FILE NAME --- AVEC   Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - January to December 1985

Date Sampled	Core Lab													Baseline		
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	UUS	STATE	LLD
Temperature, C, Field	17.93	18.88	18.69	18.7	19.28	19.45	19.62	18.99	18.75	18.13	17.67	17.46	18.63	12.63	13.5	
pH, Units, Field	6.75	6.3	6.34	6.46	5.91	6.51	6.52	6.55	6.26	6.58	6.58	6.64	6.41	8.53	8.5	
pH, Units, Lab at 25 C	7.05	7.11	7.39	7.85	7.49	7.91	7.29	7.16	7.06	7.14	7.48	7.55	7.37	8.13	8.1	
Conductivity,umhos, Field-Ambient	250	344	386	387	415	329	376	402	397	358	384	369	366	453	440	
Conductivity,umhos, Lab at 25 C	277	337	382	434	457	432	427	416	389	416	405	396	397	515	516	
TDS, Evaporation at 180 C	189	255	299	337	360	323	299*	305	301	287	297	316	297	338	335	
Sodium	56	82	72	81	77	69	71	71	73	69	73	69	72	112	112	1
Potassium	1.71	1.18		1.82	1.09		1		1	1	1	1	1.2	4	4	1
Calcium	7.09	13	18.91	24.55	28.45	28.00	25	27	28	27	27	27	23	8	7	1
Magnesium	0	1.18		1.55	2.64		2		3	3	2.6	2.9	2.1	2	2	1
Sulfate	91	133	155	186	183	149	130	137	139	128	126	123	140	102	101	
Chloride	7.45	9.09	7.36	8.91	8.73	7.27	6	5	6	4	9	6.6	7.1	6	6	
Carbonate	0	0		1.91	0		0	0	0	0	0	0	.19	20	*	
Bicarbonate	44	46		57	70		109	112	108	116	109	119	89	157	161	
Hydroxide					0		0	0	0	0	0	0	0			
Total Milliequivalent Major Cations																
Total Milliequivalent Major Anions																
Absolute Value, Charged, Balance																
Ammonia as N	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1	*	.1
Nitrate as N	.18	ND		ND	ND		ND		ND	ND	ND	ND	ND	.06	*	.1
Fluoride	.16	.16		0.12	.1		.2		.21	.06	.19	.24	.16	.41	.49	.01
Total Alkalinity as CaCO3	36.45	43	44.27	50	57	79	95	92	88	95	90	98	72	160	157	
Total Hardness as CaCO3	26.73	43		68	82		74		81	81	77	80	68	26	26	
Boron	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.07	*	.1
Aluminum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.11	*	.1
Arsenic	.03	.019	.019	.018	.016	.012	.023	.026	.02	.022	.021	.02	.021	.011	*	.004
Barium	.026	.016		.043	.041		.05		ND	.05	.04	.05	.035	.04	*	.01
Cadmium	.013	ND		ND	ND		ND		ND	ND	ND	ND	ND	.003	*	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	ND	*	.05
Copper	.016	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01	*	.01
Iron	.47	.74	1.86	2.47	3.37	1.65	1.54	1.54	1.37	1.47	1.31	1.27	1.59	.07	*	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02	*	.05
Manganese	.15	.17	.3	.41	0.52	0.53	.4	.42	.41	.43	.41	.42	.38	.013	*	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	ND	*	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	ND	*	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.01	*	.001
Zinc	.033	ND		ND	ND		ND		ND	ND	ND	ND	ND	.08	*	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	ND	*	.02
Uranium, U3O8	.041	.06	.044	.084	.062	.103	.33	.247	.404	.292	.434	.408	.209	.017	*	.001
Vanadium, V2O5	.12	.05	.05	0.06	0.03	0.03	.04	.04	.038	.041	.025	.039	.047	.05	*	.02
Radium 226, pCi/l	41	45	122	129	146	131	140	115	136	150	162	145	122	111	111	
Radium, Precision pCi/l, +/-																

Analyses reported in milligrams per liter except where noted.
ND - not detected.   NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

8602110409 851231
PDR ADOCK 04008783
C PDR

FILE NAME --- DEC1C   Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - December 1985

Date Sampled 12/11/85	Core Lab 5S	7S	9S	13S	16S	17S	19S	20S	26S	27S	29S	Average	LLD
Temperature, C, Field	17.3	18.7	17.2	18.1	16.5	18.6	18.8	16.5	16.4	16.9	17.1	17.46	
pH, Units, Field	6.68	6.45	6.67	6.26	6.52	6.11	6.66	7.1	6.78	6.67	7.15	6.64	
pH, Units, Lab at 25 C	7.8	7.1	7.7	7.6	7.3	7.3	7.8	7.8	7.8	7.2	7.6	7.55	
Conductivity,umhos, Field-Ambient	433	352	410	365	268	350	375	308	338	410	447	369	
Conductivity,umhos, Lab at 25 C	506	383	444	359	274	390	410	322	348	470	455	396	
TDS, Evaporation at 180 C	400	310	370	278	230	330	305	250	258	382	362	316	
Sodium	100	70	58	80	52	40	66	56	71	79	88	69	1
Potassium	2	1	1	1	1	0	0	1	1	1	1	1	1
Calcium	22	19	48	20	17	43	31	23	14	35	28	27	1
Magnesium	4	2	4	2	3	6	2	2	1	3	3	2.9	1
Sulfate	132	138	146	146	98	156	122	74	78	140	120	123	
Chloride	7	10	9	7	8	4	3	3	7	8	7	6.6	
Carbonate	0	0	0	0	0	0	0	0	0	0	0	0	
Bicarbonate	183	61	122	98	73	61	116	134	134	146	183	119	
Hydroxide	0	0	0	0	0	0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	5.83	4.18	5.27	4.67	3.38	4.38	4.58	3.77	3.89	5.46	5.50		
Total Milliequivalent Major Anions	5.94	4.15	5.29	4.84	3.46	4.36	4.52	3.82	4.02	5.53	5.69		
Absolute Value, Charged, Balance	0.99	0.36	0.18	1.82	1.15	0.24	0.63	0.63	1.55	0.70	1.76		
Ammonia as N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.1
Nitrate as N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.1
Fluoride	.14	.17	.26	.16	.15	.25	.16	.39	.36	.22	.33	.24	.01
Total Alkalinity as CaCO3	150	50	100	80	60	50	95	110	110	120	150	98	
Total Hardness as CaCO3	71	56	136	58	55	132	86	66	39	100	82	80	
Boron	ND	ND	ND	ND	ND	.1	ND	ND	ND	ND	ND	ND	.1
Aluminum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.1
Arsenic	.031	.015	ND	.023	.057	ND	.006	ND	.03	.006	.056	.02	.004
Barium	.04	.04	.06	.04	.03	.1	.06	.03	.03	.04	.04	.05	.01
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.01
Chromium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.05
Copper	ND	ND	ND	ND	ND	ND	ND	.02	ND	ND	ND	ND	.01
Iron	.84	2.80	0.25	1.40	3.90	0.82	2.20	.04	0.94	0.71	.06	1.27	.03
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.05
Manganese	0.34	0.39	0.65	0.25	0.27	0.63	0.59	0.15	0.34	0.48	0.48	.42	.01
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.0004
Nickel	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	.009	ND	ND	ND	.001
Zinc	ND	ND	ND	ND	ND	.01	ND	ND	ND	ND	.2	ND	.01
Molybdenum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.02
Uranium, U3O8	.09	.04	.09	.14	.02	.19	.4	.3	1.2	.02	2	.408	.001
Vanadium, V2O5	.02	ND	ND	.04	ND	.08	ND	ND	ND	ND	.2	.039	.02
Radium 226, pCi/l	61	154	59	192	104	342	103	27	113	156	286	145	
Radium, Precision pCi/L, +/-	2.6	4.1	2.5	4.6	3.4	6.1	3.4	1.8	3.5	4.1	5.5		

Analyses reported in milligrams per liter except where noted.
ND - not detected.   NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 55 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 55

Date Sampled	Core Lab													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
Temperature, C, Field	19.1	18.7	18.5	18.3	18.5	18.6	19.2	18.5	18.3	17.8	17.4	17.3	18.35	
pH, Units, Field	6.15	6.45	6.4	6.35	6.2	6.79	6.6	6.64	6.4	6.71	6.68	6.68	6.5	
pH, Units, Lab at 25 C	7.2	6.9	7.7	6.6	7.5	7.6	7.3	7.1	7.1	7.2	8	7.8	7.33	
Conductivity,umhos, Field-Ambient	280	420	587	489	677	375	422	472	497	435	468	433	463	
Conductivity,umhos, Lab at 25 C	302	405	562	684	833	477	505	483	489	511	504	506	522	
TDS, Evaporation at 180 C	182	328	444	598	702	378	364	368	334	388	366	400	404	
Sodium	58	75	102	130	139	94	95	101	102	100	104	100	100	1
Potassium	2	2		3	2		2		2	3	3	2	2.3	1
Calcium	8	22	33	46	63	20	20	22	23	27	22	22	27	1
Magnesium	ND	1		4	7		3		3	4	3	4	3.6	1
Sulfate	82	168	244	376	406	138	135	136	147	158	132	132	188	
Chloride	10	8	8	6	10	8	6	4	6	4	10	7	7	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	54	61		73	98		146	171	171	159	159	183	128	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.97	4.49		8.36	9.82		5.44		5.88	6.1	5.95	5.83		
Total Milliequivalent Major Anions	2.88	4.72		9.19	10.38		5.37		6.03	6.01	5.64	5.94		
Absolute Value, Charged, Balance	1.59	2.47		4.73	2.77		0.58		1.25	.79	2.68	.99		
Ammonia as N	ND	.13		.1	ND		ND		ND	ND	ND	ND	ND	.1
Nitrate as N	ND	ND		ND	.1		ND		ND	ND	ND	ND	ND	.1
Fluoride	.19	.16		.07	ND		.17		.14	ND	.11	.14	.11	.01
Total Alkalinity as CaCO3	44	50	55	60	80	115	120	140	140	130	130	150	101	
Total Hardness as CaCO3	20	59		132	186		63		70	84	67	71	84	
Boron	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.057	.031	.017	.016	.021	.01	.024	.026	.023	.027	.026	.031	.026	.004
Barium	.02	.03		.08	.11		.06		ND	.04	.03	.04	.046	.01
Cadmium	.02	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.47	2.4	5	8.1	13	2.5	1.3	1.1	.98	.96	.83	.84	3.12	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.11	.38	.57	.87	1.4	.41	.38	.39	.39	.38	.34	.34	.497	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	.007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	.02		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U308	.013	.024	.025	.027	.07	.09	.086	.075	.075	.13	.094	.09	.067	.001
Vanadium, V205	ND	.03	.02	.02	ND	ND	ND	ND	ND	ND	ND	.02	ND	.02
Radium 226, pCi/l	54	20	206	205	379	103	126	98	117	171	150	61	141	
Radium, Precision pCi/l, +/-	1.2	1		6.2	6.1	3.1	3.6	3	4	4.1	3.8	2.6		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 57   Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 7S

Date Sampled	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
	-----------	Core Lab	-----------											
Temperature, C, Field	-	19.8	19.4	19.8	19.2	20	20.1	19.6	19.3	19.2	18.7	18.7	19.44	
pH, Units, Field	6.85	6.45	6.15	6.45	5.8	6.22	6.26	6.29	5.99	6.31	6.38	6.45	6.3	
pH, Units, Lab at 25 C	6.9	7.1	7.3	7.8	6.9	7.6	7.1	6.9	6.8	6.8	7.3	7.1	7.13	
Conductivity,umhos, Field-Ambient	176	346	433	495	485	317	339	369	353	357	381	352	367	
Conductivity,umhos, Lab at 25 C	279	330	410	498	543	377	386	372	382	405	399	383	397	
TDS, Evaporation at 180 C	172	246	312	390	422	254	272	272	278	276	286	310	291	
Sodium	57	66	80	93	98	66	67	69	72	70	74	70	73.5	1
Potassium	1	2		2	1		1		1	1	1	1	1	1
Calcium	3	1	15	24	30	15	16	17	19	21	19	19	17	1
Magnesium	ND	9		2	3		2		3	3	2	2	3.3	1
Sulfate	96	142	182	244	266	144	147	150	157	160	140	138	164	
Chloride	4	8	8	8	10	10	6	8	8	7	14	10	8.4	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	30	27		34	39		49	55	61	55	61	61	47	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.66	3.71		5.46	6.03		3.90		4.35	4.37	4.36	4.18		
Total Milliequivalent Major Anions	2.6	3.62		5.87	6.45		4.03		4.49	4.43	4.31	4.15		
Absolute Value, Charged, Balance	1.13	1.24		3.66	3.38		1.58		1.58	.71	.58	.36		
Ammonia as N	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Nitrate as N	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Fluoride	.14	.13		.09	[illegible]		.15		.16	.04	.12	.17	.12	.01
Total Alkalinity as CaCO3	25	52	26	28	[illegible]	50	[illegible]	45	50	45	50	50	41	
Total Hardness as CaCO3	100	81		68	87		48		60	65	56	56	69	
Boron	ND	ND		.1	.12		ND		ND	ND	ND	ND	ND	.1
Aluminum	ND	.1		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.019	.02	.02	.014	[illegible]	.011	.015	.014	.012	.012	.015	.015	.016	.004
Barium	.03	.02		[illegible]	[illegible]		.04		ND	.05	.04	.04	.04	.01
Cadmium	ND	ND		ND	[illegible]		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	[illegible]		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		.03	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.38	.74	1.2	2.6	3.1	2.8	2.7	2.9	2.9	3.2	2.9	2.8	2.35	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.12	.1	.14	.28	.38	.35	.32	.35	.37	.38	.39	.39	.3	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.01	ND		.07	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U3O8	.007	.015	.016	.034	.028	.02	.029	.028	.028	.036	.044	.04	.027	.001
Vanadium, V2O5	.05	.02	.04	.02	ND	ND	ND	.03	ND	.025	ND	ND	ND	.02
Radium 226, pCi/l	55	52	178	168	136	120	155	131	160	90	179	154	132	
Radium, Precision pCi/l, +/-	1.2	3		5.7	3.5	3.3	4	3.4	5	2.4	4.2	4.1		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 59 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 95

Date Sampled	Core Lab												Average	LLD
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.		
Temperature, C, Field	16.7	18.9	19.4	19	19.9	20	19.7	19.3	19	18.2	17.5	17.2	18.73	
pH, Units, Field	6.15	6	6.35	6.2	5.5	6.58	6.54	6.54	6.38	6.54	6.64	6.67	6.35	
pH, Units, Lab at 25 C	7.4	7.1	7.5	8.3	8.2	8	7.3	7.3	7.2	7.1	7.6	7.7	7.56	
Conductivity,umhos, Field-Ambient	223	249	275	282	393	362	469	513	504	434	445	410	380	
Conductivity,umhos, Lab at 25 C	246	250	265	331	385	507	550	527	473	495	459	444	411	
TDS, Evaporation at 180 C	176	192	198	260	328	410	390	397	360	348	348	370	315	
Sodium	50	53	58	60	65	74	75	73	71	65	68	58	64	1
Potassium	5	1		1	1		1		1	1	1	1	1.4	1
Calcium	6	9	10	22	31	46	51	53	52	47	48	48	35	1
Magnesium	0	0		1	2		4		4	5	4	4	2.7	1
Sulfate	62	78	83	108	132	175	175	188	173	153	154	146	136	
Chloride	10	8	6	8	8	8	6	4	6	4	10	9	7.3	
Carbonate	0	0		2	0		0	0	0	0	0	0	.2	
Bicarbonate	63	63		76	105		146	146	134	134	134	122	112	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.6	2.79		3.8	4.56		6.16		6.04	5.61	5.71	5.27		
Total Milliequivalent Major Anions	2.6	2.88		3.8	4.69		6.2		5.97	5.49	5.68	5.29		
Absolute Value, Charged, Balance	0	1.67		0	1.39		.3		.6	1.05	.22	.18		
Ammonia as N	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Nitrate as N	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Fluoride	.17	.26		.15	.17		.24		.25	.09	.22	.26	.2	.01
Total Alkalinity as CaCO3	52	52	64	66	86	110	120	120	110	110	110	100	92	
Total Hardness as CaCO3	15	23		59	86		144		146	138	136	136	98	
Boron	ND	ND		ND	ND		ND		ND	ND	.1	ND	ND	.1
Aluminum	.2	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.032	.008	.008	.006	.004	ND	ND	ND	ND	.004	ND	ND	.005	.004
Barium	.03	ND	-	.02	ND		.07		ND	.05	.06	.06	.03	.01
Cadmium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	.01	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.24	.22	.22	.21	.36	.44	.37	.32	.27	.28	.28	.25	.29	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.06	.11	.14	.17	.33	.54	.58	.63	.59	.61	.61	.65	.4	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.03	ND		ND	ND		.01		ND	ND	ND	ND	ND	.01
Molybdenum	ND	.02		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U308	.012	.049	.054	.13	.07	.05	.082	.051	.05	.056	.1	.09	.066	.001
Vanadium, V205	.16	.11	.13	.09	.05	.03	.03	.02	ND	.023	ND	ND	.054	.02
Radium 226, pCi/1	27	14	22	31	41	45	69	56	48	61	52	59	44	
Radium, Precision pCi/1, +/-	1	1.2		2.5	2.1	2.1	2.7	2.5	3	2.5	2.3	2.5		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- S13 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 135

Date Sampled	Core Lab													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
Temperature, C, Field	17.1	20.3	19.4	19.8	19.7	20.6	20.8	20.2	19.7	19.4	18.6	18.1	19.48	
pH, Units, Field	6.5	6.7	6.75	6.75	5.5	6.2	6.11	6.23	[illegible].92	6.24	6.26	6.26	6.29	
pH, Units, Lab at 25 C	6.9	6.9	7.4	7.8	7.2	7.6	7.2	6.8	6.8	6.9	7.4	7.6	7.21	
Conductivity,umhos, Field-Ambient	283	327	340	328	331	311	411	398	341	341	358	365	345	
Conductivity,umhos, Lab at 25 C	301	326	325	356	435	383	413	390	366	370	373	359	366	
TDS, Evaporation at 180 C	209	242	242	270	270	292	280	282	266	248	268	278	262	
Sodium	64	67	70	77	74	78	80	79	75	74	78	80	75	1
Potassium	0	1		2	1		1		1	1	0	1	.89	1
Calcium	4	7	8	9	9	9	10	11	11	11	12	20	10	1
Magnesium	0	0		1	1		1		1	1	1	2	.89	1
Sulfate	108	132	141	154	147	152	160	174	148	136	146	146	145	
Chloride	12	4	8	8	10	8	8	8	6	4	8	7	7.6	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	17	20		29	39		37	37	37	49	39	98	40	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.98	3.29		3.91	3.78		4.09		3.92	3.88	4.07	4.67		
Total Milliequivalent Major Anions	2.87	3.19		3.91	3.98		4.17		3.85	3.75	3.9	4.84		
Absolute Value, Charged, Balance	1.95	1.61		0	2.62		.97		.83	1.71	2.16	1.82		
Ammonia as N	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Nitrate as N	2	ND		ND	ND		ND		ND	ND	ND	ND	.22	.1
Fluoride	.14	.15		.13	.12		.16		.13	.04	.22	.16	.14	.01
Total Alkalinity as CaCO3	14	16	18	24	32	33.3	30	30	30	40	32	80	32	
Total Hardness as CaCO3	10	18		26	27		29		32	32	34	58	30	
Boron	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.036	.039	.038	.03	.031	.023	.024	.023	022	.029	.025	.023	.029	.004
Barium	ND	.01		.08	ND		.04		ND	.034	ND	.04	.023	.01
Cadmium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		.04	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.37	.63	.52	.51	.42	.46	.67	.95	.99	1.3	1.3	1.4	.79	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.01	.04	.04	.06	.06	.08	.12	.15	.16	.2	.22	.25	.12	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.02	.01		ND	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U308	.018	.025	.027	.042	.045	.055	.14	.08	.08	.094	.18	.14	.077	.001
Vanadium, V205	.17	.02	.14	.08	.08	.06	.06	.04	.052	.052	ND	.04	.066	.02
Radium 226, pCi/l	8.6	6.3	54	66	71	88	117	90	118	159	110	192	90	
Radium, Precision pCi/l, +/-	.5	.5		3.6	2.7	2.2	3.5	2.8	4	4	3.3	4.6		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 516 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 16S

Date Sampled	Core Lab													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Average	LLD
Temperature, C, Field	18.1	18.2	18	17.7	18.4	19.1	18.6	17.9	17.8	17	16.7	16.5	17.83	
pH, Units, Field	6.05	6.25	6.05	6.25	5.5	6.33	6.48	6.55	6.08	6.51	6.54	6.52	6.26	
pH, Units, Lab at 25 C	6.8	6.7	6.8	6.7	6.2	7.5	7.1	7.1	6.9	6.9	7.2	7.3	6.93	
Conductivity,umhos, Field-Ambient	252	398	491	430	380	191	230	261	274	240	261	268	306	
Conductivity,umhos, Lab at 25 C	259	394	488	520	426	220	269	288	259	285	278	274	330	
TDS, Evaporation at 180 C	186	304	398	410	338	188	182	206	206	186	196	230	253	
Sodium	56	80	90	103	65	37	46	48	51	48	54	52	61	1
Potassium	0	1		3	1		1		1	1	1	1	1	1
Calcium	3	10	18	22	24	12	13	14	14	12	13	17	14	1
Magnesium	0	1		3	4		2		2	2	2	3	2	1
Sulfate	94	175	240	280	202	88	73	90	84	69	80	98	131	
Chloride	4	8	8	8	10	6	6	6	6	4	9	8	6.9	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	29	24		7	5		76	67	73	73	79	73	51	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.59	4.09		5.91	4.38		2.84		3.11	2.88	3.19	3.38		
Total Milliequivalent Major Anions	2.55	4.26		6.16	4.57		2.94		3.11	2.75	-3.21	3.46		
Absolute Value, Charged, Balance	.7	2.04		2.07	2.08		1.71		.1	2.34	.4	1.1512		
Ammonia as N	ND	ND		ND	ND		ND		ND	.11	ND	ND	ND	.1
Nitrate as N	ND	ND		.34	ND		ND		ND	ND	.46	ND	ND	.1
Fluoride	.13	.14		.07	ND		.13		.13	ND	.11	.15	.1	.01
Total Alkalinity as CaCO3	24	20	10	6	4	26	125	55	60	60	65	60	43	
Total Hardness as CaCO3	8	29		68	76		41		43	38	41	55	44	
Boron	.1	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	ND	ND		ND	ND		.11		ND	ND	ND	ND	ND	.1
Arsenic	.04	.038	.056	047	.029	.036	.056	.056	.049	.057	.052	.057	.048	.004
Barium	.02	ND		.04	.07		.02		ND	.023	.03	.03	.026	.01
Cadmium	.03	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.48	ND	7.8	9.8	13	5.2	3.4	4.1	4	4.5	4	3.9	5.47	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.07	ND	.6	.74	.78	.36	.25	.31	.29	.28	.27	.27	.38	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	.013	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.05	ND		.02	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U3O8	.01	.035	.038	.056	.032	.011	.018	.011	.01	.018	.02	.02	.023	.001
Vanadium, V2O5	.23	ND	.08	.11	ND	.03	ND	.02	ND	.023	ND	ND	.041	.02
Radium 226, pCi/l	26	48	248	259	261	102	66	85	91	135	142	104	131	
Radium, Precision pCi/l, +/-	.8	2.9		7	5.1	3.1	2.6	3	4	3.7	3.7	3.4		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 17S

Date Sampled	Core Lab													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
Temperature, C, Field	19.9	19.3	19.6	19.4	20.4	20.6	21.2	20.4	19.6	19.6	19	18.6	19.8	
pH, Units, Field	5.9	6.1	6.25	6.3	5.5	5.81	6.02	5.95	5.61	6.05	6.09	6.11	6.01	
pH, Units, Lab at 25 C	6.8	7.3	7.3	7.8	7.6	7.5	6.7	6.6	6.3	6.5	7	7.3	7.06	
Conductivity,umhos, Field-Ambient	210	234	266	297	358	348	392	404	390	361	389	350	333	
Conductivity,umhos, Lab at 25 C	215	233	252	302	360	458	438	419	380	413	411	390	356	
TDS, Evaporation at 180 C	128	176	208	252	302	346	320	311	302	302	314	330	274	
Sodium	44	49	53	63	74	80	60	54	50	44	44	40	55	1
Potassium	0	1		1	2		1		1	1	1	0	.9	1
Calcium	3	5	6	7	12	15	31	34	39	49	43	43	24	1
Magnesium	0	0		0	1		4		5	7	6	6	3.2	1
Sulfate	70	90	102	132	152	216	166	172	171	206	164	156	150	
Chloride	6	10	5	8	10	4	6	4	4	4	10	4	6.3	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	24	27		22	37		55	49	49	49	43	61	42	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.06	2.41		3.12	3.95		4.52		4.56	4.96	4.58	4.38		
Total Milliequivalent Major Anions	2.02	2.59		3.34	4.05		4.52		4.47	5.2	4.4	4.36		
Absolute Value, Charged, Balance	1.08	3.57		3.41	1.24		0		.94	2.37	2.01	.24		
Ammonia as N	ND	ND		ND	ND		ND		.4	ND	ND	ND	ND	.1
Nitrate as N	ND	ND		.35	.12		ND		ND	ND	ND	ND	.05	.1
Fluoride	.18	.16		.12	.11		.21		.22	.07	.19	.25	.17	.01
Total Alkalinity as CaCO3	20	22	26	18	30	20	45	40	40	40	35	50	32	
Total Hardness as CaCO3	8	13		18	34		94		118	151	132	132	78	
Boron	ND	ND		ND	ND		ND		ND	ND	ND	.1	ND	.1
Aluminum	.2	ND		ND	ND		ND		.12	ND	.1	ND	ND	.1
Arsenic	.008	.012	.006	.005	.005	.006	ND	.007	ND	ND	.004	ND	ND	.004
Barium	.01	ND		.01	ND		.12		ND	.11	.1	.1	.05	.01
Cadmium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.5	.78	.1	.2	.16	.2	.99	1	.95	.98	.87	.82	.63	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.02	.02	.02	.03	.04	.17	.44	.48	.54	.59	.61	.63	.3	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	.012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.02	ND		ND	.01		ND		ND	ND	ND	.01	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U3O8	.019	.095	.085	.11	.087	.012	.27	.21	.22	.2	.24	.19	.14	.001
Vanadium, V2O5	ND	.1	.02	.06	.09	.04	.07	.11	.09	.095	.09	.08	.077	.02
Radium 226, pCi/l	38	29	36	30	41	160	332	305	382	424	429	342	212	
Radium, Precision pCi/l, +/-	1	1.7		2.5	2.1	3.8	5.9	5.2	7.2	6.5	6.4	6.1		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- S19 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 195

Date Sampled	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
	Core Lab													
Temperature, C, Field	19.8	19.8	19.2	19.1	20.2	19.8	20.3	19.8	19.6	19.2	19.1	18.8	19.56	
pH, Units, Field	6.15	6.25	6.65	6.75	6	6.64	6.44	6.48	6.27	6.61	6.66	6.66	6.46	
pH, Units, Lab at 25 C	7.2	7.1	7.4	8.2	7.5	7.8	7.2	7	7	7.2	7.6	7.8	7.42	
Conductivity,umhos, Field-Ambient	310	369	339	392	403	335	384	423	405	396	420	375	379	
Conductivity,umhos, Lab at 25 C	316	355	349	385	395	408	437	440	393	456	432	410	398	
TDS, Evaporation at 180 C	191	250	276	278	280	316	298	310	308	302	308	305	285	
Sodium	66	68	64	73	70	73	70	73	77	72	79	66	71	1
Potassium	1	1		2	1		1		1	1	1	0	1	1
Calcium	7	15	18	21	22	23	27	30	32	32	33	31	24	1
Magnesium	0	0		1	1		1		2	3	2	2	1.3	1
Sulfate	113	144	138	152	147	148	150	166	204	146	146	122	148	
Chloride	6	8	8	8	8	8	6	4	6	4	8	3	6.4	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	44	44		59	61		85	85	43	122	116	116	78	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.86	3.74		4.36	4.25		4.51		5.14	5	5.27	4.58		
Total Milliequivalent Major Anions	2.86	3.95		4.36	[illegible] 28		4.68		5.12	5.15	5.16	4.52		
Absolute Value, Charged, Balance	0	2.76		0	.39		1.91		.18	1.47	1.04	.63		
Ammonia as N	ND	ND		ND	ND		ND		ND	.14	ND	ND	ND	.1
Nitrate as N	ND	ND		.38	ND		ND		ND	ND	ND	ND	ND	.1
Fluoride	.16	.16		.13	.12		.14		.14	ND	.12	.16	.13	.01
Total Alkalinity as CaCO3	36	56	40	48	50	70	70	70	35	100	95	95	64	
Total Hardness as CaCO3	18	38		56	59		72		88	92	91	86	67	
Boron	ND	ND		.1	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	.1	ND		ND	ND		ND		ND	.11	ND	ND	ND	.1
Arsenic	.025	.023	.013	.021	.018	.014	.014	.014	.01	.005	.008	.006	.014	.004
Barium	.01	.02		.02	ND		.05		ND	.063	.06	.06	.031	.01
Cadmium	.02	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.44	.9	1.1	1.2	1.6	2.2	2.3	2.4	2.3	2.4	2.3	2.2	1.78	.03
L[illegible]d	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manga[illegible]se	.12	.27	.31	.36	39	.5	.57	.58	.62	.65	.63	.59	.47	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U3O8	.15	.03	.02	.023	.065	.13	.12	.19	.46	.5	.54	.4	.219	.001
Vanadium, V2O5	ND	.03	ND	.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	.02
Radium 226, pCi/l	33	35	72	67	91	89	115	108	122	137	149	103	93	
Radium, Precision pCi/l, +/-	1.1	2.9		3.6	3	2.9	3.5	3.1	4.1	3.7	3.8	3.4		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 520 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 20S

Date Sampled	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
	Core Lab													
Temperature, C, Field	16.7	17.9	17.8	17.9	18.4	18.5	18.8	18.2	17.9	17	16.9	16.5	17.71	
pH, Units, Field	6.4	6.55	6.4	6.4	6.2	7.12	6.9	6.96	6.69	7.04	6.99	7.1	6.73	
pH, Units, Lab at 25 C	7.4	7.6	7.8	8.4	7.9	8.3	7.8	8	7.9	7.8	8	7.8	7.85	
Conductivity,umhos, Field-Ambient	261	341	311	341	299	260	285	317	323	279	309	308	303	
Conductivity,umhos, Lab at 25 C	286	337	330	352	345	321	336	352	326	328	328	322	330	
TDS, Evaporation at 180 C	204	258	280	272	262	238	224	249	234	218	234	250	244	
Sodium	47	47	45	50	48	51	52	53	57	55	57	56	52	1
Potassium	1	1		2	1		1		1	2	1	1	1.2	1
Calcium	22	35	37	37	29	25	26	28	26	22	24	23	28	1
Magnesium	1	1		1	2		2		2	2	2	2	1.7	1
Sulfate	81	111	103	106	96	70	65	70	79	68	72	74	83	
Chloride	6	8	6	8	8	6	4	4	5	4	8	3	5.8	
Carbonate	0	0		5	0		0	0	0	0	0	0	.5	
Bicarbonate	85	107		100	98		140	146	134	128	122	134	119	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.03	4.05		4.16	3.73		3.76		3.97	3.71	3.87	3.77		
Total Milliequivalent Major Anions	2.03	4.29		4.24	3.83		3.76		3.98	3.63	3.72	3.82		
Absolute Value, Charged, Balance	0	2.82		.95	1.38		0		.19	1.08	1.89	.63		
Ammonia as N	ND	ND		ND	ND		ND		ND	.12	ND	ND	ND	.1
Nitrate as N	ND	ND		.35	.18		ND		ND	ND	ND	ND	.06	.1
Fluoride	.16	.16		.17	.21		.13		.32	.14	.29	.39	.22	.01
Total Alkalinity as CaCO3	70	88	92	90	80	100	115	120	110	105	100	110	98	*
Total Hardness as CaCO3	59	99		96	81		73		73	63	68	66	75	
Boron	.1	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	ND	.1		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.033	ND	ND	ND	.006	ND	.004	.01	.005	.005	ND	ND	.005	.004
Barium	.04	.03		.03	ND		.04		ND	.032	.03	.03	.026	.01
Cadmium	.03	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		ND	ND		ND		ND	ND	ND	.02	ND	.01
Iron	.39	.08	.04	.07	.05	.04	.04	.03	ND	.046	ND	.04	.069	.03
Lead	ND	ND		ND	.06		.03		ND	ND	ND	ND	ND	.05
Manganese	.14	.17	.17	.1	.12	.14	.15	.16	.12	.14	.15	.15	.142	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.07	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U308	.13	.115	.088	.11	.097	.235	.135	.095	.2	.23	.34	.3	.173	.001
Vanadium, V205	.05	.04	.04	.03	ND	ND	.02	.02	ND	ND	ND	ND	ND	.02
Radium 226, pCi/l	30	16	32	10	26	23	22	20	23	25	95	27	29	
Radium, Precision pCi/l, +/-	1	1.7		1.6	1.7	1.5	1.6	1.4	2	1.6	3.1	1.8		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 526 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 265

Date Sampled	Core Lab													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
Temperature, C, Field	17.5	18	18	18.1	18.8	18.7	19.3	18.3	18	17.3	16.8	16.4	17.93	
pH, Units, Field	5.95	6.35	6.6	6.8	6	6.66	6.72	6.68	6.42	6.71	6.81	6.78	6.54	
pH, Units, Lab at 25 C	7	7.4	7.4	8.2	7.7	8.3	7.4	7.1	7	7.2	7.7	7.8	7.52	
Conductivity,umhos, Field-Ambient	328	455	503	385	423	278	34[illegible]	344	344	296	319	338	363	
Conductivity,umhos, Lab at 25 C	331	442	490	463	417	394	358	383	343	358	347	348	390	
TDS, Evaporation at 180 C	246	336	340	342	346	256	236	244	264	232	244	258	279	
Sodium	69	89	97	91	82	72	71	72	70	72	79	71	78	1
Potassium	1	1		2	1		1		1	2	1	1	1.2	1
Calcium	10	17	21	20	18	13	14	15	16	14	14	14	16	1
Magnesium	0	1		1	2		1		2	2	1	1	1.2	1
Sulfate	122	192	212	198	160	114	92	102	86	84	92	78	128	
Chloride	8	8	8	6	8	6	8	4	5	3	8	7	6.6	
Carbonate	0	0		0	0		0	0	0	0	0	0	0	
Bicarbonate	51	49		68	76		116	122	134	134	122	134	101	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	3.53	4.83		5.09	4.66		3.9		4.03	4.05	4.24	3.89		
Total Milliequivalent Major Anions	3.61	5.02		5.41	4.8		4.04		4.13	4.03	4.14	4.02		
Absolute Value, Charged, Balance	1.1	1.91		3.05	1.53		1.78		1.15	.21	1.23	1.55		
Ammonia as N	ND	.1		ND	ND		ND		.12	ND	ND	ND	ND	.1
Nitrate as N	ND	ND		.41	ND		ND		ND	ND	ND	ND	ND	.1
Fluoride	.14	.15		.14	.14		.28		.29	.09	.27	.36	.21	.01
Total Alkalinity as CaCO3	42	40	45	56	62	75	95	100	110	110	100	110	79	
Total Hardness as CaCO3	25	47		54	53		39		48	43	39	39	43	
Boron	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	.2	.1		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.028	.02	.032	.02	.033	.024	.025	.029	.02	.027	.033	.03	.027	.004
Barium	.02	.03		.04	ND		.03		ND	.026	.02	.03	.022	.01
Cadmium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	.16	ND		ND	ND		ND		ND	ND	ND	ND	.02	.01
Iron	.4	1.4	2.2	2.1	1.8	1.3	1.4	1.5	1.2	1.2	1	.94	1.37	.03
Lead	ND	ND		ND	.05		ND		ND	ND	ND	ND	ND	.05
Manganese	.32	.5	.53	.39	.44	.4	.39	.42	.39	.39	.36	.34	.41	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	.006	ND	.004	.025	ND	.008	.009	.004	.001
Zinc	.02	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	.02		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U308	.04	.085	.08	.034	.13	.15	.23	.65	1.2	1.3	1.4	1.2	.54	.001
Vanadium, V205	.07	.02	ND	.06	ND	ND	ND	ND	ND	.021	ND	ND	.014	.02
Radium 226, pCi/l	13	44	157	108	104	74	97	101	89	53	25	113	82	
Radium, Precision pCi/l, +/-	1	1.2		4.5	3.2	2.6	3.2	3	4	2.3	1.6	3.5		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- 527 Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 275

Date Sampled	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
	Core Lab													
Temperature, C, Field	-	18.1	17.5	17.3	18.5	18.2	18.8	18.2	17.9	17.4	17	16.9	17.8	
pH, Units, Field	6.65	6.25	6.2	6.6	6.5	6.59	6.44	6.55	6.29	6.56	6.67	6.67	6.5	
pH, Units, Lab at 25 C	7.5	7.8	7.6	8.3	7.7	8.4	7.2	7.1	6.9	7.1	7	7.2	7.48	
Conductivity,umhos, Field-Ambient	191	377	416	519	446	374	468	497	492	415	440	410	420	
Conductivity,umhos, Lab at 25 C	270	361	448	542	505	545	543	493	461	491	475	470	467	
TDS, Evaporation at 180 C	206	282	390	396	426	410	414	392	414	354	370	382	370	
Sodium	54	68	77	89	83	79	87	85	91	80	85	79	80	1
Potassium	1	1		1	1		1		1	1	1	1	1	1
Calcium	11	19	34	44	42	37	41	40	43	35	36	35	35	1
Magnesium	0	0		1	2		3		3	3	3	3	2	1
Sulfate	86	142	176	216	196	171	172	160	168	119	148	140	158	
Chloride	8	10	8	12	8	8	6	4	6	5	10	8	7.8	
Carbonate	0	0		12	0		0	0	0	0	0	0	1.2	
Bicarbonate	61	70		85	110		152	159	159	183	146	146	127	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.93	4.14		6.18	5.9		6.11		6.38	5.5	5.77	5.46		
Total Milliequivalent Major Anions	3.02	4.48		6.62	6.11		6.24		6.27	5.62	5.75	5.53		
Absolute Value, Charged, Balance	1.53	3.97		3.44	1.75		1.02		.83	1.07	.1	.7		
Ammonia as N	ND	.1		ND	ND		ND		ND	ND	ND	ND	ND	.1
Nitrate as N	ND	ND		.41	ND		ND		ND	ND	ND	ND	ND	.1
Fluoride	.17	.13		.09	ND		.18		.18	ND	.16	.22	.13	.01
Total Alkalinity as CaCO3	50	62	75	90	90	115	125	130	130	150	120	120	105	
Total Hardness as CaCO3	28	58		114	113		115		120	100	102	100	94	
Boron	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Aluminum	.2	.1		.1	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.037	.022	.016	.03	.01	.004	.006	.012	.009	.007	.009	.006	.014	.004
Barium	.03	.02		.03	.05		.06		ND	.049	.04	.04	.04	.01
Cadmium	.02	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		.01	ND		ND		ND	ND	ND	ND	ND	.01
Iron	.33	.75	2.1	2.2	2.6	2.3	3.4	2.5	1.4	1.[illegible]	.85	.71	1.7	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.12	.14	.39	.53	.03	.63	.62	.61	.52	.54	.49	.48	.43	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.01	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Molybdenum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U308	.037	.038	.029	.13	.027	.34	.046	.025	.32	.018	.014	.02	.087	.001
Vanadium, V205	.1	.13	.05	ND	ND	.02	.03	.02	.02	.02	ND	ND	.033	.02
Radium 226, pCi/l	33	39	95	150	130	186	180	85	159	192	179	156	132	
Radium, Precision pCi/l, +/-	1.2	3		5.3	3.2	4.1	4.3	2.8	5	4.6	4.2	4.1		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FILE NAME --- S29   Revised - 01/06/86

Water Quality Data For 20-Sand Aquifer
Stabilization - Well 29S

Date Sampled	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average	LLD
	Core Lab													
Temperature, C, Field	16.5	18.7	18.8	19.3	20.1	19.9	19	18.5	19.2	17.3	16.7	17.1	18.43	
pH, Units, Field	6.05	5.9	5.95	5.75	6.3	6.66	7.23	7.16	6.77	7.05	6.71	7.15	6.56	
pH, Units, Lab at 25 C	6.4	6.3	7.1	8.3	8	8.4	7.9	7.8	7.8	7.8	7.5	7.6	7.58	
Conductivity,umhos, Field-Ambient	233	267	283	298	374	465	392	425	439	389	430	447	370	
Conductivity,umhos, Lab at 25 C	238	278	288	344	385	667	463	430	410	467	450	455	406	
TDS, Evaporation at 180 C	178	190	200	240	288	460	304	328	350	306	336	362	295	
Sodium	56	60	58	58	44	54	81	79	87	82	86	88	69	1
Potassium	0	1		1	0		1		1	2	1	1	.9	1
Calcium	1	3	8	18	33	93	30	30	32	28	29	28	28	1
Magnesium	0	0		2	4		4		4	4	3	3	2.7	1
Sulfate	87	88	85	84	104	222	94	96	111	110	112	120	109	
Chloride	8	20	8	18	6	8	4	4	6	4	6	7	8.3	
Carbonate	0	0		2	0		0	0	0	0	0	0	.2	
Bicarbonate	29	17		73	102		195	195	189	195	183	183	136	
Hydroxide				0	0		0	0	0	0	0	0	0	
Total Milliequivalent Major Cations	2.49	2.79		3.61	3.89		5.38		5.74	5.34	5.46	5.5		
Total Milliequivalent Major Anions	2.52	2.67		3.53	4.01		5.27		5.58	5.6	5.5	5.69		
Absolute Value, Charged, Balance	.68	2.2		1.12	1.47		1.07		1.4	2.33	.36	1.76		
Ammonia as N	ND	ND		ND	ND		ND		ND	.11	ND	ND	ND	.1
Nitrate as N	ND	ND		.42	.1		ND		ND	ND	ND	ND	ND	.1
Fluoride	.18	.2		.15	.21		.37		.34	.2	.26	.33	.25	.01
Total Alkalinity as CaCO3	24	14	36	64	84	150	160	160	155	160	150	150	109	
Total Hardness as CaCO3	3	8		53	99		92		96	86	85	82	67	
Boron	.1	ND		.1	.12		ND		ND	ND	ND	ND	ND	.1
Aluminum	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.1
Arsenic	.015	ND	ND	.005	.005	ND	.085	.099	.07	.073	.063	.056	.039	.004
Barium	.05	.01		.06	.14		.05		ND	.04	.04	.04	.05	.01
Cadmium	.02	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Chromium	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Copper	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.01
Iron	1.2	.2	.23	.2	1	.75	.33	.17	.13	.087	.06	.06	.368	.03
Lead	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.05
Manganese	.58	.16	.39	.98	1.7	2.3	.58	.54	.52	.57	.49	.48	.77	.01
Mercury	ND	ND		ND	ND		ND		ND	ND	ND	ND	ND	.0004
Nickel	.05	ND		ND	ND		ND		ND	ND	ND	ND	ND	.04
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001
Zinc	.07	ND		ND	ND		ND		ND	ND	ND	.1	ND	.01
Molybdenum	ND	.03		ND	ND		ND		ND	ND	ND	ND	ND	.02
Uranium, U3O8	.01	.15	.017	.23	.027	.04	2.45	1.3	1.8	.63	1.8	2	.871	.001
Vanadium, V2O5	.16	.07	.04	.11	.06	.07	.26	.2	.26	.19	.19	.2	.151	.02
Radium 226, pCi/l	132	195	246	323	331	451	257	182	184	202	273	286	255	
Radium, Precision pCi/l, +/-	7	5.9		8.5	5.7	6.4	5.2	4	5	4.7	5.1	5.5		

Analyses reported in milligrams per liter except where noted.
ND - not detected. NR - not reported.
The underlined data are considered as outliers and are not included in the calculations.

FINAL REPORT
RESTORATION AND STABILIZATION
RUTH ISL R & D

I. INTRODUCTION

A. Location and Land Status

The Ruth ISL R & D facility (WDEQ-LQD Permit # 9RD - USNRC Source Material License # SUA-1401) and wellfield is located in Sections 13 and 14, Township 42 North, Range 77 West, Johnson County, Wyoming.

The permit area is 40 acres (14 ha). The test site is in the Central Powder River Basin Uranium District. It is located on fee land, private surface and mineral ownership.

B. Project Goals and Objectives

The Ruth ISL project was developed to provide a demonstration of the following:

(1) Technical Feasibility
(2) Economic Feasibility to include
(3) Aquifer Restoration and Stabilization

The project was constructed as a small scale research and development facility. License limitations placed on the project were; (1) the permit area no larger than 40 acres (14 ha), (2) a wellfield no larger than 1 acre (0.4 ha) and that the production capacity be limited to 100 gpm (380 lt/min).

II. TECHNICAL DISCUSSION OF MINING PHASE

A. Summary of Activities

A brief summary of the mining activities can be best described by the following table. It will outline the operation and give pertinent data as per different phases and operational modes:

Table II.1
Project Production Summary

Location	Johnson County, Wyoming 65 miles (105 km) North of Casper, Wyoming
Access	State Highway 387 to milepost 117 - North dirt access 4.5 mi.
Type of Operation	R & D Pilot In Situ
Operational Status	Production completed Restoration completed Stabilization on-going
Production Duration	2/25/83 - 2/5/84 (11 months)
Restoration Duration	2/6/84 - 12/27/84 (11 months)
Stabilization	12/28/84 to date
Leach Chemistry	Sodium Carbonate/bicarbonate
pH Range	6.7 to 7.2
Lixiviant Concentration	up to 1.8 g/l of sodium bicarbonate
pH Control	Carbon dioxide
Oxidant	Oxygen
Wellfield Description	
Total Number of Wells	Thirty-two (32)
Monitor Wells	Seven (7)

The uranium enriched solution is then pumped from the formation into the processing facility for recovery. The plant mainly consists of an absorption circuit, an elution circuit, and a final yellowcake precipitation circuit. Waste water is disposed of in evaporation ponds. Finally, a reverse osmosis (RO) unit is added for final restoration. A very simplified flowsheet is shown in Figure II.2. The process steps during the production and restoration phases are shown in Figures II.3 and II.4.

The basic process utilized in the Ruth facility can be broken down into five major sections. The most important reactions underground and in the plant are listed in Figures II.5, II.6 and II.7.

1. Lixiviant Make-up

The carbonated lixiviant is created by the following procedure:

$NaHCO_3$ lixiviant - Dissolve soda ash (Na_2CO_3) in the existing groundwater or barren mining solution. Carbon dioxide gas is then injected into the resulting solution to adjust the pH to a desirable range and to convert the carbonate ion to the bicarbonate species. The lixiviant pH is controlled at 6.7 - 7.2.

2. Underground Leaching

The above lixiviant is injected into the mineralized sands with the addition of dissolved oxygen. The leaching process underground consists of the following steps (Figure II.7)

- Oxidation - oxygen is used to oxidize U^{4+} to U^{6+}.
- Complexing - The carbonated lixiviant which is created by the above process is used to complex with the hexavalent uranium. The resulting uranyl tricarbonate (UTC) and uranyl bicarbonate (UDC) are soluble in a carbonate solution.

E. Surface Equipment

The process equipment is housed in a 40 ft. x 100 ft. (12 X 30 m) building. The site laboratory, lunch room, locker (charge) rooms, and office space are in two attached 14 ft. X 60 ft. (4.3 X 18.3 m) trailers. The general arrangement is shown in Figure II.1.

A separate 30 ft. X 32 ft.(9 X 10 m) warehouse building is used for the storge of equipment, materials, and spare parts, and for maintenance and repair of equipment.

The plant installation consists of different tanks, ion exchange columns, piping systems and pumps, plus additional electrical equipment, mounted on four mobile skids. Besides the plant itself, surface installations consist of a stand-by generator, fuel storage tanks, evaporation ponds and accompanying systems, and storage tanks for chemicals.

F. Chemical Nature of Aquifer Prior to Restoration

At the conclusion of the production phase of the project (February, 1984), the production recovery stream was sampled and analyzed as required by permit. This sample represents the chemical nature of the wellfield at the end of the production phase of the project.

However, prior to the start of restoration, an intermediate phase (Phase 1) was completed. Restoration, for the purpose of this report, is defined by the start up of the reverse osmosis unit. A specific volume was withdrawn and sent directly to the ponds in an effort to assure that the "chemical halo" caused through the "sweep effect" had been drawn inside the outer perimeter of wells, within the wellfield. After that volume had been removed, another sample was taken from the recovery wells. The results of this data are somewhat different from the post-production data; however, it was within the expected chemistries of production. This data has also been included since it represents the chemical environment immediately prior to restoration.

Phase 1

Duration: February 6 through February 11, 1984.
Total Gallons Displaced: 461,705
Total Pore Volume: 0.27
Disposition of Water: 100% Evaporation Ponds

Phase 1 of the restoration process was an intermediate step between the operation phase and the start up of the Reverse Osmosis Unit marking the start of restoration. This step was incorporated to simulate actual commercial operation. The concept was to withdraw a specified amount of water/chemicals from the wellfield in order that two things could be accomplished:

(1) Conservation of Chemicals: In commercial operation, this volume would be transferred to the next mining unit. During the R & D restoration it was transferred to the evaporation ponds.

(2) Reduce Chemical Halo: This step was designed to pull the chemical halo inside the outside perimeter of production wells to allow complete restoration of the impacted area.

The recovered solutions during this phase were processed through the IX columns to remove and recover the uranium and then sent directly to the evaporation pond. This phase is a groundwater sweep since it removed a specified volume of water from the impacted aquifer and replaced it with natural recharge.

Phase 2

Duration:	February 15 through May 24, 1984
Total Gallons Displaced:	9,446,472
Total Pore Volume:	5.58
Disposition of water:	Approximately 90% recirculated 10% evaporation pond

Phase 2 was the first recirculation process utilizing the R.O. Unit. This unit is a sixty (60) gallon per minute Polymetrics High Recovery Reverse Osmosis Unit. During this phase the permeate was reinjected into the wellfield, recirculation. The concentrate was then recycled through the unit until the specified recovery rate was reached and then the heavy brine solution was pumped to the evaporation ponds. All through the restoration phase(s) an effort to conserve water was made. This was an effort to (1) reduce the amount of water consumed and (2) maintain minimum volumes in the evaporation ponds.

Phase 3

Duration:	May 24 through September 29, 1984
Total Gallons Displaced:	5,677,115
Total Pore Volume:	3.35
Disposition of Water:	Approximately 90% surface discharged 10% evaporation pond

As mentioned in the introduction of this section, Phase 3 is similar to Phase 1 in the fact that they were both groundwater sweep. However, Phase 3 was modified to the extent that the recovery stream passed through the R.O. unit and the permeate was surface discharged and the concentrate was pumped to the evaporation ponds.

This step was incorporated into the restoration process since the chemical parameters, particularly in the outside perimeter wells, had not responded to the previous efforts. This indicated that there was still some chemical outside in the "halo" around the wellfield contaminating the restoration process. It was apparent that additional sweep was necessary; however, the pond capacity was critical and the additional volume would fill them beyond licensed capacity.

Therefore, a surface discharge permit was requested and granted by the State Water Quality Division. This then allowed for the additional sweep.

The production solutions were recovered from the "halo" and wellfield areas by setting up a program that called for alternating the recovery wells, causing changes in the recovery flow pattern through the restoration zone. The recovered solutions were then passed through the R.O. unit for removal of potential contaminates assuring that the permeate or discharge stream met the required specifications of the discharge permit. The concentrates were pumped to the ponds.

Phase 4

Duration:	October 1 through November 14, 1984.
Total Gallons Displaced:	4,169,628
Total Pore Volume:	2.46
Disposition of Water:	Approximately 90% recirculated
	10% evaporation pond

Phase 4 returned to the recirculation mode utilizing the R. O. unit. During this phase the majority of the chemical parameters dropped drastically. However, it was apparent that a few were not responding:

(1) arsenic
(2) selenium
(3) vanadium

and, in fact showed some increase as indicated in Appendix D, Vanadium, Arsenic, and Selenium Data. A management decision was made that this phase would not reduce these heavy metals and that an additional phase was necessary.

Phase 5

Duration:	November 15 through December 27, 1984
Total Gallons Displaced:	2,082,690
Total Pore Volume:	1.23
Disposition of Water:	Approximately 90% recirculation 10% evaporation pond

This phase involved the addition of a reductant to the recirculation process. Several types were tested in the lab, with the best results being hydrogen sulfide (H_2S). The same procedures were followed as in Phase 4; however, the H_2S was added to the permeate prior to the reinjection into the wellfield. The concentrate was again pumped to the evaporation ponds.

The injection of the H_2S was on a well by well basis. As each well was injected, it was monitored until the gas was detected in the nearest recovery well and then the next well was injected, and so on, until the entire wellfield had been injected. After the injection process was completed the wellfield was permitted to sit and allow the H_2S to reduce the oxidated chemical species. A final report on H_2S has been included as Appendix "F".

This final phase was successful and with a combination of the above phases; restoration, as determined in the January 1985 sample, was within the target and goals of baseline and use category.

Each of these phases will be described in more detail throughout this report. This brief introduction to each phase was only to allow for an overview of the steps taken during restoration.

As the restoration process developed and these phases were developed, it is believed with the experience gained during the R & D operation, that on a commercial scale operation, restoration can be more efficient and should not require as much time nor the pore volumes which were experienced in the pilot test. For example, in commercial operations Phases 3 and 4 would be omitted.

C. Wellfield Operation

In order that the production solutions remaining underground could be removed and to draw any solutions that migrated beyond the perimeter of the wellfield or out into the "halo", the wells being pumped were constantly switched to various recovery well combinations. The procedure continued throughout the restoration operation. As areas of higher solution concentrations changed or as areas demonstrated lower chemical values, the pumps were moved, assuring that the impacted aquifer was influenced, as much as possible, by the pumping action.

As mentioned in the previous section, the restoration program was made up of five (5) phases. Either, wellfield operations or the pumping well combinations changed as chemical concentrations and conditions were dictated by the phase in operation at the time.

All five phases are described as to the operation and mode of the wellfield during each individual phase:

Phase 1 of the restoration process began in February 1984, and only lasted five days. During this time 461,705 gallons of recovery solution were pumped. The intent of this phase was to draw the solutions into the wellfield and the perimeter wells in order to start the restoration process. The recovery well combination for this phase included the following:

6S, 9S, 13S, 17S, 20S, 24S, 29S

Figure 1 shows the locations of these wells within the wellfield.

The Phase 2 of the restoration process was the actual beginning of the restoration with the start up of the R. O. unit and the recycling of the chemical solutions and water through the system. This phase involved the switching of several wells back and forth from injectors to producers and back. The purpose for this switching was to start creating different patterns of flow of clean water towards the interior of the wellfield, drawing in the solutions in the sweep area. The water produced from the wellfield was processed through the R.O. unit and the permeate was reinjected into the wellfield. The wellfield was overproduced during this time to create a drawdown in the interior which would facilitate drawing in of the solutions in the sweep area.

During this phase, eighteen (18) different wells served as pumped producers. Approximately 9.2 million gallons were produced and recirculated from mid-February through the end of this phase on May 24, 1984. The wells which were used as various producers were:

Operational Production Wells:

6S, 9S, 13S, 17S, 20S, 24S, 29S

Injection Wells - Used as Pumped Producers:

1S, 3S, 4S, 5L, 5S, 10S, 26S, 27S, 30S, 31S, 32SA

Figure 2 shows the locations of these wells in relation to the original wellfield production pattern.

Phase 3 of the restoration program was a groundwater sweep, utilizing the R.O. unit and a surface discharge permit. The restoration process continued in this mode from late May through the end of September 1984. Again, the combination of wells on line as recovery wells, at any one time, was altered across the wellfield to change and manipulate the flows of the recovery and restoration stream. During this time, eighteen (18) different wells were pumped as recovery wells and approximately six million (6,000,000) gallons were pumped. The following wells were used in this phase:

Original Production Wells:

9S, 13S, 17S, 20S, 29S

Converted Injection Wells:

1S, 3S, 4S, 5S, 7S, 12S, 16S, 19S, 26S, 27S, 30S, 31S, 32SA

These wells have been indicated on Figure 3 as to their location in the wellfield.

The fourth phase (4) of the restoration process was a recirculation, similar to the second phase. It started at the end of September and was continued through the middle of November, 1984. The purpose of this phase was to concentrate the restoration effort on the center of the wellfield. The operations personnel felt that the remaining solutions were in that portion of the field and that by concentrating in this area, final restoration could be accomplished. However, several heavy metal parameters actually increased in value and a management decision was made to put in a fifth phase and inject a reductant.

During the fourth phase, seventeen (17) wells were used in the same alternating concept as used in previous phases. The following wells were used:

Original Production Wells:

9S, 13S, 17S, 20S, 24S, 29S

Converted Injections Wells:

3S, 5S, 7S, 12S, 16S, 18S, 25S, 26S, 27S, 30S

These wells are indicated on Figure 4.

VI. RESTORATION CONCLUSIONS

A. Introduction

After completing restoration and monitoring the stabilization phase of the Ruth project to date, it appears that an aquifer similar to the Ruth can be impacted by solution extraction techniques, utilizing sodium bicarbonate lixiviants, and then restored to baseline and/or pre-mining use category.

B. Discussion

As in the case with most human endeavors the use of history and repetition of events makes things easier and more efficient. This also applies to uranium extraction using in situ technology. UUS developed five (5) phases in their effort to restore the Ruth mining zone. After completing those steps, separate and independent to each other, several things became apparent and based on the review of the data collected, the following conclusion statements can be made.

It is now concluded that the restoration process could have been completed in three phases. Two phases, #3 and 4, are not necessary to achieve restoration. The following three phases will restore the wellfield.

Phase 1

Groundwater sweep to draw the "halo" of the sweep area back inside the outer perimeter of wells within the wellfield. This will assure control of the production solutions and allow for complete restoration.

An example of this is in the case of restoring uranium. During the production phase, one of the primary reactions for uranium recovery involved the increasing of the oxidation valance of the uranium ion (naturally a 4^+ valance) to a 6^+ state in order that the carbonate based lixiviant can be effective in complexing the chemical species and rendering it soluble. However, even though uranium is very easy to mobilize in this oxidized state, residual oxidation potential causes small quantities of other chemical species to become soluble also, particularly other metal ions. Therefore, one conclusion drawn from the Ruth experience is that if a chemical reaction (oxidation) started the process, then a chemical reaction (reduction) would be required to stop the process.

Another factor that was experienced in the operation of the Ruth facility that later became a restoration and stabilization problem was that of production debris by-passing the filter systems within the plant and being deposited in the completion zone of the wells. This assorted debris actually acted as a contamination that started to appear in the restoration sampling and became very apparent in the stabilization samples.

To correct this situation, UUS conducted several cleaning and swabbing operations in the suspect wells. This basically amounted to swabbing and airlifting the materials out of the wells. However, in the case of three wells, cleaning required that the completion zone be underreamed to cut the contaminated material away from the ore zone interface. The removed material was then airlifted from the well.

In every well cleaned in this manner, water quality data showed a significant drop in values; therefore, indicating that the wells can be contaminated and later influence the quality of the water during restoration and stabilization.

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URANERZ U.S.A., INC.

190 Pronghorn
Casper, WY 82601

January 15, 1986

RETURN ORIGINAL TO PDR, HQ.

DOCKETED USNRC JAN 21 1986 MAIL SECTION DOCKET CLERK

RECEIVED JAN 21 1986 U.S. Nuclear Regulatory Commission Mail Section

Dr. Harry Pettengill, Section Chief
Operating Facility Section I
U.S. Nuclear Regulatory Commission
Uranium Recovery Field Office
Lakewood Office
Lakewood Office Plaza
730 Simms Street, Suite 100A
Golden, CO 80401

Attention: Mr. Gary Kowiniski
Project Manager

Re: Stabilization Data - Ruth ISL
License #SUA-1401
Docket #40-8783

Dear Dr. Pettengill:

Attached you will find the December, 1985 sample data for the Ruth ISL wellfield. This is the twelveth and final sample as per our understanding.

Should you or your staff require additional copies, or have questions, contact either myself or Mr. George Hartman, Operations Manager.

Sincerely,

URANERZ U.S.A., INC.

K Gary

K. Gary Somerville
Environmental Officer

Attachments
KGS:jm
CC: Mr. Roger Shaffer - LQD

DESIGNATED ORIGINAL

Certified By Mary C. Hood

FEE EXEMPT

Addl Info
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