental solutions (Q1-K).

Solution bottles were weighed on AE 240:

Sample	Wt. (g)
Q1-K *pH 5.5	69.5488
Q1-KC* pH 5.5	69.3763
Q1-K* pH 6	69.0138
Q1-KC* pH 6	69.2558
Q1-K * pH 6.5	69.0099
Q1-KC* pH 6.5	69.1435
Q1-K * IU	66.9669

Two .5 ml samples were taken:

Q1-KLSA2

Sample	wt of vial (g)	wt of vial + sample (g)	wt. of sample (g)
Q1-K*pH 5.5a	7.8947	8.4008	.5061
Q1-K*pH 5.5 b	7.6981	8.2025	.5044
Q1-KC *pH 5.5a	7.8018	8.3073	.5055
Q1-KC *pH 5.5 b	7.7232	8.2273	.5041
Q1-K *pH 6 a	7.7412	8.2460	.5048
Q1-K *pH 6 b	7.7986	8.3014	.5028
Q1-KC *pH 6 a	7.7549	8.2577	.5028
Q1-KC *pH 6 b	7.7423	8.2457	.5034
Q1-K *pH 6.5 a	7.7473	8.2514	.5041
Q1-K*pH 6.5 b	7.7963	8.2997	.5034
Q1-KC*pH 6.5 a	7.7814	8.2833	.5019
Q1-KC *pH 6.5 b	7.7292	8.2311	.5019
Q1-K* IU a	7.8014	8.3036	.5022
Q1-K* IU b	7.7492	8.2507	.5015

pH meter was calibrated with buffers pH 2, pH 4, pH 7, pH 10
pH measurements on listed on next page.

MA

Sample	pH	Temp (°C)
Q1-K* pH 5.5	4.52	20.4°
Q1-KC* pH 5.5	4.58	20.4°
Q1-K* pH 6	4.68	20.4°
Q1-KC* pH 6	4.66	20.4°
Q1-K* pH 6.5	5.04	20.4°
Q1-KC* pH 6.5	5.10	20.3°
Q1-K* IU	1.81	20.3°

After some difficulty calibrating the pH meter + probe, it appeared that pH values of the KINETICS samples (Q1-K*pHi) were lower than they were when measured 5-16-94 (p. 191).

At this point it was suggested that the solutions sit one more day. If pH values are still not acceptable, $NaHCO_3$ will be added to adjust pH.

Solution bottles were weighed, and put on shaker.

Sample	Wt. (g) AE 240
Q1-K* pH 5.5	68.4830
Q1-KC* pH 5.5	68.3026
Q1-K* pH 6	MA 5-19-94 ~~67.9996~~ 68.0000
Q1-KC* pH 6	68.2144
Q1-K* pH 6.5	67.8816
Q1-KC* pH 6.5	68.0984
Q1-K* IU	65.9495

A fresh batch of $NaHCO_3$ solutions were made by the following procedure: ~2 L DSIONized H_2O was degassed by boiling it in ~~a~~ MA 5-19-94 Erlenmeyer Flasks, and cooling while the mouth was stoppered shut. This water was used to prepare 500 ml each of 1.0M, 0.5M, 0.1M, 0.05M, 0.01M, 0.005M, 0.001M $NaHCO_3$ solutions.

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Molarity	wt. needed (g)	wt. used (g)
1.0	42.005	42.0058
.5	21.003	21.0027
.1	4.2010	4.2029
.05	2.100	2.1004
.01	.4201	.4209
.005	.2100	.2104

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PH Measurements taken:

a) solution bottles were weighed
b) pH values + Temp were recorded
c) solution bottles weighed again

	Sample	wt. (g)	pH	Temp (°C)	Wt (g) (after pH measurement)
KINETICS	Q1-K*pH 5.5	68.4567	4.52	20.2	68.4357
	Q1-KC*pH 5.5	68.2738	4.58	20.2	68.2471
	Q1-K* pH 6	67.9716	4.67	20.2°	67.9182
	Q1-KC* pH 6	68.1786	4.64	20.2°	68.1482
	Q1-K* pH 6.5	67.8531	5.03	20.2°	67.8346
	Q1-KC* pH 6.5	68.0727	5.09	20.2°	68.0193
	Q1-K* IU	65.8911	1.80	20.2°	65.8708
Q1 Sorption					
	Q1-pH 2	70.5561	1.91	20.6°	70.5356
	Q1-pH 2.25	70.2183	2.15	20.6°	70.2037
	Q1-pH 2.5	70.0502	2.42	20.7°	70.0263
	Q1-pH 2.75	69.9994	2.68	20.7°	69.9799
	Q1-pH 3	70.2970	2.93	20.7°	70.2901
	Q1-C*pH 3	70.6172	2.93	20.7°	70.5968
	Q1-pH 3.25	70.1044	3.17	20.7°	70.0724
	Q1-pH 3.5	70.2005	3.42	20.7°	70.1802
	Q1-pH 3.75	69.8657	3.63	20.7°	69.8399
	Q1-pH 4	69.8885	3.84	20.7°	69.8690
	Q1-C*pH 4	69.9745	3.83	20.7°	69.9422

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SAMPLE	WT. (g)	pH	TEMP (°C)	WT (g) (AFTER pH)
Q1-pH 4.25	70.3420	3.98	21.1°	70.2998
Q1-pH 4.5	70.2017	4.21	21.1°	70.1773
Q1-pH 4.75	69.8432	4.36	21.2°	69.8179
Q1-pH 5	70.1767	4.47	21.2°	70.1612
Q1-C*pH 5	70.1531	4.51	21.2°	70.1322
Q1-pH 5.25	70.3108	~~4.50~~ 4.55 MA 5-20-94	21.2°	MA 5-20-94 ~~70.3~~ 70.2309
Q1-pH 5.5	70.2698	4.50	21.2°	70.2272
Q1-C*pH 5.5	70.2445	4.55	21.3°	70.2222
Q1-pH 5.75	~~70.4728~~ 70.4712 MA	4.74	21.3°	70.4462
Q1-pH 6	70.5607	4.63	21.3°	70.5227
Q1-C*pH 6	70.1935	4.79	21.3	70.1569
Q1-pH 6.25	70.3996	4.90	21.4	70.3638
Q1-pH 6.5	69.8404	4.86	21.4	69.8170
Q1-C*pH 6.5	70.1751	5.03	21.4°	70.1377
Q1-pH 6.75	70.1086	6.02	21.4°	70.0766
Q1-pH 7	70.1865	6.85	22.1°	70.1598
Q1-C*pH 7	69.9050	6.73	22.1°	69.8719
Q1-pH 7.25	69.9390	7.22	22.2°	69.9012
Q1-pH 7.5	70.4194	7.50	22.2°	70.3671
Q1-C*pH 7.5	70.4438	7.51	22.3°	70.4042
Q1-pH 7.75	70.0082	7.77	22.3°	69.9804
Q1-pH 8	70.1794	8.04	22.3°	70.1533
Q1-C*pH 8	70.3404	8.03	22.4°	70.3157
Q1-pH 8.25	69.9622	8.28	22.7°	69.9205
Q1-pH 8.5	69.9458	8.55	22.7°	69.9158
Q1-pH 8.75	70.3767	8.78	22.7°	70.3602
Q1-pH 9	70.2042	9.01	22.7°	70.1693
Q1-C*pH 9	70.4369	9.00	22.7°	70.4005
Q1-HCl	67.0124	1.83	22.7°	66.9866

AE 240 AE 240

Q2-Sorption

Sample	WT (g)	pH	TEMP (°C)	WT (g) (After pH Measurement)
Q2-pH 2	70.7197	1.95	23.0°	70.7090
Q2-pH 2.25	70.2623	2.20	23.1°	70.2175
Q2-pH 2.5	70.0793	2.46	23.1°	70.0443
Q2-pH 2.75	70.0869	2.73	23.1°	70.0589
Q2-pH 3	70.3575	2.95	23.1°	70.3241
Q2-C*pH 3	70.5019	2.94	23.1°	70.4656
Q2-pH 3.25	70.2999	3.20	23.1°	70.2646
Q2-pH 3.5	70.2473	3.45	23.1°	70.2298
Q2-pH 3.75	70.0665	3.71	23.2°	70.0320
Q2-pH 4	70.0883	3.95	23.2°	70.0582
Q2-pH 4.25	69.8686	4.16	23.2°	69.8386
Q2-pH 4.5	70.1998	4.48	23.2°	70.1582
Q2-pH 4.75	70.1710	4.83	23.2°	70.1446
Q2-pH 5	70.2062	5.03	23.2°	70.1798
Q2-C*pH 5	70.2361	5.18	23.3°	70.2126
Q2-C*pH 4 ★ out of order	70.1296	3.96	23.3°	70.0991
Q2-pH 5.25	70.4225	5.00	23.5°	70.4089
Q2-pH 5.5	70.5006	5.55	23.5°	70.4793
Q2-C*pH 5.5	70.2693	5.46	23.5°	70.2607
Q2-pH 5.75	70.2168	5.84	23.5°	70.1920
Q2-pH 6	70.2165	6.09	23.5°	70.1714
Q2-C*pH 6	70.4481	6.17	23.6°	70.4207
Q2-pH 6.25	70.3698	6.29	23.6°	70.3426
Q2-pH 6.5	69.8008	6.58	23.6°	69.7727
Q2-C*pH 6.5	70.0145	6.63	23.7°	69.9783
Q2-pH 6.75	70.0087	6.82	23.7°	69.9925
Q2-pH 7	69.9737	7.10	23.7°	69.9375
Q2-C*pH 7	69.9652	7.11	23.7°	69.9440
Q2-pH 7.25	70.0736	7.35	23.7°	70.0386
Q2-pH 7.5	70.2910	7.56	~~23~~ 23.7° 5-20-94	70.2634
Q2-C*pH 7.5	70.1743	7.60	23.7°	70.1334
Q2-pH 7.75	70.1109	7.83	23.7°	70.0799

SAMPLE	WT (g)	pH	TEMP	WT(g) (after)
Q2-pH 8	70.3029	8.09	23.7°	70.2770
Q2-C*pH 8	70.2208	8.08	23.7°	70.1921
Q2-pH 8.25	69.9925	8.31	23.7°	69.9728
Q2-pH 8.5	70.1341	8.56	23.7°	70.1189
Q2-pH 8.75	70.2840	8.77	23.9°	70.2629
Q2-pH 9	70.3830	8.99	23.9°	70.3606
Q2-C*pH9	70.3703	9.00	23.9°	70.3426
Q2-IU	67.9495	1.85	23.9°	67.9212

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Continued Q2 Sorption Experiment (from page 189)

6.) Measure equilibration pH and U concentration of experimental solutions.

a.) Weigh each solution container, Record weight.
b.) From each solution, withdraw two 0.5 ml samples and transfer into labeled, pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Re-weigh vials and record. Add 5.0 ml of cocktail. Homogenize samples, and set aside for LSA.
c.) Measure and record the pH of each solution. Re-weigh and record weight.

7.) Add 1.0 g quartz sand to Q2-pH*i* solutions.

a.) Tare aliquots of Wedron silica sand weighing 1.0 ± 0.001 g onto weighing paper.
b.) Carefully transfer silica to each Q2-pH*i* solution (not the Q2-C*pH*i* solutions). Swirl each bottle. Replace cover loosely. Re-weigh and record. Replace bottles on gyratory shaker at ~120 rpm.

8.) Sample sorption and sorption control solutions for U concentration and pH.

a.) Sample the sorption solutions (Q2-pHi and Q2-C*pH*i*) after 21 days.
b.) Sample solutions by:
- weighing and recording weight of container
- withdrawing two 0.5 ml aliquots and transferring into labeled, pre-weighed scintillation vials containing 0.5 ml 0.02 M HNO3, re-weighing vials, add 5.0 ml scintillation cocktail, homogenizing, and setting aside vials for LSA.
- measuring pH of each solution, Q2-pH*i* and Q2-C*pH*i*, re-weighing solution containers and replacing bottles on gyratory shaker.

9.) Determine the U concentration of solutions by analyzing sample vials using LSA.

If analytical results are deemed satisfactory, reversibility and reproducibility tests will be performed. The procedure for reversibility and reproducibility experiments will be provided at a later date.

6 a) Solution bottles were weighed: (on AE 240)

Sample	wt. (g)	Sample	wt. (g)
Q2-pH 2	70.5264	Q2-pH 8.25	69.8605
Q2-pH 2.25	70.0298	Q2-pH 8.5	70.0656
Q2-pH 2.5	69.9651	Q2-pH 8.75	70.2010
Q2-pH 2.75	69.8875	Q2-pH 9	70.3108
Q2-pH 3	70.2400	Q2-C*pH 9	70.2948
Q2-C*pH 3	70.3953	Q2-IU	67.8682
Q2-pH 3.25	70.1952		
Q2-pH 3.5	70.1447		
Q2-pH 3.75	69.9567		
Q2-pH 4	69.9484		
Q2-pH 4.25	69.7645		
Q2-pH 4.5	70.0869		
Q2-pH 4.75	69.9645		
Q2-pH 5	70.1253		
Q2-C*pH 5	70.1502		
Q2-C*pH 4	69.9914		
Q2-pH 5.25	70.3250		
Q2-pH 5.5	70.3283		
Q2-C*pH 5.5	70.1780		
Q2-pH 5.75	70.0489		
Q2-pH 6	70.1039		
Q2-C*pH 6	70.3485		
Q2-pH 6.25	70.1651		
Q2-pH 6.5	69.6346		
Q2-C*pH 6.5	69.8434		
Q2-pH 6.75	69.9185		
Q2-pH 7	69.8635		
Q2-C*pH 7	69.8894		
Q2-pH 7.25	69.9818		
Q2-pH 7.5	70.1074		
Q2-C*pH 7.5	70.0871		
Q2-pH 7.75	69.9396		
Q2-pH 8	70.2303		
Q2-C*pH 8	70.0679		

6(b) Two .5 mls of .02M HNO_3 was added to vials and weighed. Then .5 ml of sample was added. Vials were weighed again.

2-LSA2

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
2-pH 2 a	7.7988	8.2999	.5011
2-pH 2 b	7.7245	8.2261	.5016
Q2-pH 2.25 a	7.8129	8.3129	.5000
Q2-pH 2.25 b	7.6971	8.1969	.4998
Q2-pH 2.5 a	7.7687	8.2687	.5000
Q2-pH 2.5 b	7.7351	8.2363	.5012
Q2-pH 2.75 a	7.7591	8.2591	.5000
Q2-pH 2.75 b	7.7826	8.2840	.5014
Q2-pH 3 a	7.7065	8.2081	.5016
Q2-pH 3 b	7.7887	8.2905	.5018
Q2-C* pH 3 a	7.7840	8.2858	.5018
Q2-C* pH 3 b	7.7706	8.2720	.5014
Q2-pH 3.25 a	7.7793	8.2800	.5007
Q2-pH 3.25 b	7.8005	8.3010	.5005
Q2-pH 3.5 a	7.7743	8.2771	.5028
Q2-pH 3.5 b	7.8071	8.3094	.5023
Q2-pH 3.75 a	7.7210	8.2207	.4997
Q2-pH 3.75 b	7.7496	8.2499	.5003
Q2-pH 4 a	7.6933	8.1931	.4998
Q2-pH 4 b	7.7969	8.2963	.4994
Q2-C* pH 4 a	7.7851	8.2832	.4981
Q2-C* pH 4 b	7.7543	8.2542	.4999
Q2-pH 4.25 a	7.7827	8.2811	.4984
Q2-pH 4.25 b	7.7472	8.2475	.5003
Q2-pH 4.5 a	7.7786	8.2778	.4992
Q2-pH 4.5 b	7.7486	8.2496	.5010
Q2-pH 4.75 a	7.7406	8.2410	.5004
Q2-pH 4.75 b	7.7365	8.2385	.5020
Q2-pH 5 a	7.7199	8.2206	MA ~~.507~~ 5.23.94 .5007
Q2-pH 5 b	7.8137	8.3157	.5020
Q2-C* pH 5 a	7.7088	8.2105	.5017
Q2-C* pH 5 b	7.7535	8.2548	.5013

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q2-pH 5.25 a	7.7446	8.2460	.5014
Q2-pH 5.25 b	7.7619	8.2639	.5020
Q2-pH 5.5 a	7.8123	8.3126	.5003
Q2-pH 5.5 b	7.8167	8.3169	.5002
Q2-C*pH 5.5 a	7.7546	8.2534	.4988
Q2-C*pH 5.5 b	7.7530	8.2534	.5004
Q2-pH 5.75 a	7.7583	8.2572	.4989
Q2-pH 5.75 b	7.7954	8.2940	.4986
Q2-pH 6 a	7.7512	8.2479	.4967
Q2-pH 6 b	7.7892	8.2877	.4985
Q2-C*pH 6 a	7.7548	8.2534	.4986
Q2-C*pH 6 b	7.7793	8.2771	.4978
Q2-pH 6.25 a	7.7667	8.2640	.4973
Q2-pH 6.25 b	7.7219	8.2190	.4971
Q2-pH 6.5 a	7.7407	8.2401	.4994
Q2-pH 6.5 b	7.7442	8.2440	.4998
Q2-C*pH 6.5 a	7.7823	8.2873	.5050
Q2-C*pH 6.5 b	7.7839	8.2852	.5013
Q2-pH 6.75 a	7.7563	8.2574	.5011
Q2-pH 6.75 b	7.7389	8.2377	.4988
Q2-pH 7 a	7.7461	8.2447	.4986
Q2-pH 7 b	7.7567	8.2557	.4990
Q2-C*pH 7 a	7.7854	8.2877	.5023
Q2-C*pH 7 b	7.7912	8.2913	.5001
Q2-pH 7.25 a	7.7474	8.2466	.4992
Q2-pH 7.25 b	7.7527	8.2515	.4988
Q2-pH 7.5 a	7.7386	8.2322	.4936
Q2-pH 7.5 b	7.7605	8.2570	.4965
Q2-C*pH 7.5 a	7.7395	8.2391	.4996
Q2-C*pH 7.5 b	7.7508	8.2477	.4969
Q2-pH 7.75 a	7.7413	8.2413	.5000
Q2-pH 7.75 b	7.7863	8.2794	.4931
Q2-pH 8 a	7.7803	8.2801	.4998
Q2-pH 8 b	7.7891	8.2881	.4990

Sample	wt. of vial	wt. of vial + sample	wt. of sample
Q2-C*pH 8 a	7.7014	8.2000	.4986
Q2-C*pH 8 b	7.7559	8.2549	.4990
Q2-pH 8.25a	7.7353	8.2331	.4978
Q2-pH 8.25 b	7.7155	8.2134	.4979
Q2-pH 8.5 a	7.7089	8.2019	5-23-94 MA ~~.4930~~ .4930
Q2-pH 8.5 b	7.7657	8.2645	.4988
Q2-pH 8.75 a	7.7415	8.2403	.4988
Q2-pH 8.75 b	7.7495	8.2473	.4978
Q2-pH 9 a	7.7750	8.2735	.4985
Q2-pH 9 b	7.7393	8.2375	.4982
Q2-C*pH 9 a	7.7603	8.2600	.4997
Q2-C*pH 9 b	7.7738	8.2721	.4983
Q2-IU a	7.7606	8.2561	.4955
Q2-IU b	7.7562	8.2532	.4970

pH was measured: pH meter was calibrated with the following four buffers: pH 2, pH 4, pH 7, pH 10.

Sample	pH	TEMP (°C)	wt (in grams) (after sampling and pH measurement)
Q2-pH2			
Q2-pH 2.25			

Note: the pH readings from 5-20-94 (LC-09 p.p. 199-200) will be used as the intial pH readings.

1.0g of quartz sand was added to Q2-pHi solutions.
solution containers were weighed:

MA

Sample	wt. (initial) g	wt. of bottle + quartz (g)	wt. of quartz added (g)
Q2-pH 2	MA ~~70.4110~~ 69.5224	MA ~~70.5112~~ 70.5232	MA ~~.9888~~ 1.0008
Q2-pH 2.25	69.0248	70.0257	1.0009
Q2-pH 2.5	68.9579	69.9577	.9998
Q2-pH 2.75	68.8812	MA ~~69.8779~~ 69.8825	MA ~~.9967~~ 1.0013
Q2-pH 3	69.2312	70.2290	.9978
Q2-pH 3.25	69.1880	70.1863	.9983
Q2-pH 3.5	69.1340	70.1337	.9997
Q2-pH 3.75	68.9519	69.9510	1.0096
Q2-pH 4	68.9414	69.9405	.9991
Q2-pH 4.25	68.7594	69.7577	.9983
Q2-pH 4.5	69.0805	70.0800	.9995
Q2-pH 4.75	68.9581	69.9565	.9984
Q2-pH 5	69.1165	70.1149	.9984
Q2-pH 5.25	69.2971	70.2965	.9994
Q2-pH 5.5	69.3240	70.3230	.9990
Q2-pH 5.75	69.0475	70.0469	.9994
Q2-pH 6	69.1047	70.1042	.9995
Q2-pH 6.25	69.1681	70.1675	.9994
Q2-pH 6.5	68.6291	69.6271	.9980
Q2-pH 6.75	68.9127	69.9114	.9987
Q2-pH 7	68.8606	69.8596	.9990
Q2-pH 7.25	68.9784	69.9783	.9999
Q2-pH 7.5	69.1112	MA ~~70.0919~~ 70.1119	MA ~~.9807~~ 1.0007
Q2-pH 7.75	68.9416	69.9414	.9998
Q2-pH 8	69.2243	70.2236	.9993
Q2-pH 8.25	68.8608	69.8610	1.0002
Q2-pH 8.5	69.0678	70.0670	.9992
Q2-pH 8.75	69.1992	70.1991	.9999
Q2-pH 9	69.3059	70.3066	1.0007

Bottles were placed on gyratory shaker at ~120 RPM, and will be sampled in 21 days.

MA 5-23-94 values lined out because I added quartz to get more accurate amount in solution.

24 May 94
MA

pH Adjustment for Kinetics (Q1-K) AND Q1 Sorption solutions:

The table shows the calculations for the pH adjustment to be made on the selected solutions:

The solution bottles were:

1) weighed on AE 240
2) $NaHCO_3$ was added according to the table
3) weighed bottles after $NaHCO_3$ was added
4) placed on gyratory shaker at ~ 120 rpm.

pH adjustment 5/23/94 3:17 PM

Calculations for adjustment of selected Q1 solutions

Sample number	desired pH	Initial pH	ml NaHCO3 added	molarity NaHCO3 used	desired moles NaHCO3	calculated moles/kg Na added	calculated moles Na added	moles Na needed	molarity NaHCO3 to use	ml NaHCO3 needed	Sample number
Q1-K*pH5.5	5.5	4.52	0.39	0.01	3.9E-06	4.35E-05	2.17E-06	1.73E-06	0.01	0.173	Q1-K*pH5.5
Q1-KC*pH5.5	5.5	4.58	0.39	0.01	3.9E-06	4.82E-05	2.41E-06	1.49E-06	0.01	0.149	Q1-KC*pH5.5
Q1-K*pH6.0	6	4.67	0.43	0.01	4.3E-06	5.42E-05	2.71E-06	1.59E-06	0.01	0.159	Q1-K*pH6.0
Q1-KC*pH6.0	6	4.64	0.43	0.01	4.3E-06	5.24E-05	2.62E-06	1.68E-06	0.01	0.168	Q1-KC*pH6.0
Q1-K*pH6.5	6.5	5.03	0.1	0.05	0.000005	6.92E-05	3.46E-06	1.54E-06	0.01	0.154	Q1-K*pH6.5
Q1-KC*pH6.5	6.5	5.09	0.1	0.05	0.000005	7.08E-05	3.54E-06	1.46E-06	0.01	0.146	Q1-KC*pH6.5
Q1-pH4.25	4.25	3.98	0.12	0.005	6E-07	-4.64E-05	-2.3E-06	2.92E-06	0.01	0.292	Q1-pH4.25
Q1-pH4.5	4.5	4.21	0.42	0.005	2.1E-06	5.48E-06	2.74E-07	1.83E-06	0.01	0.183	Q1-pH4.5
Q1-pH4.75	4.75	4.36	0.295	0.01	2.95E-06	2.72E-05	1.36E-06	1.59E-06	0.01	0.159	Q1-pH4.75
Q1-pH5.0	5	4.47	0.34	0.01	3.4E-06	3.90E-05	1.95E-06	1.45E-06	0.01	0.145	Q1-pH5.0
Q1-C*pH5.0	5	4.51	0.34	0.01	3.4E-06	4.26E-05	2.13E-06	1.27E-06	0.01	0.127	Q1-C*pH5.0
Q1-pH5.25	5.25	4.55	0.37	0.01	3.7E-06	4.59E-05	2.3E-06	1.4E-06	0.01	0.140	Q1-pH5.25
Q1-pH5.5	5.5	4.5	0.39	0.01	3.9E-06	4.18E-05	2.09E-06	1.81E-06	0.01	0.181	Q1-pH5.5
Q1-C*pH5.5	5.5	4.55	0.39	0.01	3.9E-06	4.59E-05	2.3E-06	1.6E-06	0.01	0.160	Q1-C*pH5.5
Q1-pH5.75	5.75	4.74	0.41	0.01	4.1E-06	5.81E-05	2.91E-06	1.19E-06	0.01	0.119	Q1-pH5.75
Q1-pH6.0	6	4.63	0.43	0.01	4.3E-06	5.18E-05	2.59E-06	1.71E-06	0.01	0.171	Q1-pH6.0
Q1-C*pH6.0	6	4.79	0.43	0.01	4.3E-06	6.06E-05	3.03E-06	1.27E-06	0.01	0.127	Q1-C*pH6.0
Q1-pH6.25	6.25	4.9	0.46	0.01	4.6E-06	6.51E-05	3.25E-06	1.35E-06	0.01	0.135	Q1-pH6.25
Q1-pH6.5	6.5	4.86	0.1	0.05	0.000005	6.35E-05	3.18E-06	1.82E-06	0.01	0.182	Q1-pH6.5
Q1-C*pH6.5	6.5	5.03	0.1	0.05	0.000005	6.92E-05	3.46E-06	1.54E-06	0.01	0.154	Q1-C*pH6.5
Q1-pH6.75	6.75	6.02	0.12	0.05	0.000006	8.59E-05	4.3E-06	1.7E-06	0.01	0.170	Q1-pH6.75
Q1-pH7.0	7	6.85	0.15	0.05	7.5E-06	1.28E-04	6.4E-06	1.1E-06	0.01	0.110	Q1-pH7.0
Q1-C*pH7.0	7	6.73	0.15	0.05	7.5E-06	1.16E-04	5.81E-06	1.69E-06	0.01	0.169	Q1-C*pH7.0
						via EQ3NR					

Sample	Wt. (g)	Vol $NaHCO_3$ Needed (ml)	Vol $NaHCO_3$ Added (ml)	Wt. (g)
Q1-K*pH 5.5	68.2303	.173	.175	68.4033
Q1-KC*pH 5.5	68.1441	.149	.150	68.2907
Q1-K*pH 6	67.7607	.159	.160	67.9179
Q1-KC*pH 6	67.8801	.168	.170	68.0468
Q1-K*pH 6.5	67.7385	.154	.155	67.8898
Q1-KC*pH 6.5	67.7978	.146	.145	67.9400
Q1-pH 4.25	70.2099	.292	.295	70.5013
Q1-pH 4.5	70.0766	.183	.185	70.2548
Q1-pH 4.75	69.7028	.159	.160	69.8567
Q1-pH 5	69.9440	.145	.145	70.0855
Q1-C*pH 5	70.0364 ✓	.127	.125 ✓	70.1567
Q1-pH 5.25	70.1591	.140	.140	70.2964
Q1-pH 5.5	70.1296	.181	.180	70.3049
Q1-C*pH 5.5	70.0887 ✓	.160	.160 ✓	70.2432
Q1-pH 5.75	70.3574	.119	.120	70.4728
Q1-pH 6	70.4200	.171	.170	70.5840
Q1-C*pH 6	69.9948 ✓	.127	.125 ✓	70.1152
Q1-pH 6.25	70.2387	.135	.135	70.3696
Q1-pH 6.5	69.5839	.182	.185	69.7667
Q1-C*pH 6.5	70.0409 ✓	.154	.155 ✓	70.1914
Q1-pH 6.75	69.9492	.170	.170	70.1161
Q1-pH 7	70.0545	.110	.110	70.1600
Q1-C*pH 7	69.7897 ✓	.169	.170 ✓	69.9586
	AE 240			AE 240

24 May 94

The following weights were taken from the Q2 control solutions which were sampled on 5-23-94 (p.200-205). The weights were taken After two .5ml samples were taken. The Q2-pHi solutions were weighed after quartz was added. (p.205)

SAMPLE	wt. (g)	Sample	wt. (g)
Q2-C*pH 3	69.3923	Q2-C*pH5.5	69.1790
Q2-C*pH 4	68.9933	Q2-C*pH 6	69.3521
Q2-C*pH 5	69.1469	Q2-C*pH6.5	68.8373

Continued from bottom of p.206

Sample	wt. (g)
Q2-C*pH 7	68.8872
Q2-C*pH 7.5	69.0904
Q2-C*pH 8	69.0703
Q2-C*pH 9	69.2968

27 May 94 Equilibration pH measurement of Q1 (cont. from p. 190)
MA

Continuing on Q1 sorption experiment, after pH adjustments were made, the solutions equilibrated for 3 days.

a) Each container was weighed + recorded

b) pH was taken (~~equilibrat~~ MA calibrated pH meter with buffers pH = 2 pH = 4 pH = 7 pH = 10

Sample	wt. (g)	pH	Temp (°C)
Q1-pH 2	70.3983	2.02	21.6°
Q1-pH 2.25	70.0590	2.24	21.6°
Q1-pH 2.5	69.7666	2.49	21.6°
Q1-pH 2.75	69.6441	2.74	21.6°
Q1-pH 3	69.9263	2.97	21.6°
Q1-C* pH 3	70.1797	2.98	21.6°
Q1-pH 3.25	69.6853	3.20	21.6°
Q1-pH 3.5	70.0426	3.45	21.6°
Q1-pH 3.75	69.6774	3.63	21.6°
Q1-pH 4	69.6121	3.84	21.6°
Q1-C* pH 4	69.7002	3.83	21.6°
Q1-pH 4.25	70.4398	4.32	21.6°
Q1-pH 4.5	70.1747	4.48	21.6°
Q1-pH 4.75	69.7422	4.62	21.7°
Q1-pH 5	69.9533	4.78	21.7°
Q1-C* pH 5	70.0946	4.80	21.7°
Q1-pH 5.25	70.2475	5.04	21.7°
Q1-pH 5.5	MA 5-27-94 ~~70.17~~ 70.1510	5.15	21.7°
Q1-C* pH 5.5	70.1992	5.16	21.7°
Q1-pH 5.75	70.4060	5.35	21.7°
Q1-pH 6	70.5083	5.51	21.7°
Q1-C* pH 6	70.0409	5.48	21.7°
Q1-pH 6.25	70.2874	5.90	21.7°
Q1-pH 6.5	69.7011	6.24	21.7°
Q1-C* pH 6.5	70.0958	6.26	21.7°
Q1-pH 6.75	70.0576	6.66	21.7°
Q1-pH 7	70.0848	6.89	21.7°
Q1-C* pH 7	69.8934	6.91	21.7°
Q1-pH 7.25	69.7457	7.09	21.7°

Sample	wt (g)	pH	Temp (°C)
Q1-pH 7.5	70.1342	7.40	21.7°
Q1-C* pH 7.5	70.1550	7.41	21.7°
Q1-pH 7.75	69.7033	7.70	21.7°
Q1-pH 8	69.7534	7.98	21.7°
Q1-C* pH 8	70.1641	7.97	21.7°
Q1-pH 8.25	69.7282	8.25	21.7°
Q1-pH 8.5	69.5571	8.52	21.7°
Q1-pH 8.75	70.0256	8.75	21.7°
Q1-pH 9	69.9640	8.98	21.7°
Q1-C* pH 9	70.0238	9.00	21.7°
Q1-IU	66.7183	1.90	21.7°

two .5 ml samples were transferred into labeled, pre-weighed scintillation vials containing .5 ml of .02 M HNO_3 :

"Q1-LSA2" Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-pH 2 a	7.7832	8.2854	.5022
Q1-pH 2 b	7.7220	8.2243	.5023
Q1-pH 2.25 a	7.8054	8.3085	.5031
Q1-pH 2.25 b	7.8053	8.3087	.5034
Q1-pH 2.5 a	7.7442	8.2470	.5028
Q1-pH 2.5 b	7.7839	8.2866	.5027
Q1-pH 2.75 a	7.7761	8.2768	.5007
Q1-pH 2.75 b	7.7192	8.2200	.5008
Q1-pH 3 a	7.8495	8.3496	.5001
Q1-pH 3 b	7.7901	8.2903	.5002
Q1-C* pH 3 a	7.7479	8.2463	.4984
Q1-C* pH 3 b	7.7282	8.2284	.5002
Q1-pH 3.25 a	7.6783	8.1803	.5020
Q1-pH 3.25 b	7.7262	8.2280	.5018
Q1-pH 3.5 a	7.6494	8.1505	.5011
Q1-pH 3.5 b	7.7182	8.2208	.5026
Q1-pH 3.75 a	7.7993	8.3012	.5019
Q1-pH 3.75 b	7.6896	8.1915	.5019
Q1-pH 4 a	7.7930	8.2943	.5013
Q1-pH 4 b	7.7321	8.2331	.5010

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-C* pH 4a	7.7437	8.2454	.5017
Q1-C* pH 4b	7.8122	8.3132	.5010
Q1-pH 4.25 a	7.7386	8.2398	.5012
Q1-pH 4.25 b	7.7039	~~8.1392~~ MA 5/27/94 8.2039	.5000
Q1-pH 4.5a	7.7894	8.2910	.5016
Q1-pH 4.5 b	7.8357	8.3369	.5012
Q1-pH 4.75a	7.7879	8.2888	.5009
Q1-pH 4.75 b	7.7780	8.2798	.5018
Q1-pH 5 a	7.7198	8.2195	.4997
Q1-pH 5 b	7.8334	8.3340	.5006
Q1-C*pH 5a	7.7575	8.2584	.5009
Q1-C*pH 5 b	7.7626	8.2646	.5020
Q1-pH 5.25a	7.7734	8.2746	.5012
Q1-pH 5.25 b	7.7313	8.2332	.5019
Q1-pH 5.5a	7.7481	8.2502	.5021
Q1-pH 5.5 b	7.7862	8.2889	.5027
Q1-C*pH 5.5a	7.8046	8.3040	.4994
Q1-C*pH 5.5b	7.7735	8.2745	.5010
Q1-pH 5.75a	7.7568	8.2584	.5016
Q1-pH 5.75b	7.7697	8.2727	.5030
Q1-pH 6 a	7.9002	8.3997	.4995
Q1-pH 6 b	7.7527	8.2533	.5006
Q1-C*pH 6 a	7.8265	8.3256	.4991
Q1-C*pH 6 b	7.6793	8.1796	.5003
Q1-pH 6.25a	7.7474	8.2514	.5040
Q1-pH 6.25 b	7.7722	8.2732	.5010
Q1-pH 6.5a	7.8228	8.3255	.5027
Q1-pH 6.5 b	7.7821	8.2848	.5027
Q1-C*pH 6.5a	7.7790	8.2799	.5009
Q1-C*pH 6.5b	7.7748	8.2768	.5020
Q1-pH 6.75a	7.8346	8.3360	.5014
Q1-pH 6.75 b	7.7525	8.2540	.5015
Q1-pH 7 a	7.7469	8.2483	.5014
Q1-pH 7 b	7.7203	8.2212	.5009
Q1-C*pH 7a	7.7472	8.2464	.4992
Q1-C*pH 7b	7.8100	8.3115	.5015

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (g)
Q1-pH 7.25a	7.7602	8.2614	.5012
Q1-pH 7.25 b	7.8322	8.3345	.5023
Q1-pH 7.5a	7.7224	8.2239	.5015
Q1-pH 7.5 b	7.7590	8.2598	.5008
Q1-C*pH 7.5a	7.7289	8.2304	.5015
Q1-C*pH 7.5 b	7.7696	8.2710	.5014
Q1-pH 7.75 a	7.7914	8.2922	.5008
Q1-pH 7.75 b	7.7839	8.2865	.5026
Q1-pH 8 a	7.8007	8.3020	.5013
Q1-pH 8 b	7.7444	8.2454	.5010
Q1-C*pH 8 a	7.7457	8.2470	.5013
Q1-C*pH 8 b	7.8006	8.3017	.5011
Q1-pH 8.25 a	7.8017	8.3034	.5017
Q1-pH 8.25 b	7.7814	8.2832	.5018
Q1-pH 8.5a	7.7729	8.2750	.5021
Q1-pH 8.5 b	7.7358	8.2390	.5032
Q1-pH 8.75 a	7.9120	8.4113	.4993
Q1-pH 8.75 b	7.8231	8.3229	.4998
Q1-pH 9a	7.7492	8.2490	.4998
Q1-pH 9 b	7.7006	8.2012	.5006
Q1-C*pH 9a	7.7460	8.2464	.5004
Q1-C*pH 9 b	7.7679	8.2679	.5000
Q1-IU a	7.7404	8.2402	.4998
Q1-IU b	7.7105	8.2095	.4990

The solution bottles were weighed
About 0.1g of quartz was added to Q1-pHi solutions.
Solutions were weighed again.
Results on next page:

MA

Sample	wt. (g)	wt. of bottle + quartz (g)		wt. of quartz (g)
Q1-pH 2	69.3744	5-27-94 MA ~~69.4705~~	69.4738	.0994
Q1-pH 2.25	69.0264	69.1265		.1001
Q1-pH 2.5	68.7372	5-27-94 MA ~~68.8332~~	68.8376	.1004
Q1-pH 2.75	68.6222	68.7215		.0993
Q1-pH 3	68.8985	68.9989		.1004
Q1-C* pH 3	69.1479	69.1479		—
Q1-pH 3.25	68.6402	68.7399		.0997
Q1-pH 3.5	69.0019	69.0989		.0970
Q1-pH 3.75	68.6476	5-27-94 MA ~~68.7451~~	68.7481	.1005
Q1-pH 4	68.5810	68.6795		.0985
Q1-C* pH 4	68.6606	68.6606		—
Q1-pH 4.25	69.4019	69.5012		.0993
Q1-pH 4.5	69.1490	69.2481		.0991
Q1-pH 4.75	68.7112	68.8106		.0994
Q1-pH 5	68.9199	69.0195		.0996
Q1-C* pH 5	69.0385	69.0385		—
Q1-pH 5.25	69.2014	69.3001		.0987
Q1-pH 5.5	69.1150	69.2149		.0999
Q1-C* pH 5.5	69.1594	69.1594		—
Q1-pH 5.75	69.3746	69.4756		.1010
Q1-pH 6	69.4620	69.5615		.0995
Q1-C* pH 6	69.0040	69.0040		—
Q1-pH 6.25	69.2365	69.3368		.1003
Q1-pH 6.5	68.6663	68.7654		.0991
Q1-C* pH 6.5	69.0510	69.0510		—
Q1-pH 6.75	69.0299	69.1289		.0990
Q1-pH 7	69.0505	69.1512		.1007
Q1-C* pH 7	68.8506	68.8506		—
Q1-pH 7.25	68.7066	68.8069		.1003
Q1-pH 7.5	69.0918	69.1915		.0997
Q1-C* pH 7.5	69.1178	69.1178		—
Q1-pH 7.75	68.6635	68.7649		.1014
Q1-pH 8	68.7169	68.8179		.1010
Q1-C* pH 8	69.1297	69.1297		—
Q1-pH 8.25	68.6650	68.7640		.0990
Q1-pH 8.5	68.5095	68.6101		.1006

Sample	wt. (g)	wt. of bottle + quartz (g)	wt. of quartz (g)
Q1-pH 8.75	69.0036	69.1046	.1010
Q1-pH 9	68.9356	69.0354	.0998
Q1-C* pH 9	68.9917	68.9917	—
Q1-IU	65.6933	65.6933	—

MA: values lined out because quartz was added to solution.
5-27-94

Solution bottles were placed on gyratory shaker @ 120 rpm.

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27 May 94 PB

Examination of competitive sorption of U between polycarbonate containers and dialysis membranes at near neutral pH

Purpose: To determine if U desorbs from container walls due to addition of a competitive substrate, and if desorption occurs, the magnitude of the U desorption.

Method: Equilibrate several containers with atmospheric CO_2, 5 or 50 ppb U solution in $NaNO_3$ and $NaHCO_3$ to establish pH values near neutral. Measure the sorption of U onto containers at the equilibrium pH. Introduce a known quantity of competitive substrate and allow the system to re-equilibrate. Remeasure [U] and pH. Remove competitive substrate and transfer to pre-acidified solution; acidify original solution / container. Compare U concentration of container before and after substrate addition, mass balance of acidified solutions.

Materials and Equipment:

- 5 and 50 ppb U solutions at near neutral pH in PC bottles (from W3-5 and W3-50 experiments)
- Spectra Por 4 dialysis membrane

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PB

- Orion pH/ISE/°C/mV meter
- combination pH electrode w/ 4 and 7 pH buffers
- Packard LSA
- 7 ml scintillation vials
- Eppendorf pipette and tips
- 0.02 M HNO_3
- nano pure H_2O
- Mettler AE 240 analytical balance
- Ultima Gold scintillation cocktail

Procedure:

① use W3-50 and W3-5 polycarbonate solutions and containers. Uncap and allow to re-equilibrate for 2-3 days. Weigh, sample for U concentration, measure pH, and re-weigh solution.

- sample for U: withdraw 0.5 ml from solution using eppendorf pipettor. Transfer to pre weighed LSA vial containing 0.5 ml, 0.02 M HNO_3, reweigh vial. Add 5 ml Ultima Gold scintillation cocktail.

② Cut several strips (~ 6 inches long) of SpectraPor 4 dialysis membrane. Weigh each strip (dry). record weight Label each strip #1 - #7 w/ permanent marker.

③ Place membrane into W3 container. Leave a portion hanging out over the edge of the mouth of the container, so that when the cap is replaced, the cap will prevent the entire membrane from falling into the solution.

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PB

④ Allow membrane/solution to remain in contact for 7-10 days. After ~~10 days~~ 5-27-94 PB that time, measure solution weight, sample for [U], measure pH, re-weigh solution.

⑤ Carefully remove membrane, take care not to spill any solution, minimize amount withdrawn with membrane. Transfer membrane to pre-acidified solution of known mass. (Add 1 ml 0.1 N HNO_3 to 49 ml H_2O and weigh). After transfer, reweigh W3 containers and pre-acidified containers w/ membranes. Acidify W3 by adding 1 ml 0.1M HNO_3. reweigh W3 containers.

⑥ Allow solutions to equilibrate for 7-10 days. reweigh, ~~measure~~ 5-27-94 PB sample for [U], and reweigh

solution container	weight (g)	sampled	pH	weight (g) after sample/pH	membrane used	membrane weight (g)
W3-50 A	66.2466	✓✓	5.18	65.2100	#1	0.3098
W3-50 B	65.6718	✓✓	5.07	64.6395	#2	0.2752
W3-50 C	65.8586	✓✓	5.05	64.8325	#3	0.2605
W3-50 D	65.5941	✓✓	5.06	64.5706	#4	0.2414
W3-5 A	64.7318	✓✓	6.37	63.7240	#5	0.2647
W3-5 B	65.6854	✓✓	6.42	64.6570	#7 * PB	~~0.2499~~ 0.2778
W3-5 C	66.0770	✓✓	6.29	65.0460	#6 *	0.2499
W3-5 D	66.5322	✓✓	6.33	65.5067	#8	0.2778

* membrane #6 in W3-5C, #7 in W3-5B

7 May 94
PD

Sampling of W3-5 and W3-50

sample vial	wt vial + HNO_3	wt vial + sample	sample wt.
MA1-50	7.7462	8.2514	
MA2-50	7.8033	8.3052	
MB1-50	7.8057	8.3078	
MB2-50	7.7637	8.2648	
MC1-50	7.7855	8.2864	
MC2-50	7.9973	8.2987	
MD1-50	7.7084	8.2091	
MD2-50	7.8441	8.3451	
MA1-5	7.6963	8.1990	
MA2-5	7.7508	8.2514	
MB1-5	7.7866	8.2928	
MB2-5	7.7844	8.2849	
MC1-5	7.8136	8.3145	
MC2-5	7.7362	8.2371	
MD1-5	7.7711	8.2715	
MD2-5	7.8279	8.3286	

30 May 94
MA

Q1-K Kinetics Experiment Continued

After pH adjustments were made on the Kinetics solutions on 24 May '94 (p.p. 206-207) the solutions were given time to equilibrate. Today, equilibration pH and U concentration will be measured.

1 - Each container was weighed
3 - pH measured
2 - two .5 ml samples taken for LSA
4. - containers weighed

Results are listed on the following pages:

Sample	Container wt. (g) (before sample)	pH	Temp (°C)
Q1-K*pH 5.5	68.2661	5.04	21.2°
Q1-KC*pH 5.5	67.9792	5.17	21.2°
Q1-K* pH 6	67.7674	5.51	21.2°
Q1-KC* pH 6	67.8935	5.54	21.3°
Q1-K* pH 6.5	67.7625	6.18	21.3°
Q1-KC* pH 6.5	67.7873	6.18	21.3°
Q1-K* IU	65.6099	1.80	21.3°

Two .5 ml samples were withdrawn and transferred into pre-weighed scintillation vials containing .5 ml of .02M HNO_3:

Filename: "Kinlsa"

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (After sampling and pH)
Q1-K*pH 5.5a1	7.7323	8.2316	.4993
Q1-K* pH 5.5b1	7.7435	8.2417	.4982
Q1-KC*pH 5.5a1	7.7759	8.2710	.4951
Q1-KC*pH 5.5b1	7.8321	8.3259	.4938
Q1-K*pH 6a1	7.7808	8.2758	.4950
Q1-K*pH 6b1	7.7997	8.2931	.4934
Q1-KC*pH 6a1	7.7244	8.2208	5-30-94 MA ~~.4864~~ .4964
Q1-KC*pH 6b1	7.7701	8.2580	.4879
Q1-K*pH 6.5a1	7.7394	5-30-94 MA ~~8.1982~~ 8.2374	.4980
Q1-K*pH 6.5b1	7.7646	8.2573	.4927
Q1-KC*pH 6.5a1	7.7900	8.2810	.4910
Q1-KC*pH 6.5b1	7.7542	8.2453	.4911
Q1-K*IUa1	7.8039	8.2936	.4897
Q1-K*IUb1	7.7856	8.2754	.4898

* Note: Additional solution of Q1-K*pH 6.5a was added.

The solution containers were reweighed, then 0.1 g of quartz was added to Q1-K*pH i solutions. The containers were then weighed again.

Results are listed on next page.

MA ~~11:00 AM~~ 11:10 AM 5/30/94

Sample	Wt. (initial)	wt. of container + quartz	Wt. of quartz
Q1-K*pH 5.5	67.1993	67.3005	.1012
Q1-KC*pH 5.5	66.9537	66.9537	—
Q1-K*pH 6	66.7355	66.8359	.1004
Q1-KC*pH 6	66.8770	66.8770	—
Q1-K*pH 6.5	66.7408	66.8418	.1010
Q1-KC*pH 6.5	66.7152	66.7152	—
Q1-K*IU	64.5938	64.5938	—

Bottles were placed on gyratory shaker @ 120 rpm.
The solutions will be sampled again in 2 hours.
(Sample intervals: 2 hrs, 4 hrs, 1 day, 2 days, 4 days 8 days, 12 days, 16 days, and 21 days).

13:10 5/30/94
MA

Sample	wt (g) (before sampling and pH measurement)	pH	Temp (°C)	wt. (after sampling + pH)
Q1-K*pH 5.5	67.2952	4.85	23.2°	66.2362
Q1-KC*pH 5.5	66.9482	5.18	23.2°	65.9216
Q1-K*pH 6	66.8313	5.52	23.2°	65.8040
Q1-KC*pH 6	66.8727	5.56	23.3°	65.8412
Q1-K*pH 6.5	66.8376	6.20	23.3°	65.8110
Q1-KC*pH 6.5	66.7065	6.20	23.3°	65.6802

Two .5 ml samples were taken:

Sample	Wt. of vial (g)	wt. of vial + sample (g)	wt. of sample
Q1-pH 5.5a 2hr	7.8189	8.3203	.5014
Q1-K*pH 5.5b 2hr	7.7523	8.2529	.5006
Q1-KC*pH 5.5a 2hr	7.7742	8.2737	.4995
Q1-KC*pH 5.5b 2hr	7.8048	8.3036	.4988
Q1-K*pH 6a 2hr	7.8082	8.3089	.5007
Q1-K*pH 6b 2hr	7.7981	8.2989	.5008
Q1-KC*pH 6a 2hr	7.8391	8.3394	.5003
Q1-KC*pH 6b 2hr	7.7473	8.2483	.5010
Q1-K*pH 6.5a 2hr	7.7652	8.2679	.5027
Q1-K*pH 6.5b 2hr	7.7615	8.2607	.4992
Q1-KC*pH 6.5a 2hr	7.7365	8.2370	.5005
Q1-KC*pH 6.5b 2hr	7.8303	8.3300	.4997

Samples were placed back on the gyratory shaker, and will be sampled again at 15:10, 5-30-94.

15:10 5/30/94
MA

Sample	wt. (g)	pH	Temp (°C)
Q1-K*pH 5.5	66.2347	4.84	24.5°
Q1-KC*pH 5.5	65.9198	5.19	24.5°
Q1-K*pH 6	65.8019	5.51	24.6°
Q1-KC*pH 6	65.8395	5.55	24.6°
Q1-K*pH 6.5	65.8099	6.20	24.6°
Q1-KC*pH 6.5	65.6782	6.21	24.7°

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample
Q1-K*pH 5.5a 4hr	7.7512	8.2511	.4999
Q1-K*pH 5.5b 4hr	7.7876	8.2895	.5019
Q1-KC*pH 5.5a 4hr	7.7523	8.2532	.5009
Q1-KC*pH 5.5b 4hr	7.8555	8.3557	.5002
Q1-K*pH 6a 4hr	7.6877	8.1895	.5018
Q1-K*pH 6b 4hr	7.8107	8.3117	.5010
Q1-KC*pH 6a 4hr	7.7127	8.2149	.5022
Q1-KC*pH 6b 4hr	7.6772	8.1792	.5020
Q1-K*pH 6.5a 4hr	7.7182	8.2201	.5019
Q1-K*pH 6.5b 4hr	7.7419	8.2440	.5021
Q1-KC*pH 6.5a 4hr	7.7470	8.2499	.5029
Q1-KC*pH 6.5b 4hr	7.8744	8.3761	.5017

Sample containers were then weighed and placed on gyratory shaker @ 120 rpm.

Sample	Wt. (g)
Q1-K*pH 5.5	65.2033
Q1-KC*pH 5.5	64.8922
Q1-K*pH 6	64.7650
Q1-KC*pH 6	64.8080
Q1-K*pH 6.5	64.7774
Q1-KC*pH 6.5	64.6499

31 May 94 Q1-K pH and U concentration measured:
14:50
MA

1) Sample containers were weighed: (AE 240)

Sample	wt. (g)	③ pH	Temp (°C)
① Q1-K * pH 5.5	65.1434	4.82	25.1°
Q1-KC * pH 5.5	64.8308	5.15	25.2°
Q1-K * pH 6	64.7136	5.45	25.2°
Q1-KC * pH 6	64.7690	5.49	25.2°
Q1-K * pH 6.5	64.7421	6.18	25.3°
Q1-KC * pH 6.5	64.5911	6.18	25.3°

② Two .5 ml's samples were withdrawn at 15:20

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Q1-K * pH 5.5 a 1d	7.7632	8.2646	.5014
Q1-K * pH 5.5 b 1d	7.7083	8.2087	.5004
Q1-KC * pH 5.5 a 1d	7.7624	8.2629	.5005
Q1-KC * pH 5.5 b 1d	7.7410	8.2402	.4992
Q1-K * pH 6 a 1d	7.7233	8.2253	.5020
Q1-K * pH 6 b 1d	7.7205	8.2157	.4952
Q1-KC * pH 6 a 1d	7.7299	8.2297	.4998
Q1-KC * pH 6 b 1d	7.8499	8.3499	.5000
Q1-K * pH 6.5 a 1d	7.7552	8.2560	.5008
Q1-K * pH 6.5 b 1d	7.8141	8.3138	.4997
Q1-KC * pH 6.5 a 1d	7.7321	8.2318	.4997
Q1-KC * pH 6.5 b 1d	7.7725	8.2729	.5004
	AE 240	AE 240	

Sample containers were weighed and placed on gyratory shaker @ 120 rpm.

Sample	wt. (g)
Q1-K * pH 5.5	64.1152
Q1-KC * pH 5.5	63.8093
Q1-K * pH 6	63.6859
Q1-KC * pH 6	63.7340
Q1-K * pH 6.5	63.7047
Q1-KC * pH 6.5	63.5697

1 June 94 Q1-K pH and U concentration measured:
MA
11:00 AM
- Sample containers were weighed:
- 2 .5 ml samples were withdrawn
- pH measured
- sample containers re-weighed and put back on gyratory shaker

Sample	wt. (g)	pH	Temp (°C)
Q1-K * pH 5.5	64.0885	4.85	21.6°
Q1-KC * pH 5.5	63.7775	5.15	21.7°
Q1-K * pH 6	63.6623	5.42	21.7°
Q1-KC * pH 6	63.7142	5.46	21.7°
Q1-K * pH 6.5	63.6828	6.13	21.7°
Q1-KC * pH 6.5	63.5499	6.14	21.7°

samples taken
At 11:10 AM

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Q1-K * pH 5.5 a 2D	7.7354	8.2404	.5050
Q1-K * pH 5.5 b 2D	7.7239	8.2312	.5073
Q1-KC * pH 5.5 a 2D	7.8185	8.3236	.5051
Q1-KC * pH 5.5 b 2D	7.7494	8.2545	.5051
Q1-K * pH 6 a 2D	7.8017	8.3046	.5029
Q1-K * pH 6 b 2D	7.8271	8.3322	.5051
Q1-KC * pH 6 a 2D	7.7664	8.2687	.5023
Q1-KC * pH 6 b 2D	7.7952	8.2997	.5045
Q1-K * pH 6.5 a 2D	7.7699	8.2749	.5050
Q1-K * pH 6.5 b 2D	7.7933	8.2986	.5053
Q1-KC * pH 6.5 a 2D	7.7739	8.2762	.5023
Q1-KC * pH 6.5 b 2D	7.7458	8.2505	.5047

Sample	wt. (g)
Q1-K * pH 5.5	63.0532
Q1-KC * pH 5.5	62.7381
Q1-K * pH 6	62.6320
Q1-KC * pH 6	62.6820
Q1-K * pH 6.5	62.6404
Q1-KC * pH 6.5	62.5199

1 JUNE 94
MA

LSA RESULTS ARE listed below:

Protocol #: 5 Name:U-233 3% 2 sigma 26-May-94 02:54
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

Q1-K (Kinetics)
Samples taken
5-19-94
pp. 195 6C-11

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	19.09	1.45	2.952	3.68	28.12	1.19	134.77	B
2	8.72	4.30	76.42	506.681	3.02	512.02	3.07	705.35	
3	8.89	7.57	45.92	497.273	3.02	505.29	3.07	700.43	
4	9.00	9.46	37.76	491.159	3.02	502.88	3.06	696.21	
5	8.87	6.95	49.47	498.288	3.02	505.47	3.07	696.46	
6	9.16	7.22	47.12	482.528	3.02	491.31	3.07	699.25	
7	9.17	4.79	67.63	482.108	3.02	488.02	3.08	702.91	
8	8.95	5.04	65.37	494.031	3.02	499.36	3.08	702.08	
9	8.93	6.10	55.23	495.144	3.02	501.78	3.07	699.69	
10	9.16	6.67	50.44	482.419	3.02	488.14	3.08	699.41	
11	9.50	4.91	65.02	465.364	3.02	469.98	3.08	703.00	
12	8.70	6.08	56.14	507.853	3.02	512.34	3.08	701.65	
13	8.95	4.82	68.09	493.584	3.02	499.48	3.08	700.77	
14	8.12	8.49	43.52	544.462	3.02	555.50	3.05	701.27	
15	8.32	5.79	59.95	531.183	3.02	540.63	3.06	700.64	
(3 missing vials)									
19	8.28	4.22	79.85	534.367	3.02	540.60	3.07	700.44	
20	8.10	2.02	160.5	545.937	3.02	551.26	3.07	705.42	
21	8.33	2.40	134.6	531.021	3.02	534.06	3.08	702.17	
22	8.29	2.38	135.8	533.719	3.02	536.53	3.08	700.70	
23	8.44	4.60	73.03	523.825	3.02	529.22	3.07	701.19	
24	8.18	2.30	141.1	540.935	3.01	543.27	3.08	714.27	
25	8.21	3.32	99.90	538.704	3.02	541.43	3.08	700.84	
26	8.29	0.00	0.00	533.236	3.02	535.45	3.08	704.48	
27	8.61	0.77	397.0	513.540	3.02	514.15	3.09	704.79	
28	8.39	0.00	0.00	527.322	3.02	526.23	3.09	706.44	
29	8.43	0.00	0.00	524.924	3.02	525.26	3.09	706.97	
30	8.36	2.08	153.6	528.627	3.02	531.57	3.08	702.65	
31	8.28	5.42	63.65	534.004	3.02	540.23	3.07	694.95	
32	8.21	3.20	103.4	538.826	3.02	543.98	3.07	704.03	
33	8.27	7.75	46.62	534.412	3.02	542.25	3.06	695.64	
34	8.46	7.62	46.77	522.343	3.02	532.04	3.06	696.66	
35	8.27	4.00	83.78	534.412	3.02	540.68	3.07	695.46	
36	8.34	6.69	52.75	529.902	3.02	535.91	3.07	699.18	
37	8.45	2.09	152.0	523.083	3.02	526.55	3.08	703.33	
38	8.28	3.13	105.1	533.763	3.02	537.94	3.07	703.22	
39	8.46	6.79	51.65	522.343	3.02	530.03	3.07	699.50	
40	8.33	5.04	67.80	531.021	3.02	536.58	3.07	697.54	
41	8.28	3.73	89.25	533.763	3.02	536.97	3.08	695.66	
42	8.39	2.36	135.9	526.726	3.02	529.92	3.08	700.70	
43	8.60	2.07	152.1	514.373	3.02	516.53	3.08	700.46	
44	8.60	3.47	93.80	514.141	3.02	519.20	3.07	697.30	
45	8.94	1.60	190.8	494.140	3.02	496.60	3.09	700.78	
46	8.95	1.13	266.9	493.919	3.02	498.25	3.08	702.69	
47	8.70	2.40	131.4	508.197	3.02	512.57	3.08	697.03	
48	8.97	1.98	155.6	492.477	3.02	495.85	3.08	704.06	
49	9.14	2.46	125.3	483.591	3.02	486.54	3.09	699.04	
50	9.35	1.13	267.8	499.195	3.02	502.05	3.08	700.79	
51	9.30	0.00	0.00	475.112	3.02	476.18	3.09	703.59	

Q2-Sorption
Samples taken
5-23-94
pp 202-204
Filename:
Q2-LSA2

MA

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
52	9.08	3.15	99.63	486.585	3.02	490.38	3.08	698.78	
53	9.36	1.95	154.1	472.048	3.02	474.44	3.09	705.15	
54	9.62	3.26	93.98	459.314	3.02	464.60	3.08	705.04	
55	9.39	2.63	116.0	470.424	3.02	474.54	3.08	705.60	
56	9.42	3.20	96.52	469.235	3.02	473.05	3.08	702.31	
57	9.51	2.57	118.0	464.976	3.02	468.51	3.09	702.26	
58	9.36	1.85	162.6	472.582	3.02	475.83	3.08	704.61	
59	10.02	0.00	0.00	440.561	3.02	440.74	3.11	705.26	
60	9.72	1.48	197.0	454.250	3.02	457.27	3.09	705.00	
61	10.22	2.34	124.5	431.882	3.02	435.58	3.09	700.42	
62	10.09	3.60	83.60	437.682	3.02	443.33	3.08	704.89	
63	10.76	2.56	111.3	410.524	3.02	415.09	3.09	706.12	
64	10.87	2.16	130.2	406.064	3.02	408.40	3.10	702.25	
65	10.95	4.38	67.18	402.893	3.02	407.68	3.10	696.53	
66	10.32	5.13	59.95	427.668	3.02	433.99	3.08	696.04	
67	9.92	6.11	52.38	445.737	3.02	452.12	3.08	698.92	
68	9.57	1.91	155.7	462.147	3.02	464.35	3.09	703.95	
69	9.44	4.21	74.88	467.917	3.02	472.41	3.08	702.04	
70	9.20	1.89	160.8	480.309	3.02	482.75	3.09	706.35	
71	9.66	1.92	154.1	457.089	3.02	462.15	3.08	703.17	
72	9.64	4.25	73.55	458.044	3.02	462.02	3.09	701.33	
73	8.96	4.68	69.86	493.477	3.02	500.11	3.07	703.55	
74	8.87	3.91	82.74	498.626	3.02	503.11	3.08	703.26	
75	8.89	2.62	119.9	496.935	3.02	500.00	3.08	704.53	
76	8.62	3.30	98.11	512.709	3.02	516.54	3.08	703.32	
77	8.71	2.72	116.7	507.496	3.02	511.14	3.08	706.88	
78	8.64	0.12	2484.	511.863	3.02	513.43	3.08	709.12	
79	8.41	1.48	212.4	525.704	3.02	528.48	3.08	709.30	
80	8.54	2.57	124.4	517.657	3.02	521.06	3.08	709.09	
81	8.73	3.59	90.17	506.326	3.02	511.17	3.08	702.74	
82	8.54	4.09	80.80	518.008	3.02	521.76	3.08	701.61	
83	8.20	3.47	95.97	538.999	3.02	544.07	3.07	704.98	
84	8.37	5.28	64.84	528.470	3.02	535.20	3.07	702.59	
85	8.43	5.11	66.57	524.450	3.02	531.43	3.07	700.90	
86	8.26	4.64	73.36	535.305	3.02	541.61	3.07	701.29	
87	8.14	3.39	98.41	543.117	3.02	547.92	3.07	709.22	
88	8.17	1.35	235.5	540.989	3.02	543.36	3.08	711.24	
89	8.45	4.34	77.01	523.083	3.02	528.21	3.07	709.10	
90	8.20	2.49	130.6	538.999	3.02	542.98	3.07	710.47	
91	8.13	5.26	66.00	544.034	3.02	549.37	3.07	707.37	
92	8.25	6.85	51.95	536.078	3.02	542.54	3.07	704.81	
93	8.20	2.86	114.9	539.853	3.01	544.56	3.07	707.41	
94	8.45	3.16	103.2	522.965	3.02	526.91	3.08	708.43	
95	8.36	1.60	197.3	528.627	3.02	531.69	3.08	706.53	
96	8.14	3.63	92.25	543.362	3.02	548.78	3.07	704.24	
97	8.03	4.20	81.45	550.971	3.01	556.68	3.07	701.91	
98	8.05	7.49	48.65	549.719	3.01	559.33	3.06	697.18	

Q2-Sorption

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

Kinetics

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
	1	2.95				
Q1-K*pH5.5a	2	506.68	1001.146	1.1577E+14	1.9221E-10	44.7934
Q1-K*pH 5.5b	3	497.27	985.864	1.1400E+14	1.8928E-10	44.1096
Q1-KC*pH 5.5a	4	491.16	971.632	1.1236E+14	1.8655E-10	43.4729
Q1-KC*pH 5.5b	5	498.29	988.475	1.1430E+14	1.8978E-10	44.2264
Q1-K*pH 6a	6	482.53	955.884	1.1054E+14	1.8352E-10	42.7682
Q1-K*pH 6b	7	482.11	958.850	1.1088E+14	1.8409E-10	42.9010
Q1-KC*pH 6a	8	494.03	982.558	1.1362E+14	1.8864E-10	43.9617
Q1-KC*pH 6b	9	495.14	983.592	1.1374E+14	1.8884E-10	44.0079
Q1-K*pH 6.5a	10	482.42	956.993	1.1066E+14	1.8374E-10	42.8179
Q1-K*pH 6.5b	11	465.36	924.434	1.0690E+14	1.7749E-10	41.3611
Q1-KC*pH 6.5a	12	507.85	1011.855	1.1701E+14	1.9427E-10	45.2725
Q1-KC*pH 6.5b	13	493.58	983.423	1.1372E+14	1.8881E-10	44.0004
Q1-K* IUa	14	544.46	1084.150	1.2537E+14	2.0815E-10	48.5071
Q1-K*IUb	15	531.18	1059.182	1.2248E+14	2.0336E-10	47.3900

Calculations verified
in 6C-11 pp. 143-144
MA
6-15-94

MA

Q2-LSA2.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	2.952				
Q2-pH2a	19	534.37	1066.394	1.2332E+14	2.0474E-10	47.7127
Q2-pH 2b	20	545.94	1088.397	1.2586E+14	2.0897E-10	48.6972
Q2-pH 2.25a	21	531.02	1062.040	1.2281E+14	2.0390E-10	47.5179
Q2-pH 2.25b	22	533.72	1067.867	1.2349E+14	2.0502E-10	47.7786
Q2-pH 2.5a	23	523.83	1047.660	1.2115E+14	2.0114E-10	46.8745
Q2-pH 2.5b	24	540.94	1079.290	1.2481E+14	2.0722E-10	48.2897
Q2-pH 2.75a	25	538.7	1077.400	1.2459E+14	2.0685E-10	48.2051
Q2-pH 2.75b	26	533.24	1063.502	1.2298E+14	2.0419E-10	47.5833
Q2-pH3 a	27	513.54	1023.804	1.1839E+14	1.9656E-10	45.8071
Q2-pH 3b	28	527.32	1050.857	1.2152E+14	2.0176E-10	47.0175
Q2-C* pH3a	29	524.92	1046.074	1.2097E+14	2.0084E-10	46.8035
Q2-C*pH 3b	30	528.63	1054.308	1.2192E+14	2.0242E-10	47.1719
Q2-pH 3.25a	31	534	1066.507	1.2333E+14	2.0476E-10	47.7178
Q2-pH 3.25b	32	538.83	1076.583	1.2449E+14	2.0670E-10	48.1686
Q2-pH 3.5a	33	534.41	1062.868	1.2291E+14	2.0406E-10	47.5549
Q2-pH 3.5 b	34	522.34	1039.896	1.2025E+14	1.9965E-10	46.5271
Q2-pH 3.75 a	35	534.41	1069.462	1.2367E+14	2.0533E-10	47.8500
Q2-pH 3.75b	36	529.9	1059.165	1.2248E+14	2.0335E-10	47.3892
Q2-pH 4a	37	523.08	1046.579	1.2102E+14	2.0094E-10	46.8261
Q2-pH 4b	38	533.76	1068.803	1.2359E+14	2.0520E-10	47.8205
Q2-C* pH 4a	39	522.34	1048.665	1.2127E+14	2.0134E-10	46.9195
Q2-C* pH 4b	40	531.02	1062.252	1.2284E+14	2.0395E-10	47.5274
Q2-pH 4.25a	41	533.76	1070.947	1.2384E+14	2.0561E-10	47.9164
Q2-pH 4.25b	42	526.73	1052.828	1.2175E+14	2.0214E-10	47.1057
Q2-pH 4.5a	43	514.37	1030.389	1.1915E+14	1.9783E-10	46.1017
Q2-pH 4.5b	44	514.14	1026.228	1.1867E+14	1.9703E-10	45.9156
Q2-pH 4.75a	45	494.14	987.490	1.1419E+14	1.8959E-10	44.1824
Q2-pH 4.75b	46	493.92	983.904	1.1378E+14	1.8890E-10	44.0219
Q2-pH 5a	47	508.2	1014.979	1.1737E+14	1.9487E-10	45.4123
Q2-pH 5b	48	492.48	981.036	1.1344E+14	1.8835E-10	43.8936
Q2-C* pH 5a	49	483.59	963.903	1.1146E+14	1.8506E-10	43.1270
Q2-C* pH 5b	50	499.19	995.791	1.1515E+14	1.9119E-10	44.5538
Q2-pH 5.25a	51	475.11	947.567	1.0957E+14	1.8193E-10	42.3961
Q2-pH 5.25b	52	486.59	969.303	1.1209E+14	1.8610E-10	43.3686
Q2-pH 5.5a	53	472.05	943.534	1.0911E+14	1.8115E-10	42.2157
Q2-pH 5.5b	54	459.31	918.253	1.0618E+14	1.7630E-10	41.0845
Q2-C* pH 5.5a	55	470.42	943.103	1.0906E+14	1.8107E-10	42.1964
Q2-C*pH 5.5b	56	469.23	937.710	1.0843E+14	1.8003E-10	41.9551
Q2-pH 5.75a	57	464.98	932.010	1.0778E+14	1.7894E-10	41.7001
Q2-pH 5.75b	58	472.58	947.814	1.0960E+14	1.8197E-10	42.4072
Q2-pH 6a	59	440.56	886.974	1.0257E+14	1.7029E-10	39.6851
Q2-pH 6b	60	454.25	911.234	1.0537E+14	1.7495E-10	40.7705
Q2-C* pH 6a	61	431.88	866.185	1.0016E+14	1.6630E-10	38.7549
Q2-C*pH 6b	62	437.68	879.229	1.0167E+14	1.6881E-10	39.3385
Q2-pH 6.25a	63	410.52	825.498	9.5459E+13	1.5849E-10	36.9345
Q2-pH 6.25b	64	406.06	816.858	9.4460E+13	1.5683E-10	36.5479
Q2-pH 6.5a	65	402.89	806.748	9.3290E+13	1.5489E-10	36.0956

Q2-LSA2.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	PPb U (233)
Q2-pH 6.5b	66	427.67	855.682	9.8949E+13	1.6429E-10	38.2850
Q2-C* pH 6.5a	67	445.74	882.653	1.0207E+14	1.6946E-10	39.4918
Q2-C* pH 6.5b	68	462.15	921.903	1.0661E+14	1.7700E-10	41.2479
Q2-pH 6.75a	69	467.92	933.786	1.0798E+14	1.7928E-10	41.7795
Q2-pH 6.75b	70	480.31	962.931	1.1135E+14	1.8488E-10	43.0836
Q2-pH 7a	71	457.09	916.747	1.0601E+14	1.7601E-10	41.0172
Q2-pH 7b	72	458.04	917.916	1.0615E+14	1.7623E-10	41.0695
Q2-C* pH 7a	73	493.48	982.441	1.1361E+14	1.8862E-10	43.9565
Q2-C* pH 7b	74	498.63	997.061	1.1530E+14	1.9143E-10	44.6106
Q2-pH 7.25a	75	496.94	995.473	1.1511E+14	1.9112E-10	44.5395
Q2-pH 7.25b	76	512.71	1027.887	1.1886E+14	1.9735E-10	45.9898
Q2-pH 7.5a	77	507.5	1028.160	1.1889E+14	1.9740E-10	46.0021
Q2-pH 7.5b	78	511.86	1030.937	1.1922E+14	1.9793E-10	46.1263
Q2-C* pH 7.5a	79	525.7	1052.242	1.2168E+14	2.0202E-10	47.0795
Q2-C* pH 7.5b	80	517.66	1041.779	1.2047E+14	2.0001E-10	46.6114
Q2-pH 7.75a	81	506.33	1012.660	1.1710E+14	1.9442E-10	45.3085
Q2-pH 7.75b	82	518.01	1050.517	1.2148E+14	2.0169E-10	47.0023
Q2-pH 8a	83	539	1078.431	1.2471E+14	2.0705E-10	48.2513
Q2-pH 8b	84	528.47	1059.058	1.2247E+14	2.0333E-10	47.3845
Q2-C* pH 8a	85	524.45	1051.845	1.2163E+14	2.0195E-10	47.0618
Q2-C* pH 8a	86	535.3	1072.745	1.2405E+14	2.0596E-10	47.9969
Q2-pH 8.25a	87	543.12	1091.041	1.2617E+14	2.0947E-10	48.8154
Q2-pH 8.25b	88	540.99	1086.543	1.2565E+14	2.0861E-10	48.6142
Q2-pH 8.5a	89	523.08	1061.014	1.2269E+14	2.0371E-10	47.4720
Q2-pH 8.5b	90	539	1080.593	1.2496E+14	2.0747E-10	48.3480
Q2-pH 8.75a	91	544.03	1090.678	1.2612E+14	2.0940E-10	48.7992
Q2-pH 8.75b	92	536.08	1076.898	1.2453E+14	2.0676E-10	48.1827
Q2-pH 9a	93	539.85	1082.949	1.2523E+14	2.0792E-10	48.4534
Q2-pH 9b	94	522.97	1049.719	1.2139E+14	2.0154E-10	46.9666
Q2-C*pH 9a	95	528.63	1057.895	1.2233E+14	2.0311E-10	47.3324
Q2-C*pH 9b	96	543.36	1090.427	1.2609E+14	2.0935E-10	48.7880
Q2-IUa	97	550.97	1111.948	1.2858E+14	2.1349E-10	49.7509
Q2-IUb	98	549.72	1106.076	1.2790E+14	2.1236E-10	49.4882

MA

6-1-94
MA

Q2-LSA2.XLS calculations were verified by using example and method described in 6C-11 pp. 143-144.

Protocol #: 5 Name:U-233 3% 2 sigma 29-May-94 06:43
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	18.83	1.46	3.041	3.63	28.10	1.19	136.86	B
2	8.09	0.00	0.00	547.021	3.01	546.69	3.08	696.36	
3	8.25	3.84	86.60	535.626	3.02	540.51	3.07	685.79	
4	8.42	2.43	131.1	524.869	3.02	527.61	3.08	693.88	
5	8.46	2.10	150.6	522.254	3.02	524.03	3.08	692.28	
6	8.32	2.21	144.5	531.454	3.02	534.77	3.08	692.89	
7	8.09	2.93	112.3	546.526	3.02	550.15	3.07	691.11	
8	8.16	2.01	159.7	542.057	3.02	545.07	3.08	691.19	
9	8.28	4.60	73.31	534.036	3.02	539.30	3.07	686.66	
10	8.30	3.83	86.67	533.706	3.01	538.65	3.07	694.19	
11	8.34	1.56	201.4	530.412	3.02	532.58	3.08	692.91	
12	8.26	0.00	0.00	535.216	3.02	536.31	3.08	695.24	
13	8.02	1.87	172.2	551.572	3.02	554.32	3.08	692.77	
14	8.50	1.65	189.4	520.253	3.02	522.73	3.08	692.48	
15	8.44	0.84	363.7	523.973	3.02	524.98	3.08	693.14	
16	8.47	0.77	395.1	522.107	3.02	522.55	3.09	695.40	
17	8.05	0.68	461.1	549.133	3.02	550.79	3.08	695.81	
18	8.19	0.83	373.6	540.305	3.02	541.99	3.08	699.23	
19	8.15	1.91	167.6	542.480	3.02	546.87	3.07	688.19	
20	8.04	1.08	293.8	550.193	3.02	551.01	3.08	696.85	
21	8.01	4.40	77.72	552.390	3.02	558.05	3.07	697.46	
22	8.21	3.83	87.04	538.615	3.02	544.74	3.07	695.87	
23	8.45	2.48	128.7	523.349	3.02	525.63	3.08	696.43	
24	8.20	2.27	141.7	539.276	3.02	541.29	3.08	695.73	
25	8.22	0.52	595.0	537.956	3.02	538.94	3.08	697.62	
26	8.31	5.00	67.94	531.857	3.02	537.49	3.07	693.68	
27	8.50	0.47	645.5	520.135	3.02	523.43	3.08	698.56	
28	8.50	4.94	67.93	520.253	3.02	525.90	3.07	689.68	
29	8.82	1.36	224.0	500.927	3.02	502.29	3.09	697.27	
30	8.80	1.74	176.2	502.413	3.02	506.00	3.08	693.96	
31	8.71	3.45	93.10	508.096	3.02	510.48	3.08	696.26	
32	8.37	0.41	742.5	527.903	3.02	527.94	3.09	695.82	
33	8.41	0.00	0.00	525.378	3.02	524.46	3.09	700.16	
34	8.79	1.31	231.8	502.647	3.02	504.56	3.09	692.34	
35	8.84	0.63	471.8	500.126	3.02	501.32	3.09	695.49	
36	9.00	3.40	92.87	490.848	3.02	495.46	3.08	692.30	
37	8.71	2.87	110.3	507.177	3.02	509.56	3.08	692.02	
38	8.73	0.00	0.00	506.581	3.02	506.96	3.09	697.65	
39	8.73	0.00	0.00	506.237	3.02	506.61	3.09	697.35	
40	9.08	1.33	225.2	486.827	3.02	488.75	3.09	695.73	
41	9.00	2.29	134.6	490.737	3.02	492.02	3.09	690.93	
42	9.28	0.25	1162.	476.269	3.02	477.51	3.09	697.31	
43	9.20	0.00	0.00	480.002	3.02	479.40	3.10	696.57	
44	9.12	0.80	367.5	484.349	3.02	486.60	3.09	694.63	
45	8.81	3.31	96.17	501.726	3.02	506.86	3.08	690.43	
46	9.59	2.76	109.2	460.567	3.02	464.29	3.09	693.91	
47	9.55	0.55	523.8	462.613	3.02	463.63	3.10	693.25	
48	9.43	3.87	80.52	468.433	3.02	475.30	3.08	690.50	
49	9.57	2.39	125.3	461.745	3.02	463.96	3.09	694.09	

Q1- Sorption

SAMPLES TAKEN 5-27-94 pp. 209-211

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	9.28	2.62	116.6	475.946	3.02	479.02	3.09	693.00	
51	9.15	1.83	164.9	482.970	3.02	487.53	3.08	690.49	
52	9.53	0.00	0.00	463.276	3.02	465.29	3.09	698.12	
53	9.44	2.57	117.5	467.722	3.02	469.47	3.09	691.22	
54	9.46	0.94	308.3	467.255	3.02	469.37	3.09	695.85	
55	8.93	0.88	337.7	494.943	3.02	497.88	3.08	693.31	
56	8.87	0.11	2555.	497.974	3.02	499.30	3.09	696.49	
57	8.98	2.44	126.4	492.059	3.02	493.73	3.09	693.54	
58	8.90	1.96	156.5	496.285	3.02	498.98	3.09	691.96	
59	8.76	3.21	99.28	504.493	3.02	509.58	3.08	693.21	
60	8.53	0.99	310.1	518.413	3.02	520.91	3.08	694.83	
61	8.54	2.49	127.6	517.568	3.02	520.50	3.08	692.42	
62	8.44	2.74	117.2	523.855	3.02	526.05	3.08	693.73	
63	8.56	1.62	191.7	516.702	3.02	519.33	3.08	695.24	
64	8.17	0.51	601.4	540.900	3.02	541.18	3.09	694.02	
65	8.42	2.31	137.4	525.106	3.02	527.61	3.08	693.38	
66	8.17	3.57	92.98	541.635	3.02	546.20	3.07	693.59	
67	8.05	2.54	128.7	549.133	3.02	551.41	3.08	690.05	
68	8.21	3.83	87.04	538.737	3.02	541.70	3.08	693.68	
69	8.15	2.52	128.7	542.358	3.02	544.54	3.08	694.51	
70	8.17	4.19	80.46	541.267	3.02	544.36	3.08	690.09	
71	8.28	1.83	173.6	533.674	3.02	538.21	3.07	693.17	
72	8.11	1.77	181.1	545.294	3.02	548.85	3.07	691.34	
73	7.86	5.09	68.71	562.862	3.02	567.83	3.07	691.47	
74	8.29	3.49	94.33	533.630	3.02	537.65	3.07	695.27	
75	8.22	1.37	229.8	538.321	3.02	541.37	3.08	696.60	
76	8.12	0.00	0.00	544.250	3.02	544.07	3.09	696.52	
77	8.14	6.36	55.49	542.905	3.02	549.67	3.07	685.80	
78	8.30	0.69	444.5	532.622	3.02	532.63	3.09	692.09	
79	8.09	3.67	91.15	546.650	3.02	550.15	3.07	691.75	
80	7.65	4.31	80.92	578.789	3.01	585.24	3.06	688.53	
81	7.89	0.00	0.00	560.711	3.02	562.02	3.08	696.67	
(10 missing vials)									
92	12.07	1.97	134.0	365.310	3.02	369.17	3.11	691.39	
93	12.17	4.18	66.08	362.119	3.03	367.80	3.10	689.47	
94	11.85	1.17	222.4	372.318	3.02	375.20	3.11	692.77	
95	11.68	1.04	252.7	377.438	3.02	379.27	3.12	694.37	
96	11.85	2.78	97.71	372.149	3.02	375.36	3.11	693.33	
97	12.10	3.82	72.00	364.232	3.03	369.76	3.10	688.29	
98	11.98	2.38	112.6	367.911	3.03	371.40	3.11	690.70	
99	11.59	2.83	97.05	380.652	3.02	383.03	3.11	693.92	
100	230.78	0.01	5899.	16.215	3.63	16.58	5.68	695.51	
101	236.39	0.02	3048.	15.758	3.65	16.06	5.77	699.15	
102	252.71	0.35	175.5	14.544	3.71	15.17	5.89	687.05	
103	261.67	0.20	304.7	13.942	3.74	14.43	6.05	692.24	
104	274.53	0.00	0.00	13.154	3.79	13.39	6.32	712.02	
105	264.23	0.00	0.00	13.778	3.75	13.81	6.26	713.77	
106	313.06	0.12	470.0	11.161	3.94	11.52	6.83	700.90	
107	316.71	0.10	541.1	10.994	3.96	11.37	6.88	707.80	

Q1 Sorption

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

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1 JUNE 94
MA

Q1-LSA2.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.04				
Q1-pH2a	2	547.02	1089.247	1.2596E+14	2.0913E-10	48.7352
Q1-pH2b	3	535.63	1066.355	1.2331E+14	2.0473E-10	47.7109
Q1-pH 2.25a	4	524.87	1043.272	1.2064E+14	2.0030E-10	46.6782
Q1-pH 2.25b	5	522.25	1037.445	1.1997E+14	1.9918E-10	46.4175
Q1-pH 2.5a	6	531.45	1056.981	1.2223E+14	2.0293E-10	47.2915
Q1-pH 2.5b	7	546.53	1087.189	1.2572E+14	2.0873E-10	48.6431
Q1-pH 2.75a	8	542.06	1082.604	1.2519E+14	2.0785E-10	48.4380
Q1-pH 2.75b	9	534.04	1066.374	1.2331E+14	2.0474E-10	47.7118
Q1-pH 3a	10	533.71	1067.207	1.2341E+14	2.0490E-10	47.7491
Q1-pH 3b	11	530.41	1060.396	1.2262E+14	2.0359E-10	47.4443
Q1-C*pH 3a	12	535.22	1073.876	1.2418E+14	2.0618E-10	48.0475
Q1-C*pH 3b	13	551.57	1102.699	1.2751E+14	2.1171E-10	49.3371
Q1-pH 3.25a	14	520.25	1036.355	1.1984E+14	1.9897E-10	46.3687
Q1-pH 3.25b	15	523.97	1044.181	1.2075E+14	2.0048E-10	46.7188
Q1-pH 3.5a	16	522.11	1041.928	1.2049E+14	2.0004E-10	46.6180
Q1-pH 3.5b	17	549.13	1092.579	1.2634E+14	2.0977E-10	48.8843
Q1-pH 3.75a	18	540.3	1076.509	1.2449E+14	2.0668E-10	48.1653
Q1-pH 3.75b	19	542.48	1080.853	1.2499E+14	2.0752E-10	48.3596
Q1-pH 4a	20	550.19	1097.526	1.2692E+14	2.1072E-10	49.1056
Q1-pH 4b	21	552.39	1102.575	1.2750E+14	2.1169E-10	49.3315
Q1-C*pH 4a	22	538.62	1073.590	1.2415E+14	2.0612E-10	48.0347
Q1-C* pH 4b	23	523.35	1044.611	1.2080E+14	2.0056E-10	46.7381
Q1-pH 4.25a	24	539.28	1075.978	1.2442E+14	2.0658E-10	48.1415
Q1-pH 4.25b	25	537.96	1075.920	1.2442E+14	2.0657E-10	48.1389
Q1-pH 4.5a	26	531.86	1060.327	1.2261E+14	2.0358E-10	47.4412
Q1-pH 4.5b	27	520.14	1037.789	1.2001E+14	1.9925E-10	46.4329
Q1-pH 4.75a	28	520.25	1038.630	1.2010E+14	1.9941E-10	46.4705
Q1-pH 4.75b	29	500.93	998.266	1.1544E+14	1.9166E-10	44.6645
Q1-pH 5a	30	502.41	1005.423	1.1626E+14	1.9303E-10	44.9847
Q1-pH 5b	31	508.1	1014.982	1.1737E+14	1.9487E-10	45.4124
Q1-C* pH 5a	32	527.9	1053.903	1.2187E+14	2.0234E-10	47.1538
Q1-C* pH 5b	33	525.38	1046.574	1.2102E+14	2.0094E-10	46.8259
Q1- pH 5.25a	34	502.65	1002.893	1.1597E+14	1.9255E-10	44.8715

MA: Calculations for Q1-LSA2.XLS were verified by using method described in GC-11 pp. 143-144.

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
Q1-pH 5.25b	35	500.13	996.473	1.1523E+14	1.9132E-10	44.5843
Q1-pH 5.5a	36	490.85	977.594	1.1305E+14	1.8769E-10	43.7396
Q1-pH 5.5b	37	507.18	1008.912	1.1667E+14	1.9370E-10	45.1408
Q1-C* pH 5.5a	38	506.58	1014.377	1.1730E+14	1.9475E-10	45.3854
Q1-C* pH 5.5b	39	506.24	1010.459	1.1685E+14	1.9400E-10	45.2101
Q1-pH 5.75a	40	486.83	970.554	1.1223E+14	1.8634E-10	43.4246
Q1-pH 5.75b	41	490.74	975.626	1.1282E+14	1.8731E-10	43.6516
Q1-pH 6a	42	476.27	953.493	1.1026E+14	1.8306E-10	42.6613
Q1-pH 6b	43	480	958.849	1.1088E+14	1.8409E-10	42.9009
Q1-C* pH 6a	44	484.35	970.447	1.1222E+14	1.8632E-10	43.4198
Q1-C* pH 6b	45	501.73	1002.858	1.1597E+14	1.9254E-10	44.8700
Q1-pH 6.25a	46	460.57	913.829	1.0567E+14	1.7545E-10	40.8866
Q1-pH 6.25b	47	462.61	923.373	1.0678E+14	1.7728E-10	41.3137
Q1-pH 6.5a	48	468.43	931.828	1.0775E+14	1.7890E-10	41.6919
Q1-pH 6.5b	49	461.74	918.520	1.0622E+14	1.7635E-10	41.0965
Q1-C* pH 6.5a	50	475.95	950.190	1.0988E+14	1.8243E-10	42.5135
Q1-C* pH 6.5b	51	482.97	962.092	1.1125E+14	1.8472E-10	43.0460
Q1-pH 6.75a	52	463.28	923.973	1.0685E+14	1.7740E-10	41.3405
Q1-pH 6.75b	53	467.72	932.642	1.0785E+14	1.7906E-10	41.7284
Q1-pH 7a	54	467.25	931.891	1.0776E+14	1.7892E-10	41.6947
Q1-pH 7b	55	494.94	988.101	1.1426E+14	1.8971E-10	44.2097
Q1-C* pH 7a	56	497.97	997.536	1.1535E+14	1.9152E-10	44.6319
Q1-C* pH 7b	57	492.06	981.176	1.1346E+14	1.8838E-10	43.8999
Q1-pH 7.25a	58	496.28	990.184	1.1450E+14	1.9011E-10	44.3029
Q1-pH 7.25b	59	504.49	1004.360	1.1614E+14	1.9283E-10	44.9372
Q1-pH 7.5a	60	518.41	1033.719	1.1954E+14	1.9847E-10	46.2507
Q1-pH 7.5b	61	517.57	1033.486	1.1951E+14	1.9842E-10	46.2403
Q1-C* pH 7.5a	62	523.85	1044.566	1.2079E+14	2.0055E-10	46.7361
Q1-C* pH 7.5b	63	516.7	1030.515	1.1917E+14	1.9785E-10	46.1074
Q1-pH 7.75a	64	540.9	1080.072	1.2490E+14	2.0737E-10	48.3247
Q1-pH 7.75b	65	525.11	1044.787	1.2082E+14	2.0059E-10	46.7460
Q1-pH 8a	66	541.63	1080.451	1.2494E+14	2.0744E-10	48.3416
Q1-pH 8b	67	549.13	1096.068	1.2675E+14	2.1044E-10	49.0404
Q1-C* pH 8a	68	538.74	1074.686	1.2427E+14	2.0633E-10	48.0837
Q1-C* pH 8b	69	542.36	1082.339	1.2516E+14	2.0780E-10	48.4261
Q1-pH 8.25a	70	541.27	1078.872	1.2476E+14	2.0714E-10	48.2710
Q1-pH 8.25b	71	533.67	1063.511	1.2298E+14	2.0419E-10	47.5837
Q1-pH 8.5a	72	545.29	1086.019	1.2558E+14	2.0851E-10	48.5908
Q1-pH 8.5b	73	562.86	1118.561	1.2935E+14	2.1476E-10	50.0468
Q1-pH 8.75a	74	533.63	1068.756	1.2359E+14	2.0519E-10	47.8184
Q1-pH 8.75b	75	538.32	1077.071	1.2455E+14	2.0679E-10	48.1904
Q1-pH 9a	76	544.25	1088.936	1.2592E+14	2.0907E-10	48.7213
Q1-pH 9b	77	542.9	1084.499	1.2541E+14	2.0822E-10	48.5227
Q1-C* pH 9a	78	532.62	1064.388	1.2308E+14	2.0436E-10	47.6230
Q1-C*pH 9b	79	546.65	1093.300	1.2643E+14	2.0991E-10	48.9165
Q1-IUa	80	578.79	1158.043	1.3391E+14	2.2234E-10	51.8133
Q1-IUb	81	560.71	1123.667	1.2994E+14	2.1574E-10	50.2752

3 June 94
MA

Q1-K pH and U concentration measured: (4½ day interval)

1. sample containers were weighed
2. Two .5 ml samples withdrawn from each container
3. pH of solutions was measured
4. sample containers weighed again, and placed on gyratory shaker @ 120 rpm.

Sample	wt. (g) (before sampling + pH)	pH	Temp (°C)
Q1-K*pH 5.5	62.9635	4.79	23.0
Q1-KC*pH 5.5	62.6211	5.09	23.1
Q1-K*pH 6	62.5705	5.35	23.1
Q1-KC*pH 6	62.5462	5.38	23.1
Q1-K*pH 6.5	62.5670	6.12	23.2
Q1-KC*pH 6.5	62.4552	6.12	23.2

* samples withdrawn at 14:10 *

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-K*pH 5.5a 4D	7.7654	8.2689	.5035
Q1-K*pH 5.5b 4D	7.7461	8.2485	.5024
Q1-KC*pH 5.5a 4D	7.7336	8.2326	.4990
Q1-KC*pH 5.5b 4D	7.8476	8.3461	.4985
Q1-K*pH 6a 4D	7.7503	8.2475	.4972
Q1-K*pH 6b 4D	7.7579	8.2557	.4978
Q1-KC*pH 6a 4D	7.7647	8.2616	.4969
Q1-KC*pH 6b 4D	7.7867	8.2824	.4957
Q1-K*pH 6.5a 4D	7.7919	8.2882	.4963
Q1-K*pH 6.5b 4D	7.7309	8.2285	.4976
Q1-KC*pH 6.5a 4D	7.7168	8.2158	.4990
Q1-KC*pH 6.5b 4D	7.7737	8.2715	.4978

Sample	wt. (g) - After sampling and pH measurement
Q1-K*pH 5.5	61.9417
Q1-KC*pH 5.5	61.5986
Q1-K*pH 6	61.5527
Q1-KC*pH 6	61.5216
Q1-K*pH 6.5	61.5423
Q1-KC*pH 6.5	61.4144

3 Jun 94

Sampling of competitive sorption experiment containers and initiation of desorption.

After one week, the W3-50 and W3-5 solutions w/membrane will be sampled and processed to initiate desorption and to quantify mass transfer.

Solution w/membrane	weight sol. bottle (g)	samp	weight w/o memb. after samp	samp	weight after samp.	⊛ acid added	final weight
W3-50A	65.2172	✓✓	63.2822	✓	62.7786	✓	63.7708
W3-50B	~~61.2744~~ 61.2779	✓✓	62.7881	✓	62.2866	✓	63.2722
W3-50C	64.6839	✓✓	62.3012	✓	62.2962	✓	63.2873
W3-50D	64.5425	✓✓	63.1230	✓	62.6224	✓	63.6090
W3-5A	63.6521	✓✓	61.8847	✓	61.3807	✓	62.3718
W3-5B	64.6979	✓✓	62.8959	✓	62.3936	✓	63.3839
W3-5C	64.9613	✓✓	63.1980	✓	62.6978	✓	63.6967
W3-5D	65.5827	✓✓	63.7668	✓	63.2631	✓	64.2554

membrane bottles	wt. bottle empty	memb. ID	wt + membrane	⊛ acid added	wt acid + membrane
W3-50 MAR	13.8316	#1	14.7594	✓	65.1259
W3-50 MBR	13.8039	#2	14.6466	✓	65.2481
W3-50 MCR	13.6996	#3	14.5883	✓	64.7472
W3-50 MDR	14.1013	#4	14.~~95~~ 8359	✓	65.1142
W3-5 MAR	14.1287	#5	14.8920	✓	65.6243
W3-5 MBR	14.5731	#7	15.3693	✓	65.3251
W3-5 MCR	14.4228	#6	15.1799	✓	64.8865
W3-5 MDR	13.8910	#8	14.6949	✓	64.8554

⊛ 0.1 M HNO_3 added to both W3 and membrane bottles

3 Jun 94
PB

Sample vial	vial wt	vial + sample wt.
W3-50 MA3	7.8367	8.3348
" MA4	7.7314	8.2294
" MA5	7.8034	8.3046
" MB3	7.7261	8.2187
" MB4	7.7576	8.2517
" MB5	7.7294	8.2295
" MC3	7.7169	8.2104
" MC4	7.7284	8.2220
" MC5	7.7531	8.2565
" MD3	7.7414	7.9232
" MD4	7.7089	8.2041
" MD5	7.7187	8.2182
W3-5 MA3	7.7954	8.2931
" MA4	7.7542	8.2521
" MA5	7.7743	8.2770
" MB3	7.8407	8.3375
" MB4	7.7367	8.2352
" MB5	7.8152	8.3156
" MC3	7.8011	8.2997
" MC4	7.7579	8.2580
" MC5	7.7535	8.2527
" MD3	7.8112	8.3131
" MD4	7.7750	8.2962
" MD5	7.7813	8.2833
BLANK	7.7659	8.2657 (nH_2O)

① W3 solutions were sampled in duplicate prior to removing membranes

3 Jun 94
PB

② membranes were removed from W3 containers and transferred to membrane bottles (PE bottles). weight change of PE bottles determines amount of W3 solution carry-over. No W3 solution was lost during transfer.

③ Membrane bottles were filled w/ ~50 g of 0.1 M HNO_3 to release any sorbed U from the dialysis membranes.

④ W3 bottles were resampled after membrane transfer to verify ~~d~~ PB solution U concentration did not change.

⑤ W3 bottles were acidified using ~1.0 ml of 0.1 M HNO_3 and reweighed.

⑥ membrane bottles and W3 bottles were placed on gyratory shaker at ~120 rpm. Solutions will be allowed to react for ~1 week prior to final sampling.

MA

6 JUNE 94
MA

U Sorption on Wedron Silica
Sorption (Q3) Experiment

WRITTEN BY: F.P. Bertetti
REVISION NO.: 0

DATE WRITTEN: June 6, 1994
DATE REVISED: N/A

CONDITIONS:

1.) ΣU= 500 ppb
2.) 0.1 m $NaNO_3$ matrix, equilibrium with atmospheric $CO_2(g)$; $pCO_2=10^{-3.5}$
3.) pH range 2-9
4.) initial solution volume = 50 ml, initial quartz sand mass = ~~1.0 g~~ 2.59 MA 6-20-94

OBJECTIVES:

- To investigate the characteristics of U sorption on quartz sand as a function of solution pH and as a function of solution volume to solid mass ratio. Experimental data will be correlated with uranium aqueous speciation and compared with results of U sorption on clinoptilolite and α-alumina.

- To investigate the reproducibility and reversibility of U sorption reactions.

EQUIPMENT:

Gyratory shaker
Packard liquid scintillation counter
Orion pH/mV/ISE/°C meter
Combination pH electrode
ATC probe
Analytical balances (Mettler 4600 and 240AE)
α, β and γ survey instruments

SUPPLIES:

40	2 oz. polycarbonate bottles (acid washed and dried)
1	2000-ml FEP bottle (acid cleaned and dried)
1	Repipettor for transfer of scintillation cocktail
various	Eppendorf micropipettors for solution transfer
	Eppendorf pipet tips
	pH buffer solutions
	Ultima-Gold liquid scintillation cocktail
	7 ml scintillation vials
	weighing paper
	Wedron silica sand (W510*60/100*UC*RC*RFe*HL)
	reagent grade $NaHCO_3$

- Sample vials should "rest" in the absence of light for at least 24 hours prior to initial analysis to allow for decay of incident radiation pulses.

- Following each sampling period, swipes and frisks of the work area should be performed. If contamination is found, follow the radiological procedures for clean-up, and inform the division radiation safety point of contact (RSPOC). Radioactive solutions may not be disposed of without following all radiation safety guidelines. Do not dispose of any solutions without prior approval of the division RSPOC.

1.) Stock solution preparation

1000 ml stock solution of 1.0 M HNO_3
1000 ml stock solution of 0.1 M HNO_3
1000 ml stock solution of 0.02 M HNO_3
500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml H_2O)
500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 g in 500 ml H_2O)
500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml H_2O)
500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml H_2O)
500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml H_2O)

500 ppb U stock solution
ultrapure water
2L 0.1 m $NaNO_3$ stock solution
stock solution of 1.0 M HNO_3
stock solution of 0.1 M HNO_3
stock solution of 0.02 M HNO_3
stock solution of 1.0 M $NaHCO_3$
stock solution of 0.5 M $NaHCO_3$
stock solution of 0.1 M $NaHCO_3$
stock solution of 0.05 M $NaHCO_3$
stock solution of 0.01 M $NaHCO_3$

PROCEDURE:

Special considerations:

- Experimental solutions and sample containers/vials should be weighed at each step. Do not add or subtract contents without weighing before and after each process. Always record weight of solutions.

- When measuring pH, minimize the amount of time the glass electrode is in contact with the U bearing solution. Make sure to rinse the electrode thoroughly before measuring another solution. Take care not to introduce lint particles or other foreign objects into the experimental or sample containers.

The NaHCO3 solutions should be prepared with *degassed* ultrapure water and stored in tightly capped glass reagent bottles.

2000 ml 0.1 m $NaNO_3$ stock solution (16.999 g in 2000 g H_2O)

2.) Prepare 500 ppb U solution.

*Note: If quantitative transfer can be accomplished from the large stock solution container, this step may be excluded.

a.) On the Mettler 4600 balance, transfer 2000 g of 500 ppb U stock solution into a tared 2000 ml FEP bottle.
b.) Cap and label the bottle accordingly (sorption solution).

3.) Add 500 ppb U solution to each experiment container.

a.) Label twenty-nine 2 oz. polycarbonate containers Q3-pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
b.) Add 50 g of the 500 ppb U (from the 2000 ml FEP bottle) solution to each container. Record weight.
c.) Label ten 2 oz. polycarbonate containers Q3-C*pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
d.) Add 50 g of the 500 ppb U solution to each container. Record weight.
e.) Transfer the remaining (~50 g) 500 ppb U solution into a pre-weighed 2 oz. polycarbonate bottle labeled Q3-IU. Add 100 µl of 50% HNO3 solution to the bottle and mix thoroughly. Record weight.

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

4.) For Q3-pH*i* and Q3-C*pH*i*, add HNO_3 or $NaHCO_3$ to adjust pH to desired value.

a.) Adjust pH by adding HNO_3 or $NaHCO_3$ using an Eppendorf micropipet. The amount to be added to each solution is given in Table 1. Record the amount and concentration actually added to each container. Mix well by swirling the solutions.
b.) Re-weigh each container. Record weight.
c.) Replace screw caps, but **do not tighten!** Solutions must be open to atmosphere.
d.) Place bottles on a gyratory shaker at ~120 rpm. Allow at least 10 days for pH equilibration.

5.) Sample Q3-IU to determine initial U concentration for experimental solutions.

a.) Label (e.g., Q3-IUa and Q3-IUb) and pre-weigh 2 liquid scintillation vials each containing 0.5 ml 0.02 M HNO_3.

b.) Using an Eppendorf pipet, withdraw two 0.5 ml samples from Q3-IU and transfer to liquid scintillation vials. Re-weigh vials and record weight.
c.) Add 5 ml of Ultima-Gold cocktail to each vial. Homogenize sample and set aside for LSA.

6.) Measure equilibration pH and U concentration of experimental solutions.

a.) Weigh each solution container, Record weight.
b.) From each solution, withdraw two 0.5 ml samples and transfer into labeled, pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Re-weigh vials and record. Add 5.0 ml of cocktail. Homogenize samples, and set aside for LSA.
c.) Measure and record the pH of each solution. Re-weigh and record weight.
2.5g MA 6-20-94

7.) Add ~~1.0~~ g quartz sand to Q3-pH*i* solutions.

a.) Tare aliquots of Wedron silica sand weighing 1.0 ± 0.001 g onto weighing paper.
b.) Carefully transfer silica to each Q3-pH*i* solution (not the Q3-C*pH*i* solutions). Swirl each bottle. Replace cover loosely. Re-weigh and record. Replace bottles on gyratory shaker at ~120 rpm.

8.) Sample sorption and sorption control solutions for U concentration and pH.

a.) Sample the sorption solutions (Q3-pHi and Q3-C*pH*i*) after ~21 days.
b.) Sample solutions by:
- weighing and recording weight of container
- withdrawing two 0.5 ml aliquots and transferring into labeled, pre-weighed scintillation vials containing 0.5 ml 0.02 M HNO3, re-weighing vials, add 5.0 ml scintillation cocktail, homogenizing, and setting aside vials for LSA.
- measuring pH of each solution, Q3-pH*i* and Q3-C*pH*i*, re-weighing solution containers and replacing bottles on gyratory shaker.

9.) Determine the U concentration of solutions by analyzing sample vials using LSA.

If analytical results are deemed satisfactory, reversibility and reproducibility tests will be performed. The procedure for reversibility and reproducibility experiments will be provided at a later date.

6 June '94 Q3 Sorption Exp. Started:
MA

Polycarbonate containers were labeled accordingly. (These containers were acid washed and dried.)
- The containers were weighed (AE 240)
- 50 g of the 500 ppb U solution was transferred into each individual (tared) container.

Note: Step 2 was excluded.

Sample	wt. of container (g)	wt. of container + U sol'n (g)	wt. of U sol'n (g)
Q3-pH 2	20.2768	70.4710	
Q3-pH 2.25	20.2705	70.3452	
Q3-pH 2.5	20.3265	70.4535	
Q3-pH 2.75	20.2137	70.2905	
Q3-pH 3	20.1818	70.3125	
Q3-C*pH 3	20.1447	70.3872 —	
Q3-pH 3.25	20.1387	70.4023	
Q3-pH 3.5	20.2161	70.3311	
Q3-pH 3.75	20.1119	70.2850	
Q3-pH 4	20.2485	70.4841	

Sample	wt. of container	wt. of container + U sol'n (g)	wt. of U sol'n (g)
Q3-C*pH 4	20.0373	70.1937 —	
Q3-pH 4.25	20.2828	70.3440	
Q3-pH 4.5	20.1128	70.2058	
Q3-pH 4.75	20.2425	70.1285	
Q3-pH 5	20.1844	70.3821	
Q3-C*pH 5	20.2909	70.5318 —	
Q3-pH 5.25	20.2791	70.5646	
Q3-pH 5.5	20.0707	70.2046	
Q3-C*pH 5.5	20.2197	70.3826 —	
Q3-pH 5.75	20.2713	70.4655	
Q3-pH 6	20.1764	70.2733	
Q3-C*pH 6	20.1077	70.2711 —	
Q3-pH 6.25	20.1947	70.4210	
Q3-pH 6.5	20.0900	70.1491	
Q3-C*pH 6.5	20.2529	70.4851 —	
Q3-pH 6.75	20.1935	70.4230	
Q3-pH 7	20.1756	70.3890	
Q3-C*pH 7	20.2052	70.4882 —	
Q3-pH 7.25	20.1125	70.2915	
Q3-pH 7.5	20.2139	70.3358	
Q3-C*pH 7.5	20.2694	70.3963 —	
Q3-pH 7.75	20.0999	70.3030	
Q3-pH 8	20.1006	70.2447	
Q3-C*pH 8	20.3242	70.4207 —	
Q3-pH 8.25	20.1184	70.3149	
Q3-pH 8.5	20.1383	70.3020	
Q3-pH 8.75	20.1160	70.2940	
Q3-pH 9	20.1799	70.4038	
Q3-C*pH 9	20.1912	70.4529 —	
Q3-IU	20.1086	64.8609	

Note: Spike #27A was to be used. Since there was 1861 g of it remaining 139 g of Spike #28A will be added.
- First, a .5 ml sample of #27A and #28A was taken. (for LSA
- Then, ~~139~~ (140.10 g) of #28A was thoroughly mixed with the #27A spike. MA 6-6-94
- A .5 ml sample of this "mix" was taken for LSA.
- The U solution was weighed out (50 g) and transferred to the containers listed.

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Spike #27	7.7909	8.2907	
Spike #28	7.7523	8.2528	
Spike #27+28	7.7201	8.2122	

Table 1. Polycarbonate bottle labels, estimated solution pH, and volume of HNO_3 or $NaHCO_3$ solutions needed for adjustment of pH in 0.1m $NaNO_3$ solutions with 500 ppb U. Amount of reagent needed for pH adjustment was calculated using EQ3 v7.2.

Sample Label	Estimated solution pH	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
Q3-pH2	2	0.567	1
Q3-pH2.25	2.25	0.3	1
Q3-pH2.5	2.5	0.151	1
Q3-pH2.75	2.75	0.067	1
Q3-pH3 Q3-C*pH3	3	0.205	0.1

Sample Label	Estimated solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ to use
Q3-pH3.25	3.25	0.118	0.05
Q3-pH3.5	3.5	0.207	0.1
Q3-pH3.75	3.75	0.291	0.1
Q3-pH4 Q3-C*pH4	4	0.338	0.1
Q3-pH4.25	4.25	0.364	0.1
Q3-pH4.5	4.5	0.379	0.1
Q3-pH4.75	4.75	0.388	0.1
Q3-pH5 Q3-C*pH5	5	0.393	0.1
Q3-pH5.25	5.25	0.396	0.1
Q3-pH5.5 Q3-C*pH5.5	5.5	0.398	0.1
Q3-pH5.75	5.75	0.4	0.1
Q3-pH6 Q3-C*pH6	6	0.403	0.1
Q3-pH6.25	6.25	0.406	0.1
Q3-pH6.5 Q3-C*pH6.5	6.5	0.411	0.1
Q3-pH6.75	6.75	0.42	0.1
Q3-pH7 Q3-C*pH7	7	0.436	0.1
Q3-pH7.25	7.25	0.464	0.1

Sample Label	Estimated solution pH	Volume of $NaHCO_3$ needed, ml	Molarity of $NaHCO_3$ to use
Q3-pH7.5 Q3-C*pH7.5	7.5	0.514	0.1
Q3-pH7.75	7.75	0.121	0.5
Q3-pH8 Q3-C*pH8	8	0.153	0.5
Q3-pH8.25	8.25	0.212	0.5
Q3-pH8.5	8.5	0.32	0.5
Q3-pH8.75	8.75	0.264	1
Q3-pH9 Q3-C*pH9	9	0.473	1

7 JUNE 94 Q3 Sorption Experiment
MA

pH adjustments were made following TABLE 1 (p. 240).
An eppendorf pipet was used.
The actual amounts added and weight of containers AFTER the additions are listed:

Sample	Vol of HNO_3 added (ml)	Molarity	wt. of container AFTER pH adjustment
Q3-pH 2	.570	1	71.0668
Q3-pH 2.25	.300	1	70.6377
Q3-pH 2.5	.150	1	70.6123
Q3-pH 2.75	.065	1	70.3631
Q3-pH 3	.210	.1	70.5961
Q3-C*pH 3	.210	.1	70.5222 —
Sample	**Vol. of $NaHCO_3$ added (ml)**	**Molarity**	**wt. after pH adjustment**
Q3-pH 3.25	.120	0.05	70.5275
Q3-pH 3.5	.210	0.1	70.5477
Q3-pH 3.75	.290	0.1	70.5731
Q3-pH 4	.340	0.1	70.8233
Q3-C*pH 4	.340	0.1	70.5383 —
Q3-pH 4.25	.365	0.1	70.7164
Q3-pH 4.5	.380	0.1	70.5944
Q3-pH 4.75	.385	0.1	70.5143
Q3-pH 5	.390	0.1	70.8163
Q3-C*pH 5	.390	0.1	70.9253 —
Q3-pH 5.25	.395	0.1	70.9683
Q3-pH 5.5	.400	0.1	70.6140
Q3-C*pH 5.5	.400	0.1	70.7852 —
Q3-pH 5.75	.400	0.1	70.8766
Q3-pH 6	.405	0.1	70.6855
Q3-C*pH 6	.405	0.1	70.6869 —
Q3-pH 6.25	.410	0.1	70.8701
Q3-pH 6.5	.415	0.1	70.5792
Q3-C*pH 6.5	.415	0.1	70.8997 —
Q3-pH 6.75	.420	0.1	70.8648
Q3-pH 7	.440	0.1	70.8377
Q3-C*pH 7	.440	0.1	70.9478 —
Q3-pH 7.25	.460	0.1	70.7604

Sample	Vol of $NaHCO_3$ added	Molarity	Wt. of container (after adjustment)
Q3-pH 7.5	.510	0.1	70.8527
Q3-C*pH 7.5	.510	0.1	70.9114 —
Q3-pH 7.75	.120	0.5	70.4496
Q3-pH 8	.150	0.5	70.4208
Q3-C*pH 8	.150	0.5	70.5899 —
Q3-pH 8.25	.210	0.5	70.5626
Q3-pH 8.5	.320	0.5	70.6488
Q3-pH 8.75	.260	1.0	70.5738
Q3-pH 9	.475	1.0	70.9138
Q3-C*pH 9	.475	1.0	70.9506 —

SAMPLE	Vol of 50% HNO_3 added	Wt. (after addition)
Q3-IU	.100	64.9944

After weighing the containers, the caps were placed upon the containers lightly (Not tight) so that the solutions are open to the Atmosphere.

The containers were then placed on a gyratory shaker at 120 rpm. They will be sampled for pH and U concentration in about 10 days.

Q3-IU was sampled to determine initial U concentration.

- 2 .5ml samples were withdrawn and transferred to liquid scintillation vials. (Step 5 of procedure followed; p.237)

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Q3-IU a	7.7604	8.2607	.5003
Q3-IU b	7.7734	8.2713	.4979

These two samples were set aside for LSA.

7 June 94 Q1-K pH and U concentration measured: 8th Day
MA

1. - Sample containers were weighed
2. - 2 .5 ml samples were withdrawn and put in LSA vials
3. - pH of solutions was measured
4. - Sample containers were re-weighed, then placed on gyratory shaker.

Sample	Wt. of container (before pH and sampling)	pH	Temp (°C)
Q1-K*pH 5.5	61.8217	4.76	25.7
Q1-KC*pH 5.5	61.4770	5.02	25.7
Q1-K*pH 6	61.4281	5.25	25.7
Q1-KC*pH 6	61.3833	5.26	25.7°
Q1-K*pH 6.5	61.3562	6.05	25.7°
Q1-KC*pH 6.5	61.2813	6.05	25.7°

AE 240 AE 240

Samples taken at 15:00

Sample	Wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-K*pH 5.5a 8D	7.8011	8.2975	.4964
Q1-K*pH 5.5b 8D	7.7755	8.2730	.4975
Q1-KC*pH 5.5a 8D	7.7727	8.2703	.4976
Q1-KC*pH 5.5b 8D	7.7754	8.2734	.4980
Q1-K*pH 6 a 8D	7.7181	8.2164	.4983
Q1-K*pH 6 b 8D	7.7776	8.2764	.4988
Q1-KC*pH 6a 8D	7.7690	8.2690	.5000
Q1-KC*pH 6b 8D	7.7911	8.2919	.5008
Q1-K*pH 6.5a 8D	7.7623	8.2642	.5019
Q1-K*pH 6.5b 8D	7.7855	8.2844	.4989
Q1-KC*pH 6.5a 8D	7.7414	8.2421	.5007
Q1-KC*pH 6.5b 8D	7.7584	8.2470	.4886

Sample	Wt. (g) - After pH measurement and sampling
Q1-K*pH 5.5	60.8022
Q1-KC*pH 5.5	60.4580
Q1-K*pH 6	60.3957
Q1-KC*pH 6	60.3545
Q1-K*pH 6.5	60.3223
Q1-KC*pH 6.5	60.2523

AE 240

U Sorption on Wedron Silica
Sorption (Q4) Experiment

WRITTEN BY: F.P. Bertetti
REVISION NO.: 0

DATE WRITTEN: June 6, 1994
DATE REVISED: N/A

CONDITIONS:

1.) ΣU= 5 ppb
2.) 0.1 m $NaNO_3$ matrix, equilibrium with atmospheric CO_2(g); $pCO_2=10^{-3.5}$
3.) pH range 2-9
4.) initial solution volume = 50 ml, initial quartz sand mass = ~~1.0 g~~ 1.0g 6-23-94
~~2.5 g~~
~~MA 6-20-94~~
MA 6-23-94

OBJECTIVES:

- To investigate the characteristics of U sorption on quartz sand as a function of solution pH and as a function of solution volume to solid mass ratio. Experimental data will be correlated with uranium aqueous speciation and compared with results of U sorption on clinoptilolite and α-alumina.

- To investigate the reproducibility and reversibility of U sorption reactions.

EQUIPMENT:

Gyratory shaker
Packard liquid scintillation counter
Orion pH/mV/ISE/°C meter
Combination pH electrode
ATC probe
Analytical balances (Mettler 4600 and 240AE)
α, β and γ survey instruments

SUPPLIES:

40	2 oz. polycarbonate bottles (acid washed and dried)
1	2000-ml FEP bottle (acid cleaned and dried)
1	Repipettor for transfer of scintillation cocktail
various	Eppendorf micropipettors for solution transfer
	Eppendorf pipet tips
	pH buffer solutions
	Ultima-Gold liquid scintillation cocktail
	7 ml scintillation vials
	weighing paper
	Wedron silica sand (W510*60/100*UC*RC*RFe*HL)
	reagent grade $NaHCO_3$
	5 ppb U stock solution
	ultrapure water
2L	0.1 m $NaNO_3$ stock solution
	stock solution of 1.0 M HNO_3
	stock solution of 0.1 M HNO_3
	stock solution of 0.02 M HNO_3
	stock solution of 1.0 M $NaHCO_3$
	stock solution of 0.5 M $NaHCO_3$
	stock solution of 0.1 M $NaHCO_3$
	stock solution of 0.05 M $NaHCO_3$
	stock solution of 0.01 M $NaHCO_3$

PROCEDURE:

Special considerations:

- Experimental solutions and sample containers/vials should be weighed at each step. Do not add or subtract contents without weighing before and after each process. Always record weight of solutions.

- When measuring pH, minimize the amount of time the glass electrode is in contact with the U bearing solution. Make sure to rinse the electrode thoroughly before measuring another solution. Take care not to introduce lint particles or other foreign objects into the experimental or sample containers.

- Sample vials should "rest" in the absence of light for at least 24 hours prior to initial analysis to allow for decay of incident radiation pulses.

- Following each sampling period, swipes and frisks of the work area should be performed. If contamination is found, follow the radiological procedures for clean-up, and inform the division radiation safety point of contact (RSPOC). Radioactive solutions may not be disposed of without following all radiation safety guidelines. Do not dispose of any solutions without prior approval of the division RSPOC.

1.) Stock solution preparation

1000 ml stock solution of 1.0 M HNO_3
1000 ml stock solution of 0.1 M HNO_3
1000 ml stock solution of 0.02 M HNO_3
500 ml stock solution of 1.0 M $NaHCO_3$ (42.005 g in 500 ml H_2O)
500 ml stock solution of 0.5 M $NaHCO_3$ (21.003 g in 500 ml H_2O)
500 ml stock solution of 0.1 M $NaHCO_3$ (4.201 g in 500 ml H_2O)
500 ml stock solution of 0.05 M $NaHCO_3$ (2.100 g in 500 ml H_2O)
500 ml stock solution of 0.01 M $NaHCO_3$ (0.4201 g in 500 ml H_2O)

The NaHCO3 solutions should be prepared with *degassed* ultrapure water and stored in tightly capped glass reagent bottles.

2000 ml 0.1 m $NaNO_3$ stock solution (16.999 g in 2000 g H_2O)

2.) Prepare 5 ppb U solution.

a.) On the Mettler 4600 balance, transfer 20 g of 500 ppb U stock solution into a tared 2000 ml FEP bottle.
b.) Dilute with 0.1 m $NaNO_3$ to a total weight of 2000 g.
b.) Cap and label the bottle accordingly (sorption solution).

3.) Add 5 ppb U solution to each experiment container.

a.) Label twenty-nine 2 oz. polycarbonate containers Q4-pH*i* (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
b.) Add 50 g of the 5 ppb U (from the 2000 ml FEP bottle) solution to each container. Record weight.
c.) Label ten 2 oz. polycarbonate containers Q4-C*pH*i (where *i* is the approximate pH of each solution, see Table 1) and pre-weigh. Record weight.
d.) Add 50 g of the 5 ppb U solution to each container. Record weight.
e.) Transfer the remaining (~50 g) 5 ppb U solution into a pre-weighed 2 oz. polycarbonate bottle labeled Q4-IU. Add 100 µl of 50% HNO3 solution to the bottle and mix thoroughly. Record weight.

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

4.) For Q4-pH*i* and Q4-C*pH*i*, add HNO_3 or $NaHCO_3$ to adjust pH to desired value.

a.) Adjust pH by adding HNO_3 or $NaHCO_3$ using an Eppendorf micropipet. The amount to be added to each solution is given in Table 1. Record the amount and concentration actually added to each container. Mix well by swirling the solutions.
b.) Re-weigh each container. Record weight.
c.) Replace screw caps, but **do not tighten!** Solutions must be open to atmosphere.
d.) Place bottles on a gyratory shaker at ~120 rpm. Allow at least 10 days for pH equilibration.

5.) Sample Q4-IU to determine initial U concentration for experimental solutions.

a.) Label (e.g., Q4-IUa and Q4-IUb) and pre-weigh 2 liquid scintillation vials each containing 0.5 ml 0.02 M HNO_3.
b.) Using an Eppendorf pipet, withdraw two 0.5 ml samples from Q4-IU and transfer to liquid scintillation vials. Re-weigh vials and record weight.
c.) Add 5 ml of Ultima-Gold cocktail to each vial. Homogenize sample and set aside for LSA.

6.) Measure equilibration pH and U concentration of experimental solutions.

a.) Weigh each solution container, Record weight.
b.) From each solution, withdraw two 0.5 ml samples and transfer into labeled, pre-weighed scintillation vials containing 0.5 ml of 0.02 M HNO_3. Re-weigh vials and record. Add 5.0 ml of cocktail. Homogenize samples, and set aside for LSA.
c.) Measure and record the pH of each solution. Re-weigh and record weight.

7.) Add 1.0 g quartz sand to Q4-pH*i* solutions.

a.) Tare aliquots of Wedron silica sand weighing 1.0 ± 0.001 g onto weighing paper.
b.) Carefully transfer silica to each Q4-pH*i* solution (not the Q4-C*pH*i* solutions). Swirl each bottle. Replace cover loosely. Re-weigh and record. Replace bottles on gyratory shaker at ~120 rpm.

8.) Sample sorption and sorption control solutions for U concentration and pH.

a.) Sample the sorption solutions (Q4-pHi and Q4-C*pH*i*) after ~21 days.
b.) Sample solutions by:
- weighing and recording weight of container
- withdrawing two 0.5 ml aliquots and transferring into labeled, pre-weighed scintillation vials containing 0.5 ml 0.02 M HNO_3, re-weighing vials, add 5.0 ml scintillation cocktail, homogenizing, and setting aside vials for LSA.
- measuring pH of each solution, Q4-pH*i* and Q4-C*pH*i*, re-weighing solution containers and replacing bottles on gyratory shaker.

9.) Determine the U concentration of solutions by analyzing sample vials using LSA.

If analytical results are deemed satisfactory, reversibility and reproducibility tests will be performed. The procedure for reversibility and reproducibility experiments will be provided at a later date.

8 June 94 MA

Q4 Experiment Started.

Procedure:

Step 2) Prepared 5 ppb U solution.
a. transferred 19.98 g of 500 ppb (spike #23A) into a tared 2000 ml POLYCARBONATE Bottle.
b. Diluted with .1m $NaNO_3$ to 2000 g.

Step 3) Containers were acid cleaned and dried, then weighed on AE 240. Containers were labeled accordingly.
- On Mettler 4600 balance, about 50 g of the 5 ppb U solution was transferred to each container.
- The containers were then weighed out on the AE 240 balance:

Sample	wt. of empty container	wt. of container + U solution	wt. of U solution
Q4-pH 2	20.1918	70.4231	50.2313
Q4-pH 2.25	20.1660	70.2819	50.1159
Q4-pH 2.5	20.2314	70.3977	50.1663
Q4-pH 2.75	20.2101	70.4288	50.2187
Q4-pH 3	20.2590	70.4088	50.1498
Q4-C*pH 3	20.2645	70.4921 —	50.2276

Sample	Wt. of Empty Container	Wt. of container + U solution	Wt. of U solution
Q4-pH 3.25	20.2672	70.5001	50.2329
Q4-pH 3.5	20.2122	70.4321	50.2199
Q4-pH 3.75	20.1973	70.3294	50.1321
Q4-pH 4	20.2606	70.4642	50.2036
Q4-C*pH 4	20.1972	70.3728 —	50.1756
Q4-pH 4.25	20.1048	70.2216	50.1168
Q4-pH 4.5	20.1451	70.2558	50.1107
Q4-pH 4.75	20.1840	70.2764	50.0924
Q4-pH 5	20.2022	70.3728	50.1706
Q4-C*pH 5	20.2203	70.2749 —	50.0546
Q4-pH 5.25	20.1034	70.2102	50.1068
Q4-pH 5.5	20.2965	70.4203	50.1238
Q4-C*pH 5.5	20.1730	70.3272 —	50.1542
Q4-pH 5.75	MA 6-8-94 ~~20.22~~ 20.2169	70.2976	50.0807
Q4-pH 6	20.2218	70.3425	50.1207
Q4-C*pH 6	20.1292	70.1769 —	50.0477
Q4-pH 6.25	20.2982	70.5640	50.2658
Q4-pH 6.5	20.2149	70.3657	50.1508
Q4-C*pH 6.5	20.2816	70.4468 —	50.1652
Q4-pH 6.75	20.2031	70.3716	
Q4-pH 7	20.1468	70.3376	
Q4-C*pH 7	20.1550	70.3893 —	
Q4-pH 7.25	20.1180	70.3025	
Q4-pH 7.5	20.1909	70.4261	
Q4-C*pH 7.5	20.1417	70.3148 —	
Q4-pH 7.75	20.2673	70.4087	
Q4-pH 8	20.1668	70.3545	
Q4-C*pH 8	20.3466	70.4683 —	
Q4-pH 8.25	20.1910	70.2591	
Q4-pH 8.5	20.3212	70.3972	
Q4-pH 8.75	20.1476	70.2814	
Q4-pH 9	20.3903	70.5171	
Q4-C*pH 9	20.2501	70.3386 —	

	wt. of Empty Container	wt. of Container + U sol'n	wt. of U sol'n (g)
Q4-IU	20.2865	69.3968	

(from previous page)

	wt (g)	wt. (g) After Adding 100ml of 50% HNO_3
Q4-IU	68.3968	69.5162

step 5) Sampled Q4-IU to determine intial U concentration

b) withdrew two .5 ml samples from Q4-IU, and transferred to LSA vials. (pre-weighed).
- re-weighed
- added 5 ml of Ultima-Gold cocktail to each vial.
* Re-weighed Q4-IU container.

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Q4-IUa	7.8126	8.3151	.5025
Q4-IUb	7.7566	8.2570	.5004

The containers were capped tightly because pH adjustment will be made later.

* Q4-IU container wt after sampling: 68.5133 g. (AE 240)

9 June 94
MA

Q4 Sorption Experiment

pH Adjustments were made following TABLE 1. The actual amounts added and the weight of each container is listed.

Table 1. Polycarbonate bottle labels, estimated solution pH, and volume of HNO_3 or $NaHCO_3$ solutions needed for adjustment of pH in 0.1m $NaNO_3$ solutions with 5 ppb U. Amount of reagent needed for pH adjustment was calculated using EQ3 v7.2.

Sample Label	Estimated solution pH	Volume of HNO_3 needed, ml	Molarity of HNO_3 to use
Q4-pH2	2	0.606	1
Q4-pH2.25	2.25	0.34	1
Q4-pH2.5	2.5	0.19	1
Q4-pH2.75	2.75	0.107	1
Q4-pH3 Q4-C*pH3	3	0.06	1
Q4-pH3.25	3.25	0.335	0.1
Q4-pH3.5	3.5	0.187	0.1
Q4-pH3.75	3.75	0.103	0.1
Q4-pH4 Q4-C*pH4	4	0.281	0.02
Q4-pH4.25	4.25	0.149	0.02
Q4-pH4.5	4.5	0.075	0.02
Q4-pH4.75	4.75	0.653	0.001
Q4-pH5 Q4-C*pH5	5	0.168	0.001
Q4-pH5.25	5.25	0.123	0.001
Q4-pH5.5 Q4-C*pH5.5	5.5	0.321	0.001
Q4-pH5.75	5.75	0.492	0.001
Q4-pH6 Q4-C*pH6	6	0.139	0.005
Q4-pH6.25	6.25	0.2	0.005
Q4-pH6.5 Q4-C*pH6.5	6.5	0.301	0.005
Q4-pH6.75	6.75	0.478	0.005
Q4-pH7 Q4-C*pH7	7	0.396	0.01
Q4-pH7.25	7.25	0.135	0.05
Q4-pH7.5 Q4-C*pH7.5	7.5	0.234	0.05
Q4-pH7.75	7.75	0.412	0.05
Q4-pH8 Q4-C*pH8	8	0.367	0.1
Q4-pH8.25	8.25	0.132	0.5
Q4-pH8.5	8.5	0.241	0.5
Q4-pH8.75	8.75	0.448	0.5
Q4-pH9 Q4-C*pH9	9	0.433	1

* Wt. of container was taken after pH adjustments were made

Sample	Actual Vol of HNO_3 added (ml)		Molarity	Wt. of container
Q4-pH 2	.610		1.0	71.0464
Q4-pH 2.25	.340		1.0	70.6298
Q4-pH 2.5	.190		1.0	70.5846
Q4-pH 2.75	.110		1.0	70.5308
Q4-pH 3	.060		1.0	70.4643
Q4-C*pH 3	.060		1.0	70.5374
Q4-pH 3.25	.335		.1	70.8151
Q4-pH 3.5	.190		.1	70.6211
Q4-pH 3.75	.100		.1	70.4288
Q4-pH 4	.280		.02	70.7668
Q4-C*pH 4	.280		.02	70.6482
Q4-pH 4.25	.150		.02	70.3729
Q4-pH 4.5	.075		.02	70.3264
Q4-pH 4.75	.650		.002	70.9158
Q4-pH 5	.170		.001	70.5412
Q4-C*pH 5	.170		.001	70.4424
Q4-pH 5.25	.125	(Vol of $NaHCO_3$ Added) →	.001	70.3313
Q4-pH 5.5	.320	←	.001	70.7322 → ~~70.6788~~
Q4-C*pH 5.5	.320		.001	70.6288
Q4-pH 5.75	.495		.001	70.7873

Sample	Actual Vol of $NaHCO_3$ added (ml)	Molarity	Wt. of Container (g) After pH Adjustment
Q4-pH 6	.140	.005	70.4796
Q4-C*pH 6	.140	.005	— 70.3199
Q4-pH 6.25	.200	.005	70.7669
Q4-pH 6.5	.300	.005	70.6697
Q4-C*pH 6.5	.300	.005	— 70.7502
Q4-pH 6.75	.480	.005	70.8619
Q4-pH 7	.400	.01	70.7350
Q4-C*pH 7	.400	.01	— 70.7860
Q4-pH 7.25	.135	.05	70.4309
Q4-pH 7.5	.235	.05	70.6722
Q4-C*pH 7.5	.235	.05	— 70.5364
Q4-pH 7.75	.410	.05	70.8239
Q4-pH 8	.370	.1	70.7428
Q4-C*pH 8	.370	.1	— 70.8390
Q4-pH 8.25	.135	.5	70.4018
Q4-pH 8.5	.240	.5	70.6453
Q4-pH 8.75	.450	.5	70.7562
Q4-pH 9	.435	1.0	70.9786 ~~70.98~~ MA 6-9-94
Q4-C*pH 9	.435	1.0	— 70.7969

After weighing the containers, the caps were placed on the containers (Not tightened) and the containers were set on a gyratory shaker at 120 rpm. for at least 10 DAYS for pH equilibration.

10 JUNE 94
MA

Q1-K Kinetics : Sampling on 12th DAY.

Q1-K pH and U concentration was done today (11th day) instead of tomorrow. The following procedures were done:

1. Q1-K sample containers were weighed
2. Two .5 ml samples were withdrawn and transferred to labeled (and pre-weighed) L.S.A vials.
3. pH of sample solutions was measured.
4. Sample containers were weighed again, then placed on a gyratory shaker @ 120 rpm. (Caps were fitted on loosely.)

Sample	Wt. of container before sampling procedures (g)	pH	Temp (°C)
Q1-K*pH 5.5	60.6333	4.74	24.2°
Q1-KC*pH 5.5	60.3207	4.97	24.2°
Q1-K*pH 6	60.2487	5.18	24.2°
Q1-KC*pH 6	60.2077	5.19	24.2°
Q1-K*pH 6.5	60.1419	5.98	24.2°
Q1-KC*pH 6.5	60.2324	5.97	24.3°

Samples were withdrawn at 14:10

Sample		Wt. of vial (g)	Wt. of vial + sample	Wt. of sample (g)
Q1-K*pH 5.5a	12D	7.7926	8.2919	.4993
Q1-K*pH 5.5b	12D	MA 6-10-94 ~~7.78~~ 7.7795	8.2797	.5002
Q1-KC*pH 5.5a	12D	7.7966	8.2945	MA 6-10-94 ~~.34976~~ .4979
Q1-KC*pH 5.5b	12D	7.7937	8.2877	.4940
Q1-K*pH 6a	12D	7.8165	8.3150	.4985
Q1-K*pH 6b	12D	7.7933	8.2943	.5010
Q1-KC*pH 6a	12D	7.8133	8.3135	.5002
Q1-KC*pH 6b	12D	7.7590	8.2588	.4998
Q1-K*pH 6.5a	12D	7.8313	8.3303	.4990
Q1-K*pH 6.5b	12D	7.7395	8.2401	.5006
Q1-KC*pH 6.5a	12D	7.7726	8.2734	.5008
Q1-KC*pH 6.5b	12D	7.7457	8.2470	.5013

After taking samples and measuring pH, the sample containers were weighed on AE 240 balance.

Sample	Weight (g)
Q1-K*pH 5.5	59.6153
Q1-KC*pH 5.5	59.2972
Q1-K*pH 6	59.2083
Q1-KC*pH 6	59.1614
Q1-K*pH 6.5	59.2104
Q1-KC*pH 6.5	59.0983

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10 Jun 94
PB

Sampling of W3/membrane desorption solutions

- The W3-5 and W3-50 solution containers have reacted with acidified U solution for ~7 days. Also, the W3-MAR, etc containers with membrane in HNO_3 have reacted for ~7 days. All containers will be weighed, sampled in duplicate and reweighed. Samples will be processed for LSA to determine U content.

exp soln.	weight (g)	sample	wt. after sample s (g)	spot check pH
W3-50A	63.6138	✓ ✓	62.6221	2.70
W3-50B	63.1425	✓ ✓	62.1498	—
W3-50C	63.1577	✓ ✓	62.1641	2.68
W3-50D	63.4939	✓ ✓	62.5021	—
W3-5A	62.1874	✓ ✓	61.1900	—
W3-5B	63.2455	✓ ✓	62.2561	2.60
W3-5C	63.5813	✓ ✓	62.5866	2.70
W3-5D	64.1454	✓ ✓	63.1471	—
W3-50 MAR	65.0326	✓ ✓	64.0362	2.72
W3-50 MBR	65.1030	✓ ✓	64.1098	—
W3-50 MCR	64.6504	✓ ✓	63.6588	2.75
W3-50 MDR	65.0258	✓ ✓	64.0360	—
W3-5 MAR	65.4366	✓ ✓	64.4396	—
W3-5 MBR	65.1384	✓ ✓	64.1475	—
W3-5 MCR	64.~~7770~~ 7710 PB	✓ ✓	63.8007	—
W3-5 MDR	64.7835	✓ ✓	63.7900	—

10 Jun 94
PB

Sampling of W3/membrane solutions cont'd

Sample	vial wt (g)	vial + sample (g)
50-MA6	7.7542	8.2464
50-MA7	7.7493	8.2456
50-MB6	7.7912	8.2859
50-MB7	7.7644	8.2591
50-MC6	7.7839	8.2792
50-MC7	7.7546	8.2499
50-MD6	7.7661	8.2581
50-MD7	7.7844	8.2821
5-MA6	7.7607	8.2538
5-MA7	7.8071	8.3041
5-MB6	7.7813	8.2737
5-MB7	7.8079	8.3032
5-MC6	7.8113	8.3063
5-MC7	7.8422	8.3394
5-MD6	7.7923	8.2912
5-MD7	7.7995	8.2970
50-MAR1	7.7495	8.2439
50-MAR2	7.7768	8.2734
50-MBR1	7.8029	8.3002
50-MBR2	7.7877	8.2843
50-MCR1	7.8544	8.3489
50-MCR2	7.8015	8.2964
50-MDR1	7.7859	8.2790
50-MDR2	7.8107	8.3045
5-MAR1	7.8308	8.3280
5-MAR2	7.7632	8.2607
5-MBR1	7.8022	8.2958
5-MBR2	7.7967	8.2921
5-MCR1	7.8162	8.3061
5-~~MBR2~~ MCR2 PB	7.7676	8.2436
5-MDR1	7.8084	8.3040
5-MDR2	7.7083	8.2045

13 June 94
MA

Q2 Sorption Exp. (Continued)

From p. 200 (6C-09), Step 8 of the procedure listed (p. 200) was performed. Solutions were sampled for U concentration and pH.

1. Sample containers were weighed.
2. Two .5 ml aliquots of the solution was transferred into pre-weighed LSA vials, 5 mls of Ultima-Gold organic cocktail was added to each vial, then vials were set aside for LSA.
3. pH of each solution was measured.
4. Sample containers were then re-weighed, and placed on the gyratory shaker @ 120 rpm.

Sample	Wt(g). before sampling and pH measurement	pH	Temp (°C)	Wt.(g) after sampling and pH measurement
Q2-pH 2	69.5557	1.96	23.5°	68.5243
Q2-pH 2.25	69.0964	2.21	23.5°	68.0515
Q2-pH 2.5	69.2507	2.46	23.5°	MA 6-13-94 ~~68.17~~ 68.1803
Q2-pH 2.75	69.3379	2.74	23.5°	68.2515
Q2-pH 3	69.5046	2.97	23.6°	68.4669
Q2-C*pH 3	68.6569	2.98	23.6°	67.6402
Q2-pH 3.25	69.7127	3.23	23.7°	68.6802
Q2-pH 3.5	69.1045	3.45	23.7°	68.0687
Q2-pH 3.75	68.9135	3.74	23.7°	67.8897
Q2-pH 4	69.3759	3.99	23.7°	68.2652
Q2-C*pH 4	68.4036	3.93	23.7°	67.3193
Q2-pH 4.25	69.0253	4.14	23.7°	67.9182
Q2-pH 4.5	69.3665	4.41	23.7°	68.2856
Q2-pH 4.75	68.9571	4.71	23.7°	67.9180
Q2-pH 5	69.0554	4.86	23.7°	68.0221
Q2-C*pH 5	68.5752	4.92	23.7°	67.5452
Q2-pH 5.25	69.6093	4.70	23.7°	68.5398
Q2-pH 5.5	69.2040	5.07	23.7°	68.1861
Q2-C*pH 5.5	68.5349	4.92	23.7°	67.4723
Q2-pH 5.75	68.9466	5.19	23.7°	67.9051
Q2-pH 6	68.9887	5.38	23.9°	67.9612
Q2-C*pH 6	68.6428	5.70	24.0°	67.6112
Q2-pH 6.25	69.5099	5.39	24.0°	68.4376
Q2-pH 6.5	68.6369	6.12	24.1°	67.6061
	AE 240			AE 240

Sample	Wt. before sampling and pH measurement (g)	pH	Temp	Wt. after sampling and pH measurement (g)
Q2-C* pH 6.5	68.3363	6.20	24.1°	67.3124
Q2-pH 6.75	68.9046	6.43	24.2°	67.8723
Q2-pH 7	69.0894	6.81	24.3°	68.0125
Q2-C*pH 7	68.1755	6.76	24.4°	67.1284
Q2-pH 7.25	69.4990	7.12	24.5°	68.4514
Q2-pH 7.5	68.9601	7.38	24.6°	67.9128
Q2-C*pH 7.5	68.4315	7.37	24.6°	67.3836
Q2-pH 7.75	69.1196	7.64	24.7°	68.0983
Q2-pH 8	69.7566	7.91	24.7°	68.7099
Q2-C*pH 8	68.5494	7.90	24.7°	67.5124
Q2-pH 8.25	68.6181	8.16	24.7°	67.5918
Q2-pH 8.5	69.6113	8.45	24.6°	68.5905
Q2-pH 8.75	69.5956	8.68	24.6°	68.5874
Q2-pH 9	69.8029	8.95	24.6°	68.7859
Q2-C*pH 9	68.6572	8.94	24.6°	67.6421

Sample	Wt. of vial (g)	Wt. of vial + sample	Wt. of sample (g)
Q2-pH 2a	7.7938	8.2971	
Q2-pH 2b	7.7922	8.2942	
Q2-pH 2.25 a	7.7795	8.2796	
Q2-pH 2.25 b	7.7856	8.2863	
Q2-pH 2.5 a	7.7953	8.2934	
Q2-pH 2.5 b	7.7748	8.2733	
Q2-pH 2.75 a	7.8044	8.2999	
Q2-pH 2.75 b	7.8101	8.3070	
Q2-pH 3 a	7.8089	8.3054	
Q2-pH 3 b	7.7187	8.2152	
Q2-C*pH 3 a	7.7964	8.2930	
Q2-C*pH 3 b	7.7977	8.2926	
Q2-pH 3.25 a	7.7695	8.2678	
Q2-pH 3.25 b	7.7517	8.2501	
Q2-pH 3.5 a	7.7531	8.2498	
Q2-pH 3.5 b	7.7923	8.2888	
Q2-pH 3.75 a	7.7942	8.2905	
Q2-pH 3.75 b	7.7740	8.2701	

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Q2-pH 4 a	7.8209	8.3212	
Q2-pH 4 b	7.7303	8.2311	
Q2-C*pH 4 a	7.7730	8.2753	
Q2-C*pH 4 b	7.8032	8.3043	
Q2-pH 4.25 a	7.8278	8.3278	
Q2-pH 4.25 b	7.8477	8.3487	
Q2-pH 4.5 a	7.7742	8.2772	
Q2-pH 4.5 b	7.7874	8.2878	
Q2-pH 4.75 a	7.7762	8.2752	
Q2-pH 4.75 b	7.8470	8.3461	
Q2-pH 5 a	7.7815	8.2795	
Q2-pH 5 b	7.8031	8.3007	
Q2-C*pH 5 a	7.8197	8.3164	
Q2-C*pH 5 b	7.7809	8.2789	
Q2-pH 5.25 a	7.7439	8.2396	
Q2-pH 5.25 b	7.7281	8.2232	
Q2-pH 5.5 a	7.8134	8.3099	
Q2-pH 5.5 b	7.7709	8.2666	
Q2-C*pH 5.5 a	7.7968	8.2943	
Q2-C*pH 5.5 b	7.7788	8.2755	
Q2-pH 5.75 a	7.7968	8.2960	
Q2-pH 5.75 b	7.7984	8.2964	
Q2-pH 6 a	7.7806	8.2790	
Q2-pH 6 b	7.7591	8.2571	
Q2-C*pH 6 a	7.7981	8.2947	
Q2-C*pH 6 b	7.7355	8.2335	
Q2-pH 6.25 a	7.7920	8.2788	
Q2-pH 6.25 b	7.8167	8.3157	
Q2-pH 6.5 a	7.8165	8.3088	
Q2-pH 6.5 b	7.7892	8.2908	
Q2-C*pH 6.5 a	7.7949	8.2952	
Q2-C*pH 6.5 b	7.7775	8.2656	
Q2-pH 6.75 a	7.8255	8.3260	
Q2-pH 6.75 b	7.7098	8.2113	
Q2-pH 7 a	7.7323	8.2307	
Q2-pH 7 b	7.8171	8.3139	

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (g)
Q2-C*pH 7 a	7.7832	8.2712	
Q2-C*pH 7 b	7.7593	8.2552	
Q2-pH 7.25 a	7.7768	8.2660	
Q2-pH 7.25 b	7.8022	8.3005	
Q2-pH 7.5 a	7.7483	8.2484	
Q2-pH 7.5 b	7.7851	8.2825	
Q2-C*pH 7.5 a	7.7279	8.2237	
Q2-C*pH 7.5 b	7.7211	8.2139	
Q2-pH 7.75 a	7.8045	8.3012	
Q2-pH 7.75 b	7.8105	8.3067	
Q2-pH 8 a	7.8090	8.3021	
Q2-pH 8 b	7.7220	8.2153	
Q2-C*pH 8 a	7.7410	8.2380	
Q2-C*pH 8 b	7.7797	8.2760	
Q2-pH 8.25 a	7.8014	8.2965	
Q2-pH 8.25 b	7.7419	8.2345	
Q2-pH 8.5 a	7.8166	8.3086	
Q2-pH 8.5 b	7.8467	8.3354	
Q2-pH 8.75 a	MA 6-13-94 ~~7.75~~ 7.7999	8.2940	
Q2-pH 8.75 b	7.7965	8.2866	
Q2-pH 9 a	7.8127	8.3016	
Q2-pH 9 b	7.7741	8.2654	
Q2-C*pH 9 a	7.8241	8.3161	
Q2-C*pH 9 b	7.8006	8.2906	

15 June 94 Q1-K Kinetics : 16 Day Interval Sampling
MA pH and U concentration measurement was done:

1) Q1-K sample containers were weighed (AE 240)
2) Two .5 ml aliquots were withdrawn and transferred to pre-weighed, labeled L.S.A vials.
3) pH was taken
4) Sample containers were weighed again, then placed on a gyratory shaker at 120 rpm. (Caps were fitted on loosely).

Sample	Wt. of container before sampling procedures (g)	pH	Temp (°C)
Q1-K*pH 5.5	59.4594 ~~59.1652~~ MA 6-15-94	4.70	22.9°
Q1-KC*pH 5.5	59.1647 ~~59.4594~~ MA 6-15-94	4.91	22.9°
Q1-K*pH 6	59.0279	5.11	22.9°
Q1-KC*pH 6	58.9728	5.12	22.9°
Q1-K*pH 6.5	59.0727	5.86	23.0°
Q1-KC*pH 6.5	58.9997	5.88	23.0°

Samples were withdrawn at: 15:10

Sample		wt. of vial (g)	wt. of vial + sample (g)	wt. of sample
1-K*pH 5.5a	16D	7.8223	8.3257	
1-K*pH 5.5b	16D	7.7949	8.3008	
-KC*pH 5.5a	16D	7.8321	8.3305	
1-KC*pH 5.5b	16D	7.8545	8.3567	
-K*pH 6a	16D	7.7614	8.2593	
-K*pH 6b	16D	7.7806	8.2816	
-KC*pH 6a	16D	7.7790	8.2746	
1-KC*pH 6b	16D	7.7965	8.2963	
-K*pH 6.5a	16D	7.7809	8.2793	
-K*pH 6.5b	16D	7.7925	8.2905	
-KC*pH 6.5a	16D	7.8409	8.3349	
1-KC*pH 6.5b	16D	7.7635	8.2611	

After taking samples and measuring pH, the sample containers were weighed:

Sample	Wt. (g)
Q1-K*pH 5.5	58.4230
Q1-KC*pH 5.5	58.1247
Q1-K*pH 6	57.9992
Q1-KC*pH 6	57.9500
Q1-K*pH 6.5	58.0480
Q1-KC*pH 6.5	57.9807

17 June '94 Q1 Sorption Experiment (Continued)
MA

Following STEP 9 from the procedure posted on p. 190 (6C-09), the Q1-pH: solutions were sampled for U concentration and pH was measured:

1) sample containers weighed
2) Two .5 ml aliquots of the solution was transferred into pre-weighed LSA vials; 5 mls of Ultima-Gold was added, to each vial, vials set aside for LSA.
3) pH of each solution was taken
4) sample containers were re-weighed, and placed on gyratory shaker @ 120 rpm.

Sample	initial wt. of container (g)	pH	Temp	wt. of container after sampling and pH measurement
Q1-pH2	68.4927	1.95	23.7°	67.4583
Q1-pH2.25	68.3854	2.19	23.7°	67.3565
Q1-pH 2.5	68.3207	2.44	23.7°	67.2999
Q1-pH 2.75	68.1386	2.70	23.8°	67.0814
Q1-pH 3	68.3988	2.93	23.8°	67.3654
MA 6-17-94 ~~Q1-pH 3.25~~ Q1-C*pH3	68.4046	2.94	23.8°	67.3800
~~Q1-pH 3.5~~ Q1-pH3.25 MA 6-17-94	67.9124	3.17	23.8°	66.8876
~~Q1-pH 3.75~~ Q1-pH 3.5 MA 6-17-94	68.3899	3.41	23.8°	67.2057
~~Q1-pH 4~~ Q1-pH 3.75 MA 6-17-94	68.0467	3.60	23.8°	67.0058
~~Q1-C*pH 4~~ MA 6-17-94 Q1-pH4	68.0962	3.80	23.8°	67.0583
~~Q1-pH 4.25~~ MA Q1-C*pH4	68.1235	3.80	23.8°	67.0970
~~Q1-pH 4.5~~ MA 6-17-94 Q1-pH4.25	68.4661	4.24	23.8°	67.4306
Q1-pH 4.5	68.5342	4.38	23.8°	67.4999
Q1-pH 4.75	68.1642	4.50	23.8°	67.1115
Q1-pH 5	68.4118	4.60	23.8°	67.3186
Q1-C*pH 5	68.1952	4.61	23.8°	67.1476
Q1-pH 5.25	68.1761	4.80	23.9°	67.1512
Q1-pH 5.5	68.5939	4.81	23.9°	67.5553
Q1-C*pH 5.5	68.6879	4.82	23.9°	67.6575
Q1-pH 5.75	68.5268	4.98	23.9°	67.4835
Q1-pH 6	68.8587	5.01	23.9°	67.8225
Q1-C*pH 6	68.1289	5.01	23.9°	67.0929
Q1-pH 6.25	68.7548	5.26	23.9°	67.6223
Q1-pH 6.5	68.2063	5.68	23.9°	67.0268

AE 240 AE 240

Sample	initial wt of container (g)	pH	Temp (°C)	Wt. of container after sampling and pH measurement (g)
)1-C*pH 6.5	68.3106	5.71	23.9°	67.2138
Q1-pH 6.75	68.5631	6.40	24.0°	67.4872
Q1-pH 7	68.6300	6.71	24.0°	67.5541
1-C*pH 7	68.2690	6.72	24.0°	67.2071
)1-pH 7.25	68.2279	6.96	24.1°	67.1740
Q1-pH 7.5	68.4633	7.31	24.7°	67.3650
)1-C*pH 7.5	67.9727	7.32	24.7°	66.9228
)1-pH 7.75	68.0051	7.62	24.8°	66.9055
Q1-pH 8	67.9601	7.91	24.9°	66.8938
1-C*pH 8	67.9834	7.90	24.9°	66.8933
)1-pH 8.25	68.1301	8.21	24.9°	67.0794
Q1-pH 8.5	67.9349	8.53	24.9°	66.8535
Q1-pH 8.75	68.5124	8.73	24.9°	67.4625
Q1-pH 9	68.0787	8.96	25.0°	67.0361
)1-C*pH 9	68.2006	8.97	25.0	67.1636

SAMPLE	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
)1-pH 2a	7.7057	8.2094	
)1-pH 2b	7.7187	8.2214	
)1-pH 2.25a	7.6900	8.1905	
)1-pH 2.25b	7.6350	8.1357	
Q1-pH 2.5a	7.6931	8.1928	
Q1-pH 2.5b	7.6769	8.1768	
Q1-pH 2.75a	7.6930	8.1924	
Q1-pH 2.75b	7.7164	8.2177	
Q1-pH 3a	7.7118	8.2110	
Q1-pH 3b	7.7268	8.2266	
)1-C*pH 3a	7.6559	8.1545	
)1-C*pH 3b	7.7201	8.2190	
Q1-pH 3.25a	7.6667	8.1640	
Q1-pH 3.25b	7.6715	8.1695	
Q1-pH 3.5a	7.7144	8.2153	
Q1-pH 3.5b	7.6614	8.1637	
Q1-pH 3.75a	7.7179	8.2186	
Q1-pH 3.75b	7.6886	8.1878	
Q1-pH 4a	7.6681	8.1684	
	AE 240	AE 240	

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (g)
Q1-pH 4b	7.7220	8.2212	
Q1-C*pH 4a	7.6805	8.1806	
Q1-C*pH 4b	7.7214	8.2224	
Q1-pH 4.25a	7.7470	8.2463	
Q1-pH 4.25b	7.6883	8.1892	
Q1-pH 4.5a	7.7017	8.2011	
Q1-pH 4.5b	7.7100	8.2103	
Q1-pH 4.75a	7.7104	8.2103	
Q1-pH 4.75b	7.7084	8.2086	
Q1-pH 5a	7.6971	8.1961	
Q1-pH 5b	7.6485	8.1497	
Q1-C*pH 5a	7.6960	8.1940	
Q1-C*pH 5b	MA 6-17-94 ~~7.75~~ 7.7488	8.2470	
Q1-pH 5.25a	7.7141	8.2145	
Q1-pH 5.25b	7.7149	8.2141	
Q1-pH 5.5a	7.6818	8.1831	
Q1-pH 5.5b	7.6874	8.1888	
Q1-C*pH 5.5a	7.7367	8.2362	
Q1-C*pH 5.5b	7.7266	8.2266	
Q1-pH 5.75a	7.6899	8.1925	
Q1-pH 5.75b	7.7175	8.2201	
Q1-pH 6a	7.6829	8.1831	
Q1-pH 6b	7.6699	8.1699	
Q1-C*pH 6a	7.7289	8.2309	
Q1-C*pH 6b	7.7143	8.2155	
Q1-pH 6.25a	7.7036	8.2062	
Q1-pH 6.25b	7.7366	8.2379	
Q1-pH 6.5a	7.6754	8.1767	
Q1-pH 6.5b	7.7195	8.2199	
Q1-C*pH 6.5a	7.7158	8.2175	
Q1-C*pH 6.5b	7.7328	8.2336	
Q1-pH 6.75a	7.7471	8.2481	
Q1-pH 6.75b	7.7212	8.2209	
Q1-pH 7a	7.7392	8.2377	
Q1-pH 7b	7.7032	8.2022	
Q1-C*pH 7a	7.7272	8.2232	
	AE 240	AE 240	

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MA

SAMPLE	wt. of vial	wt. of vial + sample	wt. of sample
1-C*pH 7 b	7.7369	8.2355	
1-pH 7.25 a	7.6572	8.1558	
1-pH 7.25 b	7.7268	8.2262	
1-pH 7.5 a	7.7241	8.2231	
1-pH 7.5 b	7.6843	8.1813	
1-C*pH 7.5 a	7.6727	8.1700	
1-C*pH 7.5 b	7.7486	8.2497	
1-pH 7.75 a	7.6651	8.1643	
1-pH 7.75 b	7.7125	8.2128	
1-pH 8 a	7.7308	8.2314	
1-pH 8 b	7.7093	8.2107	
1-C*pH 8 a	7.7071	8.2074	
1-C*pH 8 b	7.7217	8.2220	
1-pH 8.25 a	7.7147	8.2137	
1-pH 8.25 b	7.7481	8.2490	
1-pH 8.5 a	7.6851	8.1852	
1-pH 8.5 b	7.7215	8.2197	
1-pH 8.75 a	7.7177	8.2154	
1-pH 8.75 b	7.7399	8.2394	
Q1-pH 9 a	7.7141	8.2123	
1-pH 9 b	7.6840	8.1830	
1-C*pH 9 a	7.7485	8.2465	
1-C*pH 9 b	7.2041	7.7031	
	AE 240	AE 240	

20 June 94
MA

Kinetics: 21 Day Sampling Interval
pH and K concentration measurements done:
1. Q1-K sample containers were weighed.
2. Two .5 ml aliquots of sample solution was ~~weighed~~ MA 6-20-94 withdrawn and transferred into pre-weighed, labeled, LSA vials.
3. pH was measured
4. sample containers were re-weighed.

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MA

Sample	wt. of container before sampling procedures (g)	pH	Temp (°C)
Q1-K*pH 5.5	58.2222	4.71	25.0°
Q1-KC*pH 5.5	57.9495	4.87	25.0°
Q1-K*pH 6	57.7782	5.03	25.1°
Q1-KC*pH 6	57.6654	5.04	25.1°
Q1-K*pH 6.5	57.9068	5.76	25.1°
Q1-KC*pH 6.5	57.7562	5.77	25.1°
	AE 240		

Samples were withdrawn AT

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q1-K*pH 5.5 a 21D	MA 6-20-94 ~~7.7~~ 7.6998	8.1984	
Q1-K*pH 5.5 b 21D	7.6887	8.1897	
Q1-KC*pH 5.5 a 21D	7.6920	8.1927	
Q1-KC*pH 5.5 b 21D	7.7056	8.2063	
Q1-K*pH 6 a 21D	7.7107	8.2078	
Q1-K*pH 6 b 21D	7.6977	8.1948	
Q1-KC*pH 6 a 21D	7.7079	8.2051	
Q1-KC*pH 6 b 21D	7.7185	8.2175	
Q1-K*pH 6.5 a 21D	7.7781	8.2755	
Q1-K*pH 6.5 b 21D	7.7346	8.2324	
Q1-KC*pH 6.5 a 21D	7.6996	8.1932	
Q1-KC*pH 6.5 b 21D	7.7382	8.2323	

After taking samples and measuring pH, the sample containers were weighed:

Sample	wt. (g)
Q1-K*pH 5.5	57.1967
Q1-KC*pH 5.5	56.9154
Q1-K*pH 6	56.7574
Q1-KC*pH 6	56.6482
Q1-K*pH 6.5	56.8818
Q1-KC*pH 6.5	56.7346
	AE 240

21 June '94
MA

Sorption (Q3) Experiment (Continued)

Beginning with step 6 of the procedure posted on p. 238 (6C-09), equilibration pH and U concentration were measured, and 2.5 g of W510 * 60/100 * uc * RC * RFe * HL sand was added to Q3-pH: solutions:

1) Sample containers were weighed on AE 240
2) Two .5 ml aliquots of each solution was transferred into a pre-weighed LSA vial, which were then set aside for LSA.
3) pH of each solution was measured.
4) containers were weighed
5) 2.5 g of quartz sand was transferred into Q3-pH: solutions.
6) containers were weighed
7) containers placed on syratory shaker @ 120 rpm.

) Sample containers weighed:

Sample	Container Wt. (initial) g)	pH	Temp (°C)
3-pH 2	70.7380	1.96	22.8°
3-pH 2.25	70.2556	2.18	22.8°
3-pH 2.5	70.3497	2.45	22.9°
3-pH 2.75	70.0857	2.71	22.9°
3-pH 3	70.3886	2.96	22.9°
3-C*pH 3	70.2593	2.94	22.9°
3-pH 3.25	70.1346	3.21	22.9°
3-pH 3.5	70.2589	3.48	22.9°
3-pH 3.75	70.1224	3.73	23.0°
3-pH 4	70.5407	4.01	23.0°
3-C*pH 4	70.0295	4.02	23.0°
3-pH 4.25	70.3620	4.37	23.0°
3-pH 4.5	70.2878	4.76	23.0°
3-pH 4.75	70.2029	4.93	23.0°
3-pH 5	70.5208	5.61	23.0°
3-C*pH 5	70.5856	5.15	23.1°
3-pH 5.25	70.4155	6.05	23.1°
3-pH 5.5	70.3206	6.19	23.1°
3-C*pH 5.5	70.2975	6.15	23.1°
3-pH 5.75	70.5136	6.36	23.1°
3-pH 6	70.2146	6.41	23.2°

Sample	initial wt. of container	pH	Temp (°C)
Q3-C*pH 6	70.2489	6.40	23.2°
Q3-pH 6.25	70.5378	6.68	23.2°
Q3-pH 6.5	70.0867	6.75	23.2°
Q3-C*pH 6.5	70.3834	6.63	23.6°
Q3-pH 6.75	70.5498	6.80	23.6°
Q3-pH 7	70.4399	7.00	23.6°
Q3-C*pH 7	70.6003	7.04	23.7°
Q3-pH 7.25	70.4449	7.15	23.8°
Q3-pH 7.5	70.5551	7.38	23.8°
Q3-C*pH 7.5	70.6543	7.36	23.9°
Q3-pH 7.75	70.1750	7.74	23.9°
Q3-pH 8	70.2170	7.97	23.9°
Q3-C*pH 8	70.2390	7.98 MA 6-21-94	24.0°
Q3-pH 8.25	70.0643	8.17 ~~8.42~~	24.0°
Q3-pH 8.5	70.3843	8.42	24.0°
Q3-pH 8.75	70.0615	8.68	24.0°
Q3-pH 9	70.5861	8.94	24.1°
Q3-C*pH 9	70.7018	8.95	24.1°

2)

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (g)
Q3-pH 2 a	7.6160	8.1181	
Q3-pH 2 b	7.6546	8.1539	
Q3-pH 2.25 a	7.7374	8.2360	
Q3-pH 2.25 b	7.6561	8.1519	
Q3-pH 2.5 a	7.7533	8.2493	
Q3-pH 2.5 b	7.7293	8.2241	
Q3-pH 2.75 a	7.6610	8.1592	
Q3-pH 2.75 b	7.7215	8.2180	
Q3-pH 3 a	7.6851	8.1792	
Q3-pH 3 b	7.7211	8.2162	
Q3-C*pH 3 a	7.7410	8.2349	
Q3-C*pH 3 b	7.7371	8.2320	
Q3-pH 3.25 a	7.6731	8.1674	
Q3-pH 3.25 b	7.6618	8.1572	
Q3-pH 3.5 a	7.6732	8.1686	

SAMPLE	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
3-pH 3.5 b	7.7102	8.2052	
3-pH 3.75a	7.6720	8.1660	
3-pH 3.75b	7.6980	8.1923	
-pH 4 a	7.7242	8.2121	
3-pH 4 b	7.7102	8.1994	
-C*pH 4 a	7.6716	8.1622	
3-C*pH 4 b	7.6560	8.1467	
-pH 4.25 a	7.6563	8.1474	
-pH 4.25 b	7.7286	8.2216	
3-pH 4.5 a	7.7195	8.2132	
-pH 4.5 b	7.6201	8.1141	
-pH 4.75 a	7.6885	8.1836	
-pH 4.75 b	7.7120	8.2067	
3-pH 5 a	7.7145	8.2085	
3-pH 5 b	7.7583	8.2535	
3-pH 5.25 a	7.7195	8.2155	
-pH 5.25 b	7.6345	8.1305	
-pH 5.5 a	7.6932	8.1918	
-pH 5.5 b	7.7044	8.1979	
-C*pH 5.5 a	7.6537	8.1499	
3-C*pH 5.5 b	7.7135	8.2081	
-pH 5.75 a	7.7135	8.2101	
-pH 5.75 b	7.6976	8.1926	
-pH 6 a	7.6875	8.1793	
-pH 6 b	7.7072	8.1996	
~~3-pH 6.25a~~ MA 6-21-94			
~~-pH 6.25b~~ MA 6-21-94			
3-C*pH 6a	7.7077	8.2044	
3-C*pH 6 b	7.7265	8.2233	
-pH 6.25 a	7.6974	8.1916	
3-pH 6.25 b	7.7111	8.2061	
3-pH 6.5 a	7.7076	8.2011	
3-pH 6.5 b	7.6820	8.1761	
-C*pH 6.5 a	7.7017	8.2019	
3-C*pH 6.5 b	7.6871	8.1856	
3-pH 6.75 a	7.7019	8.1963	

SAMPLE	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Q3-pH 6.75b	7.7126	MA 6-21-94 ~~8.2079~~	8.2084
Q3-pH 7 a	7.6439	8.1369	
Q3-pH 7 b	7.6611	8.1528	
Q3-C*pH 7 a	7.6515	8.1416	
Q3-C*pH 7 b	7.7275	8.2173	
Q3-pH 7.25 a	7.6962	8.1875	
Q3-pH 7.25 b	7.6592	8.1510	
Q3-pH 7.5 a	7.6894	8.1808	
Q3-pH 7.5 b	7.7673	8.2592	
Q3-C*pH 7.5 a	7.7945	8.2860	
Q3-C*pH 7.5 b	7.6812	8.1733	
Q3-pH 7.75 a	7.6719	8.1668	
Q3-pH 7.75 b	7.7123	8.2080	
Q3-pH 8 a	7.7015	8.1923	
Q3-pH 8 b	7.6954	8.1881	
Q3-C*pH 8 a	7.7437	8.2376	
Q3-C*pH 8 b	7.7210	8.2137	
Q3-pH 8.25 a	7.6998	8.1937	
Q3-pH 8.25 b	7.7206	8.2160	
Q3-pH 8.5 a	7.6673	8.1617	
Q3-pH 8.5 b	7.6850	8.1795	
Q3-pH 8.75 a	7.6637	8.1599	
Q3-pH 8.75 b	7.6505	8.1483	
Q3-pH 9 a	7.7057	8.2035	
Q3-pH 9 b	7.6856	8.1816	
Q3-C*pH 9 a	7.6590	8.1532	
Q3-C*pH 9 b	7.7335	8.2286	
*(out of order) Q3-C*pH 5 a	7.6474	8.1430	
Q3-C*pH 5 b	7.7008	8.1969	

AFTER aliquots were withdrawn and pH measurements were taken, the solution containers were weighed.

- ~ 2.5g quartz was added to Q3-pH solutions.
- containers were weighed again (AE 240)
- caps were placed on loosely, and containers were set on gyratory shaker at 120 rpm for about 21 days.

Sample	Wt. of container (g)	Wt. of container + quartz	Wt. of quartz
Q3-pH 2	69.6933	72.1938	2.5005
Q3-pH 2.25	69.2065	71.7075	2.5007
Q3-pH 2.5	69.3137	71.8120	2.4983
Q3-pH 2.75	69.0627	MA 6-21-94 ~~71.52~~ 71.5624	2.4997
Q3-pH 3	69.3670	71.8678	2.5008
Q3-C*pH 3	69.2046	69.2046	0.00
Q3-pH 3.25	69.1042	71.6044	2.5002
Q3-pH 3.5	69.2454	71.7456	2.5001
Q3-pH 3.75	69.0967	71.5962	2.4994
Q3-pH 4	69.5226	72.0226	2.4999
Q3-C*pH 4	69.0178	69.0178	0.00
Q3-pH 4.25	69.3440	71.8425	2.4985
Q3-pH 4.5	69.2718	71.7712	2.4994
Q3-pH 4.75	69.1835	71.6836	2.4999
Q3-pH 5	69.4959	71.9951	2.4992
Q3-C*pH 5	69.5317	69.5317	0.00
Q3-pH 5.25	69.3994	71.8981	2.4987
Q3-pH 5.5	69.3049	71.8013	2.4964
Q3-C*pH 5.5	69.2718	69.2718	0.00
Q3-pH 5.75	69.4880	71.9854	2.4972
Q3-pH 6	69.1771	71.6768	2.4997
Q3-C*pH 6	69.2107	69.2107	0.00
Q3-pH 6.25	69.5200	72.0190	2.4990
Q3-pH 6.5	69.0492	71.5475	2.4983
Q3-C*pH 6.5	69.3508	69.3508	0.00
Q3-pH 6.75	69.5374	72.0360	2.4986
Q3-pH 7	69.4225	MA 6-21-94 71.9211 ~~71.9044~~	MA 6-21-94 2.4986 ~~2.4819~~
Q3-C*pH 7	69.5832	69.5832	0.00
Q3-pH 7.25	69.4248	71.9255	2.5007
Q3-pH 7.5	69.5322	72.0354	2.5032
Q3-C*pH 7.5	69.5966	69.5966	0.00
Q3-pH 7.75	69.1573	71.6533	2.4960
Q3-pH 8	69.1722	71.6703	2.4981
Q3-C*pH 8	69.2049	69.2049	0.00
Q3-pH 8.25	69.0415	71.5410	2.4995
Q3-pH 8.5	69.3541	71.8525	2.4984

Sample	wt. of container(s)	wt. of container + quartz (s)	wt. of quartz
Q3-pH 8.75	69.0262	71.5244	2.4982
Q3-pH 9	69.5468	72.0449	2.4981
Q3-C*pH 9	69.6700	69.6700	0.00

MA 6-21-94

Note: Additional quartz was added to Q3-pH7 to obtain a mass in solution closer to 2.5 g.

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MA

Sorption (Q4)** Experiment (Continued)

Starting with step 6 of the procedure posted on page 245 (6C-09) the following ~~st~~ MA 6-23-94 procedures were done:

1) Sample containers were weighed.
2) Two .5 ml aliquots of each solution was transferred into a pre-weighed LSA vial and set aside for LSA.
3) pH of each solution was measured
4) containers were weighed
5) ~ 1.0 g of quartz sand (W510*60/100*UC*RC*RFe*HL) was transferred to Q4-pHi solutions.
6) solution containers were weighed
7) sol'n containers were set on gyratory shaker (capped loosely) at 120 rpm.

Sample	initial wt. of container	pH	Temp (°C)
Q4-pH 2	70.5763	1.97	23.4°
Q4-pH 2.25	70.0614	MA 6-23-94 ~~1.21~~ 2.21	23.4°
Q4-pH 2.5	70.2246	2.43	23.4°
Q4-pH 2.75	69.9663	2.69	23.4°
Q4-pH 3	70.0691	2.96	23.4°
Q4-C*pH 3	70.1169	2.95	23.4°
Q4-pH 3.25	70.4452	3.22	23.4°
Q4-pH 3.5	70.1280	3.47	23.4°
Q4-pH 3.75	70.0441	3.74	23.4°
Q4-pH 4	70.3812	3.94	23.5°
Q4-C*pH 4	70.1551	3.95	23.5°
Q4-pH 4.25	69.9683	4.23	23.5°
Q4-pH 4.5	69.7881	4.51	23.5°
Q4-pH 4.75	70.3436	4.82	23.5°
Q4-pH 5	70.1307	5.17	23.5°
Q4-C*pH 5	70.0565	5.18	23.5°
Q4-pH 5.25	69.8911	5.51	23.5°
Q4-pH 5.5	70.1462	5.77	23.5°
Q4-C*pH 5.5	70.2510	5.80	23.5°
Q4-pH 5.75	70.3680	5.97	23.5°
Q4-pH 6	70.0659	6.11	23.6°
Q4-C*pH 6	69.8903	6.15	23.6°

Sample	initial wt of container	pH	Temp (°C)
Q4-pH 6.25	70.3901	6.30	23.6°
Q4-pH 6.5	70.2978	6.51	23.6°
Q4-C*pH 6.5	70.2091	6.50	23.6°
Q4-pH 6.75	70.3197	6.73	23.7
Q4-pH 7	70.4894	6.92	23.7°
Q4-C*pH 7	70.3354	6.95	23.7°
Q4-pH 7.25	69.9386	7.19	23.7°
Q4-pH 7.5	70.3000	7.44	23.8°
Q4-C*pH 7.5	70.1468	7.42	23.8°
Q4-pH 7.75	70.5286	7.69	23.9°
Q4-pH 8	70.2503	7.99	23.9°
Q4-C*pH 8	70.3423	MA 6-23-94 ~~7.97~~ 7.97	23.9°
Q4-pH 8.25	70.1362	8.24	24.0°
Q4-pH 8.5	70.2228	8.46	24.0°
Q4-pH 8.75	70.4341	8.71	24.0°
Q4-pH 9	70.5749	8.95	24.0°
Q4-C*pH 9	70.5412	8.96	24.0°

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample
Q4-pH 2a	7.7010	8.2032	
Q4-pH 2b	7.7284	8.2306	
Q4-pH 2.25a	7.6745	8.1741	
Q4-pH 2.25b	7.7246	8.2262	
Q4-pH 2.5a	7.6871	8.1885	
Q4-pH 2.5b	7.7127	8.2140	
Q4-pH 2.75a	7.7235	8.2233	
Q4-pH 2.75b	7.6899	8.1911	
Q4-pH 3a	7.7491	8.2452	
Q4-pH 3b	7.7187	8.2177	
Q4-C*pH 3a	7.7437	8.2443	
Q4-C*pH 3b	7.7307	8.2300	
Q4-pH 3.25a	7.7447	8.2436	
Q4-pH 3.25b	7.7573	8.2561	
Q4-pH 3.5a	7.7305	8.2276	
Q4-pH 3.5b	7.6817	8.1795	
Q4-pH 3.75a	7.7243	8.2224	

Sample	wt. of vial	wt. of vial + sample	wt. of sample
Q4-pH 3.75 b	7.6752	8.1738	
Q4-pH 4 a	7.7097	8.2097	
Q4-pH 4 b	7.7436	8.2442	
Q4-C*pH 4 a	7.7030	8.2016	
Q4-C*pH 4 b	7.7116	8.2108	
Q4-pH 4.25 a	7.6441	8.1425	
Q4-pH 4.25 b	7.7134	8.2128	
Q4-pH 4.5 a	7.7741	8.2731	
Q4-pH 4.5 b	7.7182	8.2170	
Q4-pH 4.75 a	7.7306	8.2307	
Q4-pH 4.75 b	7.7228	8.2235	
Q4-pH 5 a	7.7493	8.2497	
Q4-pH 5 b	7.7608	8.2603	
Q4-C*pH 5 a	7.6760	8.1755	
Q4-C*pH 5 b	7.7225	8.2227	
Q4-pH 5.25 a	7.7909	8.2913	
Q4-pH 5.25 b	7.6891	8.1880	
Q4-pH 5.5 a	7.7350	8.2323	
Q4-pH 5.5 b	7.7271	8.2263	
Q4-C*pH 5.5 a	7.7685	8.2670	
Q4-C*pH 5.5 b	7.7424	8.2415	
Q4-pH 5.75 a	7.7872	8.2855	
Q4-pH 5.75 b	7.6807	8.1794	
Q4-pH 6 a	7.7366	8.2350	
Q4-pH 6 b	7.7116	8.2106	
Q4-C*pH 6 a	7.6864	8.1838	
Q4-C*pH 6 b	7.6597	8.1577	
Q4-pH 6.25 a	7.6695	8.1695	
Q4-pH 6.25 b	7.7000	8.1995	
Q4-pH 6.5 a	7.6923	8.1908	
Q4-pH 6.5 b	7.6665	8.1660	
Q4-C*pH 6.5 a	7.7138	8.2120	
Q4-C*pH 6.5 b	7.7461	8.2427	
Q4-pH 6.75 a	7.7438	8.2430	
Q4-pH 6.75 b	7.7715	8.2726	
Q4-pH 7 a	7.7802	8.2782	

Sample	wt. of vial(s)	wt. of vial + sample	wt. of sample(s)
Q4-pH 7 b	7.7499	8.2475	
Q4-C*pH 7 a	7.7300	8.2244	
Q4-C*pH 7 b	7.7299	8.2264	
Q4-pH 7.25 a	7.7692	8.2654	
Q4-pH 7.25 b	7.6904	8.1883	
Q4-pH 7.5 a	7.6920	8.1898	
Q4-pH 7.5 b	7.7021	8.2008	
Q4-C*pH 7.5 a	7.7244	8.2211	
Q4-C*pH 7.5 b	7.6835	8.1819	
Q4-pH 7.75 a	7.6892	8.1853	
Q4-pH 7.75 b	7.6943	8.1921	
Q4-pH 8 a	7.6480	8.1447	
Q4-pH 8 b	7.6935	8.1916	
Q4-C*pH 8 a	7.7081	8.2072	
Q4-C*pH 8 b	7.7122	8.2090	
Q4-pH 8.25 a	7.7061	8.2040	
Q4-pH 8.25 b	7.7149	8.2130	
Q4-pH 8.5 a	7.7250	8.2230	
Q4-pH 8.5 b	7.6970	8.1921	
Q4-pH 8.75 a	7.6458	8.1441	
Q4-pH 8.75 b	7.6722	8.1714	
Q4-pH 9 a	7.6982	8.1983	
Q4-pH 9 b	7.7079	8.2076	
Q4-C*pH 9 a	7.6704	8.1657	
Q4-C*pH 9 b	7.6924	8.1907	

After sampling and pH measurements were taken, the solution containers were weighed.

- ~ 1.0 g of quartz sand was added to Q4-pHi solutions.
- containers were weighed again.
- caps were placed ~~on~~ AA 6-23-94 loosely on containers which were then set on gyratory shaker at 120 rpm

(continued on next page)

Sample	wt. of container	wt. of container + quartz	wt. of quartz
Q4-pH ~~4~~ 2 (MA 6-23-94)	69.5378	~~70.54~~ 70.5398 (MA 6-23-94)	1.002
Q4-pH 2.25	69.0253	70.0256	1.0003
Q4-pH 2.5	69.1812	70.1807	.9995
Q4-pH 2.75	68.9303	69.9309	1.0006
Q4-pH 3	69.0434	70.0438	1.0004
Q4-C*pH 3	69.0744	69.0744	0.00
Q4-pH 3.25	69.4172	70.4167	.9995
Q4-pH 3.5	69.0987	70.0990	1.0003
Q4-pH 3.75	69.0115	70.0115	1.0000
Q4-pH 4	69.3473	70.3470	.9997
Q4-C*pH 4	69.1226	69.1226	0.00
Q4-pH 4.25	68.9485	69.9479	
Q4-pH 4.5	68.7585	69.7592	
Q4-pH 4.75	69.3160	70.3169	
Q4-pH 5	~~69.0969~~ 69.0936 (MA 6-23-94)	70.0933	
Q4-C*pH 5	69.0168	69.0168	0.00
Q4-pH 5.25	68.8465	69.8471	
Q4-pH 5.5	69.1097	70.1095	
Q4-C*pH 5.5	69.2100	69.2100	0.00
Q4-pH 5.75	69.3290	70.3281	
Q4-pH 6	69.0157	70.0168	
Q4-C*pH 6	68.8488	68.8488	0.00
Q4-pH 6.25	69.3408	70.3417	
Q4-pH 6.5	69.2562	70.2575	
Q4-C*pH 6.5	69.1719	69.1719	0.00
Q4-pH 6.75	69.2890	70.2896	
Q4-pH 7	69.4402	70.4394	
Q4-C*pH 7	69.2926	69.2926	0.00
Q4-pH 7.25	68.8991	69.8995	
Q4-pH 7.5	69.2596	70.2601	
Q4-C*pH 7.5	69.1082	69.1082	0.00
Q4-pH 7.75	69.4885	70.4892	
Q4-pH 8	69.2075	70.2083	
Q4-C*pH 8	69.2937	69.2937	0.00
Q4-pH 8.25	69.0933	70.0924	
Q4-pH 8.5	69.1823	70.1818	

Sample	wt. of container	wt. of container + quartz (g)	wt. of quartz (g)
Q4-pH 8.75	69.3965	70.3975	
Q4-pH 9	69.5243	70.5247	
Q4-C*pH 9	69.5103	69.5103	0.00

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Sampling of selected Q1 experimental solutions and preparation for desorption experiment.

Overview: Results of competitive sorption expt. between PC containers and dialysis membrane shows that U will desorb from container walls when a competitive substrate is added to the solution. To quantify desorption of U from container walls to quartz, I will remove the quartz sand from the exp. soln. containers (along with some solution) and transfer the sand to an acidified solution for desorption. By comparing the amount of U desorbed from the sand and the amount of U left in the original exp. container, I should be able to determine if desorption due to competitior has occurred. The results will be used to determine if container sorption corrections are needed in the analysis of final [U] data.

Equipment and Materials:

- 1 M HNO_3 - to acidify original and transferred solutions
- PP centrifuge tubes - to hold transferred sand/solution
- Eppendorf pipetter w/ tips
- analytical balance (AE 240)
- Q1 exp solutions pH 4 - pH 8 (except 6.25 and 7: sampled previously).
- LSA 7 ml vials w/ ultima gold® cocktail
- 1900 TR LSA - Packard.
- gyratory shaker

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PD

Procedure:

① Weigh original experimental containers to get start total weight. record wt.

② Preweigh / label PP centrifuge tubes, record wt.

③ Using an Eppendorf pipet (1 ml with blue tip), carefully remove all sand by "vacuuming" it out of the container:

a.) tap container to accumulate sand in one corner. make sure all grains are in the corner.

b.) Insert tip and withdraw sand / solution. Be careful to remove tip quickly. Sand will "leak" out of tip when the tip is immersed in solution and no suction is applied.

c.) transfer sand / soln. to PP tube. Attempt to minimize amt of soln. transferred.

d.) if necessary, use a 100 µl pipettor w/ yellow tip to withdraw the last few grains.

④ Weigh exp containers and PP tubes, record wt.

⑤ Add ~3 ml 1.0 M HNO_3 to exp containers and PP tubes to acidify all solutions. Reweigh PP tubes and exp. containers. record wt.

⑥ cap all solns tightly and place on gyratory shaker at ~120 rpm for ~10-12 days

⑦ after ~10-12 days. Remove tubes / containers. Sample by withdrawing 0.5 ml aliquonts (duplicates)

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⑦ and transferring to pre-labeled and weighed, USA vials. Add cocktail (5 ml) and analyze with LSA.

experiment solution	total wt (g)	wt. after transfer (g)	amt. acid added (ml)	wt. after acid added (g)
Q1 pH 4.0	66.9234	60.8285	3	63.9004
Q1 pH 4.25	67.2010	63.8726	3	66.9387
Q1 pH 4.5	67.3464	64.0125	3	67.0623
Q1 pH 4.75	66.8747	63.6989	3	66.7733
Q1 pH 5	67.0685	63.7571	3	66.8334
Q1 pH 5.25	67.0467	63.8359	3	66.9609
Q1 pH 5.5	67.3397	64.2763	3	67.3519
Q1 pH 5.75	67.3933	63.6430	3	66.7187
Q1 pH 6	67.6296	64.5791	3	67.6523
Q1 pH 6.5	66.8630	62.6342	3	65.7090
Q1 pH 6.75	67.3135	63.4528	3	66.5239
Q1 pH 7.25	67.0641	63.5403	3	66.6077
Q1 pH 7.5	67.2004	64.5772	3	67.6503
Q1 pH 7.75	66.6494	63.5749	3	66.6363
Q1 pH 8	66.7292	63.6634	3	66.7617

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desorption test tube	wt. of tube (g)	wt. after transfer (g)	amt. acid added (ml)	wt. after acid add. (g)
Q1 pH 4 D	13.7227	19.8242	3	22.8993
" " 4.25 D	13.7365	17.0579	3	20.1134
" " 4.5 D	13.7407	17.0684	3	19.9734
" " 4.75 D	13.7423	16.9134	3	19.8741
" " 5 D	13.7269	17.0313	3	20.0987
" " 5.25 D	13.8271	16.9815	3	20.0335
" " 5.5 D	13.8342	16.8919	3	19.9657
" " 5.75 D	13.6974	17.4426	3	20.5188
" " 6 D	13.8675	16.9142	3	19.9142
" " 6.5 D	13.7741	17.9871	3	21.0599
" " 6.75 D	13.7614	17.5573	3	20.6383
" " 7.25 D	13.7978	17.3157	3	20.4016
" " 7.5 D	13.7736	16.3913	3	19.4614
" " 7.75 D	13.7879	16.8551	3	19.8020
" " 8 D	13.7484	16.7871	3	19.8535
* control - D	13.8179	13.8179	6	19.9571

* control solution used to determine if any U or other alpha leaches from PP tubes.

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Sampling of Q1 experimental solutions and Preparation for Desorption Experiment:

Procedure:

1. Original experimental containers were weighed.
2. (Empty) ~~PP~~ MA FEP 6-22-94 centrifuge tubes weighed (AE 240)
3. Sand was withdrawn from the experimental container and transferred to the PP centrifuge tube.
4. Containers were weighed
5. .1N HNO_3 added to both containers
6. Containers weighed & recorded.
7. Containers were set on gyratory shaker.

Experiment solution	total wt	wt. after transfer	Amt. of Acid Added	wt. after Acid added
Q1-pH 6.25	67.4479	57.3621	10 ml	67.2918
Q1-pH 7	67.4232	64.2904	3 ml	67.2598

Desoption test tube	wt. of TUBE	wt. after transfer (g)	Amt. of Acid added (g)	wt. after Acid added (g)
Q1-pH 6.25 D	33.9934	44.0616	5 ml	48.8965
Q1-pH 7 D	34.6072	37.7206	3 ml	40.6904

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LSA Results For Q1 and Q2 Soeption Experiments

Q1 samples taken 6-17-94 pp. 262-264 of this book

Q2 samples taken 6-13-94 pp. 257-259

Protocol #: 5 Name:U-233 3% 2 sigma 18-Jun-94 10:38
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	2.880	3.73	27.48	1.21	133.29	B
2	8.13	1.52	209.6	544.229	3.01	547.55	3.07	712.77	
3	8.12	3.64	91.94	544.780	3.02	548.75	3.07	710.02	
4	8.26	4.71	72.06	535.255	3.02	542.13	3.06	708.41	
5	8.02	2.30	118.1	551.858	3.01	555.44	3.07	709.74	
6	8.14	4.20	80.57	543.557	3.01	548.81	3.07	710.33	
7	8.25	4.61	73.41	536.150	3.02	541.97	3.07	706.96	
8	8.28	5.62	61.47	533.956	3.02	540.88	3.06	706.80	
9	8.42	6.99	50.32	525.148	3.02	532.97	3.06	705.24	
10	8.45	2.16	146.4	523.037	3.02	524.35	3.08	714.60	
11	8.45	9.50	38.70	523.510	3.02	532.28	3.06	703.18	
12	8.47	7.19	48.96	522.149	3.02	530.61	3.06	709.04	
13	8.65	4.34	75.85	511.108	3.02	517.03	3.07	710.50	
14	8.10	3.34	85.54	546.503	3.01	550.67	3.07	711.16	
15	8.15	5.03	68.40	542.764	3.02	547.86	3.07	709.22	
16	8.41	4.17	79.76	526.014	3.02	530.31	3.07	708.37	
17	8.12	4.50	75.72	544.534	3.02	550.11	3.07	709.45	
18	8.35	4.45	75.37	529.815	3.02	535.15	3.07	707.77	
19	8.38	3.39	85.04	527.669	3.02	530.75	3.08	708.81	
20	8.59	4.36	67.38	515.048	3.02	520.48	3.07	709.97	
21	8.53	5.02	67.00	518.574	3.02	525.74	3.06	709.01	
22	8.11	5.14	67.16	545.209	3.02	551.68	3.06	707.91	
23	8.46	6.99	50.23	522.770	3.02	529.97	3.06	705.85	
24	8.49	5.72	59.77	520.677	3.02	526.82	3.07	710.66	
25	8.46	9.70	38.00	522.770	3.02	532.80	3.06	706.85	
26	8.51	7.42	47.54	519.447	3.02	527.98	3.06	703.88	
27	8.74	3.41	94.03	505.816	3.02	511.08	3.07	712.49	
28	9.25	4.23	74.97	477.552	3.02	482.36	3.08	713.01	
29	9.16	4.35	73.48	482.382	3.02	487.15	3.08	710.82	
30	9.28	6.64	50.15	476.107	3.02	482.65	3.07	706.58	
31	9.35	3.45	89.92	472.949	3.02	477.76	3.08	711.68	
32	8.99	10.02	35.90	491.558	3.02	502.55	3.06	705.81	
33	9.18	6.81	49.33	481.434	3.02	488.21	3.07	706.29	
34	9.34	2.08	144.4	472.923	3.02	475.30	3.09	712.37	
35	9.63	2.59	115.6	458.594	3.02	464.21	3.08	713.39	
36	9.86	2.80	102.8	448.337	3.02	452.34	3.09	713.64	
37	10.13	5.19	59.70	436.409	3.02	441.52	3.08	704.77	
38	8.90	2.90	108.4	496.446	3.02	499.37	3.08	712.90	
39	8.79	6.24	54.37	503.605	3.01	509.95	3.07	704.38	
40	9.89	3.34	90.06	447.272	3.02	452.90	3.08	710.97	
41	10.21	2.26	128.2	432.477	3.02	436.18	3.09	712.72	
42	10.61	3.91	75.36	416.064	3.02	420.12	3.09	707.02	
43	11.06	4.70	62.46	398.928	3.02	405.34	3.09	702.84	
44	8.52	0.85	341.4	463.927	3.02	465.48	3.09	711.02	
45	8.58	3.65	84.48	461.107	3.02	465.21	3.08	711.33	
46	12.07	0.00	0.00	365.471	3.02	364.98	3.13	718.00	
47	11.96	4.76	59.36	368.692	3.02	374.28	3.10	705.23	
48	15.83	3.53	67.97	277.979	3.03	281.68	3.14	709.51	
49	14.87	3.63	68.27	296.111	3.03	300.50	3.13	706.10	

"Q2-LSA3"
pp. 257-263

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MA

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	9.69	5.87	54.70	456.253	3.02	462.92	3.07	705.07	
51	9.59	5.40	59.22	461.354	3.02	467.10	3.08	709.11	
52	14.40	4.36	58.60	305.939	3.03	311.20	3.12	707.19	
53	14.20	1.45	166.0	310.359	3.03	312.94	3.13	710.24	
54	14.49	2.91	84.91	303.814	3.03	306.82	3.13	707.77	
55	14.61	2.32	104.7	301.295	3.03	303.73	3.14	713.11	
56	9.11	9.09	38.68	485.155	3.02	495.24	3.06	704.49	
57	8.86	9.09	39.22	499.152	3.02	509.43	3.06	704.13	
58	12.88	0.98	256.3	342.229	3.03	345.27	3.12	715.23	
59	12.59	4.37	62.51	350.337	3.02	355.76	3.10	706.64	Q2·LSA3
60	11.66	3.31	83.75	378.338	3.02	382.81	3.10	709.74	
61	11.51	4.21	67.63	383.480	3.02	387.90	3.10	707.73	
62	8.57	4.09	80.43	516.490	3.01	521.41	3.07	706.08	
63	8.46	3.91	84.23	522.534	3.02	527.72	3.07	711.05	
64	9.97	3.07	97.25	442.957	3.02	446.54	3.09	713.82	
65	8.83	4.80	64.92	449.409	3.02	455.02	3.08	709.67	
66	9.03	5.02	65.08	489.922	3.02	494.89	3.07	713.05	
67	9.03	6.24	53.68	489.590	3.02	498.10	3.06	708.44	
68	8.07	6.50	54.73	548.049	3.02	554.92	3.06	708.03	
69	8.13	7.79	46.65	544.352	3.01	551.98	3.06	708.71	
70	8.19	5.52	62.77	539.733	3.02	546.15	3.07	709.54	
71	8.00	6.35	56.13	553.370	3.01	560.77	3.06	709.65	
72	8.44	3.61	90.76	523.897	3.02	528.92	3.07	714.61	
73	8.58	5.92	57.61	515.535	3.02	521.12	3.07	712.59	
74	8.21	5.58	62.07	538.776	3.02	545.48	3.06	711.89	
75	8.39	2.08	152.8	527.036	3.02	530.09	3.08	716.98	
76	8.41	3.45	94.74	525.895	3.02	530.66	3.07	715.08	
77	8.48	4.09	80.71	521.412	3.02	526.06	3.07	714.11	
78	8.45	2.28	139.2	523.747	3.01	528.50	3.07	715.19	
79	8.36	8.13	44.35	529.058	3.02	538.19	3.06	707.93	
11 missing vials)									
91	8.04	1.62	197.7	550.105	3.02	551.75	3.08	711.94	
92	7.92	4.21	81.49	558.357	3.02	562.42	3.07	709.41	
93	8.28	0.00	0.00	534.439	3.01	533.75	3.09	714.14	
94	8.28	0.00	0.00	534.318	3.02	534.96	3.08	711.09	
95	8.03	2.15	151.4	551.416	3.01	553.34	3.07	712.66	
96	8.03	1.15	276.0	551.416	3.01	552.35	3.08	711.42	
97	8.25	2.68	121.3	535.787	3.02	540.28	3.07	714.17	
98	8.02	0.93	341.2	551.484	3.02	553.82	3.08	712.96	
99	8.09	1.50	213.2	546.564	3.02	548.54	3.08	714.31	
100	8.19	3.20	103.0	540.221	3.01	544.56	3.07	712.53	
101	7.94	2.38	137.8	557.573	3.01	561.44	3.07	714.71	
102	7.91	3.22	104.1	559.193	3.01	564.68	3.07	713.47	
103	8.21	3.15	104.5	538.898	3.01	541.95	3.07	709.70	
104	8.17	3.13	105.3	541.551	3.01	544.98	3.07	709.77	
105	8.00	5.47	63.97	553.370	3.01	559.52	3.06	711.69	
106	8.12	2.04	158.3	544.780	3.02	548.87	3.07	711.30	
107	8.17	2.52	129.0	541.061	3.02	544.86	3.07	714.00	
108	8.12	4.50	75.72	544.657	3.02	550.48	3.07	710.46	
109	8.10	1.96	164.1	546.009	3.02	549.31	3.07	711.31	
110	8.26	3.38	97.64	535.861	3.01	540.07	3.07	713.58	
111	7.92	0.00	0.00	558.231	3.02	558.76	3.08	713.88	
112	8.14	3.95	85.12	543.189	3.02	549.42	3.07	707.93	
113	8.50	3.81	86.20	520.061	3.02	525.81	3.07	711.44	
114	8.17	2.15	149.7	541.796	3.01	544.12	3.08	710.84	
115	8.42	2.95	109.5	525.030	3.02	528.93	3.07	714.61	
S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
116	8.40	1.34	233.0	526.287	3.02	528.59	3.08	714.74	
117	8.32	0.00	0.00	531.375	3.02	531.29	3.09	716.20	
118	8.19	1.61	197.0	539.977	3.02	542.85	3.08	713.74	
119	8.55	2.74	116.7	517.237	3.02	521.88	3.07	712.54	
120	8.60	6.22	55.16	513.980	3.02	519.96	3.07	706.87	
121	8.39	1.12	276.1	527.394	3.01	530.09	3.08	716.76	
122	8.50	2.75	116.6	520.179	3.02	524.64	3.07	712.36	
123	8.67	2.44	129.2	509.807	3.02	514.85	3.07	713.24	
124	8.72	2.77	114.1	506.753	3.02	512.08	3.07	709.50	
125	8.52	0.58	520.7	518.833	3.02	519.23	3.09	716.56	
126	8.40	3.00	107.9	526.525	3.02	531.57	3.07	708.72	
127	8.69	1.47	209.4	508.973	3.02	511.64	3.08	712.74	
128	8.48	0.91	336.9	521.412	3.02	523.58	3.08	715.61	
129	8.60	6.45	53.42	513.864	3.02	521.59	3.06	707.65	
130	8.77	2.08	149.3	503.961	3.02	506.61	3.08	711.24	
131	8.92	0.94	317.8	495.326	3.02	497.30	3.09	712.88	
132	8.85	2.12	146.2	499.832	3.02	502.91	3.08	710.59	
133	8.60	2.03	154.3	514.097	3.02	519.03	3.07	715.02	
134	8.39	1.60	196.1	527.394	3.01	530.56	3.07	713.49	
135	9.44	5.15	62.26	468.200	3.02	473.90	3.08	706.73	
136	9.39	3.91	321.4	471.135	3.02	472.95	3.09	713.57	
137	9.47	0.00	0.00	466.603	3.02	465.55	3.10	713.96	
138	9.19	3.95	80.13	481.668	3.02	486.34	3.08	708.89	
139	8.93	3.38	93.71	494.880	3.02	500.51	3.07	709.06	
140	8.67	4.17	78.55	509.692	3.02	513.58	3.08	707.71	
141	10.34	1.31	214.1	427.101	3.02	428.81	3.10	714.26	
142	10.21	0.30	929.6	432.379	3.02	433.64	3.10	713.77	
143	9.49	2.60	116.4	465.613	3.02	469.67	3.08	713.54	
144	9.52	2.21	135.2	464.032	3.02	466.32	3.09	712.24	
145	9.07	2.49	123.9	487.307	3.02	492.48	3.08	717.33	

Q1·LSA3

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146	9.23	1.03	285.3	478.593	3.02	480.75	3.09	715.12
147	9.19	1.67	180.4	480.689	3.02	484.38	3.08	711.70
148	8.98	4.71	69.13	492.220	3.02	499.25	3.07	707.78
149	8.65	3.30	97.56	510.877	3.02	515.06	3.08	709.83
150	8.56	3.18	101.4	516.629	3.02	519.37	3.08	713.22
151	8.49	3.83	85.70	521.030	3.02	526.47	3.07	710.15
152	8.15	2.45	132.6	542.764	3.02	546.75	3.07	712.48
153	8.47	2.11	149.5	521.913	3.02	525.18	3.08	707.40
154	8.22	2.88	113.6	538.361	3.01	542.35	3.07	711.45
155	8.11	2.31	140.6	545.332	3.02	549.46	3.07	711.74
156	7.93	2.79	119.0	557.776	3.02	561.17	3.07	709.94
157	8.16	3.28	100.9	542.341	3.01	546.91	3.07	710.46
158	8.41	3.22	101.2	526.252	3.01	530.07	3.07	711.90
159	8.06	0.83	380.0	548.733	3.02	549.81	3.08	714.26
160	8.09	4.83	71.11	546.564	3.02	552.12	3.07	712.16
161	7.83	4.22	81.77	564.808	3.02	569.71	3.07	709.22
162	8.02	2.42	135.2	551.609	3.01	555.44	3.07	714.01
163	8.07	0.00	0.00	548.049	3.02	547.74	3.08	717.16
164	8.02	1.05	301.6	552.107	3.01	556.06	3.07	714.52
165	7.99	3.00	110.7	553.816	3.01	558.50	3.07	713.55
166	7.93	0.39	796.0	557.902	3.01	560.79	3.07	717.44
167	8.13	2.50	130.2	543.983	3.02	547.80	3.07	714.02
168	7.97	2.05	158.5	555.589	3.01	557.09	3.08	710.64
12 missing vials)								
181	9.18	2.34	130.5	481.760	3.02	484.18	3.08	720.59
182	8.59	2.64	120.8	514.466	3.02	517.69	3.08	717.73
S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
183	9.20	4.69	68.58	480.707	3.02	487.41	3.07	715.52	
184	9.38	0.61	475.6	470.894	3.02	474.33	3.08	722.39	
185	10.08	4.31	70.64	438.489	3.02	442.26	3.09	714.02	
186	9.85	1.71	170.1	448.490	3.02	451.81	3.09	718.22	
187	9.84	3.36	90.01	449.051	3.02	453.41	3.08	720.18	
188	9.89	4.86	64.02	446.564	3.02	452.90	3.08	715.30	
189	11.56	2.77	98.13	371.825	3.02	377.24	3.10	717.04	
190	12.18	0.23	1099.	362.227	3.02	363.98	3.12	721.72	
191	10.51	4.32	68.17	408.591	3.02	413.87	3.09	714.19	
192	10.26	4.10	73.32	430.258	3.02	434.22	3.09	711.76	

Q1-LSA3

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

Q2-LSA3.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	2.88				
Q2-pH2a	2	544.23	1081.323	1.2504E+14	2.0761E-10	48.3807
Q2-pH 2b	3	544.78	1085.219	1.2549E+14	2.0836E-10	48.5550
Q2-pH 2.25a	4	535.26	1070.306	1.2377E+14	2.0549E-10	47.8877
Q2-pH 2.25b	5	551.86	1102.177	1.2745E+14	2.1161E-10	49.3137
Q2-pH 2.5a	6	543.56	1091.267	1.2619E+14	2.0952E-10	48.8256
Q2-pH 2.5b	7	536.15	1075.527	1.2437E+14	2.0649E-10	48.1213
Q2-pH 2.75a	8	533.96	1077.619	1.2461E+14	2.0690E-10	48.2149
Q2-pH 2.75b	9	525.15	1056.852	1.2221E+14	2.0291E-10	47.2858
Q2-pH3 a	10	523.04	1053.454	1.2182E+14	2.0226E-10	47.1337
Q2-pH 3b	11	523.51	1054.401	1.2193E+14	2.0244E-10	47.1761
Q2-C* pH3a	12	522.15	1051.450	1.2159E+14	2.0187E-10	47.0441
Q2-C*pH 3b	13	511.11	1032.754	1.1943E+14	1.9828E-10	46.2076
Q2-pH 3.25a	14	546.5	1096.729	1.2682E+14	2.1056E-10	49.0699
Q2-pH 3.25b	15	542.76	1089.005	1.2593E+14	2.0908E-10	48.7244
Q2-pH 3.5a	16	526.01	1059.009	1.2246E+14	2.0332E-10	47.3823
Q2-pH 3.5 b	17	544.53	1096.737	1.2682E+14	2.1057E-10	49.0703
Q2-pH 3.75 a	18	529.81	1067.520	1.2345E+14	2.0496E-10	47.7631
Q2-pH 3.75b	19	527.67	1063.636	1.2300E+14	2.0421E-10	47.5893
Q2-pH 4a	20	515.05	1029.482	1.1905E+14	1.9765E-10	46.0612
Q2-pH 4b	21	518.57	1035.483	1.1974E+14	1.9881E-10	46.3297
Q2-C* pH 4a	22	545.21	1085.427	1.2552E+14	2.0839E-10	48.5643
Q2-C* pH 4b	23	522.77	1043.245	1.2064E+14	2.0030E-10	46.6770
Q2-pH 4.25a	24	520.68	1041.360	1.2042E+14	1.9993E-10	46.5926
Q2-pH 4.25b	25	522.77	1043.453	1.2066E+14	2.0034E-10	46.6863
Q2-pH 4.5a	26	519.45	1032.704	1.1942E+14	1.9827E-10	46.2053
Q2-pH 4.5b	27	505.82	1010.831	1.1689E+14	1.9407E-10	45.2267
Q2-pH 4.75a	28	477.55	957.014	1.1067E+14	1.8374E-10	42.8188
Q2-pH 4.75b	29	482.38	966.500	1.1176E+14	1.8556E-10	43.2432
Q2-pH 5a	30	476.11	956.044	1.1055E+14	1.8355E-10	42.7754
Q2-pH 5b	31	472.95	950.462	1.0991E+14	1.8248E-10	42.5257
Q2-C* pH 5a	32	491.56	989.652	1.1444E+14	1.9001E-10	44.2791
Q2-C* pH 5b	33	481.43	966.727	1.1179E+14	1.8561E-10	43.2534
Q2-pH 5.25a	34	472.92	954.045	1.1032E+14	1.8317E-10	42.6860
Q2-pH 5.25b	35	458.59	926.257	1.0711E+14	1.7784E-10	41.4427
Q2-pH 5.5a	36	448.34	903.001	1.0442E+14	1.7337E-10	40.4022
Q2-pH 5.5b	37	436.41	880.391	1.0181E+14	1.6903E-10	39.3906
Q2-C* pH 5.5a	38	496.45	997.889	1.1539E+14	1.9159E-10	44.6477
Q2-C*pH 5.5b	39	503.6	1013.892	1.1724E+14	1.9466E-10	45.3636

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Q2-pH 5.75a	40	447.27	895.974	1.0361E+14	1.7202E-10	40.0877
Q2-pH 5.75b	41	432.48	868.434	1.0042E+14	1.6673E-10	38.8555
Q2-pH 6a	42	416.06	834.791	9.6533E+13	1.6027E-10	37.3503
Q2-pH 6b	43	398.93	801.064	9.2633E+13	1.5380E-10	35.8413
Q2-C* pH 6a	44	463.93	934.213	1.0803E+14	1.7936E-10	41.7986
Q2-C*pH 6b	45	461.11	925.924	1.0707E+14	1.7777E-10	41.4278
Q2-pH 6.25a	46	365.47	750.760	8.6816E+13	1.4414E-10	33.5906
Q2-pH 6.25b	47	368.69	738.858	8.5440E+13	1.4186E-10	33.0580
Q2-pH 6.5a	48	277.98	564.656	6.5295E+13	1.0841E-10	25.2639
Q2-pH 6.5b	49	296.11	590.331	6.8265E+13	1.1334E-10	26.4126
Q2-C* pH 6.5a	50	456.25	911.953	1.0546E+14	1.7509E-10	40.8027
Q2-C* pH 6.5b	51	461.35	945.196	1.0930E+14	1.8147E-10	42.2900
Q2-pH 6.75a	52	305.94	611.269	7.0686E+13	1.1736E-10	27.3494
Q2-pH 6.75b	53	310.36	618.863	7.1564E+13	1.1882E-10	27.6892
Q2-pH 7a	54	303.81	609.571	7.0489E+13	1.1703E-10	27.2735
Q2-pH 7b	55	301.3	606.481	7.0132E+13	1.1644E-10	27.1353
Q2-C* pH 7a	56	485.16	994.180	1.1496E+14	1.9088E-10	44.4817
Q2-C* pH 7b	57	499.15	1006.554	1.1640E+14	1.9325E-10	45.0353
Q2-pH 7.25a	58	342.23	699.571	8.0897E+13	1.3431E-10	31.3003
Q2-pH 7.25b	59	350.34	703.070	8.1301E+13	1.3498E-10	31.4568
Q2-pH 7.5a	60	378.34	756.529	8.7483E+13	1.4525E-10	33.8487
Q2-pH 7.5b	61	383.48	770.969	8.9153E+13	1.4802E-10	34.4948
Q2-C* pH 7.5a	62	516.49	1041.731	1.2046E+14	2.0001E-10	46.6092
Q2-C* pH 7.5b	63	522.53	1060.329	1.2261E+14	2.0358E-10	47.4413
Q2-pH 7.75a	64	442.96	891.806	1.0313E+14	1.7122E-10	39.9013
Q2-pH 7.75b	65	449.41	905.703	1.0473E+14	1.7389E-10	40.5231
Q2-pH 8a	66	489.92	993.551	1.1489E+14	1.9076E-10	44.4536
Q2-pH 8b	67	489.59	992.479	1.1477E+14	1.9055E-10	44.4056
Q2-C* pH 8a	68	548.05	1102.716	1.2752E+14	2.1171E-10	49.3378
Q2-C* pH 8a	69	544.35	1096.816	1.2683E+14	2.1058E-10	49.0739
Q2-pH 8.25a	70	539.73	1090.143	1.2606E+14	2.0930E-10	48.7753
Q2-pH 8.25b	71	553.37	1123.366	1.2990E+14	2.1568E-10	50.2617
Q2-pH 8.5a	72	523.9	1064.837	1.2314E+14	2.0444E-10	47.6431
Q2-pH 8.5b	73	515.53	1054.901	1.2199E+14	2.0253E-10	47.1985
Q2-pH 8.75a	74	538.78	1090.427	1.2609E+14	2.0935E-10	48.7880
Q2-pH 8.75b	75	527.04	1075.372	1.2435E+14	2.0646E-10	48.1144
Q2-pH 9a	76	525.9	1075.680	1.2439E+14	2.0652E-10	48.1282
Q2-pH 9b	77	521.41	1061.286	1.2272E+14	2.0376E-10	47.4842
Q2-C*pH 9a	78	523.75	1064.533	1.2310E+14	2.0438E-10	47.6294
Q2-C*pH 9b	79	529.06	1079.714	1.2486E+14	2.0730E-10	48.3087
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

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MA

Calculations verified on pp. 143-144 in 6C-11.

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MA

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	2.88				
Q1-pH2a	91	550.11	1092.138	1.2629E+14	2.0968E-10	48.8645
Q1-pH2b	92	558.36	1110.722	1.2844E+14	2.1325E-10	49.6960
Q1-pH 2.25a	93	534.44	1067.812	1.2348E+14	2.0501E-10	47.7762
Q1-pH 2.25b	94	534.32	1067.146	1.2340E+14	2.0489E-10	47.7463
Q1-pH 2.5a	95	551.42	1103.502	1.2761E+14	2.1187E-10	49.3730
Q1-pH 2.5b	96	551.42	1103.061	1.2756E+14	2.1178E-10	49.3532
Q1-pH 2.75a	97	535.79	1072.867	1.2406E+14	2.0598E-10	48.0023
Q1-pH 2.75b	98	551.48	1100.100	1.2721E+14	2.1121E-10	49.2208
Q1-pH 3a	99	546.56	1094.872	1.2661E+14	2.1021E-10	48.9869
Q1-pH 3b	100	540.22	1080.872	1.2499E+14	2.0752E-10	48.3605
Q1-C*pH 3a	101	557.57	1118.271	1.2931E+14	2.1470E-10	50.0338
Q1-C*pH 3b	102	559.19	1120.846	1.2961E+14	2.1520E-10	50.1490
Q1-pH 3.25a	103	538.9	1083.652	1.2531E+14	2.0805E-10	48.4848
Q1-pH 3.25b	104	541.55	1087.450	1.2575E+14	2.0878E-10	48.6548
Q1-pH 3.5a	105	553.37	1104.751	1.2775E+14	2.1211E-10	49.4289
Q1-pH 3.5b	106	544.78	1084.571	1.2542E+14	2.0823E-10	48.5260
Q1-pH 3.75a	107	541.06	1080.607	1.2496E+14	2.0747E-10	48.3486
Q1-pH 3.75b	108	544.66	1091.066	1.2617E+14	2.0948E-10	48.8166
Q1-pH 4a	109	546.01	1091.365	1.2620E+14	2.0954E-10	48.8300
Q1-pH 4b	110	535.86	1073.438	1.2413E+14	2.0609E-10	48.0278
Q1-C*pH 4a	111	558.23	1116.237	1.2908E+14	2.1431E-10	49.9428
Q1-C* pH 4b	112	543.19	1084.212	1.2538E+14	2.0816E-10	48.5099
Q1-pH 4.25a	113	520.06	1041.578	1.2045E+14	1.9998E-10	46.6024
Q1-pH 4.25b	114	541.8	1081.653	1.2508E+14	2.0767E-10	48.3954
Q1-pH 4.5a	115	525.03	1051.322	1.2157E+14	2.0185E-10	47.0383
Q1-pH 4.5b	116	526.29	1051.949	1.2164E+14	2.0197E-10	47.0664
Q1-pH 4.75a	117	531.37	1062.953	1.2292E+14	2.0408E-10	47.5587
Q1-pH 4.75b	118	539.98	1079.528	1.2483E+14	2.0726E-10	48.3004
Q1-pH 5a	119	517.24	1036.553	1.1986E+14	1.9901E-10	46.3776
Q1-pH 5b	120	513.98	1025.499	1.1859E+14	1.9689E-10	45.8830
Q1-C* pH 5a	121	527.39	1059.016	1.2246E+14	2.0332E-10	47.3826
Q1-C* pH 5b	122	520.18	1044.119	1.2074E+14	2.0046E-10	46.7161
Q1- pH 5.25a	123	509.81	1018.805	1.1781E+14	1.9560E-10	45.5835
Q1-pH 5.25b	124	506.75	1015.124	1.1739E+14	1.9490E-10	45.4188
Q1-pH 5.5a	125	518.83	1034.969	1.1968E+14	1.9871E-10	46.3067
Q1-pH 5.5b	126	526.52	1050.100	1.2143E+14	2.0161E-10	46.9837
Q1-C* pH 5.5a	127	508.97	1018.959	1.1783E+14	1.9563E-10	45.5904
Q1-C* pH 5.5b	128	521.41	1042.820	1.2059E+14	2.0021E-10	46.6580
Q1-pH 5.75a	129	513.86	1022.404	1.1823E+14	1.9629E-10	45.7445
Q1-pH 5.75b	130	503.96	1002.706	1.1595E+14	1.9251E-10	44.8632
Q1-pH 6a	131	495.33	990.264	1.1451E+14	1.9012E-10	44.3065
Q1-pH 6b	132	499.83	999.660	1.1560E+14	1.9193E-10	44.7269
Q1-C* pH 6a	133	514.1	1024.104	1.1842E+14	1.9662E-10	45.8205
Q1-C* pH 6b	134	527.39	1052.255	1.2168E+14	2.0203E-10	47.0801
Q1-pH 6.25a	135	468.2	931.556	1.0772E+14	1.7885E-10	41.6798
Q1-pH 6.25b	136	471.13	939.816	1.0868E+14	1.8044E-10	42.0494
Q1-pH 6.5a	137	466.6	930.780	1.0763E+14	1.7870E-10	41.6450
Q1-pH 6.5b	138	481.67	962.570	1.1131E+14	1.8481E-10	43.0674
Q1-C* pH 6.5a	139	494.88	986.406	1.1407E+14	1.8938E-10	44.1339
Q1-C* pH 6.5b	140	509.69	1017.752	1.1769E+14	1.9540E-10	45.5363
Q1-pH 6.75a	141	427.1	852.495	9.8581E+13	1.6367E-10	38.1424
Q1-pH 6.75b	142	432.38	865.279	1.0006E+14	1.6613E-10	38.7144
Q1-pH 7a	143	465.61	934.022	1.0801E+14	1.7933E-10	41.7901
Q1-pH 7b	144	464.03	929.920	1.0753E+14	1.7854E-10	41.6066
Q1-C* pH 7a	145	487.31	982.480	1.1361E+14	1.8863E-10	43.9582
Q1-C* pH 7b	146	478.59	959.868	1.1100E+14	1.8429E-10	42.9465
Q1-pH 7.25a	147	480.69	964.079	1.1148E+14	1.8510E-10	43.1349
Q1-pH 7.25b	148	492.22	985.623	1.1398E+14	1.8923E-10	44.0988
Q1-pH 7.5a	149	510.88	1023.808	1.1839E+14	1.9656E-10	45.8073
Q1-pH 7.5b	150	516.63	1039.497	1.2021E+14	1.9958E-10	46.5093
Q1-C* pH 7.5a	151	521.03	1047.718	1.2116E+14	2.0115E-10	46.8771
Q1-C* pH 7.5b	152	542.76	1083.137	1.2525E+14	2.0796E-10	48.4618
Q1-pH 7.75a	153	521.91	1045.493	1.2090E+14	2.0073E-10	46.7775
Q1-pH 7.75b	154	538.36	1076.074	1.2443E+14	2.0660E-10	48.1458
Q1-pH 8a	155	545.33	1089.353	1.2597E+14	2.0915E-10	48.7399
Q1-pH 8b	156	557.78	1112.445	1.2864E+14	2.1358E-10	49.7731
Q1-C* pH 8a	157	542.34	1084.030	1.2535E+14	2.0813E-10	48.5018
Q1-C* pH 8b	158	526.25	1051.869	1.2164E+14	2.0195E-10	47.0628
Q1-pH 8.25a	159	548.73	1099.659	1.2716E+14	2.1113E-10	49.2011
Q1-pH 8.25b	160	546.56	1091.156	1.2618E+14	2.0949E-10	48.8206
Q1-pH 8.5a	161	564.81	1129.394	1.3060E+14	2.1684E-10	50.5315
Q1-pH 8.5b	162	551.61	1107.206	1.2803E+14	2.1258E-10	49.5387
Q1-pH 8.75a	163	548.05	1101.165	1.2734E+14	2.1142E-10	49.2684
Q1-pH 8.75b	164	552.11	1105.325	1.2782E+14	2.1222E-10	49.4546
Q1-pH 9a	165	553.82	1111.642	1.2855E+14	2.1343E-10	49.7372
Q1-pH 9b	166	557.9	1118.036	1.2929E+14	2.1466E-10	50.0233
Q1-C* pH 9a	167	543.98	1092.329	1.2631E+14	2.0972E-10	48.8731
Q1-C*pH 9b	168	555.59	1113.407	1.2875E+14	2.1377E-10	49.8162
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

Calculations verified in 6C-11, pp 143-144.
MA
7-7-94.

7 July '94
MA

LSA Results of Q3 Sorption Experiment:

7 July 94
MA

Protocol #: 5 Name:U-233 3% 2 sigma 16-Jun-94 06:24
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	18.67	1.46	2.998	3.65	27.55	1.20	138.58	B
2	9.06	4.84	66.80	487.730	3.02	493.75	3.07	667.31	
3	9.04	1.02	290.4	488.816	3.02	490.26	3.09	678.46	
4	9.37	3.42	90.09	471.708	3.02	474.79	3.09	677.78	
5	9.49	5.46	58.61	465.284	3.02	470.97	3.08	676.47	
6	10.42	6.47	48.17	423.585	3.02	430.22	3.08	672.99	
7	10.35	4.42	67.83	426.760	3.02	431.67	3.09	675.84	
8	10.00	5.03	61.44	441.702	3.02	446.75	3.08	673.94	
9	10.24	4.67	64.91	431.279	3.02	436.70	3.08	674.16	
10	11.28	1.28	209.3	391.328	3.02	393.81	3.11	677.01	
11	11.34	2.23	122.4	388.889	3.02	391.67	3.11	679.40	
12	10.48	4.04	73.18	421.143	3.02	426.64	3.09	673.65	
13	10.40	6.14	50.52	424.790	3.02	430.81	3.08	665.68	
(5 missing vials)									
19	9.11	6.03	54.81	484.927	3.02	492.86	3.07	670.13	
20	9.24	3.30	93.81	478.604	3.02	481.21	3.08	671.48	
21	9.75	3.38	89.30	453.412	3.02	457.47	3.08	673.05	
22	9.62	3.68	83.17	459.164	3.02	463.40	3.08	674.94	
23	10.46	7.62	41.76	421.859	3.02	431.05	3.07	665.49	
24	10.88	2.84	99.55	405.917	3.02	409.12	3.10	672.58	
25	10.16	5.44	56.81	434.600	3.02	439.97	3.08	667.93	
26	10.19	5.28	58.34	433.214	3.02	439.77	3.08	668.29	
27	11.90	6.88	42.80	370.447	3.02	378.24	3.09	669.08	
28	11.95	3.42	79.85	368.885	3.02	372.36	3.11	669.76	
29	10.46	5.04	59.99	421.859	3.02	427.04	3.09	669.03	
30	10.31	2.18	130.8	428.040	3.02	430.16	3.10	674.63	
(1 missing vial)									
32	0.84	64.66	30.81	5326.76	2.99	5403.40	2.98	689.74	
33	0.82	86.21	26.24	5462.86	2.99	5572.45	2.97	684.71	
34	0.85	69.57	29.29	5245.24	3.00	5335.98	2.98	686.09	
35	0.81	193.68	16.72	5501.94	3.00	5721.83	2.94	671.37	
36	0.84	165.85	17.87	5307.72	3.00	5483.16	2.95	674.26	
37	8.90	6.95	48.99	496.328	3.02	505.03	3.06	684.64	
38	9.32	8.48	40.40	473.826	3.02	482.42	3.07	682.53	
39	9.42	2.99	101.9	468.976	3.02	474.04	3.08	686.44	
40	9.37	7.90	42.75	471.495	3.02	481.30	3.06	685.01	
41	10.58	3.92	74.87	417.607	3.02	422.92	3.09	683.21	
42	10.75	5.89	51.54	410.490	3.02	415.98	3.09	684.56	
43	9.90	6.28	50.74	446.093	3.02	451.84	3.08	685.69	
44	9.80	7.66	42.96	450.879	3.02	459.69	3.07	684.40	
45	12.00	5.41	52.58	367.752	3.02	373.70	3.10	681.62	
46	11.88	4.98	56.89	371.413	3.02	378.00	3.09	684.53	
47	10.31	7.23	44.02	428.331	3.02	436.66	3.07	682.68	
48	10.68	6.89	45.07	413.481	3.02	421.88	3.08	681.05	
(6 missing vials)									
55	9.50	5.86	55.07	464.897	3.02	470.76	3.08	683.02	
56	9.36	1.95	152.9	472.002	3.02	475.01	3.09	685.65	
57	9.49	8.41	40.30	465.600	3.02	475.40	3.06	678.17	
58	9.24	3.95	79.53	478.495	3.02	483.92	3.08	684.58	

Spk 27A
spk 28A
27+28
Q3-IUa
Q3-IUb

"Q3-IU.XLS"

Q3-IU.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3				
SPK27A	32	5326.8	10657.783	1.2324E+15	2.0462E-09	476.8515
SPK28A	33	5462.9	10914.805	1.2622E+15	2.0956E-09	488.3512
SPK27&28A	34	5245.2	10658.890	1.2326E+15	2.0464E-09	476.9011
Q3-IUa	35	5501.9	10997.282	1.2717E+15	2.1114E-09	492.0414
Q3-IUb	36	5307.7	10660.213	1.2327E+15	2.0467E-09	476.9602
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

The samples for the Spikes were taken on 6-6-94 (pp. 240 of this book).
Q3-IU samples were taken on 6-7-94 (p. 242 of this book).
Verification calculations shown on pp. 143-144 of 6C-11. MA
7-7-94

Protocol #: 5 Name:U-233 3% 2 sigma 25-Jun-94 11:24
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	19.66	1.43	3.316	3.47	29.28	1.17	140.87	B
2	0.84	31.53	49.53	5346.68	2.99	5392.15	2.98	696.64	
3	0.86	38.48	42.74	5204.82	2.99	5252.12	2.98	695.51	
4	0.83	38.17	43.74	5364.15	3.00	5411.68	2.99	699.68	
5	0.82	26.68	56.37	5432.05	3.00	5473.16	2.99	695.15	
6	0.83	26.12	56.88	5379.82	2.99	5421.32	2.99	701.34	
7	0.84	26.77	55.56	5359.78	2.98	5396.91	2.98	701.76	
8	0.84	45.81	38.55	5289.54	3.00	5354.05	2.99	695.22	
9	0.81	29.72	52.55	5523.85	2.99	5557.14	2.99	698.42	
10	0.83	40.58	42.00	5361.75	3.00	5422.53	2.99	695.28	
11	0.83	17.69	75.87	5354.52	3.00	5390.00	3.00	699.75	
12	0.83	47.81	37.72	5406.32	2.99	5461.08	2.98	694.54	
13	0.86	41.97	40.35	5221.10	2.99	5271.88	2.98	697.62	
14	0.84	26.77	55.56	5338.35	2.99	5377.86	2.98	695.48	
15	0.83	20.10	68.89	5390.66	2.99	5421.32	2.99	696.87	
16	0.82	20.58	68.09	5464.98	2.99	5512.18	2.98	696.46	
17	0.86	36.15	44.57	5208.31	2.99	5252.12	2.98	694.37	
18	0.83	36.96	44.70	5362.95	3.00	5415.30	2.99	694.72	
19	0.82	41.31	41.75	5423.51	3.00	5484.13	2.99	697.54	
20	0.86	22.20	62.87	5173.43	3.00	5216.07	2.99	699.74	
21	0.86	46.62	37.67	5195.52	2.99	5260.25	2.98	694.75	
22	0.86	38.48	42.74	5195.52	2.99	5253.28	2.98	694.09	
23	0.85	53.28	34.78	5256.68	2.99	5329.54	2.98	693.16	
24	0.88	20.11	66.87	5068.28	3.00	5096.86	2.99	697.08	
25	0.87	36.66	43.90	5153.01	2.99	5200.61	2.98	695.86	
26	0.84	29.15	52.31	5291.92	3.00	5332.63	3.00	699.28	
27	0.86	43.13	39.63	5196.68	2.99	5250.95	2.98	694.72	
28	0.89	39.89	41.02	5028.15	2.99	5079.71	2.98	692.99	
29	0.87	38.96	42.15	5116.22	3.00	5176.47	2.99	695.51	
30	0.91	51.77	34.23	4915.37	2.99	4985.01	2.98	693.21	
31	0.89	26.41	54.50	5016.91	2.99	5065.10	2.99	695.85	
32	0.91	34.18	45.01	4896.68	3.00	4946.54	2.99	691.93	
33	0.88	28.06	52.49	5081.91	2.99	5112.77	2.99	695.71	
34	0.92	32.51	46.33	4867.34	2.99	4918.55	2.98	694.57	
35	0.91	28.69	50.82	4882.40	3.00	4913.58	3.00	691.93	
36	0.89	47.75	36.46	5002.30	3.00	5071.84	2.99	692.30	
37	0.89	42.14	39.56	5022.53	2.99	5075.21	2.98	694.89	
38	0.89	52.25	34.41	4991.07	3.00	5060.61	2.99	693.70	
39	0.89	30.90	48.79	5014.66	2.99	5058.36	2.99	695.19	
40	0.90	34.78	44.73	4957.80	3.00	5004.05	2.99	697.18	
41	0.89	29.78	50.07	5012.41	3.00	5050.50	2.99	696.43	
42	0.89	50.00	35.39	5014.66	2.99	5071.84	2.99	693.04	
43	0.87	40.11	41.34	5150.71	2.99	5201.75	2.98	694.49	
44	0.89	61.24	31.14	5039.38	2.99	5114.54	2.97	691.22	
45	0.88	33.75	46.18	5064.87	3.00	5099.13	2.99	696.67	
46	0.91	38.58	41.48	4920.86	2.99	4965.23	2.98	694.31	
47	0.91	22.10	61.33	4901.08	3.00	4930.06	2.99	696.13	
48	0.90	55.89	32.79	4964.46	2.99	5034.05	2.98	691.22	
49	0.90	43.67	38.42	4935.57	3.00	4994.05	2.99	691.98	

Q3-LSA I
p 266

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	0.91	58.36	31.74	4927.45	2.99	4999.29	2.97	688.62	
51	0.90	38.12	42.05	4984.46	2.99	5041.83	2.98	695.10	
52	0.90	32.56	46.80	4990.02	2.99	5027.39	2.98	697.55	
53	0.93	47.00	36.03	4818.19	2.99	4878.25	2.98	693.63	
54	0.91	48.47	35.71	4899.98	3.00	4965.23	2.98	689.43	
55	0.90	29.23	50.44	4937.80	3.00	4968.50	3.00	691.76	
56	0.90	18.12	71.55	4935.57	3.00	4964.05	3.00	696.64	
57	0.87	27.46	53.61	5153.01	2.99	5191.41	2.98	696.30	
58	0.88	36.02	44.17	5061.46	3.00	5107.08	2.99	696.76	
59	0.92	39.03	40.93	4840.16	3.00	4883.76	2.99	690.47	
60	0.87	25.17	57.06	5141.51	2.99	5183.36	2.99	694.62	
61	0.87	32.06	48.11	5120.82	3.00	5159.23	2.99	695.23	
62	0.87	34.36	45.87	5123.12	3.00	5169.57	2.99	696.46	
63	0.92	40.12	40.19	5133.64	2.91	5181.59	2.90	692.48	
64	0.84	31.53	49.53	5327.64	2.99	5361.20	2.99	693.39	
65	0.82	30.34	51.49	5466.20	2.99	5503.65	2.99	698.18	
66	0.85	17.98	74.03	5261.39	2.99	5293.07	2.99	691.48	
67	0.84	13.67	92.18	5324.07	2.99	5338.58	2.99	697.44	
68	0.82	40.09	42.59	5473.51	2.99	5529.26	2.98	692.56	
69	0.84	37.48	44.02	5355.02	2.98	5410.01	2.97	695.00	
70	0.83	39.37	42.85	5377.41	2.99	5423.73	2.99	693.19	
71	0.84	27.96	53.87	5345.49	2.99	5381.43	2.98	691.68	
72	0.85	25.04	57.93	5263.74	2.99	5297.78	2.99	689.37	
73	0.86	37.31	43.63	5202.50	2.99	5243.98	2.99	694.31	
74	0.82	51.07	36.38	5469.86	2.99	5526.82	2.98	688.87	
75	0.84	33.91	47.11	5332.40	2.99	5388.58	2.98	690.17	
76	0.85	42.69	40.13	5275.51	2.99	5327.19	2.98	691.09	
77	0.84	13.67	92.18	5310.97	3.00	5324.29	3.00	694.45	
78	0.87	25.17	57.06	5236.91	2.96	5266.12	2.96	690.83	
79	0.87	58.50	32.41	5104.73	3.00	5160.38	2.99	690.62	

"Q3-LSA I"

7 July 94
MA

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.32				
Q3-pH 2 a	2	5346.7	10648.636	1.2314E+15	2.0445E-09	476.4423
Q3-pH 2b	3	5204.8	10424.234	1.2054E+15	2.0014E-09	466.4021
Q3-pH 2.25 a	4	5364.2	10758.424	1.2441E+15	2.0655E-09	481.3544
Q3-pH 2.25 b	5	5432.1	10956.132	1.2669E+15	2.1035E-09	490.2003
Q3-pH 2.5 a	6	5379.8	10846.411	1.2543E+15	2.0824E-09	485.2911
Q3-pH 2.5 b	7	5359.8	10832.215	1.2526E+15	2.0797E-09	484.6560
Q3-pH 2.75 a	8	5289.5	10617.302	1.2278E+15	2.0385E-09	475.0403
Q3-pH 2.75 b	9	5523.8	11125.559	1.2865E+15	2.1360E-09	497.7808
Q3-pH 3 a	10	5361.7	10851.528	1.2548E+15	2.0834E-09	485.5201
Q3-pH 3b	11	5354.5	10815.027	1.2506E+15	2.0764E-09	483.8870
Q3-C* pH 3a	12	5406.3	10946.183	1.2658E+15	2.1016E-09	489.7552
Q3-C* pH 3b	13	5221.1	10549.808	1.2200E+15	2.0255E-09	472.0205
Q3-pH 3.25 a	14	5338.4	10799.818	1.2489E+15	2.0735E-09	483.2065
Q3-pH 3.25 b	15	5390.7	10881.429	1.2583E+15	2.0892E-09	486.8579
Q3-pH 3.5 a	16	5465	11031.449	1.2757E+15	2.1180E-09	493.5701
Q3-pH 3.5 b	17	5208.3	10521.838	1.2167E+15	2.0201E-09	470.7691
Q3-pH 3.75 a	18	5363	10856.174	1.2554E+15	2.0843E-09	485.7280
Q3-pH 3.75 b	19	5423.5	10972.102	1.2688E+15	2.1066E-09	490.9148
Q3- pH 4a	20	5173.4	10603.464	1.2262E+15	2.0358E-09	474.4212
Q3-pH 4 b	21	5195.5	10620.442	1.2281E+15	2.0391E-09	475.1808
Q3-C* pH 4a	22	5195.5	10590.135	1.2246E+15	2.0332E-09	473.8248
Q3-C* pH 4b	23	5256.7	10712.615	1.2388E+15	2.0568E-09	479.3048
Q3-pH 4.25 a	24	5068.3	10320.240	1.1934E+15	1.9814E-09	461.7492
Q3-pH 4.25b	25	5153	10452.353	1.2087E+15	2.0068E-09	467.6602
Q3-pH 4.5 a	26	5291.9	10718.898	1.2395E+15	2.0580E-09	479.5859
Q3-pH 4.5 b	27	5196.7	10519.595	1.2165E+15	2.0197E-09	470.6687
Q3-pH 4.75 a	28	5028.2	10155.827	1.1744E+15	1.9499E-09	454.3930
Q3-pH 4.75 b	29	5116.2	10342.066	1.1959E+15	1.9856E-09	462.7257
Q3-pH 5 a	30	4915.4	9950.142	1.1506E+15	1.9104E-09	445.1902
Q3-pH 5 b	31	5016.9	10131.078	1.1715E+15	1.9451E-09	453.2857
Q3-C* pH 5a	32	4896.7	9880.307	1.1425E+15	1.8970E-09	442.0656
Q3-C* pH 5 b	33	5081.9	10243.721	1.1846E+15	1.9667E-09	458.3255
Q3-pH 5.25 a	34	4867.3	9813.185	1.1348E+15	1.8841E-09	439.0625
Q3-pH 5.25 b	35	4882.4	9843.548	1.1383E+15	1.8899E-09	440.4210
Q3-pH 5.5 a	36	5002.3	10032.692	1.1602E+15	1.9262E-09	448.8836
Q3-pH 5.5 b	37	5022.5	10177.366	1.1769E+15	1.9540E-09	455.3567
Q3-C *pH 5.5 a	38	4991.1	10058.585	1.1632E+15	1.9312E-09	450.0422
Q3-C*pH 5.5 b	39	5014.7	10138.819	1.1724E+15	1.9466E-09	453.6320
Q3-pH 5.75 a	40	4957.8	9983.488	1.1545E+15	1.9168E-09	446.6821
Q3-pH 5.75 b	41	5012.4	10126.081	1.1710E+15	1.9441E-09	453.0621
Q3-pH 6 a	42	5014.7	10196.543	1.1791E+15	1.9577E-09	456.2147
Q3-pH 6 b	43	5150.7	10460.418	1.2096E+15	2.0083E-09	468.0210
Q3-C* pH 6a	44	5039.4	10145.722	1.1732E+15	1.9479E-09	453.9408
Q3-C* pH 6 b	45	5064.9	10194.988	1.1789E+15	1.9574E-09	456.1451
Q3-pH 6.25 a	46	4920.9	9957.224	1.1514E+15	1.9117E-09	445.5070
Q3-pH 6.25 b	47	4901.1	9901.172	1.1449E+15	1.9010E-09	442.9992
Q3-pH 6.5 a	48	4964.5	10059.696	1.1633E+15	1.9314E-09	450.0919
Q3-pH 6.5 b	49	4935.6	9989.010	1.1551E+15	1.9178E-09	446.9292
Q3-C*pH 6.5 a	50	4927.5	9850.960	1.1391E+15	1.8913E-09	440.7526
Q3-C*pH 6.5 b	51	4984.5	9998.917	1.1563E+15	1.9197E-09	447.3725
Q3-pH 6.75 a	52	4990	10093.083	1.1671E+15	1.9378E-09	451.5856
Q3-pH 6.75 b	53	4818.2	9718.011	1.1238E+15	1.8658E-09	434.8042
Q3-pH 7a	54	4900	9939.108	1.1493E+15	1.9082E-09	444.6965
Q3-pH 7b	55	4937.8	10042.302	1.1613E+15	1.9281E-09	449.3136
Q3-C* pH 7a	56	4935.6	10070.537	1.1645E+15	1.9335E-09	450.5769
Q3-C*pH 7 b	57	5153	10520.641	1.2166E+15	2.0199E-09	470.7155
Q3-pH 7.25 a	58	5061.5	10302.178	1.1913E+15	1.9780E-09	460.9410
Q3-pH 7.25 b	59	4840.2	9841.724	1.1381E+15	1.8895E-09	440.3393
Q3-pH 7.5 a	60	5141.5	10462.983	1.2099E+15	2.0088E-09	468.1358
Q3-pH 7.5 b	61	5120.8	10410.287	1.2038E+15	1.9987E-09	465.7780
Q3-C* pH 7.5 a	62	5123.1	10423.438	1.2053E+15	2.0012E-09	466.3665
Q3-C* pH 7.5 b	63	5133.6	10432.107	1.2063E+15	2.0029E-09	466.7543
Q3-pH 7.75 a	64	5327.6	10765.084	1.2448E+15	2.0668E-09	481.6524
Q3-pH 7.75 b	65	5466.2	11027.234	1.2752E+15	2.1172E-09	493.3815
Q3-pH 8a	66	5261.4	10720.029	1.2396E+15	2.0582E-09	479.6365
Q3-pH 8b	67	5324.1	10805.906	1.2496E+15	2.0747E-09	483.4789
Q3-C*pH 8a	68	5473.5	11082.223	1.2815E+15	2.1277E-09	495.8419
Q3-C* pH 8b	69	5355	10868.723	1.2568E+15	2.0867E-09	486.2894
Q3-pH 8.25 a	70	5377.4	10887.649	1.2590E+15	2.0904E-09	487.1362
Q3-pH 8.25 b	71	5345.5	10790.250	1.2478E+15	2.0717E-09	482.7784
Q3-pH 8.5 a	72	5263.7	10646.723	1.2312E+15	2.0441E-09	476.3567
Q3-pH 8.5 b	73	5202.5	10520.728	1.2166E+15	2.0199E-09	470.7194
Q3-pH 8.75 a	74	5469.9	11023.478	1.2747E+15	2.1164E-09	493.2135
Q3-pH 8.75 b	75	5332.4	10711.933	1.2387E+15	2.0566E-09	479.2743
Q3-pH 9a	76	5275.5	10597.650	1.2255E+15	2.0347E-09	474.1610
Q3-pH 9b	77	5311	10707.601	1.2382E+15	2.0558E-09	479.0805
Q3-C*pH 9a	78	5236.9	10596.742	1.2254E+15	2.0345E-09	474.1204
Q3-C*pH 9b	79	5104.7	10310.503	1.1923E+15	1.9795E-09	461.3135
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

"Q3-LSA1"

Verification calculations in GC-11 pp. 143 -144.
MA
7-7-94.

8 July 94 LSA results : Q4 Sorption
MA

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Protocol #: 6        Name:U-233 5% 2 Sigma          15-Jun-94    12:04
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
```

Q4

	S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
BKG	1	533.94	18.70	2.00	2.997	5.00	27.55	1.65	135.34	B
Q4 TRA	2	30.35	1.43	116.5	49.722	5.31	50.94	6.38	673.82	
Q4 TRB	3	29.90	1.54	109.8	50.515	5.30	52.52	6.29	671.33	

Q4-IU.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3				
Q4-IUa	2	49.72	98.945	1.1442E+13	1.8997E-11	4.4270
Q4-IUb	3	50.52	100.959	1.1675E+13	1.9384E-11	4.5171
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

MA Verification calculations DONE IN GC-11. pp. 143-144.

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Protocol #: 8        Name:U-233 5% 2 Sigma          25-Jun-94    23:01
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=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	453.48	19.70	2.12	3.528	5.00	29.87	1.72	148.77	B
2	29.09	0.55	314.7	51.473	5.35	52.95	6.45	709.86	
3	29.48	0.00	0.00	50.746	5.36	51.51	6.53	717.23	
4	30.02	0.00	0.00	49.803	5.36	50.51	6.56	713.32	
5	30.87	0.00	0.00	48.334	5.38	47.81	6.72	730.78	
6	31.83	1.10	152.2	46.739	5.39	48.80	6.53	695.55	
7	29.87	0.42	403.7	50.037	5.36	51.39	6.50	718.37	
8	29.43	1.57	111.5	50.838	5.36	52.02	6.49	691.26	
9	30.31	1.51	114.0	49.260	5.37	50.83	6.50	694.12	
10	30.92	0.00	0.00	48.218	5.38	47.43	6.75	727.35	
11	30.50	0.00	0.00	48.931	5.37	49.77	6.57	717.90	
12	31.70	0.02	10798	47.008	5.39	47.70	6.65	718.56	
13	30.20	0.86	197.5	49.518	5.36	51.33	6.47	710.02	
14	30.33	1.73	100.1	49.258	5.37	50.98	6.48	691.40	
15	31.48	0.00	0.00	47.298	5.39	45.67	6.88	733.82	
16	31.24	1.36	124.4	47.720	5.38	49.71	6.50	697.32	
17	31.78	0.00	0.00	46.849	5.39	45.94	6.82	727.67	
18	29.10	0.00	0.00	51.455	5.35	50.68	6.64	726.37	
19	29.85	0.57	299.8	50.073	5.36	50.84	6.55	704.30	
20	31.02	0.00	0.00	48.051	5.38	48.53	6.64	721.78	
21	29.92	0.79	216.9	49.981	5.36	50.25	6.59	710.57	
22	30.06	0.00	0.00	49.699	5.37	49.31	6.66	723.66	
23	28.02	0.00	0.00	53.574	5.34	53.54	6.52	720.34	
24	31.76	0.00	0.00	46.881	5.39	46.55	6.76	720.08	
25	32.03	0.00	0.00	46.425	5.39	46.69	6.71	721.35	
26	33.81	0.00	0.00	43.795	5.42	44.58	6.76	715.27	
27	31.72	0.00	0.00	46.913	5.39	46.90	6.72	720.32	
28	33.85	0.45	357.8	43.739	5.42	44.14	6.80	702.37	
29	35.63	0.70	223.3	41.378	5.44	42.29	6.84	707.36	
30	40.35	0.00	0.00	36.125	5.51	35.88	7.26	724.38	
31	38.17	0.00	0.00	38.389	5.48	37.94	7.16	741.62	
32	33.82	0.00	0.00	44.062	5.42	42.00	7.07	745.86	
33	34.83	0.00	0.00	42.409	5.43	42.00	6.95	740.36	
34	44.09	0.55	256.4	32.784	5.56	33.59	7.30	699.67	
35	42.06	0.00	0.00	34.513	5.53	34.40	7.34	738.37	
36	38.28	0.00	0.00	38.295	5.48	36.64	7.33	740.49	
37	39.81	0.00	0.00	36.688	5.50	35.49	7.36	737.14	
38	44.12	0.00	0.00	32.759	5.56	32.44	7.50	727.92	
39	44.36	0.18	771.4	32.608	5.56	33.57	7.29	713.17	
40	42.32	0.00	0.00	34.279	5.54	34.69	7.27	722.32	
41	43.38	0.00	0.00	33.447	5.55	33.50	7.38	728.96	
42	49.15	0.00	0.00	29.045	5.64	28.99	7.75	722.59	
43	48.06	1.67	83.76	29.888	5.61	31.60	7.34	683.01	
44	41.55	0.32	448.7	35.004	5.53	36.29	7.10	720.02	
45	39.84	1.11	135.9	36.632	5.50	38.18	6.98	699.61	
46	48.82	0.05	2973.	29.245	5.64	29.47	7.68	715.70	
47	48.63	0.27	506.4	29.373	5.63	30.24	7.55	711.12	
48	44.13	0.74	192.7	32.728	5.57	34.22	7.20	700.36	
49	45.19	0.88	160.7	31.900	5.58	33.44	7.24	703.40	

"Q4-LSA1"
pp. 272-275
MA

8 July 94
MA

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
50	38.40	0.00	0.00	38.295	5.47	37.84	7.15	729.66	
51	36.74	0.44	349.2	40.021	5.46	41.06	6.88	712.71	
52	38.71	1.04	146.0	37.805	5.49	39.93	6.85	699.90	
53	37.87	0.31	480.4	38.748	5.47	40.11	6.90	719.98	
54	35.84	0.75	208.7	41.115	5.45	42.96	6.74	713.81	
55	35.21	0.00	0.00	41.942	5.44	40.82	7.05	718.06	
56	35.99	0.00	0.00	40.956	5.45	41.40	6.91	727.09	
57	34.76	0.00	0.00	42.502	5.43	41.68	6.99	738.20	
58	33.69	1.23	133.1	43.993	5.41	46.18	6.60	707.80	
59	33.83	1.02	158.8	43.856	5.41	44.42	6.77	712.14	
60	30.87	0.00	0.00	48.334	5.38	48.56	6.65	687.53	
61	30.23	1.54	112.5	49.432	5.37	50.75	6.51	697.77	
62	32.63	0.89	183.8	45.537	5.40	46.72	6.65	713.59	
63	30.96	0.32	511.5	48.184	5.38	49.11	6.59	721.41	
64	30.37	0.00	0.00	49.155	5.37	49.36	6.63	714.50	
65	30.19	1.43	120.4	49.469	5.37	51.02	6.49	701.62	
66	30.67	0.25	657.6	48.640	5.37	49.07	6.62	715.53	
67	29.43	0.69	250.0	50.838	5.36	51.65	6.52	715.34	
68	30.04	0.87	195.8	49.734	5.37	50.76	6.53	712.28	
69	31.10	0.00	0.00	47.919	5.38	47.88	6.69	724.05	
70	30.45	0.46	362.7	49.017	5.37	49.25	6.63	721.43	
71	30.12	0.00	0.00	49.626	5.37	49.78	6.61	726.28	
72	29.71	0.00	0.00	50.326	5.36	49.50	6.68	727.11	
73	29.17	0.80	216.1	51.323	5.35	52.65	6.46	710.08	
74	30.46	1.44	119.2	49.000	5.37	50.24	6.54	701.81	
75	29.45	0.00	0.00	50.869	5.35	50.68	6.60	724.54	
76	29.32	0.00	0.00	51.042	5.36	50.08	6.67	741.45	
77	30.67	0.00	0.00	48.640	5.37	48.52	6.67	727.87	
78	29.10	0.68	254.8	51.455	5.35	51.75	6.55	715.56	
79	30.31	0.26	645.9	49.293	5.37	49.28	6.64	716.18	

"Q4-LSA1"
samples taken
23 June '94
pp. 272-275
in this book.

Q4-LSA1.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.53				
Q4-pH 2 a	2	51.47	102.489	1.1852E+13	1.9677E-11	4.5856
Q4-pH 2 b	3	50.75	101.055	1.1686E+13	1.9402E-11	4.5214
Q4-pH 2.25 a	4	49.8	99.680	1.1527E+13	1.9138E-11	4.4599
Q4-pH 2.25 b	5	48.33	96.352	1.1142E+13	1.8499E-11	4.3110
Q4-pH 2.5 a	6	46.74	93.219	1.0780E+13	1.7897E-11	4.1708
Q4-pH 2.5 b	7	50.04	99.820	1.1543E+13	1.9165E-11	4.4662
Q4-pH 2.75 a	8	50.84	101.721	1.1763E+13	1.9530E-11	4.5512
Q4-pH 2.75 b	9	49.26	98.284	1.1365E+13	1.8870E-11	4.3974
Q4-pH 3a	10	48.22	97.198	1.1240E+13	1.8661E-11	4.3488
Q4-pH 3 b	11	48.93	98.056	1.1339E+13	1.8826E-11	4.3872
Q4-C* pH 3 a	12	47.01	93.907	1.0859E+13	1.8030E-11	4.2016
Q4-C* pH 3 b	13	49.52	99.179	1.1469E+13	1.9042E-11	4.4375
Q4-pH 3.25 a	14	49.26	98.737	1.1418E+13	1.8957E-11	4.4177
Q4-pH 3.25 b	15	47.3	94.828	1.0966E+13	1.8206E-11	4.2428
Q4-pH 3.5 a	16	47.72	95.997	1.1101E+13	1.8431E-11	4.2951
Q4-pH 3.5 b	17	46.85	94.114	1.0883E+13	1.8069E-11	4.2109
Q4-pH 3.75 a	18	51.45	103.293	1.1945E+13	1.9831E-11	4.6215
Q4-pH 3.75 b	19	50.07	100.421	1.1612E+13	1.9280E-11	4.4931
Q4-pH 4 a	20	48.05	96.100	1.1113E+13	1.8451E-11	4.2997
Q4-pH 4 b	21	49.98	99.840	1.1545E+13	1.9169E-11	4.4671
Q4-C* pH 4 a	22	49.7	99.679	1.1527E+13	1.9138E-11	4.4599
Q4-C*pH 4 b	23	53.57	107.312	1.2409E+13	2.0603E-11	4.8014
Q4-pH 4.25 a	24	46.88	94.061	1.0877E+13	1.8059E-11	4.2085
Q4-pH 4.25 b	25	46.42	92.952	1.0749E+13	1.7846E-11	4.1588
Q4-pH 4.5 a	26	43.8	87.776	1.0150E+13	1.6852E-11	3.9273
Q4-pH 4.5 b	27	46.91	94.046	1.0875E+13	1.8056E-11	4.2078
Q4-pH 4.75 a	28	43.74	87.463	1.0114E+13	1.6792E-11	3.9133
Q4-pH 4.75 b	29	41.38	82.644	9.5568E+12	1.5867E-11	3.6977
Q4-pH 5 a	30	36.12	72.182	8.3470E+12	1.3859E-11	3.2296
Q4-pH 5 b	31	38.39	76.857	8.8875E+12	1.4756E-11	3.4387
Q4-C*pH 5 a	32	44.06	88.208	1.0200E+13	1.6935E-11	3.9466
Q4-C* pH 5 b	33	42.41	84.786	9.8045E+12	1.6278E-11	3.7935
Q4-pH 5.25 a	34	32.78	65.508	7.5751E+12	1.2577E-11	2.9309
Q4-pH 5.25 b	35	34.51	69.172	7.9989E+12	1.3281E-11	3.0949
Q4-pH 5.5 a	36	38.3	77.016	8.9059E+12	1.4787E-11	3.4459
Q4-pH 5.5 b	37	36.69	73.498	8.4991E+12	1.4111E-11	3.2884
Q4-C*pH 5.5 a	38	32.76	65.717	7.5994E+12	1.2617E-11	2.9403
Q4-C*pH 5.5 b	39	32.61	65.338	7.5555E+12	1.2544E-11	2.9233
Q4-pH 5.75 a	40	34.28	68.794	7.9552E+12	1.3208E-11	3.0780
Q4-pH 5.75 b	41	33.45	67.074	7.7563E+12	1.2878E-11	3.0010
Q4-pH 6 a	42	29.05	58.287	6.7401E+12	1.1191E-11	2.6079
Q4-pH 6b	43	29.89	59.900	6.9267E+12	1.1500E-11	2.6800
Q4-C*pH 6 a	44	35	70.366	8.1370E+12	1.3510E-11	3.1483
Q4-C*pH 6 b	45	36.63	73.554	8.5056E+12	1.4122E-11	3.2910
Q4-pH 6.25 a	46	29.25	58.500	6.7648E+12	1.1232E-11	2.6174
Q4-pH 6.25 b	47	29.37	58.799	6.7994E+12	1.1289E-11	2.6308
Q4-pH 6.5 a	48	32.73	65.657	7.5924E+12	1.2606E-11	2.9376

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Q4-pH 6.5 b	49	31.9	63.864	7.3851E+12	1.2261E-11	2.8574
Q4-C*pH 6.5 a	50	38.29	76.857	8.8875E+12	1.4756E-11	3.4387
Q4-C* pH 6.5 b	51	40.02	80.588	9.3190E+12	1.5472E-11	3.6057
Q4-pH 6.75 a	52	37.8	75.721	8.7562E+12	1.4538E-11	3.3879
Q4-pH 6.75 b	53	38.75	77.330	8.9422E+12	1.4847E-11	3.4599
Q4-pH 7 a	54	41.11	82.550	9.5459E+12	1.5849E-11	3.6935
Q4-pH 7 b	55	41.94	84.285	9.7465E+12	1.6182E-11	3.7711
Q4-C* pH 7a	56	40.96	82.848	9.5803E+12	1.5906E-11	3.7068
Q4-C* pH 7 b	57	42.5	85.599	9.8985E+12	1.6434E-11	3.8299
Q4-pH 7.25 a	58	43.99	88.654	1.0252E+13	1.7021E-11	3.9666
Q4-pH 7.25 b	59	43.86	88.090	1.0187E+13	1.6913E-11	3.9413
Q4-pH 7.5 a	60	48.33	97.087	1.1227E+13	1.8640E-11	4.3439
Q4-pH 7.5 b	61	49.43	99.118	1.1462E+13	1.9030E-11	4.4347
Q4-C* pH 7.5 a	62	45.54	91.685	1.0602E+13	1.7603E-11	4.1022
Q4-C* pH 7.5 b	63	48.18	96.669	1.1179E+13	1.8560E-11	4.3252
Q4-pH 7.75 a	64	49.16	99.093	1.1459E+13	1.9025E-11	4.4336
Q4-pH 7.75 b	65	49.47	99.377	1.1492E+13	1.9080E-11	4.4463
Q4-pH 8 a	66	48.64	97.926	1.1324E+13	1.8801E-11	4.3814
Q4-pH 8 b	67	50.84	102.068	1.1803E+13	1.9596E-11	4.5667
Q4-C*pH 8 a	68	49.73	99.639	1.1522E+13	1.9130E-11	4.4581
Q4-C* pH 8 b	69	47.92	96.457	1.1154E+13	1.8519E-11	4.3157
Q4-pH 8.25 a	70	49.02	98.454	1.1385E+13	1.8902E-11	4.4050
Q4-pH 8.25 b	71	49.63	99.639	1.1522E+13	1.9130E-11	4.4580
Q4-pH 8.5 a	72	50.33	101.064	1.1687E+13	1.9404E-11	4.5218
Q4-pH 8.5 b	73	51.32	103.656	1.1987E+13	1.9901E-11	4.6378
Q4-pH 8.75 a	74	49	98.334	1.1371E+13	1.8880E-11	4.3997
Q4-pH 8.75 b	75	50.87	101.903	1.1784E+13	1.9565E-11	4.5594
Q4-pH 9a	76	51.04	102.060	1.1802E+13	1.9595E-11	4.5664
Q4-pH 9 b	77	48.64	97.338	1.1256E+13	1.8688E-11	4.3551
Q4-C* pH 9a	78	51.45	103.876	1.2012E+13	1.9944E-11	4.6476
Q4-C* pH 9 b	79	49.29	98.916	1.1438E+13	1.8991E-11	4.4257
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

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Verification calculations made in 6C-11, pp. 143-144.

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Kinetics LSA results

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Protocol #: 5        Name:U-233 3% 2 sigma          01-Jun-94   12:58
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      DIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

 S#    TIME     CPMA A:2S%    CPMB B:2S%    CPMC C:2S%    SIS FLAG
                                                                B
  1  999.98    18.53  1.47    3.085  3.60   27.86  1.20  139.79
  2    9.48     6.05 53.43  466.430  3.02  474.88  3.07  684.38
  3    9.34     5.56 57.97  473.039  3.02  478.46  3.08  682.88
  4    9.69     4.38 70.47  456.151  3.02  461.51  3.08  685.42
  5    9.56     3.54 86.15  462.082  3.02  465.55  3.09  689.62
  6   10.30     4.48 67.00  428.663  3.02  434.18  3.09  686.06
  7   10.14     5.24 58.69  435.179  3.02  441.67  3.08  684.87
  8    9.35     3.93 79.17  472.423  3.02  475.78  3.09  683.90
  9    9.87     7.31 44.44  447.168  3.02  455.22  3.07  683.33
 10   10.75     1.56 175.7  410.310  3.02  413.54  3.10  688.21
 11   10.39     7.26 43.54  424.634  3.02  432.49  3.08  681.09
 12   10.07     3.22 91.71  438.524  3.02  442.15  3.09  685.42
 13    9.71     4.95 63.05  454.587  3.02  460.30  3.08  682.42
 14    8.19     7.48 47.80  539.772  3.02  547.84  3.06  687.79
 15    8.56     4.02 81.08  516.658  3.02  519.92  3.08  696.01
(3 missing vials)
 19    9.66     5.69 55.82  457.267  3.02  464.27  3.08  685.60
 20    9.53     3.30 92.19  463.337  3.02  468.47  3.08  687.26
 21    9.52     6.16 52.51  464.037  3.02  472.14  3.07  685.07
 22    9.59     3.26 92.74  460.836  3.02  466.20  3.08  691.13
 23   10.55     2.42 117.1  418.242  3.02  421.53  3.10  692.36
 24   10.43     2.95 97.82  422.994  3.02  427.65  3.09  692.26
 25    9.76     2.68 110.5  452.550  3.02  456.77  3.09  690.63
 26    9.75     3.73 81.40  452.812  3.02  456.35  3.09  682.96
 27   10.97     2.16 127.6  402.293  3.02  406.05  3.10  684.83
 28   10.38     3.53 82.90  425.431  3.02  428.60  3.10  686.39
 29    9.99     3.39 87.70  441.760  3.02  447.42  3.08  687.62
 30    9.63     0.68 416.5  458.493  3.02  461.13  3.09  690.96
(6 missing vials)
 37    9.38     3.43 89.51  470.796  3.02  474.38  3.09  690.40
 38    9.49     4.02 76.98  465.197  3.02  468.87  3.09  691.60
 39    9.69     3.45 87.62  455.532  3.02  458.42  3.09  690.32
 40    9.49     1.39 209.9  465.513  3.02  466.77  3.09  690.52
 41   10.80     0.64 420.3  408.582  3.02  411.59  3.10  689.40
 42   10.48     2.37 119.8  420.961  3.02  423.67  3.10  691.86
 43    9.63     2.14 137.8  458.493  3.02  462.80  3.09  688.38
 44    9.58     3.60 84.77  460.902  3.02  465.98  3.08  686.56
 45   10.89     2.13 129.9  405.179  3.02  408.87  3.10  690.18
 46   10.81     1.82 151.3  408.571  3.02  412.38  3.10  685.74
 47    9.56     3.02 99.88  461.768  3.02  464.61  3.09  688.79
 48    9.94     4.91 62.78  444.802  3.02  450.91  3.08  692.13
(6 missing vials)
 55    9.24     2.68 113.4  478.084  3.02  482.42  3.08  699.33
 56    9.16     6.58 50.50  482.177  3.02  489.61  3.07  684.28
 57    9.30     2.76 110.1  475.087  3.02  478.92  3.08  692.73
 58    9.57     3.21 94.42  461.701  3.02  466.29  3.08  686.13
 59   10.24     1.78 158.7  431.290  3.02  433.66  3.10  693.88
 60   10.50     2.33 121.7  420.248  3.02  423.09  3.10  689.63
 61   10.13     1.02 274.6  435.809  3.02  436.11  3.10  692.90

 S#    TIME     CPMA A:2S%    CPMB B:2S%    CPMC C:2S%    SIS FLAG
 62    9.99     3.79 79.15  441.760  3.02  444.41  3.10  690.93
 63   11.05     2.92 95.92  399.449  3.02  404.00  3.10  686.57
 64   11.04     3.03 92.72  399.542  3.02  403.93  3.10  693.40
 65    9.93     3.63 82.74  444.649  3.02  447.77  3.09  689.40
 66    9.84     5.66 55.63  448.541  3.02  455.07  3.08  693.28
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Samples taken 30 May '94 p. 217 of this book. "KINLSA"

sand (0.1g) added at this point. →

After 2 hr interval samples taken: p. 218 of this book "KINLSA2H"

"KINLSA4H" p. 219 (4 hour interval)

"KINLSA1D" p. 220 (one day interval)

KINLSA.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.09				
Q1-K*pH5.5a	2	466.43	934.168	1.0803E+14	1.7935E-10	41.7966
Q1-K*pH 5.5b	3	473.04	949.498	1.0980E+14	1.8230E-10	42.4825
Q1-KC*pH 5.5a	4	456.15	921.329	1.0654E+14	1.7689E-10	41.2222
Q1-KC*pH 5.5b	5	462.08	935.763	1.0821E+14	1.7966E-10	41.8680
Q1-K*pH 6a	6	428.66	865.980	1.0014E+14	1.6626E-10	38.7457
Q1-K*pH 6b	7	435.18	882.002	1.0199E+14	1.6934E-10	39.4626
Q1-KC*pH 6a	8	472.42	951.692	1.1005E+14	1.8272E-10	42.5807
Q1-KC*pH 6b	9	447.17	916.520	1.0598E+14	1.7597E-10	41.0070
Q1-K*pH 6.5a	10	410.31	823.916	9.5276E+13	1.5819E-10	36.8637
Q1-K*pH 6.5b	11	424.63	861.843	9.9662E+13	1.6547E-10	38.5607
Q1-KC*pH 6.5a	12	438.52	893.116	1.0328E+14	1.7147E-10	39.9599
Q1-KC*pH 6.5b	13	454.59	925.657	1.0704E+14	1.7772E-10	41.4158
Q1-K* IUa	14	539.77	1102.246	1.2746E+14	2.1162E-10	49.3168
Q1-K*IUb	15	516.66	1054.839	1.2198E+14	2.0252E-10	47.1957
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

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KINLSA2H.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.09				
Q1-K*pH5.5a	19	457.27	911.986	1.0546E+14	1.7510E-10	40.8042
Q1-K*pH 5.5b	20	463.34	925.569	1.0703E+14	1.7770E-10	41.4119
Q1-KC*pH 5.5a	21	464.04	929.009	1.0743E+14	1.7836E-10	41.5658
Q1-KC*pH 5.5b	22	460.84	923.897	1.0684E+14	1.7738E-10	41.3371
Q1-K*pH 6a	23	418.24	835.311	9.6593E+13	1.6037E-10	37.3735
Q1-K*pH 6b	24	422.99	844.629	9.7671E+13	1.6216E-10	37.7905
Q1-KC*pH 6a	25	452.55	904.557	1.0460E+14	1.7367E-10	40.4718
Q1-KC*pH 6b	26	452.81	903.812	1.0451E+14	1.7353E-10	40.4385
Q1-K*pH 6.5a	27	402.29	800.259	9.2540E+13	1.5364E-10	35.8052
Q1-K*pH 6.5b	28	425.43	852.224	9.8549E+13	1.6362E-10	38.1303
Q1-KC*pH 6.5a	29	441.76	882.637	1.0207E+14	1.6946E-10	39.4910
Q1-KC*pH 6.5b	30	458.49	917.531	1.0610E+14	1.7616E-10	41.0522
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

KINLSA4H.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.09				
Q1-K*pH5.5a	37	470.8	941.788	1.0891E+14	1.8082E-10	42.1376
Q1-K*pH 5.5b	38	465.2	926.878	1.0718E+14	1.7795E-10	41.4705
Q1-KC*pH 5.5a	39	455.53	909.423	1.0516E+14	1.7460E-10	40.6895
Q1-KC*pH 5.5b	40	465.51	930.648	1.0762E+14	1.7868E-10	41.6391
Q1-K*pH 6a	41	408.58	814.229	9.4156E+13	1.5633E-10	36.4303
Q1-K*pH 6b	42	420.96	840.240	9.7163E+13	1.6132E-10	37.5941
Q1-KC*pH 6a	43	458.49	912.963	1.0557E+14	1.7528E-10	40.8479
Q1-KC*pH 6b	44	460.9	918.127	1.0617E+14	1.7627E-10	41.0789
Q1-K*pH 6.5a	45	405.18	807.292	9.3353E+13	1.5499E-10	36.1199
Q1-K*pH 6.5b	46	408.57	813.722	9.4097E+13	1.5623E-10	36.4076
Q1-KC*pH 6.5a	47	461.77	918.214	1.0618E+14	1.7629E-10	41.0828
Q1-KC*pH 6.5b	48	444.8	886.586	1.0252E+14	1.7022E-10	39.6677
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

KINLSA1D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.09				
Q1-K*pH5.5a	55	478.08	953.490	1.1026E+14	1.8306E-10	42.6611
Q1-K*pH 5.5b	56	482.18	963.589	1.1143E+14	1.8500E-10	43.1130
Q1-KC*pH 5.5a	57	475.09	949.231	1.0977E+14	1.8225E-10	42.4706
Q1-KC*pH 5.5b	58	461.7	924.880	1.0695E+14	1.7757E-10	41.3811
Q1-K*pH 6a	59	431.29	859.143	9.9349E+13	1.6495E-10	38.4399
Q1-K*pH 6b	60	420.25	848.647	9.8136E+13	1.6293E-10	37.9702
Q1-KC*pH 6a	61	435.81	871.969	1.0083E+14	1.6741E-10	39.0137
Q1-KC*pH 6b	62	441.76	883.520	1.0217E+14	1.6963E-10	39.5305
Q1-K*pH 6.5a	63	399.45	797.624	9.2235E+13	1.5314E-10	35.6874
Q1-K*pH 6.5b	64	399.54	799.560	9.2459E+13	1.5351E-10	35.7740
Q1-KC*pH 6.5a	65	444.65	889.834	1.0290E+14	1.7084E-10	39.8130
Q1-KC*pH 6.5b	66	448.54	896.363	1.0365E+14	1.7210E-10	40.1052
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

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All verification calculations were made in 6C-11, pp. 143-144.

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Protocol #: 5 Name:U-233 3% 2 sigma 16-Jun-94 06:24
Region A: LL-UL= 0.0-100. Lcr= 0 Bkg= 0.00 %2 Sigma=0.25
Region B: LL-UL=100.-350. Lcr= 0 Bkg= 0.00 %2 Sigma=3.00
Region C: LL-UL= 0.0-2000 Lcr= 0 Bkg= 0.00 %2 Sigma=0.10
Time =999.99 QIP = SIS
U-233 3% 2 sigma error for 50 ppb experiments

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.98	18.67	1.46	2.998	3.65	27.55	1.20	138.58	B
2	9.06	4.84	66.80	487.730	3.02	493.75	3.07	667.31	
3	9.04	1.02	290.4	488.816	3.02	490.26	3.09	678.46	
4	9.37	3.42	90.09	471.708	3.02	474.79	3.09	677.78	
5	9.49	5.46	58.61	465.284	3.02	470.97	3.08	676.47	
6	10.42	6.47	48.17	423.585	3.02	430.22	3.08	672.99	
7	10.35	4.42	67.83	426.760	3.02	431.67	3.09	675.84	
8	10.00	5.03	61.44	441.702	3.02	446.75	3.08	673.94	
9	10.24	4.67	64.91	431.279	3.02	436.70	3.08	674.16	
10	11.28	1.28	209.3	391.328	3.02	393.81	3.11	677.01	
11	11.34	2.23	122.4	388.889	3.02	391.67	3.11	679.40	
12	10.48	4.04	73.18	421.143	3.02	426.64	3.09	673.65	
13	10.40	6.14	50.52	424.790	3.02	430.81	3.08	665.68	
(5 missing vials)									
19	9.11	6.03	54.81	484.927	3.02	492.86	3.07	670.13	
20	9.24	3.30	93.81	478.604	3.02	481.21	3.08	671.48	
21	9.75	3.38	89.30	453.412	3.02	457.47	3.08	673.05	
22	9.62	3.68	83.17	459.164	3.02	463.40	3.08	674.94	
23	10.46	7.62	41.76	421.859	3.02	431.05	3.07	665.49	
24	10.88	2.84	99.55	405.917	3.02	409.12	3.10	672.58	
25	10.16	5.44	56.81	434.600	3.02	439.97	3.08	667.93	
26	10.19	5.28	58.34	433.214	3.02	439.77	3.08	668.29	
27	11.90	6.88	42.80	370.447	3.02	378.24	3.09	669.08	
28	11.95	3.42	79.85	368.885	3.02	372.36	3.11	669.76	
29	10.46	5.04	59.99	421.859	3.02	427.04	3.09	669.03	
30	10.31	2.18	130.8	428.040	3.02	430.16	3.10	674.63	
(1 missing vial)									
32	0.84	64.66	30.81	5326.76	2.99	5403.40	2.98	689.74	
33	0.82	86.21	26.24	5462.86	2.99	5572.45	2.97	684.71	
34	0.85	69.57	29.29	5245.24	3.00	5335.98	2.98	686.09	
35	0.81	193.68	16.72	5501.94	3.00	5721.83	2.94	671.37	
36	0.84	165.85	17.87	5307.72	3.00	5483.16	2.95	674.26	
37	8.90	6.95	48.99	496.328	3.02	505.03	3.06	684.64	
38	9.32	8.48	40.40	473.826	3.02	482.42	3.07	682.53	
39	9.42	2.99	101.9	468.976	3.02	474.04	3.08	686.44	
40	9.37	7.90	42.75	471.495	3.02	481.30	3.06	685.01	
41	10.58	3.92	74.87	417.607	3.02	422.92	3.09	683.21	
42	10.75	5.89	51.54	410.490	3.02	415.98	3.09	684.56	
43	9.90	6.28	50.74	446.093	3.02	451.84	3.08	685.69	
44	9.80	7.66	42.96	450.879	3.02	459.69	3.07	684.40	
45	12.00	5.41	52.58	367.752	3.02	373.70	3.10	681.62	
46	11.88	4.98	56.89	371.413	3.02	378.00	3.09	684.53	
47	10.31	7.23	44.02	428.331	3.02	436.66	3.07	682.68	
48	10.68	6.89	45.07	413.481	3.02	421.88	3.08	681.05	
(6 missing vials)									
55	9.50	5.86	55.07	464.897	3.02	470.76	3.08	683.02	
56	9.36	1.95	152.9	472.002	3.02	475.01	3.09	685.65	
57	9.49	8.41	40.30	465.600	3.02	475.40	3.06	678.17	
58	9.24	3.95	79.53	478.495	3.02	483.92	3.08	684.58	

"KinlsA2D" pp. 221 in this Book

"KinlsA4D" p. 232 in this book

"KinlsA8D" p. 243 in this book

KinlsA12D p. 251 in this book

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
59	10.87	9.30	34.63	405.834	3.02	415.50	3.07	674.63	
60	9.95	6.96	46.29	443.736	3.02	451.34	3.08	680.89	
61	9.86	5.27	59.40	448.016	3.02	452.77	3.08	681.87	
62	9.80	3.68	82.46	450.573	3.02	454.79	3.09	683.80	
63	11.97	3.80	72.41	368.347	3.02	372.36	3.11	682.54	
64	11.72	3.09	88.68	376.609	3.02	380.21	3.10	683.18	
65	10.39	4.81	62.71	425.106	3.02	430.48	3.09	676.84	
66	10.66	3.75	77.67	413.981	3.02	419.26	3.09	685.96	

KinlsA12D

All verification calculations are shown on pp. 143-144 of 6C-11.

MA 7-8-94

8 July 94
MA

KINLSA2D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3				
Q1-K*pH 5.5a	2	487.73	965.802	1.1168E+14	1.8543E-10	43.2120
Q1-K*pH 5.5b	3	488.82	963.572	1.1143E+14	1.8500E-10	43.1122
Q1-KC*pH 5.5a	4	471.71	933.894	1.0799E+14	1.7930E-10	41.7844
Q1-KC*pH 5.5b	5	465.28	921.164	1.0652E+14	1.7686E-10	41.2148
Q1-K*pH 6a	6	423.59	842.295	9.7401E+13	1.6172E-10	37.6860
Q1-K*pH 6b	7	426.76	844.902	9.7703E+13	1.6222E-10	37.8027
Q1-KC*pH 6a	8	441.7	879.355	1.0169E+14	1.6883E-10	39.3442
Q1-KC*pH 6b	9	431.28	854.866	9.8855E+13	1.6413E-10	38.2485
Q1-K*pH 6.5a	10	391.33	774.911	8.9609E+13	1.4878E-10	34.6711
Q1-K*pH 6.5b	11	388.89	769.622	8.8997E+13	1.4776E-10	34.4345
Q1-KC*pH 6.5a	12	421.14	838.423	9.6953E+13	1.6097E-10	37.5128
Q1-KC*pH 6.5b	13	424.79	841.668	9.7329E+13	1.6159E-10	37.6580
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

KINLSA4D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3				
Q1-K*pH 5.5a	19	484.93	963.118	1.1137E+14	1.8491E-10	43.0919
Q1-K*pH 5.5b	20	478.6	952.627	1.1016E+14	1.8290E-10	42.6225
Q1-KC*pH 5.5a	21	453.41	908.637	1.0507E+14	1.7445E-10	40.6543
Q1-KC*pH 5.5b	22	459.16	921.083	1.0651E+14	1.7684E-10	41.2112
Q1-K*pH 6a	23	421.86	848.471	9.8115E+13	1.6290E-10	37.9624
Q1-K*pH 6b	24	405.92	815.428	9.4294E+13	1.5656E-10	36.4840
Q1-KC*pH 6a	25	434.6	874.623	1.0114E+14	1.6792E-10	39.1324
Q1-KC*pH 6b	26	433.21	873.936	1.0106E+14	1.6779E-10	39.1017
Q1-K*pH 6.5a	27	370.45	746.424	8.6315E+13	1.4331E-10	33.3966
Q1-K*pH 6.5b	28	368.88	741.318	8.5724E+13	1.4233E-10	33.1681
Q1-KC*pH 6.5a	29	421.86	845.411	9.7761E+13	1.6231E-10	37.8255
Q1-KC*pH 6.5b	30	428.04	859.863	9.9433E+13	1.6509E-10	38.4721
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

KINLSA8D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3				
Q1-K*pH 5.5a	37	496.33	999.859	1.1562E+14	1.9197E-10	44.7358
Q1-K*pH 5.5b	38	473.83	952.422	1.1014E+14	1.8286E-10	42.6134
Q1-KC*pH 5.5a	39	468.98	942.484	1.0899E+14	1.8095E-10	42.1687
Q1-KC*pH 5.5b	40	471.5	946.787	1.0948E+14	1.8178E-10	42.3612
Q1-K*pH 6a	41	417.61	838.069	9.6912E+13	1.6090E-10	37.4970
Q1-K*pH 6b	42	410.49	822.955	9.5165E+13	1.5800E-10	36.8207
Q1-KC*pH 6a	43	446.09	892.180	1.0317E+14	1.7129E-10	39.9180
Q1-KC*pH 6b	44	450.88	900.319	1.0411E+14	1.7286E-10	40.2822
Q1-K*pH 6.5a	45	367.75	732.716	8.4730E+13	1.4068E-10	32.7832
Q1-K*pH 6.5b	46	371.41	744.458	8.6087E+13	1.4293E-10	33.3086
Q1-KC*pH 6.5a	47	428.33	855.462	9.8924E+13	1.6424E-10	38.2752
Q1-KC*pH 6.5b	48	413.48	846.255	9.7859E+13	1.6248E-10	37.8632
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

KNLSA12D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3				
Q1-K*pH 5.5a	55	464.9	931.104	1.0767E+14	1.7877E-10	41.6595
Q1-K*pH 5.5b	56	472	943.623	1.0912E+14	1.8117E-10	42.2196
Q1-KC*pH 5.5a	57	465.6	935.128	1.0814E+14	1.7954E-10	41.8396
Q1-KC*pH 5.5b	58	478.5	968.623	1.1201E+14	1.8597E-10	43.3382
Q1-K*pH 6a	59	405.83	814.102	9.4141E+13	1.5630E-10	36.4246
Q1-K*pH 6b	60	443.74	885.709	1.0242E+14	1.7005E-10	39.6285
Q1-KC*pH 6a	61	448.02	895.682	1.0357E+14	1.7197E-10	40.0747
Q1-KC*pH 6b	62	450.57	901.501	1.0425E+14	1.7308E-10	40.3350
Q1-K*pH 6.5a	63	368.35	738.176	8.5361E+13	1.4173E-10	33.0276
Q1-K*pH 6.5b	64	376.61	752.317	8.6996E+13	1.4444E-10	33.6602
Q1-KC*pH 6.5a	65	425.11	848.862	9.8160E+13	1.6298E-10	37.9799
Q1-KC*pH 6.5b	66	413.98	825.813	9.5495E+13	1.5855E-10	36.9486
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

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MA

(12 missing vials)

181	9.18	2.34	130.5	481.760	3.02	484.18	3.08	720.59	
182	8.59	2.64	120.6	514.466	3.02	517.69	3.08	717.73	
S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
183	9.20	4.69	68.58	480.707	3.02	487.41	3.07	715.52	
184	9.38	0.61	475.6	470.894	3.02	474.33	3.08	722.39	
185	10.08	4.31	70.64	438.489	3.02	442.26	3.09	714.02	
186	9.85	1.71	170.1	448.490	3.02	451.81	3.09	718.22	
187	9.84	3.36	90.01	449.051	3.02	453.41	3.08	720.18	
188	9.89	4.86	64.02	446.564	3.02	452.90	3.08	715.30	
189	11.86	2.77	98.13	371.825	3.02	377.24	3.10	717.04	
190	12.18	0.23	1099.	362.227	3.02	363.98	3.12	721.72	
191	10.81	4.32	68.17	408.591	3.02	413.87	3.09	714.19	
192	10.26	4.10	73.32	430.258	3.02	434.22	3.09	711.76	

"KNLSA16D"
Samples taken 6-15-94 p. 260 in this book.
MA

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

KNLSA16D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	2.88				
Q1-K*pH 5.5a	181	481.76	957.012	1.1067E+14	1.8374E-10	42.8187
Q1-K*pH 5.5b	182	514.47	1016.940	1.1760E+14	1.9525E-10	45.5000
Q1-KC*pH 5.5a	183	480.71	964.506	1.1153E+14	1.8518E-10	43.1540
Q1-KC*pH 5.5b	184	470.89	937.654	1.0843E+14	1.8002E-10	41.9526
Q1-K*pH 6a	185	438.49	880.679	1.0184E+14	1.6908E-10	39.4034
Q1-K*pH 6b	186	448.49	895.190	1.0352E+14	1.7187E-10	40.0527
Q1-KC*pH 6a	187	449.05	906.073	1.0478E+14	1.7396E-10	40.5396
Q1-KC*pH 6b	188	446.56	893.477	1.0332E+14	1.7154E-10	39.9760
Q1-K*pH 6.5a	189	371.82	746.027	8.6269E+13	1.4323E-10	33.3788
Q1-K*pH 6.5b	190	362.23	727.369	8.4111E+13	1.3965E-10	32.5440
Q1-KC*pH 6.5a	191	408.59	827.105	9.5645E+13	1.5880E-10	37.0064
Q1-KC*pH 6.5b	192	430.26	864.670	9.9988E+13	1.6601E-10	38.6872
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

91	9.06	2.19	142.3	487.523	3.02	491.47	3.09	707.05	
92	9.08	1.04	291.0	486.772	3.02	489.99	3.09	706.96	
93	9.10	2.10	148.2	485.585	3.02	487.20	3.09	707.17	
94	9.17	1.28	238.0	481.744	3.02	485.12	3.09	704.82	
95	9.95	1.74	168.9	443.317	3.02	446.60	3.10	706.94	
96	10.11	6.05	52.89	436.842	3.02	444.90	3.08	696.31	
97	9.82	5.69	56.66	449.433	3.02	456.46	3.08	698.32	
98	9.83	3.53	87.34	449.075	3.02	454.75	3.09	701.81	
99	11.83	2.48	110.7	372.508	3.03	375.20	3.12	706.03	
100	12.02	3.22	86.24	366.401	3.03	368.72	3.12	701.62	
101	11.02	3.30	88.00	400.223	3.02	404.93	3.10	701.33	
102	10.64	9.10	36.28	414.635	3.02	425.23	3.08	693.68	

"KnlsA21D"
Samples taken 6-20-94 p. 265 in this Book
MA.

KNLSA21D.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
BACKGROUND	1	3.32				
Q1-K*pH 5.5a	91	487.52	977.778	1.1307E+14	1.8773E-10	43.7478
Q1-K*pH 5.5b	92	486.77	971.597	1.1235E+14	1.8654E-10	43.4713
Q1-KC*pH 5.5a	93	485.59	969.822	1.1215E+14	1.8620E-10	43.3919
Q1-KC*pH 5.5b	94	481.74	962.133	1.1126E+14	1.8472E-10	43.0478
Q1-K*pH 6a	95	443.32	891.813	1.0313E+14	1.7122E-10	39.9016
Q1-K*pH 6b	96	436.84	878.777	1.0162E+14	1.6872E-10	39.3183
Q1-KC*pH 6a	97	449.43	903.922	1.0453E+14	1.7355E-10	40.4434
Q1-KC*pH 6b	98	449.07	899.940	1.0407E+14	1.7278E-10	40.2652
Q1-K*pH 6.5a	99	372.51	748.914	8.6603E+13	1.4379E-10	33.5080
Q1-K*pH 6.5b	100	366.4	736.039	8.5114E+13	1.4131E-10	32.9319
Q1-KC*pH 6.5a	101	400.22	810.818	9.3761E+13	1.5567E-10	36.2777
Q1-KC*pH 6.5b	102	414.64	839.182	9.7041E+13	1.6112E-10	37.5468
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

7-8-94 Verification calculations worked out on pp. 143-144 of 6C-11. MA

13 July 94
MA

Sampling of Spike 25A and 28A: Determining U concentration of spikes by analyzing sample vials using LSA.

1) 2 .5 ml aliquots of Spike 25A and 28A were withdrawn and transferred into labeled, pre-weighed LSA vials, each containing .5 mls of 0.02 HNO_3.

2) vials were re-weighed, recorded, then 5 mls of Ultima-Gold organic cocktail was added.
vials then set aside for LSA.

Sample	wt. of vial (g)	wt. of vial + sample (g)	wt. of sample (g)
Spike 25A 1	7.7492	8.2524	.5032
Spike 25A 2	7.7683	8.2713	.5030
Spike 28A 1	7.7854	8.2891	.5037
Spike 28A 2	7.7514	8.2536	.5022

LSA results are as follows:

SPK25A28.XLS

SAMPLE NAME	S#	CPM B	MASS CONV	ATOM CONV	MOLE CONV	ppb U(233)
SPK 25A 1	1	6086.185	12094.962	1.3986E+15	2.3222E-09	541.1539
SPK 25A 2	2	6038.311	12004.594	1.3882E+15	2.3048E-09	537.1107
SPK 28A 1	3	5231.111	10385.370	1.2009E+15	1.9939E-09	464.6632
SPK 28A 2	4	5151.223	10257.314	1.1861E+15	1.9693E-09	458.9337
VERIFICATION		500	1000.000	1.1564E+14	1.9199E-10	44.7421

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1	999.99	699.17	0.24	6086.185	0.08	9248.07	0.07	0.000	B
2	6.63	67.95	31.76	0.000	0.00	43.79	171.5	602965	
3	7.65	0.00	0.00	0.000	0.00	0.00	0.00	0.000	
4	7.77	0.00	0.00	0.000	0.00	0.00	0.00	0.000	

S#	TIME	CPMA	A:2S%	CPMB	B:2S%	CPMC	C:2S%	SIS	FLAG
1 MISSING TUBE(S)									
2	6.63	767.12	2.80	6038.311	1.00	9291.86	0.81	787.60	
3	7.65	55.42	9.71	5231.111	1.00	5309.02	0.99	702.60	
4	7.77	57.66	9.45	5151.223	1.00	5234.23	0.99	702.05	

Verification calculations in 6C-11, pp. 143-144. (controlled copy 081)

14 July 94
MA

Sorption Q3 Experiment (continued) Following procedure on p. 238 (6C-09)

Sampled Sorption and Sorption control solutions for U concentration and pH:

1. Sorption sample solutions (containers) were weighed
2. Two .5 ml aliquots of each sample solution was withdrawn and transferred into a labeled, pre-weighed LSA vial which contained .5 ml of 0.02 HNO_3. (0.02M) MA 7-14-94
   a. 5 mls of Ultima-Gold organic scintillation cocktail was added to each vial, homogenized, then set aside for LSA.
3. pH of each solution was measured.
4. Sample containers were weighed.
5. Containers set on gyratory shaker

Sample	Container wt. before sampling and pH measurement	pH	Temp (°c)	Container wt. AFTER sampling + pH measured
Q3-pH 2	71.2874	1.97	24.7°	70.2461
Q3-pH 2.25	70.7729	2.21	24.7°	69.7307
Q3-pH 2.5	71.2411	2.49	24.7°	70.1894
Q3-pH 2.75	70.9751	2.77	24.7°	69.9354
Q3-pH 3	71.3411	3.01	24.7°	70.2856
Q3-C*pH 3	68.6622	2.97	24.9°	67.6223
Q3-pH 3.25	71.0647	3.23	24.9°	70.0202
Q3-pH 3.5	71.1677	3.53	24.9°	70.1178
Q3-pH 3.75	70.7967	3.78	24.9°	69.7486
Q3-pH 4	71.4542	4.09	24.9°	70.4190
Q3-C*pH 4	68.4950	4.05	24.9°	67.4493
Q3-pH 4.25	71.1173	4.50	25.0°	70.0737
Q3-pH 4.5	71.2627	4.86	25.0°	70.2293
Q3-pH 4.75	71.1335	5.05	25.0°	70.1046
Q3-pH 5	71.2370	5.84	25.0°	70.1928
Q3-C*pH 5	68.5262	4.99	25.0°	67.4910
Q3-pH 5.25	71.3312	6.11	25.0°	70.2940
Q3-pH 5.5	71.2420	6.30	25.1°	70.1962
Q3-C*pH 5.5	68.7505	6.17	25.1°	67.6979
Q3-pH 5.75	71.3118	6.47	25.1°	70.2645
Q3-pH 6	70.7022	6.63	25.1°	69.6713

Sample	Container wt. before sampling	pH	Temp	Container wt. AFTER sampling
Q3-C*pH 6	68.5444	6.50	25.1°	67.4986
Q3-pH 6.25	71.2563	6.79	25.1°	70.2222
Q3-pH 6.5	70.9074	6.87	25.2°	69.8738
Q3-C*pH 6.5	68.5958	6.67	25.2°	67.5552
Q3-pH 6.75	71.2634	6.95	25.2°	70.2246
Q3-pH 7	71.2948	7.04	25.3°	70.2582
Q3-C*pH 7	69.0052	7.06	25.3°	67.9685
Q3-pH 7.25	71.2986	7.17	25.3°	70.2621
Q3-pH 7.5	71.4286	7.40	25.3°	70.3908
Q3-C*pH 7.5	68.8871	7.39	25.4°	67.8410
Q3-pH 7.75	70.6330	7.78	25.4°	69.5961
Q3-pH 8	71.0034	7.98	25.4°	69.9651
Q3-C*pH 8	68.4793	7.99	25.4°	67.4359
Q3-pH 8.25	70.9801	8.20	25.4°	69.9318
Q3-pH 8.5	71.2499	8.43	25.4°	70.2072
Q3-pH 8.75	70.9261	8.70	25.4°	69.8860
Q3-pH 9	71.0677	8.95	25.5°	70.0177
Q3-C*pH 9	68.7705	8.92	25.5°	67.7332

Sample	wt. of vial (s)	wt. of vial + sample	wt. of sample (s)
Q3-pH 2a	7.7046	8.2100	
Q3-pH 2b	7.6859	8.1917	
Q3-pH 2.25a	7.7298	8.2357	
Q3-pH 2.25b	7.7428	8.2499	
Q3-pH 2.5a	7.7845	8.2913	
Q3-pH 2.5b	7.7827	8.2887	
Q3-pH 2.75a	7.7834	8.2879	
Q3-pH 2.75b	7.7852	8.2898	
Q3-pH 3a	7.7031	8.2084	
Q3-pH 3b	7.7163	8.2213	
Q3-C*pH 3a	7.7283	8.2328	
Q3-C*pH 3b	7.7997	8.3045	
Q3-pH 3.25a	7.7819	8.2887	
Q3-pH 3.25b	7.7568	8.2620	
Q3-pH 3.5a	7.8260	8.3322	

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (g)
Q3-pH 3.5 b	7.7720	8.2759	
Q3-pH 3.75 a	7.7364	8.2413	
Q3-pH 3.75 b	7.7112	8.2148	
Q3-pH 4 a	7.7547	8.2600	
Q3-pH 4 b	7.8127	8.3165	
Q3-C*pH 4 a	7.7157	8.2223	
Q3-C*pH 4 b	7.7592	8.2631	
Q3-pH 4.25 a	7.7265	8.2304	
Q3-pH 4.25 b	7.7974	8.3018	
Q3-pH 4.5 a	7.7690	8.2732	
Q3-pH 4.5 b	7.7498	8.2538	
Q3-pH 4.75 a	7.8016	8.3044	
Q3-pH 4.75 b	7.7508	8.2520	
Q3-pH 5 a	7.7648	8.2688	
Q3-pH 5 b	7.7496	8.2532	
Q3-C*pH 5 a	7.7718	8.2755	
Q3-C*pH 5 b	7.7454	8.2491	
Q3-pH 5.25 a	7.7119	8.2160	
Q3-pH 5.25 b	7.7508	8.2527	
Q3-pH 5.5 a	7.7530	8.2583	
Q3-pH 5.5 b	7.7117	8.2146	
Q3-C*pH 5.5 a	7.7666	8.2704	
Q3-C*pH 5.5 b	7.7490	8.2526	
Q3-pH 5.75 a	7.7215	8.2262	
Q3-pH 5.75 b	7.7251	8.2285	
Q3-pH 6 a	7.7220	8.2250	
Q3-pH 6 b	7.7608	8.2618	
Q3-C*pH 6 a	7.7794	8.2833	
Q3-C*pH 6 b	7.7865	8.2880	
Q3-pH 6.25 a	7.7460	8.2490	
Q3-pH 6.25 b	7.7812	8.2847	
Q3-pH 6.5 a	7.7213	8.2263	
Q3-pH 6.5 b	7.7027	8.2051	
Q3-C*pH 6.5 a	7.6696	8.1738	
Q3-C*pH 6.5 b	7.7876	8.2910	
Q3-pH 6.75 a	7.6880	8.1890	

Sample	wt. of vial (g)	wt. of vial + sample	wt. of sample (g)
Q3-pH 6.75 b	7.8180	8.3181	
Q3-pH 7 a	7.7662	8.2696	
Q3-pH 7 b	7.7460	8.2479	
Q3-C*pH 7 a	7.7539	8.2562	
Q3-C*pH 7 b	7.7784	8.2799	
Q3-pH 7.25 a	7.7381	8.2393	
Q3-pH 7.25 b	7.7973	8.2987	
Q3-pH 7.5 a	7.7638	8.2660	
Q3-pH 7.5 b	7.7703	8.2720	
Q3-C*pH 7.5 a	7.6743	8.1769	
Q3-C*pH 7.5 b	7.7444	8.2461	
Q3-pH 7.75 a	7.7240	8.2256	
Q3-pH 7.75 b	7.7509	8.2521	
Q3-pH 8 a	7.7475	8.2504	
Q3-pH 8 b	7.7913	8.2937	
Q3-C*pH 8 a	7.7749	8.2792	
Q3-C*pH 8 b	7.7491	8.2519	
Q3-pH 8.25 a	7.6831	8.1864	
Q3-pH 8.25 b	7.7279	8.2308	
Q3-pH 8.5 a	7.7642	8.2686	
Q3-pH 8.5 b	7.7163	8.2188	
Q3-pH 8.75 a	7.7652	8.2694	
Q3-pH 8.75 b	7.7605	8.2642	
Q3-pH 9 a	7.8140	8.3196	
Q3-pH 9 b	7.7546	8.2586	
Q3-C*pH 9 a	7.7052	8.2047	
Q3-C*pH 9 b	7.7547	8.2558	

This notebook is continued in 6C-12.
(CNWRA Controlled Copy 082).

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Pages 1 through 304 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 Black
SwRI-QA
10/14/94