

ATTACHMENT 8

Utah Division of Radiation Control

Summary of
Available Groundwater Quality Data
at
Arches National Park
Headquarters Well
(1978 - 1996):
Inorganics, Nutrients, and Heavy Metals.

DRC Spreadsheet
NPSWQ.XLS

	A	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
1	Arches National Park: 1978 Headquarters Well Water Quality Data																								
2	Well ID:				1978			1978			1978			1978			1978			1978			1978		
3	Sample Date:				5/24/78			4/1/81			4/17/81			6/16/81			9/28/81			12/1/81			3/2/82		
4	Lab.:				NPS			Atlas			NPS			Atlas			Atlas			Atlas			Atlas		
5	Lab. No.:				field test			n/a			811710			n/a			n/a			n/a			n/a		
6	Parameters	Units	GWQS	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.
7	Ag	mg/l	0.1								< 0.002														
8	Al	mg/l	0.2																						
9	As	mg/l	0.05					< 0.1			< 0.001			"nil"			< 0.1			< 0.01			< 0.1		
10	B	mg/l	0.6								0.14														
11	Ba	mg/l	2								< 0.05														
12	Be	mg/l	0																						
13	Br	mg/l	n/a																						
14	Ca	mg/l	n/a								70														
15	Cd	mg/l	0.005								< 0.001														
16	Cl	mg/l	250		125			57			61			88			120			62			64		
17	CN-total	mg/l	0.2																						
18	Co	mg/l	n/a																						
19	CO2	mg/l	n/a								3														
20	CO3 (CaCO3)	mg/l	n/a								0														
21	CO3 solids	mg/l	n/a								97														
22	Cr	mg/l	0.1								< 0.005														
23	Cu	mg/l	1.3		0.28			< 0.1			< 0.01			"nil"			< 0.1			0.003			< 0.01		
24	F	mg/l	4		0.5			< 0.1			0.32														
25	Fe	mg/l	0.3		0.05						< 0.03			"nil"			< 0.1			0.005			< 0.001		
26	Ga	mg/l	n/a																						
27	Hardness (non-carb.)	mg/l	n/a																						
28	HCO3 (CaCO3)	mg/l	n/a		n/a						198														
29	Hg	mg/l	0.002																						
30	K	mg/l	n/a					4.65			5			4.6			540			6.5			7.33		
31	Li	mg/l	n/a																						
32	Mg	mg/l	n/a								30														
33	Mn	mg/l	0.04		0.06			< 0.1			< 0.01			90			< 0.1			0.001			< 0.01		
34	Mo	mg/l	0.04																						
35	Na	mg/l	n/a					57			71			130			453			76			106		
36	NH3 (as N)	mg/l	25								< 0.1														
37	Ni	mg/l	0.1								< 0.01														
38	NO2 (as N)	mg/l	1								< 0.05														
39	NO3	gm/l	n/a					0.0027						0.0014			0.0008			0.01					
40	NO3 (as N)	mg/l	10		0.00			0.00			3.20			0.00			0.00			0.00			0.00		
41	NO3*	mg/l	n/a		1.4			0.61						0.32			0.18			2.26			1.4		
42	NO3+NO2 (as N)	mg/l	10								3.20														
43	OH	mg/l	n/a		n/a			n/a			n/a			n/a			n/a			n/a			n/a		
44	P-ortho (as P)	mg/l	n/a								0.02														
45	Pb	mg/l	0.015		0.7						< 0.005														
46	pH (lab)		6.5-8.5					8.1			8.0			8.0			8.2			8.1			7.85		
47	Sb	mg/l	0.01																						
48	Se	mg/l	0.05					< 0.1			< 0.001			"nil"			< 0.1			< 0.1			< 0.5		
49	Si (as SiO2)	mg/l	n/a								11														
50	Sn	mg/l	n/a																						
51	SO4	mg/l	250		> 200			186			191			130			164			187			165		
52	Sp. Cond. (lab @ 25 F)	umhos	n/a					1000			845			370			825			700			750		
53	Sr	mg/l	17																						
54	Sulfide	mg/l	n/a		0.13																				
55	T. Alkalinity (as CaCO3)	mg/l	n/a		> 200						162														
56	T. Hardness (as CaCO3)	mg/l	n/a		> 400						298														
57	T. Phos.	mg/l	n/a																						
58	TDS	mg/l	n/a		n/a			549			546			164			578			538			580		
59	Ti	mg/l	n/a																						
60	TKN	mg/l	n/a																						
61	Tl	mg/l	0.002																						
62	TOC	mg/l	n/a																						
63	TSS	mg/l	n/a																						
64	Turbidity	NTU?	n/a								6														
65	V	mg/l	0.06																						
66	Zn	mg/l	5		0.2						0.04														
67	Zr	mg/l	n/a																						

	A	C	D	Z	AA	AA	AD	AA	AG	AA	AJ	AA	AM	AA	AP	AA	AS	A
1	Arches National Park: 1978 Headqu																	
2	Well ID:				1978		1978		1978		1978		1978		1978		1978	
3	Sample Date:				6/17/82		9/21/82		12/7/82		2/15/83		5/10/83		9/27/83		11/1/83	
4	Lab.:				Atlas		Atlas		Atlas		Atlas		Atlas		Atlas		Atlas	
5	Lab. No.:				n/a		n/a		n/a		n/a		n/a		n/a		n/a	
6	Parameters	Units	GWQS	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<
7	Ag	mg/l	0.1															
8	Al	mg/l	0.2															
9	As	mg/l	0.05	<	0.1	<	0.01	<	0.1	<	0.1	<	0.1		0.09	<	0.002	
10	B	mg/l	0.6															
11	Ba	mg/l	2															
12	Be	mg/l	0															
13	Br	mg/l	n/a															
14	Ca	mg/l	n/a															
15	Cd	mg/l	0.005															
16	Cl	mg/l	250		57		57		60		60		78.5		100		55	
17	CN-total	mg/l	0.2				0.01											
18	Co	mg/l	n/a															
19	CO2	mg/l	n/a															
20	CO3 (CaCO3)	mg/l	n/a															
21	CO3 solids	mg/l	n/a															
22	Cr	mg/l	0.1															
23	Cu	mg/l	1.3		0.01				0.039	<	0.01		0.07		0.05		0.07	
24	F	mg/l	4															
25	Fe	mg/l	0.3		0.05	<	0.001		0.49		0.049		1.3		1.9		1.1	
26	Ga	mg/l	n/a															
27	Hardness (non-carb.)	mg/l	n/a															
28	HCO3 (CaCO3)	mg/l	n/a															
29	Hg	mg/l	0.002															
30	K	mg/l	n/a		9		1.2		10.8		12.7		10		7.5		4	
31	Li	mg/l	n/a															
32	Mg	mg/l	n/a															
33	Mn	mg/l	0.04		0.004	<	0.01	<	0.01		0.092		0.08		0.07	<	0.01	
34	Mo	mg/l	0.04															
35	Na	mg/l	n/a		40		50		70.7		71.7		67		73		60	
36	NH3 (as N)	mg/l	25															
37	Ni	mg/l	0.1															
38	NO2 (as N)	mg/l	1															
39	NO3	mg/l	n/a															
40	NO3 (as N)	mg/l	10		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
41	NO3*	mg/l	n/a		0.65		2.02		1.6		1.4		2.67		2.39		2.27	
42	NO3+NO2 (as N)	mg/l	10															
43	OH	mg/l	n/a		n/a		n/a		n/a		n/a		n/a		n/a		n/a	
44	P-ortho (as P)	mg/l	n/a															
45	Pb	mg/l	0.015															
46	pH (lab)		6.5-8.5		7.7		8.2		7.74		7.85		7.6		8.05		7.98	
47	Sb	mg/l	0.01															
48	Se	mg/l	0.05	<	0.5	<	0.01	<	0.5	<	0.5	<	0.5		0.25	<	0.005	
49	Si (as SiO2)	mg/l	n/a															
50	Sn	mg/l	n/a															
51	SO4	mg/l	250		201		184		203.3		192.8		176.8		153		158	
52	Sp. Cond. (lab @ 25 F)	umhos	n/a		800		900		700		950		730		900		1000	
53	Sr	mg/l	17															
54	Sulfide	mg/l	n/a															
55	T. Alkalinity (as CaCO3)	mg/l	n/a															
56	T. Hardness (as CaCO3)	mg/l	n/a															
57	T. Phos.	mg/l	n/a															
58	TDS	mg/l	n/a		421		551		612		603		657		536		660	
59	Ti	mg/l	n/a															
60	Tk1	mg/l	n/a															
61	Ti	mg/l	0.002															
62	TOC	mg/l	n/a															
63	TSS	mg/l	n/a															
64	Turbidity	NTU?	n/a															
65	V	mg/l	0.06															
66	Zn	mg/l	5															
67	Zr	mg/l	n/a															

	A	C	D	A	AV	AA	AY	AB	BB	BC	BE	BF	BN	BF	BQ	BR	BT	BU
1	Arches National Park: 1978 Headqu																	
2	Well ID:				1978		1978		1978		1978		1978		1978		1978	
3	Sample Date:				1/11/84		4/23/84		8/7/86		6/17/91		8/16/94		1/18/96		2/28/96	
4	Lab.:				Atlas		Atlas		USGS?		SHL		SHL		SHL		SHL	
5	Lab. No.:				n/a		n/a		n/a		C913939		C948730		9600390		9601432	
6	Parameters	Units	GWQS	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<	Conc.	<
7	Ag	mg/l	0.1							<	0.002			<	0.002	<	0.002	
8	Al	mg/l	0.2											<	0.03	<	0.03	
9	As	mg/l	0.05	<	0.1	<	0.1	<	0.001	<	0.005			<	0.005	<	0.005	
10	B	mg/l	0.6														n/a	
11	Ba	mg/l	2					0.01		0.03					0.025		0.026	
12	Be	mg/l	0											<	0.001	<	0	
13	Br	mg/l	n/a														n/a	
14	Ca	mg/l	n/a					97		79					84		86	
15	Cd	mg/l	0.005							<	0.001			<	0.001	<	0.001	
16	Cl	mg/l	250		63		62	280		201					64		141	
17	CN-total	mg/l	0.2														n/a	
18	Co	mg/l	n/a														n/a	
19	CO2	mg/l	n/a					14		3					6		3	
20	CO3 (CaCO3)	mg/l	n/a					0.00		0					0		0	
21	CO3 solids	mg/l	n/a							113					121		122	
22	Cr	mg/l	0.1							<	0.005			<	0.005	<	0.005	
23	Cu	mg/l	1.3		0.02		0.09			<	0.02			<	0.012	<	0.012	
24	F	mg/l	4					0.4		0.38					0.424		0.421	
25	Fe	mg/l	0.3		0.09		0.23	<	0.01	0.03				<	0.02		0.092	
26	Ga	mg/l	n/a														n/a	
27	Hardness (non-carb.)	mg/l	n/a					210									n/a	
28	HCO3 (CaCO3)	mg/l	n/a					0.00		230					246		248	
29	Hg	mg/l	0.002							<	0.0002			<	0.0002	<	0.0002	
30	K	mg/l	n/a		5.9		4.4	10		9					8		8	
31	Li	mg/l	n/a														n/a	
32	Mg	mg/l	n/a					38		36					35		35	
33	Mn	mg/l	0.04	<	0.01	<	0.01			<	0.005			<	0.005	<	0.005	
34	Mo	mg/l	0.04												0.002		0.002	
35	Na	mg/l	n/a		66		58.3	200		170					120		120	
36	NH3 (as N)	mg/l	25							<	0.1						<	0.05
37	Ni	mg/l	0.1											<	0.01	<	0.01	
38	NO2 (as N)	mg/l	1							<	0.01	<	0.02	<			n/a	
39	NO3	gm/l	n/a							0.00							n/a	
40	NO3 (as N)	mg/l	10		0.00		0.00	0.00		2.95		n/a					n/a	
41	NO3*	mg/l	n/a		3.23		4.5	0									n/a	
42	NO3+NO2 (as N)	mg/l	10														6.46	
43	OH	mg/l	n/a		n/a		n/a	n/a		n/a		n/a			n/a		0	
44	P-ortho (as P)	mg/l	n/a							<	0.01							
45	Pb	mg/l	0.015							<	0.005			<	0.003	<	0.003	
46	pH (lab)		6.5-8.5		7.8		7.87	7.4		7.9					7.81		8.13	
47	Sb	mg/l	0.01												<	0.003	<	0.003
48	Se	mg/l	0.05	<	0.5	<	0.5	0.005	<	0.005					0.006		0.004	
49	Si (as SiO2)	mg/l	n/a					12									n/a	
50	Sn	mg/l	n/a														n/a	
51	SO4	mg/l	250		175		221	260		240					232.3		225	
52	Sp. Cond. (lab @ 25 F)	umhos	n/a		900		850	1690		1360					1305		1276	
53	Sr	mg/l	17					2.6									n/a	
54	Sulfide	mg/l	n/a														n/a	
55	T. Alkalinity (as CaCO3)	mg/l	n/a					188		188					202		203	
56	T. Hardness (as CaCO3)	mg/l	n/a					400		345.2					353.6		358.6	
57	T. Phos.	mg/l	n/a														<	0.01
58	TDS	mg/l	n/a		553		628	1000		900					816		794	
59	Ti	mg/l	n/a														n/a	
60	TKN	mg/l	n/a														0.27	
61	Tl	mg/l	0.002											<	0.001	<	0.001	
62	TOC	mg/l	n/a															
63	TSS	mg/l	n/a												4		4	
64	Turbidity	NTU?	n/a							0.2					0.47		0.85	
65	V	mg/l	0.06											<	0.04	<	0.04	
66	Zn	mg/l	5							0.076					0.087		0.16	
67	Zr	mg/l	n/a												n/a		n/a	

	A	C	D	BV	BW	BXC	CI	CJ	CK	CL	CM
1	Arches National Park: 1978 Headqu.										
2	Well ID:				1978						
3	Sample Date:				7/24/96					Avg.	Ratio of
4	Lab.:				SHL					Conc.	Avg.
5	Lab. No.:				9606388		Average	Std. Dev.		Exceeds	Conc. /
6	Parameters	Units	GWQS	<	Conc.	<	Conc.	Dev.	Count	WQNC?	WQNC
7	Ag	mg/l	0.1	<	0.002	<	0.002	0	5		
8	Al	mg/l	0.2			<	0.03	0	2		
9	As	mg/l	0.05	<	0.005	<	0.054	0.048	19	YES	1.1
10	B	mg/l	0.6				0.14	#DIV/0!	1		
11	Ba	mg/l	2		0.033		0.029	0.013	6		
12	Be	mg/l	0			<	0.001	0.001	2		
13	Br	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
14	Ca	mg/l	n/a		94.6		85.1	9.99	6		
15	Cd	mg/l	0.005	<	0.001	<	0.001	0	5		
16	Cl	mg/l	250		260		100.7	67.3	21		
17	CN-total	mg/l	0.2				0.01	#DIV/0!	1		
18	Co	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
19	CO2	mg/l	n/a		7		6	4.3	6		
20	CO3 (CaCO3)	mg/l	n/a		0		0.0	0.0	6		
21	CO3 solids	mg/l	n/a		111		112.8	10.1	5		
22	Cr	mg/l	0.1	<	0.005	<	0.005	0	5		
23	Cu	mg/l	1.3	<	0.012	<	0.051	0.07	18		
24	F	mg/l	4				0.36	0.13	7		
25	Fe	mg/l	0.3		0.0287	<	0.29	0.54	19		
26	Ga	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
27	Hardness (non-carb.)	mg/l	n/a				210	#DIV/0!	1		
28	HCO3 (CaCO3)	mg/l	n/a		226		191.33	95.45	6		
29	Hg	mg/l	0.002			<	0.0002	0	3		
30	K	mg/l	n/a		9.6		33.81	119.17	20		
31	Li	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
32	Mg	mg/l	n/a		38.1		35.35	2.96	6		
33	Mn	mg/l	0.04	<	0.005	<	4.53	20.12	20	YES	113.2
34	Mo	mg/l	0.04				0.002	0	2		
35	Na	mg/l	n/a		191		112.54	92.83	20		
36	NH3 (as N)	mg/l	25	<	0.05	<	0.08	0.03	4		
37	Ni	mg/l	0.1	<	0.01	<	0.01	0	4		
38	NO2 (as N)	mg/l	1			<	0.03	0.02	3		
39	NO3	gm/l	n/a				0.00	0.00	5		
40	NO3 (as N)	mg/l	10				0.34	1.00	18		
41	NO3*	mg/l	n/a				1.68	1.21	16		
42	NO3+NO2 (as N)	mg/l	10		3.43		4.36	1.82	3		
43	OH	mg/l	n/a		0		0	0	2		
44	P-ortho (as P)	mg/l	n/a			<	0.02	0.01	2		
45	Pb	mg/l	0.015	<	0.003	<	0.12	0.28	6	YES	8.0
46	pH (lab)		6.5-8.5		7.73		7.90	0.21	2		
47	Sb	mg/l	0.01			<	0.003	0	2		
48	Se	mg/l	0.05		0.0093	<	0.22	0.23	19	YES	4.3
49	Si (as SiO2)	mg/l	n/a				11.50	0.71	2		
50	Sn	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
51	SO4	mg/l	250		273.7		196.14	35.88	21		
52	Sp. Cond. (lab @ 25 F)	umhos	n/a		1614		973.25	324.41	20		
53	Sr	mg/l	17				2.6	#DIV/0!	1		
54	Sulfide	mg/l	n/a				0.13	#DIV/0!	1		
55	T. Alkalinity (as CaCO3)	mg/l	n/a		185		189.71	14.31	7		
56	T. Hardness (as CaCO3)	mg/l	n/a		392.8		364.03	37.12	7		
57	T. Phos.	mg/l	n/a	<	0.01	<	0.01	0	2		
58	TDS	mg/l	n/a		966		632.60	191.38	20		
59	Ti	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
60	TKN	mg/l	n/a		0.152		0.21	0.08	2		
61	Tl	mg/l	0.002			<	0.00	0.00	2		
62	TOC	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
63	TSS	mg/l	n/a	<	4	<	4	0	3		
64	Turbidity	NTU?	n/a		0.303		1.56	2.49	5		
65	V	mg/l	0.06			<	0.04	0.0	2		
66	Zn	mg/l	5				0.11	0.07	5		
67	Zr	mg/l	n/a				#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!

Cell: O2

Note: Sample Description: Arches Visitor Center.

Cell: R2

Note: Sample Description: Arches Headquarters

Cell: U2

Note: Sample Description: Arches Park.

Cell: X2

Note: Sample Description: Arches National Park.

Cell: AA2

Note: Sample Description: Arches Headquarters.

Cell: AD2

Note: Sample Description: Arches Headquarters.

Cell: AG2

Note: Sample Description: Arches Headquarters.

Cell: AJ2

Note: Sample Description: Arches Headquarters.

Cell: AM2

Note: Sample Description: Arches.

Cell: AP2

Note: Sample Description: Arches Well.

Cell: AS2

Note: Sample Description: Arches.

Cell: AV2

Note: Sample Description: Arches.

Cell: AY2

Note: Sample Description: Arches.

Cell: BB2

Note: 8/7/86 Sample: from P.J. Blanchard, 1990, "Ground-Water Conditions in the Grand County Area, Utah, with Emphasis on the Mill Creek-Spanish Valley Area", Utah DNR Technical Publication No. 100, Table 4, Well (D-25-21)21bdc-1 (Arches National Park Headquarters Well drilled in 1978).

Cell: F3

Note: 5/24/78 Sample from 1978 Well = field test results from a Hydrodyne Analytical kit. Data reported in September, 1978 "Report on Evaluation of Environmental Health Facilities, Arches National Park, Utah" by Albert V. Soukup, P.E., U.S. Public Health Service Environmental Sanitation Consultant, National Park Service, Denver, Colorado, Attachment 1.

Cell: U3

Note: 4th Qtr, 1981 Sample: no sample date provided in Atlas quarterly report. Sample data assumed to be 12/1/81.

Cell: BT6

Note: 2/28/96 SHL Sample: all heavy metals = dissolved, sample was field filtered.

Cell: D8

Note: Aluminum (Al) GWQS: based on EPA DW Secondary MCL (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D10

Note: Boron (B) GWQS: based on draft EPA lifetime DW Health Advisory (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D12

Note: Beryllium (Be) and nickel (Ni) GWQS: EPA DW MCLs from 7/12/92 Federal Register, Vol. 57, No. 138, pp. 31776-31849, Table 1.

Cell: D16

Note: Chloride (Cl) GWQS: based on EPA DW Secondary MCL (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D17

Note: CN-total GWQS: GWQS based on free cyanide limit of 0.2 mg/l.

Cell: BB20

Note: Carbonate calculated from pH and bicarbonate concentration (B), as follows (Standard Methods, 17th Ed., p. 4-20):

$$\text{CO}_3 \text{ (mg/l as CaCO}_3\text{)} = 0.94 * B * 10^{(\text{pH}-10)}.$$

Cell: D25

Note: Iron (Fe) GWQS: based on EPA DW Secondary MCL (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: BB28

Note: Bicarbonate calculated from pH and Total Alkalinity (T), as follows (Standard Methods, 17th Ed., p. 4-20):

$$\text{HCO}_3 \text{ (mg/l as CaCO}_3\text{)} = \{ (T - 5 * 10^{(\text{pH}-10)}) / (1 + 0.94 * 10^{(\text{pH}-10)}) \}.$$

Cell: D33

Note: Manganese (Mn) GWQS: based on EPA DW draft Health Advisory Reference Dose (RfD). RfD = 0.005 mg/kg/day (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water). Convert the RfD to a health advisory as follows: 0.005 mg/kg/day * 1 day/2 liters consumption * 70 kg Adult * 0.2 = 0.035 mg/l, round up to 0.04 mg/l (Personal communication, Bob Benson, EPA Region VIII DW toxicologist. The 0.2 factor is the relative source contribution factor assumed for drinking water. It is also important to note that the 0.005 mg/kg/day RfD value given in the summary document is for water intake and assumes human diet is already sufficient in Mn. Although Mn has a Secondary MCL under EPA DW regulations, adverse neurological effects on man have been documented, therefore, a health advisory was calculated here). Note that this concentration, 0.04 mg/l, is slightly LOWER than the EPA secondary DW MCL of 0.05 mg/l.

Cell: D34

Note: Molybdenum (Mo) GWQS: based on EPA DW draft lifetime health advisory (from summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D36

Note: Ammonia (NH₃) GWQS: based on draft EPA DW lifetime health advisory, from EPA summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, Office of Water.

GWQS for NH₃ as N, need to factor for molecular weights:

$$N = 14.0067$$

$NH_3 = 17.0304 \text{ (or } 14.0067 + (3 * 1.0079)\text{)},$

$N / NH_3 = 14.0067 / 17.0304 = 0.8225.$

Consequently GWQS for NH_3 (as N) = $30 \text{ mg/l} * 0.8225 = 24.67$ or rounded to 25 mg/l.

Cell: D37

Note: Beryllium (Be) and nickel (Ni) GWQS: EPA DW MCLs from 7/12/92 Federal Register, Vol. 57, No. 138, pp. 31776-31849, Table 1.

Cell: A39

Note: Atlas and NPS/USGS samples for nitrate expressed as NO_3 . Utah SHL samples expressed as NO_3 (as N). To convert NO_3 (as N) data to simple NO_3 values, do as follows:

NO_3 (as N) value * 4.4268

(4.4268 = ratio of molecular weights of NO_3 / N, or $62.0049 / 14.0067$).

To convert NO_3 to NO_3 (as N) values, simply:

$NO_3 / 4.4268$

GWQS for NO_3 (as N) = 10 mg/l, corresponding GWQS for NO_3 = 44.268 mg/l or simplified to 44 mg/l.

Cell: C39

Note: NO_3 : Atlas commonly reported nitrate in units of gm/l. 1 gm/l = 1,000 mg/l.

Cell: BE39

Note: 6/17/91 NO_3 sample from 1978 Well: calculated from result reported by SHL in units of NO_3 (as N).

Cell: D46

Note: pH GWQS: 6.5 to 8.5

Cell: D47

Note: Antimony (Sb) GWQS: based on final EPA DW MCL (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D51

Note: Sulfate (SO_4) GWQS: based on EPA DW Secondary MCL (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D53

Note: Strontium (Sr) GWQS: based on draft EPA DW lifetime Health Advisory (see summary entitled "Drinking Water Regulations and Health Advisories", December, 1993, EPA Office of Water).

Cell: D61

Note: Thallium (Tl) GWQS: based on final EPA DW MCL (see EPA document entitled "Drinking Water Regulations and Health Advisories", December, 1993, Office of Water).

Cell: D65

Note: Vanadium (V) GWQS: based on human reference dose of 9 ug/kg/day for vanadium pentoxide, V_2O_5 (see EPA "Health Effects Assessment Summary Tables, 3rd Qtr., FY1989, Office of Emergency and Remedial Response, Washington DC, 64pp). This is a moderate value in that both lower and higher RfD values can be found for vanadium compounds in the literature, as follows: 1) Vanadium sulfate, VSO_4 , RfD = 20 ug/kg/day (ibid.), and 2) Sodium vanadate, $NaVO_3$, Intermediate Minimal Risk Level (equivalent to EPA RfD) = 3 ug/kg/day (see Agency for Toxic Substances & Disease Registry). To convert to an adhoc health advisory,

calculate as follows: $9 \text{ ug/kg/day} * 1 \text{ day/2 liters} * 70 \text{ kg adult} * 0.2 = 0.063 \text{ mg/l}$, round down to 0.06 (0.2 factor = drinking water Relative Source Contribution, personal communication, Bob Benson, EPA Region VIII DW toxicologist).

NRC Radioactive Materials License for Atlas facility set vanadium groundwater protection standard at 0.04 mg/l (NRC License No. SUA-917, Amendment No. 26, Docket No. 40-3453).

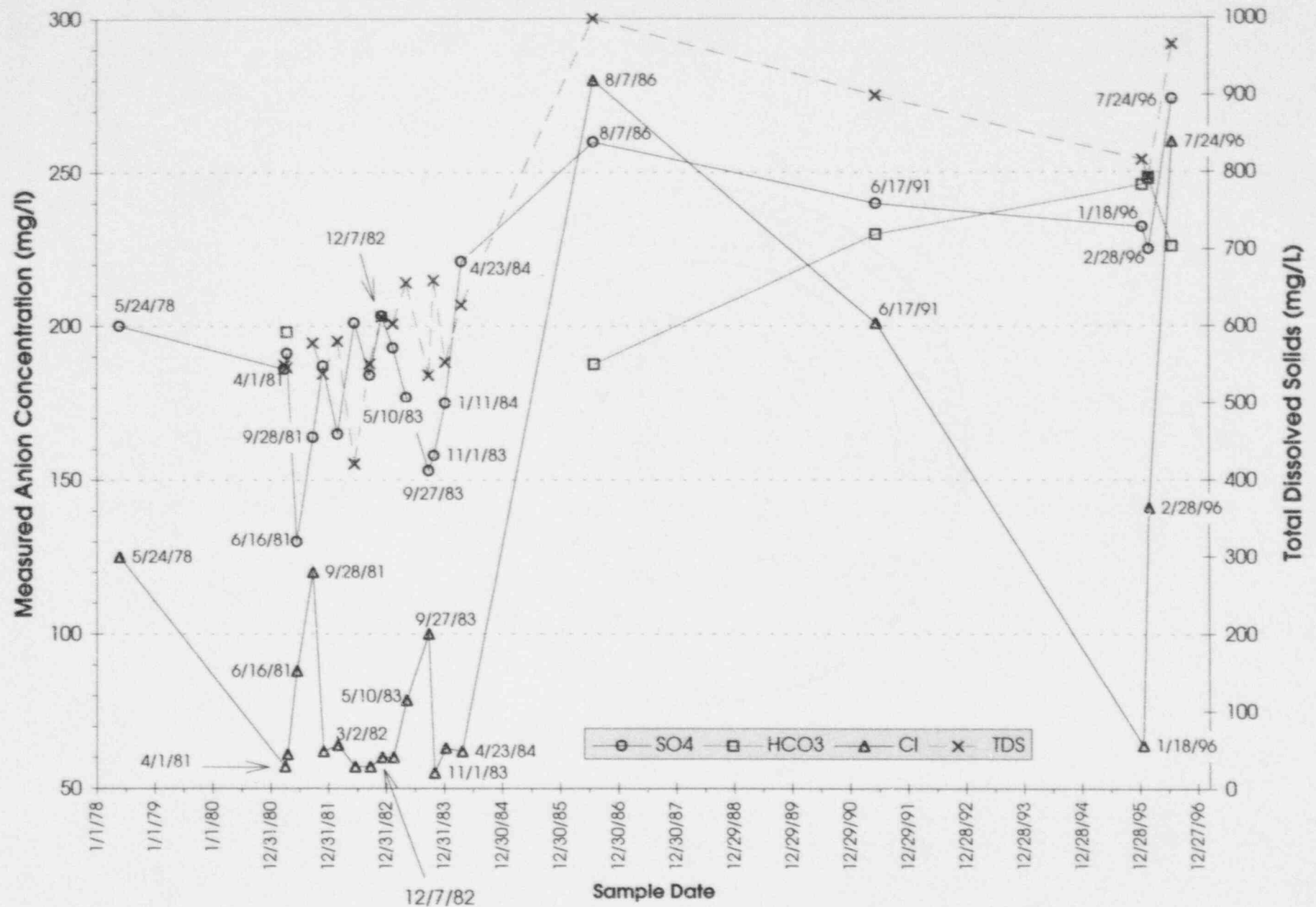
ATTACHMENT 9

Utah Division of Radiation Control

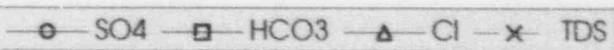
Graph of Major Anion
and
Total Dissolved Solids
Concentrations
in
Groundwater
at
Arches National Park
Headquarters Well

DRC Charts
NPSWQ.XLS - 78an1 and 78meq

Arches National Park Headquarters 1978 Well (Navajo Sandstone)
Anion Concentration vs. Total Dissolved Solids



Anion Concentration (meq/l) vs. Total Dissolved Solids



ATTACHMENT 10

Utah Division of Radiation Control

Summary of Available
Groundwater Quality Data
at
Arches National Park
Headquarters Well
(1981 - 1996):

Radiologic Parameters.

DRC Spreadsheet
NPSWQ.XLS - 78rad

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	A	
1	Arches N.P. 1978 Headquarters Well																													
2	Radiochemsitry Data															Ra-226														
3	Sample		Lab	Gross Alpha (pCi/l)					G. Beta (pCi/l)					Atlas Meas. Conc. (uCi/ml)					DEQ Calc./Meas. (pCi/l)					Ra-226 (pCi/l)						
4	Date	Lab	No.	< Conc.	+/-	lo	hi	LLD	< Conc.	+/-	LLD	< Conc.	+/-	LLD	< Conc.	+/-	LLD	< Conc.	+/-	LLD	< Conc.	+/-	LLD	< Conc.	+/-	LLD	< Conc.	+/-	LLD	
5	4/1/81	Atlas	n/a						n/a			6.5E-02	2E-10	n/a	6.5E+07	0.2	n/a	n/a												
6	6/16/81	Atlas	n/a						n/a			0.031	4.0E-11	n/a	3.1E+07	0.04	n/a	n/a												
7	9/28/81	Atlas	n/a						n/a			0.044	8.0E-11	n/a	4.4E+07	0.08	n/a	n/a												
8	12/1/81	Atlas	n/a						n/a			9.5E-10	4.0E-02	n/a	0.95	4.00E+07	n/a	n/a												
9	3/2/82	Atlas	n/a						n/a			5.1E-10	5.0E-10	4.9E-10	0.51	0.5	0.5	n/a												
10	6/17/82	Atlas	n/a						n/a			< 1.8E-10	6.0E-03	4.9E-10	< 0.18	6.0E+06	0.5	n/a												
11	9/21/82	Atlas	n/a						n/a			8.8E-10	4.0E-03	4.9E-10	0.88	4.0E+06	0.5	n/a												
12	12/7/82	Atlas	n/a						n/a			0.0E+00	7.0E-02	4.9E-10	0	7.0E+07	0.5	n/a												
13	2/15/83	Atlas	n/a						n/a			7.0E-10	1.6E-01	4.9E-10	0.7	1.6E+08	0.5	n/a												
14	5/10/83	Atlas	n/a						n/a			3.8E-10	1.7E-10	2.0E-10	0.38	0.17	0.2	n/a												
15	9/27/83	Atlas	n/a						n/a			< 1.2E-10	1.67E-10	3.0E-09	< 0.12	0.17	3	n/a												
16	11/1/83	Atlas	n/a						n/a			2.42E-10	1.25E-10	1.0E-10	0.24	0.13	0.1	n/a												
17	1/11/84	Atlas	n/a						n/a			< 2.58E-10	1.89E-10	4.9E-10	0.26	0.19	0.5	n/a												
18	4/23/84	Atlas	n/a						n/a			8.82E-10	2.22E-10	2.0E-10	0.88	0.22	0.2	n/a												
19	7/10/91	SHL	C914455	2	1	1	3		n/a			n/a			n/a			n/a												
20	1/18/96	SHL	9600390	6	4	2	10		17	5		n/a			< 0.5	0.7		< 1.0	3.0											
21	2/28/96	SHL	9601432	9.2	1	8	10		< 10	5		n/a			< 0.5	0.8		< 1	2											
22	7/24/96	SHL	9606388	24	2	22	26		13.9	4		n/a			< 0.5	0.3		1	4											
23																														
24																														
25			mean:	10.30					< 13.63			< 1.00E-02			< 0.47			< 1.00												
26			max.:	24					17			0.065			0.95			1												
27			min.:	2					10			0			0			1												
28			std dev.:	9.60					3.51			2.10E-02			0.30			0.00												
29			count:	4					3			14			14			3												

	A	B	C	AI	AE	AF	AG	AI	AI	AJ	AK	AL	AM	AA	AP	AQ	AR	A	AT	AU	AV	A
1	Arches N.P. 1978 Headc																					
2	Radiochemsitry Data				U-natural										Gross Beta-Gamma							
3	Sample		Lab	Atlas Meas. Conc. (uCi/m ³)				DEQ Calc./Meas. (pCi/l)				Atlas Meas. Conc. (uCi/m ³)				DEQ Calc./Meas. (pCi/l)						
4	Date	Lab	No.	<	Conc.	+/-	LLD	<	Conc.	+/-	lo	hi	LLD	<	Conc.	+/-	LLD	<	Conc.	+/-	LLD	
5	4/1/81	Atlas	n/a		0.0E+00	0	n/a		0	0	0	0			0.0E+00	0	n/a		0	0	n/a	
6	6/16/81	Atlas	n/a		"nil"		n/a			0					n/a				n/a			
7	9/28/81	Atlas	n/a		0.00004	0	n/a		40,000	0	40000	40000			"nil"				"nil"			
8	12/1/81	Atlas	n/a		"nil"	?	n/a			?					"nil"	0	n/a		"nil"		n/a	
9	3/2/82	Atlas	n/a	<	5.0E-10	0.0E+00	8.0E-10	<	0.8	0	1	1	0.8		0	0	n/a		0	0	n/a	
10	6/17/82	Atlas	n/a	<	5.0E-10	1.5E-05	8.0E-10	<	0.8	15000	-14999	15001	0.8		0	0	n/a		0	0	n/a	
11	9/21/82	Atlas	n/a		4.0E-10	0.0E+00	8.0E-10	<	0.8	0	1	1	0.8		0	0	n/a		0	0	n/a	
12	12/7/82	Atlas	n/a		7.4E-09	n/a	8.0E-10		7.4	n/a			0.8		1.5E-08	5.0E-03	n/a		15	5.0E+06	n/a	
13	2/15/83	Atlas	n/a		1.0E-08	n/a	8.0E-10		10.0	n/a			0.8		1.0E-08	4.0E-03	n/a		10	4.0E+06	n/a	
14	5/10/83	Atlas	n/a		6.3E-09	4.2E-11	4.0E-09		6.3	0	6	6	4.0		6.0E-09	6.0E-09			6	6		
15	9/27/83	Atlas	n/a	<	0.0E+00	3.4E-09	3.0E-09	<	3.0	3	0	6	3.0		7.0E-09	6.0E-09	n/a		7	6	n/a	
16	11/1/83	Atlas	n/a	<	0.0E+00	1.52E-10	3.0E-09	<	3.0	0	3	3	3.0		1.2E-08	4.4E-09	n/a		12	4.4	n/a	
17	1/11/84	Atlas	n/a		5.15E-09	5.70E-08	8.0E-10		5.2	57	-52	62	0.8		2.58E-08	1.89E-08	n/a		25.8	18.9	n/a	
18	4/23/84	Atlas	n/a		3.78E-09	1.10E-10	3.0E-09		3.8	0	4	4	3.0		1.10E-08	7.00E-09	1.0E-08		11	7	10	
19	7/10/91	SHL	C914455	n/a											n/a				n/a			
20	1/18/96	SHL	9600390	n/a					8.4	1	7	10			n/a				n/a			
21	2/28/96	SHL	9601432	n/a					9.2	2	7	12			n/a				n/a			
22	7/24/96	SHL	9606388	n/a					9.1	2	7	11			n/a				n/a			
23																						
24																						
25			mean:					<	5.21						7.89E-09				7.89			
26			max.:						10						2.58E-08				25.8			
27			min.:						0.8						0				0			
28			std dev.:						3.42						8.10E-09				8.10			
29			count:						13						11				11			

	A	B	C	AY	AZ	BA	BE	BC	BD	BE	BH	BI	BJ	BL	BM	BN	BO							
1	Arches N.P. 1978 Headc																							
2	Radiochemsitry Data										Th-230							Pb-210						
3	Sample		Lab	Atlas Meas. Conc. (uCi/ml)				DEQ Calc./Meas. (pCi/l)			Atlas Meas. Conc. (uCi/ml)				DEQ Calc./Meas. (pCi/l)									
4	Date	Lab	No.	<	Conc.	+/-	LLD	<	Conc.	+/-	LLD	<	Conc.	+/-	LLD	<	Conc.	+/-	LLD					
5	4/1/81	Atlas	n/a		3.0E-03	1.8E-11	n/a		3.0E+06	0.018	n/a		2.2E-01	1.21E-09	n/a		2.20E+08	1.21						
6	6/16/81	Atlas	n/a		0.0068	1.7E-09	n/a		6.8E+06	1.7	n/a		n/a		n/a		#VALUE!	0						
7	9/28/81	Atlas	n/a		0.0007	2.0E-11	n/a		7.0E+05	0.02	n/a		n/a		n/a		#VALUE!	0						
8	12/1/81	Atlas	n/a		7.0E-11	0.0E+00	n/a		0.07	0	n/a		n/a		n/a		#VALUE!	0						
9	3/2/82	Atlas	n/a		7.4E-10	0.0E+00	4.9E-10		0.74	0	0.49	<	1.0E-09	3.0E-09	3.7E-09	<	1	3	3.7					
10	6/17/82	Atlas	n/a		1.3E-09	1.0E-03	4.9E-10		1.3	1.0E+06	0.49		n/a		3.7E-09		#VALUE!	-	3.7					
11	9/21/82	Atlas	n/a		1.9E-09	8.0E-04	4.9E-10		1.9	8.0E+05	0.49		n/a		3.7E-09		#VALUE!	-	3.7					
12	12/7/82	Atlas	n/a		0.0E+00	1.7E+00	4.9E-10		0	1.7E+09	0.49		0.0E+00	4.8E+00	3.7E-09		0	4.8E+09	3.7					
13	2/15/83	Atlas	n/a		1.7E-09	2.0E-03	4.9E-10		1.7	2.0E+06	0.49		2.0E-09	2.7E-02	3.7E-09		2	2.7E+07	3.7					
14	5/10/83	Atlas	n/a	<	3.6E-10	3.3E-10	7.0E-10	<	0.362	0.33	0.7	<	4.0E-10	9.0E-10	1.0E-09	<	0.4	9.0E-01	1					
15	9/27/83	Atlas	n/a	<	3.24E-10	5.5E-10	8.0E-10	<	0.324	0.553	0.8		0.0E+00	1.0E-09	2.0E-09		0	1.0E+00	2					
16	11/1/83	Atlas	n/a		6.98E-10	1.72E-10	1.0E-10		0.698	0.172	0.1	<	9.3E-11	8.3E-10	1.0E-09	<	0.093	8.3E-01	1					
17	1/11/84	Atlas	n/a	<	1.51E-10	8.4E-10	4.9E-10	<	0.151	0.84	0.49	<	1.00E-10	1.5E-09	3.7E-09	<	0.1	1.5E+00	3.7					
18	4/23/84	Atlas	n/a		6.17E-09	4.30E-10	2.0E-10		6.17	0.43	0.2	<	9.00E-10	2.10E-09	4.0E-09	<	0.9	2.10E+00	4					
19	7/10/91	SHL	C914455	n/a					n/a				n/a				n/a							
20	1/18/96	SHL	9600390	n/a					n/a				n/a				n/a							
21	2/28/96	SHL	9601432	n/a					n/a				n/a				n/a							
22	7/24/96	SHL	9606388	n/a					n/a				n/a				n/a							
23																								
24																								
25			mean:	<	7.50E-04			<	1.22															
26			max.:		0.0068				6.17															
27			min.:		0				0															
28			std dev.:		1.92E-03				1.77															
29			count:		14				11															

	A	B	C	BF	BQ	BR	BS	BT	BU	BV	BW	BX
1	Arches N.P. 1978 Headc											
2	Radiochemsitry Data			Po-210								
3	Sample		Lab	Atlas Meas. Conc. (uCi/ml)				DEQ Calc./Meas. (pCi/l)				
4	Date	Lab	No.	<	Conc.	+/-	LLD	<	Conc.	+/-	LLD	
5	4/1/81	Atlas	n/a		0.0E+00	0	n/a		0	0	n/a	
6	6/16/81	Atlas	n/a		"nil"		n/a		"nil"		n/a	
7	9/28/81	Atlas	n/a		0.0002	1.7E-09	n/a		2.0E+05	1.7	n/a	
8	12/1/81	Atlas	n/a		1.9E-09	0.0E+00	n/a		1.9	0	n/a	
9	3/2/82	Atlas	n/a	<	1.1E-09	0.0E+00	2.0E-09	<	1.1	0	2	
10	6/17/82	Atlas	n/a	<	0.0E+00	0.0E+00	2.0E-09	<	0	0	2	
11	9/21/82	Atlas	n/a		0.0E+00	0.0E+00	2.0E-09		0	0	2	
12	12/7/82	Atlas	n/a		1.4E-09	1.6E-02	2.0E-09		1.4	1.60E+07	2	
13	2/15/83	Atlas	n/a		0.0E+00	1.2E-02	2.0E-09		0	1.20E+07	2	
14	5/10/83	Atlas	n/a		1.2E-09	1.1E-09	1.0E-09		1.2	1.1	1	
15	9/27/83	Atlas	n/a		0.0E+00	3.0E-09	5.0E-09		0	3	5	
16	11/1/83	Atlas	n/a		0.0E+00	7.73E-10	1.0E-09		0	0.773	1	
17	1/11/84	Atlas	n/a	<	0.00E+00	8.0E-10	2.0E-09	<	0	0.8	2	
18	4/23/84	Atlas	n/a	<	7.00E-10	8.00E-10	1.0E-09	<	7.00E-01	0.8	1	
19	7/10/91	SHL	C914455	n/a					n/a			
20	1/18/96	SHL	9600390	n/a					n/a			
21	2/28/96	SHL	9601432	n/a					n/a			
22	7/24/96	SHL	9606388	n/a					n/a			
23												
24												
25			mean:									
26			max.:									
27			min.:									
28			std dev.:									
29			count:									

Cell: U4

Note: $\text{uCi/ml} * 1\text{E6 pCi/uCi} * 1\text{E3 ml/l} = \text{pCi/l}$.

Cell: A14

Note: $\text{uCi/ml} * 1\text{E6 pCi/uCi} * 1\text{E3 ml/l} = \text{pCi/l}$.

Cell: AT4

Note: $\text{uCi/ml} * 1\text{E6 pCi/uCi} * 1\text{E3 ml/l} = \text{pCi/l}$.

Cell: BC4

Note: $\text{uCi/ml} * 1\text{E6 pCi/uCi} * 1\text{E3 ml/l} = \text{pCi/l}$.

Cell: BL4

Note: $\text{uCi/ml} * 1\text{E6 pCi/uCi} * 1\text{E3 ml/l} = \text{pCi/l}$.

Cell: BU4

Note: $\text{uCi/ml} * 1\text{E6 pCi/uCi} * 1\text{E3 ml/l} = \text{pCi/l}$.

Cell: A5

Note: Sample Description: Arches Visitor Center.

Cell: A6

Note: Sample Description: Arches Visitor Center.

Cell: A7

Note: Sample Description: Arches Visitor Center.

Cell: BR7

Note: 9/28/81 Sample, Po-210 error term: Atlas reported value of 0.0017 pCi/ml, which equals $1.7\text{E-}9 \text{ uCi/ml}$.

Cell: A8

Note: Sample Description: Arches Visitor Center.

Cell: BQ8

Note: 4th Qtr, 1981 sample, Po-210: Atlas reported a value of 0.0019 pCi/ml, which equals $1.9\text{E-}9 \text{ uCi/ml}$.

Cell: A9

Note: Sample Description: Arches Visitor Center.

Cell: A19

Note: $5E-10 \text{ uCi/ml} * 1E6 \text{ pCi/uCi} * 1E3 \text{ ml/l} = 0.5 \text{ pCi/l}$. However, reported LLD = 0.8 pCi/l, consequently value assigned as < 0.8 pCi/l instead.

Cell: A10

Note: Sample Description: Arches Visitor Center.

Cell: A10

Note: $5E-10 \text{ uCi/ml} * 1E6 \text{ pCi/uCi} * 1E3 \text{ ml/l} = 0.5 \text{ pCi/l}$. However, reported LLD = 0.8 pCi/l, consequently value assigned as < 0.8 pCi/l instead.

Cell: A11

Note: Sample Description: Arches Visitor Center.

Cell: A11

Note: $4E-10 \text{ uCi/ml} * 1E6 \text{ pCi/uCi} * 1E3 \text{ ml/l} = 0.5 \text{ pCi/l}$. However, reported LLD = 0.8 pCi/l, consequently value assigned as < 0.8 pCi/l instead.

Cell: A12

Note: Sample Description: Arches Visitor Center.

Cell: A13

Note: Sample Description: Arches Visitor Center.

Cell: A14

Note: Sample Description: Arches.

Cell: A15

Note: Sample Description: Arches.

Cell: A15

Note: $0.0E-10 \text{ uCi/ml} * 1E6 \text{ pCi/uCi} * 1E3 \text{ ml/l} = 0 \text{ pCi/l}$. However, reported LLD = 3.0 pCi/l, consequently value assigned as < 3.0 pCi/l instead.

Cell: A16

Note: Sample Description: Arches.

Cell: A16

Note: $0.0E-10 \text{ uCi/ml} * 1E6 \text{ pCi/uCi} * 1E3 \text{ ml/l} = 0 \text{ pCi/l}$. However, reported LLD = 3.0 pCi/l, consequently value assigned as < 3.0 pCi/l instead.

Cell: A17

Note: Sample Description: Arches.

Cell: A18

Note: Sample Description: Arches.

Cell: A19

Note: U-total, 7/10/91: not analyzed.

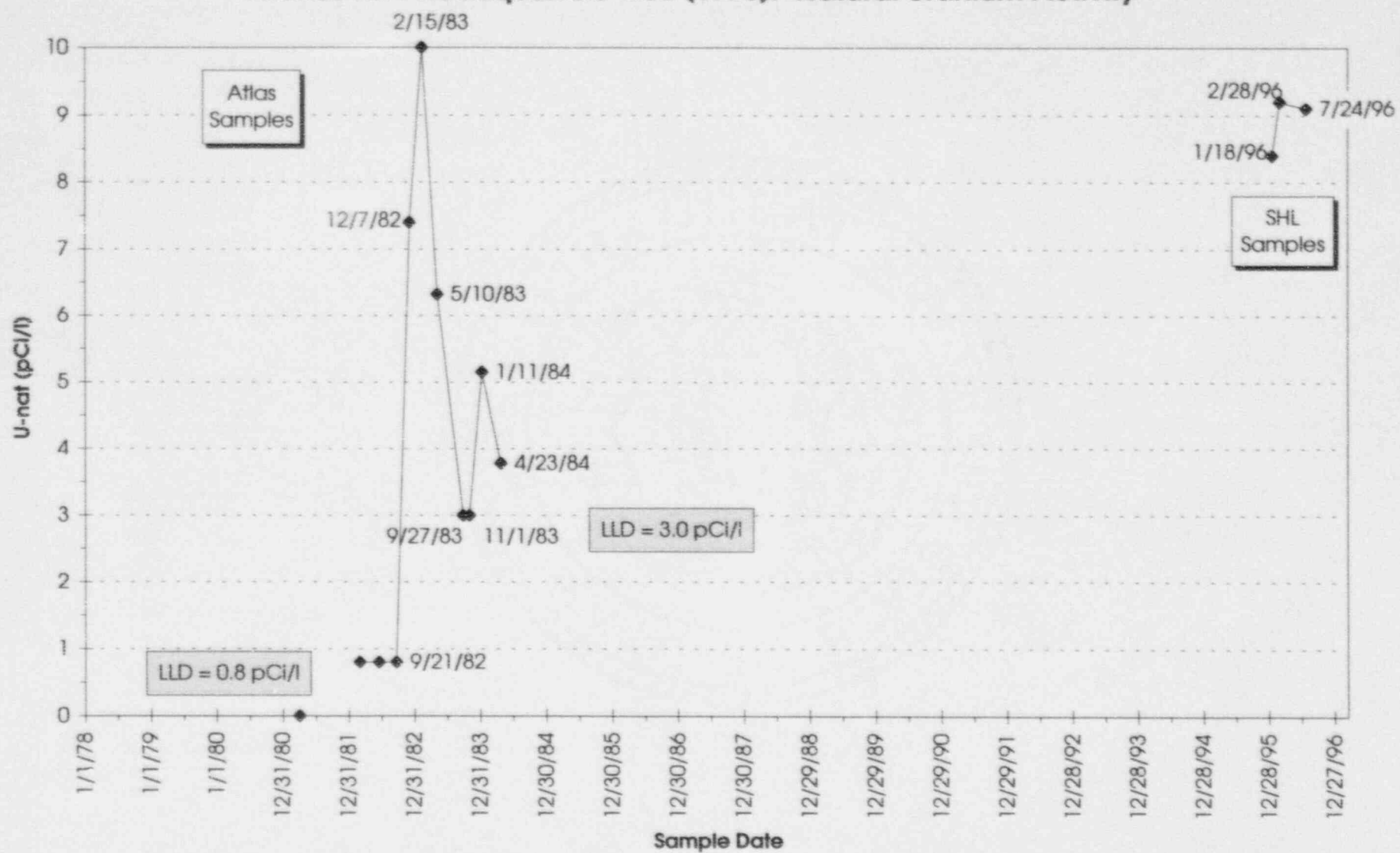
ATTACHMENT 11

Utah Division of Radiation Control

Graph of
Available Natural Uranium Activity Data
at
Arches National Park
Headquarters Well
(1982 - 1996)

DRC Graph
NPSWQ.XLS - 78u-nat

Arches N.P. Headquarters Well (1978): Natural Uranium Activity



ATTACHMENT 12

Utah Division of Radiation Control

Graph of
Available Gross Alpha Activity Data
at
Arches National Park
Headquarters Well
(1991 - 1996)

DRC Graph
NPSWQ.XLS - 78ga

Arches N. P. Headquarters Well (1978): Gross Alpha Activity (with reported error terms)
(time scaled values)

