URANERZ U.S.A., INC. 800 Werner Court Suite 140 CASPER. WYOMING 82601 July 7, 1981 Mr. John J. Linehan, Section Leader Operating Facilities Section I

Uranium Recovery Licensing Branch Division of Waste Management United States Nuclear Regulatory Commission Washington, D.C. 20555

> Re: Docket No. 40-8783 Application for Source Material

License

Dear Mr. Linehan:

Attached is the material you requested in your letter of June 16, 1981.

Please note our new address above.

Very truly yours,

URANERZ U.S.A., INC.

Dr. Christof Schmidt

Manager of Solution Mining

MAIL SECTION DOCKET CLERK

10207

DOCKETED USNAC

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A da'I Info

Attachment: As stated

cc: M. Hulbert, WDEQ

URANERZ U.S.A., INC.

Response to:

USNRC Letter dated June 16, 1981

Docket No. 10-8783

Uranerz Source Material License Application

July 7, 1981

NKC Comment 1. (6/16/81):

Submit the actual well completion data for well 7-M-20 as was done for other wells in Table D-6.4.

Response:

Revised Table D-6.4 is included giving well completion data for well 7-M-20 and well 1-M-51.

Table D-6.4 List of Hydrologic Test Wells

Well No.	Aquifer	Completed below groft.	d Interval ound (m)	Ground ft.	(m)	Hydraulio Elevation ft	Head n on 7/8/80 (m)	
3L	20-Sand	502-509	(153.1-155.2)	4829.33	(1491.98)	(Now abar (Will be	ndoned) plugged)	
4L	20-Sand	500-507	(152.2-154.6)	4828.62	(1471.76)	4859.24	(1481.10)	
5L	20-Sand	505-511	(154.0-155.8)	4833.73	(1473.32)	4859.27	(1481.11)	
6L	20-Sand	503-507	(153.4-154.6)	4836.73	(1474.24)			
8L	20-Sand	508-519	(154.9-158.3)	4821.83	(1672.74)	4859.11	(1481.06)	
1-M-20	20-Sand	492-554	(150.1-169.0)	4828.90	(1471.85)	4858.55	(1480.89)	
4-M-20	20-Sand	517-575	(157.7-175.4)	4847.44	(1477.50)	4857.88	(1480.68)	
5-M-20	20-Sand	493-563	(150.4-171.7)	4834.91	(1473.68)	4859.85	(1481.28)	
1-M-10	10-Sand	566-666	(172.6-203.1)	4829.90	(1472.15)	4892.79	(1491.32)	
1-M-30	30-Sand	419-455	(127.8-138.8)	4836.43	(1474.14)	4856.42	(1480.24)	
1-W-51	51-Sand	85-188	( 25.9- 57.3)	4836.50	(1474.17)	4800.47	(1463.18)	
7-M-20	20-Sand	492-555	(150.1-169.3)	4822.50	(1469.90)	4859.46	(1481.16)	(6/24/81)
1-M-51	51-Sand	87-187	( 26.5- 57.0)	4830.00	(1472.18)	4800.60	(1463.22)	(6/24/81)

Submit results of the well integrity testing program.

Response:

Results of the well integrity testing program will be submitted after the leaching wells have been permitted and drilled.

Submit a map showing the location and extent of the uranium ore body in relation to the Ruth ISL site and hydrologic test wells.

Response:

Map is attached as Figure D-6.4-1.

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Does Figure D-10.1 represent the radiation assessment sample location map which the text refers to as "not included"?

# Response:

Figure D-10.1 does represent the radiation assessment sample location map. The text on page RA-1, paragraph 1 should be corrected by deleting the last two sentences.

#### A. First Part

There are obvious errors in Table D-6.9, p. (i), (ex: fluoride mean concentration of 154 mg/l). These should be corrected.

## Response:

Table D-6.9, all parts, have been reviewed, proof read, corrections made as needed, and the revised table is submitted.

#### A. Second Part.

In addition, the text states (p. D-6.17) "...comparing the baseline water quality of the proposed leach field as represented by samples from wells 8L and 4L...". If baseline water quality of the ore zone is to be based on data from wells 8L and 4L the data for wells 1-M-20 and 5-M-20 should be segregated from Table D-6.9, p (i).

#### Response:

Baseline data for well 8L is given on Table D-6.9, p. 6, and for well 4L on Table D-6.9, p.5. Table D-6.9 (i) is included only for general information.

B. It appears other errors exist in other parts of Table D-6.9, (ex: D-6.9, p.5, the standard deviation of total hardness is listed as 41 mg/l). These tables should be further proof read and corrections made and copies resubmitted for substitution.

# Response:

Table D-6.9, all parts, have been reviewed, proof read, corrections made as needed, and the revised table is submitted.

NRC Comment 5 (6/16/81)

C. In Table D-6.9 (all parts) the split sample obtained on January 21, 1981, is treated as two independent samples. These are not two independent samples representative of the natural variation in water quality but are representative of the variation in lab analyses. The inclusion of both sets of data in the baseline determination will not be accepted.

## Response:

The PAL analyses for the split sample, obtained on January 21, 1981 have been removed from Table D-6.9, all parts, and the table has been recalculated, and is attached.

D. Both the NRC and DEQ agree that all data must be screened for outliers. As an example refer to TD-6.9, p.5. The WAMCO analysis for radium (January 21, 1981), appears consistent with previous samples while PAL's analysis of the sample is rather high (even ignoring the fact this was a split sample). Excluding the high value (223.43) from baseline determination would not be an unreasonable judgement. Have all the data been analyzed for outliers?

# Response:

Table D-6.9, and all other tables, have been examined for potential outliers. Outliers have been underlined on the tables, and have not been included in the calculations. Table D-6.9, and all other tables, are attached.

Table D-6.2

Baseline Surface Water Quality
Upstream Sampling Point
(Revised 7/6/81)

Remperature, OC, Field							
Mill, Unites Field Mill, Unites, Lab at 250 Mill, Unites, Mill, Mi	DATE SAMPLED	3/11/80	6/12/80	7/18/80	10/1/80	12/15/80	5/8/81
Mill, Unities Field 7, 6 7, 5 7, 6 8, 3 8, 9 Mill, Unities, Lab at 25° 8,08 7,87 8,19 7,77 7,53 8,30 Conductivity, unhos, Field Ambient 2000 3150 3500 3500 3200 3635 3600 1509 3000 3500 3500 3200 3200 3200 3200 3200	Temperature, OC. Field	8	20	20	0*	0	13
Mill, Unit's, Lab at 25°	pH. Unites Field	7.6	7.5				
Conductivity, unhos, Field Ambient   2000   3150   3500   3200   3635   3600   15/19   3200   3200   3635   3600   15/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   31/19   3200   3635   3600   3511   325   3200   3635   3600   3511   325   3200   3635   3600   3511   325   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600   3200   3600	M. Units, Lab at 250		7.87		7.77	7.53	
Conductivity, unhos, Lab at 25°   2610   2990   3220   3635   3600   15/9   105, Evaporation at 180°C   2147   2852   3050   3322   3580   1163   375   422   489   503   551   125   12	Conductivity, unhos, Field Ambient	2000	3150				1200
105, Evaporation at 180°C   2347   2852   3050   3322   3580   1163   3050	Conductivity, umhos, Lab at 250	2610			3635	3600	
Table   Tabl	IDS, Evaporation at 180°C	2347					
Total Stume	Sodium	375					125
Actium   235   377   257   232   405   133   134   136   137   138   138   130   137   137   137   138   1	Potassium	12					11
Agnessium	Calcium	235					
Sulfate		73		120	161		
Chloride							660
Compare   Comp							000
		45	45	40	38	50	12
		420	254	111	200		11.
Octal Mill*equivalent Major Cations   35.65   43.17   44.82   47.74   53.63   15.60		423	354	1/1	280	659	13
State   Mill			*****	** **		** **	
Description   Content							15.50
No.							
						.21	0 42
							סא
State   Alkaninity as CaCO3   360   290   140   230   540   60     State   Hardness as CaCO3   950   1220   1170   1240   1504   484     State   Hardness as CaCO3   950   1220   1170   1240   1504   484     State   Hardness as CaCO3   950   1220   1170   1240   1504   484     State   Hardness as CaCO3   950   1220   1170   1240   1504   484     State   Hardness as CaCO3   950   1220   1170   1240   1504   484     State   Hardness as CaCO3   950   1220   1170   1240   1504   484     State   Hardness as CaCO3   950   1220   1170   1240   1504     State   Hardness as CaCO3   950   1220   1170   1240   1504     State   Hardness as CaCO3   950   1220   1504   1504     State   Hardness as CaCO3   950   1220   1504   1504     State   Hardness as CaCO3   950   1220   1504   1504     State   Hardness as CaCO3   1240   1504   1504     State   Hardness as CaCO3   1504   1504   15							ND
Octal Hardness as CaCO3   950   1220   1170   1240   1504   484   484   484   484   484   485	fucride (U.1)	0.51				0.28 -	ND
ND   0.08   0.1   ND   ND   ND   ND   ND   ND   ND   N	ota Alkaninity as Cacua						60
ND   3.002   0.008   0.008   0.025   ND   ND   ND   ND   ND   ND   ND   N							484
ND   3.002   0.008   0.008   0.025   ND   ND   ND   ND   ND   ND   ND   N						ND	ND
NO   0.002   0.008   0.008   0.025   ND   ND   ND   ND   ND   ND   ND   N							ND
ND   0.03   ND   ND   ND   ND   ND   ND   ND   N				0.008	0.008	0.025	ND
ND   ND   ND   ND   ND   ND   ND   ND		0.04	0.05	ND	ND	ND	ND
ND   ND   ND   ND   ND   ND   ND   ND		ND	0.015	0.010	0.010	ND	ND
ND   ND   ND   ND   ND   ND   ND   ND		. ND	ND			NO	ND
ND   ND   ND   ND   ND   ND   ND   ND		ND	0.02	ND	0.02		.05
ND   0.03   ND   ND   ND   ND   ND   ND   ND   N		0.15					.23
No			0.03			ND	ND
ND		0.23					.19
ND   0.03   ND   ND   ND   ND   ND   ND   ND   N		ND					ND
ND   ND   ND   ND   ND   ND   ND   ND		ND	0.03				ND
ND 0.39 0.07 0.04 0.021 ND		, ND				ND	ND
ND N		ND					ND
leading Hall- (A AA)	lolybdenum (0.05)	ND					
	Uranius, U30g. (0.001)	0.058	0.025	0.046	0.149	0.045	0.006
(Anadium V20r) (D 06)	Vanadium V205' (0.05)	NO					
124 OF 11 10 EV	Radium 226 Pic/L (0.5)						
	Radium, Precision, PIC/L						3.2

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.3

Baseline Surface Water Quality
Downstream Sampling Point
(Revised 7/6/81)

DATE SAMPLED	3/13/80	6/12/80	7/18/80	10/1/80	12/15/80	5/8/81
emperature, <sup>OC</sup> Field	7	20	25		4.8	. 9
H, Units Field	7.4	7.5	7.0		8.2	7.8
on, units rieiu	7.61	7.64	8.06	7.41	7.6	7.88
oH, Units, Lab at 25°C	1900	3800	6000			3000
Conductivity unhos, Field Amoient		3481		5396	3425	4171
Conductivity, umhos, Lab at 25°C	2610	3328	4588	5526	3862	3947
IDS, Evaporation at 180°C	2448			758	529	554
Sodium	360	480	634		15	17
Potassium	9	15	33	35		377
Calcium	261	401	477	521	433	
	95	124	203	215	73	142
Magnesium	1495	2060	2925	3475	1960	2320
Sulfate	35	52	62	60	59	56
Chloride	10	36	-	,	0	0
Carbonate		***	403	211	500	305
Bicarbonate	293	415	403	211	300	
Hydroxide				22.64	51.00	55.02
Total Milliequivalent Major Cations	36.72	51.68	68.81	77.54		
Total Milliequivalent Major Anions	36.90	51.13	69.20	77.33	50.63	54.84
Total Milliedningleur Helot Williams	0.24	0.53	-0.21	0.14	0.36	0.16
Absolute Value, Charged, Balance	ND	QN	ND	ND	0.45	ND
Ammonia as N	0.03	ND	1.0	ND	ND	ND
Nitrate as N (0.05)	0.03	0.54	0.24	0.74	0.23	0.27
Fluoride (0.1)		340	330	173	410	250
Total Alkalinity as CaCO3	240		2025	2184	1380	1524
Total Hardness as CaCO3	1040	1510		ND ND	ND	ND
Boron (0.01)	0.07	0.08	ND		0.06	0.16
Aluminum (0.05)	0.03	0.07	ND	ND		
Arsenic (0.005)	ND	0 003	0.010	.012	ND	ND
Bartum (0.03)	ND	0.69	. ND	ND	ND	ND
Bartum (0.03)	ND	U.012	0.020	0.009	ND	0.011
Cadmium (0.002)	ND	ND	ND	ND	ND	ND
Chromium (0.01)	ND	0.01	ND	0.02	0.01	ND
Copper (0.01)	0.07	0.03	0.07	0.21	0.96	0.23
Iron, Total (0.01)			50 50	0.02	ND	ND
Lead (0.01)	ND	0.03		0.41	4.0	0.16
Manganese (0.01)	2.3	1.49	2.51			ND ND
Mercury (0.0005)	ND	ND	ND	ND	ND	
mercury (0.0003)	ND	0.03	ND	0.93	ND	ND
Mickel (C.O2)	ND	ND	ND	ND	ND	CH
Selenium (0.005)	ND	0.31	0.07	0.06	0.026	0.025
Zinc (0.005)	ND	ND	ND	ND	ND	ND
Molybdenum (0.05)	0.046	0.029	0.007	0.009	0.045	0.002
Uranium U308 (0.001)		0.23	ND	ND	ND	ND
Vanadium *205 (0.05)	ND		0.7	1.5	2.5	1.9
Radium 226, P1C/L (0.5)	0.7	0.23		+0.7	±0.8	±0.5
Radium, Precision, PIC/L	±0.2	±0.3	±0.7	10.7	10.0	30.0

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.9 (i)
Baseline Water Quality Data
4L, 8L, 1-M-20, 4-M-20, 5-M-20, 7-M-20
20-Sand Aquifer (Revised 7/6/81)

DATE SAMPLED	No. of Samples	Maximum Observed	Minimum Observed	Mean	Std. (o) Deviation
Temperature, <sup>O</sup> C, Field	32	15	11	13.3	1.2
nH. Units Field	32	9.8	8	8.7	0.5
pH, Units, Lab at 25°C	32	9.25	7.78	8.18	0.35
Conductivity, umhos, Field-Ambient	24	605	390	442	50
Conductivity, umhos, Field-Ambjent Conductivity, umhos, Lab at 25°C	32	636	445	523	41
TDS, Evaporation at 180°C	32	374	289	326	20
Sodium	32	121	98	108	6
Potassium	32	9	3	4.5	1.4
Calcium	32	10	1	6.4	2.0
Magnesium	32	7	i	2.5	1.7
Sulfate	32	128	68	97	16
Chloride	32	14	3	6.9	2.8
	24	67	ő	15.5	17
Carbonate	32	195	22	164	35
Bicarbonate	32	190	22	104	- 55
Hydroxide Total Milliequivalent Major Cation Total Milliequivalent Major Anions					
Absolute Value, Charged, Balance					
Ammonia as N	32	0.3	ND	0.09	0.07
Nitrate as N (0.05)	30	0.21	ND	0.06	0.04
Fluoride (0.1)	31	0.85	0.14	0.51	0.16
Total Alkalinity as CaCO <sub>3</sub> Total Hardness as CaCO <sub>3</sub>	32	172	130	154	8
Total Hardness as CaCO3	32	33	7	23.9	6.0
Boron (0.01)	32	0.1	ND	0.03	0.03
Aluminum (0.05)	32	0.4	ND	0.12	0.11
Arsenic (0.005)	26	0.094	ND	0.014	0.019
Barium (0.03)	32		ND	0.03	
Cadmium (0.002)	32	0.012	ND	0.003	0.002
Chromium (0.01)	32	0.02	ND	0.01	0.002
Copper (0.01)	32	0.02	ND	0.011	0.003
Iron, Total (0.01)	32	0.2	ND	0.077	0.067
Lead (0.01)	31		ND	0.01	
Manganese (0.01)	32	0.07	ND	0.018	0.013
Mercury (0.0005)	32		ND	0.0005	
Nickel (0.02)	32		ND	0.02	-
Selenium (0.005)	30	0.005	ND	0.005	The second
Zinc (0.005)	28	0.34	ND	0.046	0.082
Molybdenum (0.05)	32	-	ND	0.05	-
Uranium 11-0- (0.001)	32	0.071	<0.001	0.010	0.015
Vanadium V-08 (0.05)	32		ND	0.05	-
Uranium, U <sub>3</sub> 0 <sub>8</sub> , (0.001) Vanadium, V <sub>2</sub> 0 <sub>5</sub> , (0.05) Radium 226, PiC/L (0.5) Radium, Precision, PiC/L	31	225	0.5	56.2	71.5

<sup>( )</sup> detection limit.

ND - not detected.

TABLE D-6.9,p.1.

Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL		1-8	1-20									Standard
DATE SAMPLED	2/11/80	6/12/80	7/18/80	10/1/80	12/16/80	1/21/81	5/11/81	No. of Samples	Maximum Observed	Minimum Observed	Hean	Deviatio (o)
Temperature, °C, Field	12	12	14	14	14	13	14.5	,	14.5	12		
ph, Units Field	8.3	8.4	0.7	8.5	8.7	8.8	8.7	2	8.8	8.2	13.50	0.87
pH, Units, Lab at 25°C	8.24	8.0	8.40	8.09	8.28	7.95	8.65	,	8.65	7.95	8.51 8.23	0.23
Conductivity, unhos, Field-Ambient	390	410	450		410	400	400	6	450	390	410	0.24
Conductivity, unhos, Lab at 25°C	460	500	509	477	512	552	525	7	552	460	505	21
TDS, Evaporation at 180°C	320	329	308	289	295	303	306	,		1000		30.3
Sodium	110	109	104	98	101	104	108	,	329	289	307	14
Potassium	3	5	4	3	5	3	100		110	98	105	4.4
Calcium	6	5	6	5	6	6			,	3	3.7	0.95
Magnesium	3	2	3	3	1	i			0	3	5.3	1.1
Sulfate	91	115	89	68	86	88	70	/	3		2.0	0.93
Chloride	10	7	8	14	3	6	70	,	115	68	87	16
Carbonate	10	. 9	17		31	0	26	7	14	3	7.9	3.4
Bicarbonate	181	151	151	188	120	183		6	31	0	15.5	11.5
Hydroxide .			-		120	103	151	7	188	120	161	25
Total Milliequivalent Major Cations	5.42	5.28	5.17	4.84	4,90	4.98						
Tota' Milliequivalent Major Anions	5.47	5.30	5.13	4.89	4.87	5.00	5.01					
Absolute Value, Charged, Balance	0.46	0.19	0.39	0.58	0.31	0.2	5.01					
Ameria as N	0.30	ND	0.11	ND	ND ND							
Nitrate as N (0.05)	0.21	NO	1.0	NO	ND	ND	ND		0.30	ND	0.09	0.09
Fluoride (0.1)	0.54	0.40	0.04	0.74	0.40	N <sub>1</sub> )	ND	6	0.21	ND	0.08	0.07
Total Alkalinity as CaCO.	165	140	152	154	150	0.61	0.30	6	0.74	0.3	0.498	0.162
Total Hardness as CaCO.	28	21	28	25	19	150	168	7	168	140	154	10
Boron (0.01)	0.02	0.1	ND	ND	0.06	19	12	7	28	12	22	
Aluminum (0.05)	ND	0.40	ND	ND	.19	ND	ND	7	0.10	ND	0.031	0.035
Arsenic (0.005)	0.002	0.006	0.010	0.004		ND	ND	7	0.40	ND	0.12	0.13
Barium (0.03)	ND ND	ND		ND ND	NO	ND	ND	5	0.01	ND	0.006	0.002
Cadmium (0.002)	ND	ND	ND ND	0.005	ND	ND	ND			ND	.03	0.002
Chromium (0.01)	ND	NO	ND	ND	ND	0.002	ND		0.005	ND	0.0024	0.0011
Opper (0.01)	ND.	ND	ND	ND QA	NO	ND	ND	7		ND	0.01	0.0011
Iron (0.01)	0.17		0.01		0.02	ND	.01	7	0.02 •	ND	0.0114	0.0038
Lead (0.01)				0.02	. 19	0.06	.08	7	0.19	0.01	0.093	
	ND			ND	ND	ND	ND	7	177	ND	0.01	0.070
Manganese (0.01)	0.07	75 (10.00)	ND	NO	0.02	0.01	.01	7	0.07	ND		
Mercury (0.0005)	NO			NO	, ND	ND .	ND	7	0.07	ND	0.023	0.022
Nickel (0.02)	NO			NO	ND	ND	ND	,		ND	0.0005	*
Selenium (0.005)	NO			MD	NO	ND	ND	6	0.005	ND	0.02	
Zinc (0.005)	0.07	recommendation of the		0.03	.033	.024	ND	6	0.07	ND	0.005	
Molytxderum (0.05)	ND			NO	NO	ND	ND	,	0.07	ND	0.03	0.02
Uranium, U <sub>3</sub> O <sub>8</sub> , (0.001)	0.003			0.003	.001	<0.001	<0.001	,	0.011	0.001	0.05	
Vanadium, ♥205, (0.05)	NO			NO	ND	ND	NO	,	0.011		0.003	0.0037
Radium 226, PIC/L (0.5)	1.3			0.4	3.7	5.8	1.6			ND	0.05	
Radium, Precision, PiC/L	±0.3	10.4	±0.5	10.3	1.0	±1.4	±0.5	0	5.8	0.68	2.3	2.0

Analyses reported in milligrams por liter except where noted. The underlined data are considered as outliers and are not included in the calculations.

TABLE D-6.9, p.2.
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL		4-M-20					No. of	Maximum	Minimum		Standard Deviation
DATE SAMPLED	6/12/80	7/14/80	10/2/80	12/15/80	1/20/81	5/11/81	Samples	Observed	Observed	- Hean	(0)
emperature, <sup>Q</sup> C, Field	11.5	13.8	14.2	14.2	n	13	6	14.2	11.0	13	1.4
H, Units Field	9.6	9.6	7.9	9.8	9.4	9.0	6	9.8	8.9	9.4	0.36
H, Units, Lab at 25°C	9.25	8.56	8.67	8.25	8.36	8.85	6	9.25	8.25	8.65	0.36
broketivity, phos, Field-Ambient	405	500			400	450	4	500	400	439	47
bonductivity, unhos, Lab at 25°C	445	494	517	547	566	546	6	566	445	519	
DS, Evaporation at 180°C	343	338	305	331	345	320	6	345	305	330	15
odium	115	112	99	113	118	. 108	6	118	99	111	6.7
otassium	7	9	3	6	4	5	6	9	3	5.7	2.2
alcium	1	7	6	7	5	4	6	7	1	5.0	2.3
Magnesium	1	2	3	1	1	1	6	3	1	1.5	0.8
Sulfate	128	106	76	105	114	97	6	128	76	104	17
Chloride	9	10	13	3	6	4	6	13	3	7.1	3.8
Carbonate	67	. 34	TR	31	26	19	6	67	TR	29.5	22.0
Bicarbonate	22	120	185	129	132	137	6	185	22	121	54
hydroxide											
Total Milliequivalent Major Cations	5.31	5.61	4.93	5.50	5.56	5.11					
Total Milliequivalent Major Anions	5.50	5.58	4.98	5.41	5.57	5.01					
Absolute Value, Charged, Balance	-1.76	0.03	0.53	0.82	0.09	.99					
Vmmonia as N	0.22	0.14	ND	ND	0.12	ND	6	0.27	ND	0.11	0.07
Nitrate as N (0.05)	· ND	0.6	ND OM	0.05	ND	ND	5	0.05	ND	0.05	
Fluoride (0.1)	0.65	0.57	0.57	0.51	0.85	. 36	6	0.85	0.36	0.59	0.16
Total Alkalinity as CaCO	130	155	152	158	152	144	6	158	130	149	10.2
Total Hardness as CaCO 3	7	25	2.7	22	16	14	6	27	7	18.5	7.6
Boron (0.01)	NO	0.1	ND	ND	ND	ND	6	0.1	ND	0.025	0.037
Aluminum (0.05)	0.25	ND	ND	ND	ND	ND	6	0.25	ND	0.083	0.082
Arsenic (0.005)	0.008	0.014	0.008	_,004	ND	ND ND	5	0.014	ND	0.008	0.0037
Barium (0.03)	NO	NO	NO	ND	NO	ND	6		ND	0.03	
Cadmium (0.002)	ND	0.012	ND	ND	0.005	ND	S	0.012	ND	0.0042	0.0040
Chromium (0.01)	0.01	ND	ND	ND	ND	ND	6	0.012	ND	0.01	
Copper (0.01)	ND	ND	0.02	ND	0.01	ND	č	0.02	ND	0.0117	0.0043
Iron (0.01)	0.01	0.06	0.09	0.01	.20	.17	6	0.2	0.01	0.09	0.080
Lead (0.01)	ND	ND	ND	ND	ND	ND	6		NO	0.01	0.000
Manganese (0.01)	0.01	ND	ND	.01	.01	.01	6	0.01	ND	0.01	
Mercury (0.0005)	ND	ND	ND	, ND	NO	ND	6	0.31	NC	0.0005	1
Nickel (0.02)	(B)	ND	ND	CM	ND	ND	6		ND	0.02	
Selenium (0.005)	NO	NO	NO NO	ND	ND	ND	6		ND	0.005	
Zinc (0.005)	0.31	0.04	0.04	002	.013	ND	5	0.31	ND	0.082	0.12
Molytodenum (0.05)	ND	CIA	ND	ND	ND	ND	6		ND	0.05	
Uranium, U,O, (0.001)	0.020	0.005	0.007	0.007	.028	0.001	6	0.028	0.001	0.0113	0.010
Vanadium, \$20, (0.05)	ND	ND	ND	ND	ND	ND.	6	0.000	ND ND	0.0113	0.010
Radium 226, PiC/L (0.5)	4.7	6.7	4.6	5.6	7.0	9.7		9.7	4.6	6.42	1.8
Radium, Precision, PiC/L	11.3	11.5	11.2	11.2	±1.5	11.2		***	4.0	0.42	1.0

The underlined data are considered as outliers and are not included in the calculations.

<sup>( )</sup> detection limit.

ND - not detected.

TR - trace.

TABLE D-6.9, p.3
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

MEIT			5-M-20									Standard
DATE SAMPLED	6	5/12/80	7/15/80	10/6/80	12/15/80	1/2]/81	5/8/81	No. of Samples	Maximum Observed	Minimum Observed	Mean	Deviatio (a)
Temperature, °C, Field		13	14	14.4	14.3	14	14.5					
pH, Units Field		8.4	8.0	8.6	9.3	3.4	8.4		14.5	13	14	0.6
pH, Units, Lab at 25°C		7.93	7.78	7.92	7.94	7.98	8.32	0	9.3	. 8	8.5	0.4
Conductivity, whos, Field-Ambient		450	500			450	440	•	8.32	7.78	7.98	0.18
Conductivity, unhos, Lab at 25°C		480	497	534	558	579	636	4	500	440	460	27
TDS, Evaporation at 180°C		349	344	347	338	342	374	6	636	480	547	57
Sodium		121	114	107	110	115	111		374	338	349	13
Potassium	*	5	6	. 5	4	3	111	6	121	107	113	5
Calcium		8	8	10	j	,			6	3	4.3	1.2
Magresium		1	3	1	2	,		6	10	4	7.5	2.0
Sulfate		120	108	106	105	116		6	3	1	2.0	0.9
Chloride		7	10	4	103	5	92	6	120	92	108	10
Carbonate					ő	ő	6	6	10	3	5.8	2.5
Bicarbonate		135	195	181	190		12	3	12	0	4	6.9
Hydroxide		103	.,,	101	190	190	176	6	195	176	186	7
Total Milliequivalent Major Cations		5.87	5.76	5.36	5.45	1.02					100	
Total Milliequivalent Major Anions		5.73	5.73	5.29		5.59	5.36					
Absolute Value, Charged, Balance		1.21	0.26	0.75	5.38	5.67	5 37					
Amonia as N		ND	0.16	0.13	0.65	0.71	0.09					
Nitrate as N (0.05)		ND	0.16	ND	ND	NI:	0.1	6	0.16	ND	0.08	0.05
Fluoride (0.1)		0.61	0.2	0.85	ND	NL	ND	6	0.2	ND	0.075	0.061
Total Alkalinity as CaCO,		152	160		0.51	0.74	0.36	6	0.85	0.36	0.607	0.172
Total Hardness as CaOO		24		148	156	156	165	6	165	148	156	0.172
Boron (0.01)		0.1	32	29	28	26	22	6	32	22	27	3.6
P' ainum (0.05)		0.16	ND.	ND	ND	ND	ND	6	0.1	ND	0.025	0.037
			ND	0.29	0.08	ND	ND	6	0.29	ND	0.113	0.037
Arsenic (0.005)		0.041	0.016	0.032	.008	ND	0.012	6	0.041	ND	0.019	
Barium (0.03)		ND	ND	ND	ND	ND	ND	6	0.041	ND		0.014
Cadmium (0.002)		ND	0.003	0.004	ND	ND	- P:D	6	0.004	ND	0.0025	0.0008
Chronium (0.01)		0.02	ND	ND	ND	- ND	P:D	6	0.02	ND	0.6117	0.0008
Copper (0.01)		ND	ND	ND	.01	ND	ND .	6	0.01	ND	0.01	0.0042
Iron (0.01)		0.04	. 0.05	0.16	.01	0.09	0.07	6	0.16	0.01	0.07	0.052
Lead (0.01)		ND	ND	ND	ND	ND	KD	6		ND	0.01	0.052
Manganese (0.01)		0.04	ND	0.04	.03	0.01	0.02	6	0.04	ND	0.025	
Marcury (0.0005)		ND	ND	ND	ND	ND	ND	6	0.04	ND	0.0005	0.014
N ckel (0.02)		ND	ND	ND	ND	ND	MD.	6	To Street Co.	ND	0.0005	
Selenium (0.005)		NO	ND	ND	ND	ND	CH	6		ND	0.02	
Zinc (0.005)		0.34	0.007	0.03	.005	0.024	E:D	6	0.34	ND	0.0685	0 1000
Molybdenum (0.05)		ND	ND	ND	ND	ND	KD					0.1334
Uranium, U <sub>2</sub> O <sub>2</sub> , (0.001)		0.045	0.003	0.003	100.001	0.004	0.001			ND	0.05	
Vanadium, \$285, (0.05)		ND ND	ND	ND	ND	ND	1.D		0.045	< 0.301	0.0095	0.0174
Radium 226, PiC/L (0.5)		0.5	0.8	1.3	1.3	3.0	1.3		2.0	ND	0.05	
Radium, Precision, PiC/L		10.4	±0.5	±0.7	±0.6	±1.0	1.0	•	3.0	0.5	1.37	0.87

<sup>( )</sup> detection limit.

NO - not detected.

Table D-6.9, p. 4
Baseline Water Quality Data
20-Sand Aquifer (Revised 7/6/81)

WELL	7-M-20	(New)
DATE SAMPLED	5/8/81	
Temperature, <sup>O</sup> C, Field	15	
pH, Units Field	8.4	
pH, Units, Lab at 25°C	8.26	
Conductivity, umhos, Field-Ambjent	440	
Conductivity, umhos, Lab at 25°C	550	
TDS, Evaporation at 180°C	356	
Sodium	106	
Potassium	3 4	
Calcium	4	
Magnesium	2	
Sulfate	78	
Chloride	8	
Carbonate	10	
Bicarbanate	176	
Hydroxide		
Total Milliequivalent Major Cations		
Total Milliequivalent Major Anions	5.07	
Absolute Value, Charged, Balance	.40	
Ammonia as N	ND	
Nitrate as N (0.05)	0.30	
Fluoride (0.1) Total Alkalinity as CaCO	161	
Total Alkalinity as CaCO <sub>3</sub> Total Hardness as CaCO <sub>2</sub>	18	
Boron (0.01)	ND	
Aluminum (0.05)	ND	
Arsenic (0.005)	ND	
Barium (0.03)	ND	
Cadmium (0.002)	ND	
Chromium (0.01)	ND	
Copper (0.01)	ND	
Iron, Total (0.01)	.20	
Lead (0.01)	ND	
Manganese (0.01)	.02	
Mercury (0.0005)	ND	
Nickel (0.02)	ND	
Selenium (0.005)	ND	
Zinc (0.005)	.015	
Molybdenum (0.05)	ND	
Uranium, U <sub>3</sub> 0 <sub>8</sub> , (0.001) Vanadium, V <sub>2</sub> 0 <sub>5</sub> , (0.05)	.001	
Vanadium, V <sub>2</sub> 0 <sub>5</sub> , (0.05)	ND	
Radium 226, "PiC/L (0.5)	7.8	
Radium, Precision, PiC/L	±1.1	

<sup>( )</sup> detection limit.

ND - not detected.

TABLE D-6. 9, p. 5.
Baseline Water Guality Data For
20-Sand Aquifer
(Revised 7/6/81)

WEIL.		41.									
DATE SAMPLED	6/12/80	10/8/80	10/8/80	12/16/80	1/21/81	5/14/81	No. of Samples	Maximum Observed	Minimum Observed	Pean	Standard Deviation (o)
emperature, °C, Field	12	14	14.6	12.0	11					•	
H, Units Field	8.5	8.6	8.6	8.4	8.5	13	6	14.6	- 11	12.8	1.4
H, Units, Lab at 25°C	7.81	8.43	7.88	7.91	7.84	8.4	6	8.6	8.4	8.5	0.1
Conductivity, unhos, Field-Ambient	605	500		440	390	7.83	6	8.43	7.81	7.95	0.24
onductivity, unhos, Lab at 25°C	453	524	512	529	572	410	5	605	390	469	87
D6, Evaporation at 180°C	332	308	312	311		535	6	572	453	521	39
odium	112	102	104	107	329	346	6	346	308	323	15
otassium	5	6	5	107	112	112	6	112	102	108	5
alcium	9	7	6	4	3	5	6	6	102	4.7	1.03
Agnesium	2	3	2	8	8	9	6	9	6	7.67	1.03
Sulfate	110	85	75 -			2	6	3	,	1.83	0.75
Chloride	110	10	/5 -	- 96	105	117	6	117	75	98	
Carbonate	8			4	5	6	6	10	/5		16
more account was		22		0	0	0		22	:	6.8 5.5	2.2
Bicarbonate	193	142	185	185	185	183	6	193	142	179	11
Hydroxide								. 133	142	1/9	18
Total Milliequivalent Major Cations	5.65	5. 19	5.11	5.23	5.43	5.61					
Total Milliequivalent Major Anions	5.69	5.17	5.03	5.14	5.35	5.60					
Absolute Value, Charged, Balance	0.35	0.19	0.16	0.87	0.74	0.09					
Ammonia as N	ND	0.18	ND	ND	ND	ND					
Nitrate as N (0.05)	ND	ND	ND	NE.	ND	ND	6	0.18	ND	0.072	0.053
Fluoride	0.51	0.51	0.14	0.43	0.57	0.51	6		ND	0.05	
Total Alkalinity as CaOO,	159	153	152	152	151	150	6	0.57	0.14	0.445	0.156
Total Hardness as CaCO,	33	30	23	24	24		6	159	150	153	3
Boron (0.01)	0.08	0.1	ND	ND	ND	30	6	33	23	27	4.2
Aluminum (0.05)	0.20	ND	ND	ND	ND	ND	6	8:28	ND	0.037	0.042
Arsenic (0.005)	0.014	0.014	0.012	0.001	ND	ND	6		ND	0.075	0.061
Barium (0.03)	ND	ND	ND	ND ND	ND	0.001	4	0.014	MS	0.011	0.004
Cactuium (0.002)	ND	ND	ND	ND	ND	ND	6		ND	0.03	0.004
Chronium (0.01)	ND	ND	ND	ND		0.063	6	0.003	ND	0.0022	0.0004
Copper (0.01)	ND	ND	ND	ND	ND	ND	6		ND	0.01	0.0004
Iron (2.01)	0.02	0.05	0.14	.03	ND	ND	6		ND	0.01	
Lead (0.01)	0.15	· ND			0.04	ND	6	0.14	ND	0.048	0.047
Manganese (0.01)			ND	NO	ND	ND	5		ND	0.01	0.047
	0.01	0.01	ND	.01	0.01	0.02	6	0.02	ND	0.011	0.004
Mercury (0.0005)	ND.	ND	ND	ND	NO	ND	6		ND	0.0005	0.004
Nickel (0.02)	ND	ND	ND	ND	ND	ND	6			0.02	
Selenium (0.005)	ND	0.003	NO	ND	ND	ND	6		ND		
Zinc (0.005)	0.89	, NO	0.01	.009	0.037	0.006			ND	0.005	
Molybdenum (0.05)	ND	ND	ND	ND	ND	ND	6	0.037	ND	0.013	0.013
Uranium, U <sub>3</sub> O <sub>8</sub> , (0.001)	0.006	0.010	0.011	0.003	0.004	< 0.001	6	0.011	ND	0.05	
Vanadium, \$8, (0.05)	ND	ND	ND	ND	ND	ND	6	0.011	<0.001	0.0058	0.0040
Radium 226, 2PIC/L (0.5)	175	161	127	156	143	225		226	ND	0.058	-
Radium, Precision, PiC/L	17	17	±7	16	17	16		225	127	165	34

Analyses reported in milligrams per liter except where noted

( ) detection limit.

ND - not detected.

The underlined data are considered as outliers and are not included in the calculations.

TABLE D-6.9, p. 6.
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL		8L				The second second					Standard
DATE SAMPLED	6/12/80	7/23/80	10/6/80	12/16/80	1/22/81	5/11/81	No. of Samples	Maximum Observed	Minimum Observed	Hean	Deviatio (o)
Temperature, <sup>O</sup> C, Field	11.5	14	14.4	12.0	13	12	6	14,4	11.5	12.8	1.2
pH, Units Field	8.6	8.6	8.8	8.6	8.2	9.4	6	9.4	8.2	8.7	0.4
pH, Units, Lab at 25°C	7.82	8.25	8.12	7.98	7.90	8.48	6		7.82	8.09	0.25
Conductivity, umbos, Field-Ambient	445	500			400	420	4	8.48	400	441	43
Conductivity, unhos, Lab at 25°C	468	523	511	523	566	534		566	468	521	32
TOS, Evaporation at 180°C	232	299	321	310	335	328	6	335	299	321	14
Sodium	109	99	105	106	110	109	6	110	99	106	19
Potassium	5	5	5	4	3	105	6	110	99	4.3	
Calcium	6	6	10	8	6			10	3	7.2	0.8
Magnesium	2	4	1	i	3			10		1.2	1.6
Sulfate	98	75	99	99	108	84		108	76	2	1.3
Chloride	6	9	9	4	5				/5	94	12
Carbonate		17		0	. 0			9		6.2	2.3
Bicarbonate ·	193	163	178	183	185	41 127		41	0	14.5	19.4
Hydroxide		- Venter	-		103	127		193	127	172	24
Total Milliequivalent Major Cations	5.33	5.07	5.28	5.19	5.42	5.27					
Total Milliequivalent Major Anions	5.38	5.05	5.23	5.17	5.42	5.31					
Absolute Value, Charged, Balance	0.47	0.20	0.48	0.19	0	0.38					
Ammonia as N	ND	0.28	0.21	ND.	ND	0.36 ND		0.28	wn.	***	
Nitrate as N (0.05)	ND	ND	ND	ND	ND	ND	0		ND	115	0.103
Fluoride (0.1)	0.43	0.38	0.51	0.43	0.65	0.27		0.65	ND	1 05	0.039
Total Alkalinity as CaCO,	159	162	146	150	151	172		172	0.27	6. 45	0.128
Total Hardness as C 00,	23	32	29	24	28	21			100000	157	10
Boron (0.01)	0.08	ND	ND	ND	ND	ND .		32	21	26	4.2
Aluminum (0.05)	0.38	ND	0.23	.15	ND	0.3		0.08	ND	0.022	0.029
Arsenic (0.005)	0.094	0.022	0.008	001	ND	ND			ND ND	0.19	0.14
Barium (0.03)	ND	ND	ND	ND	ND	ND	,	0.094	- ND	0.027	0.038
Cadmium (0.002)	ND	0.004	0.008	ND	ND	ND		0.008	ND	0.03	
Chromium (0.01)	ND	ND	ND	ND	ND	ND		0.000	ND	0.0033	0.0024
Opper (0.01)	0.02	ND	ND	ND	ND	ND		0.02	ND ND	0.02	
Iron (0.01)	ND	<.01	0.14	.02	0.01	0.16	è	0.15	ND	0.0117	0.0043
Lead (0.01)	NO	ND	ND	ND	ND	ND		0.13	ND	0.058	0.071
Manganese (0.01)	0.02	0.03	0.02	.01	0.01	ND	6	0.03	ND	0.0167	
Mercury (0.0005)	ND	ND	ND	ND	ND	ND			ND		0.0082
Nickel (0.02)	ND	ND	ND	ND	ND	ND	,		ND .	0.0005	
Selenium (0.005)	ND	ND	ND	ND	ND	ND				0.02	
Zinc (0.005)	0.08	0.04	0.06	_,004	.019	ND	6	0.08	ND ND	0.005	
Molybdenum (0.05)	ND	ND	ND	ND	ND	ND	:	0.08		0.041	0.030
Uranium, U <sub>2</sub> O <sub>0</sub> , (0.001)	0.071	0.026	0.019	.019	0.003	0.008	9		ND	0.05	
Variadium, 0.8, (0.05) Radium 226, 2PIC/L (0.5)	ND	- NO	ND	ND.	ND ND	0.008 ND	•	0.07	0.003	0.024	0.024
	120	136	74	143	83	131-	6	143	ND	0.05	
Radium, Precision, PiC/L	16	17	±5	16	15	131-	6	143	74	115	29

The underlined data are considered as outliers and are not included in the calculations.

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.10
Baseline Water Quality Data for Well 1-M-30 - 30-Sand (Revised 7/6/8)

DATE SAMPLED	2/11/80	6/12/80	7/18/80	10/8/80	12/18/80	1/20/81	5/13/81	No. of	Maxinum	Minimum		Standard
Temperature, *C, Field	8	13.5	13	14.6				Samples	Observed	Observed	Mean	Deviation
pH, Units Field	10.0	9.8	10.4	10.2		13	14	5	14.6	8	12.7	
pH, Units Lab at 25°C	9.60	9.51	9.54	9.26	9.8	9.6	9.6	7	10.4	9.6	9.9	0.3
Conductivity, untos, Field-Ambient	410	605	600	9.46	9.14	8.88	9.43	7	9.6	8.88		0.26
Conductivity, umbos, Lab at 25°C	550	555	575		400	480	440	6	605			
TLS, Evaporation at 180°C	359	381	362	535	605	658	435	7		400		92
Sodium	126	135		336	378	366	326	,	658 381	435	559	69
Potassium	720		125	115	135	130	113	,	135	326	358	21
Calcium	,	10	13	7	7	5	6		17.00	113	126	9
Magnesium			- 4	2	2	3		4	13	5	7.7	2.9
Sulfate	1	1	1	4	1	2	i	,	•	1	2.3	1.0
Chloride	85	98	70	76	105	86	88	,		1	1.57	1.13
Cartonate	14	14	18	14	9	9			105	70	87	12
Bis rborate	96	108	126	86	96	05	9	7	18	9	12.4	3.5
	39	22		46	39	122	67	7	126	65	92	22
Hydroxide						122	49	6	122	22	53	35
Total Milliequivalent Major Cations	5.84	6.26	6.05	5.61	6.23						-	33
Total Milliequivalent Major Anions	6.00	6.39	6.17	5.58		6.10	5.18					
Absolute Value, Charged Balance	-1.35	1.03	0.98	0.27	6.27	6.20	5.11					
Amonia as N	0.30	ND	0.20	ND	.32	0.81	0.66					
Nitrate as N (0.05)	0.17	ND	0.4	ND	ND	ND	ND	7	0.3	ND	0.11	
Fluoride (0.1)	1.07	1.16	0.74	1.38	ND	ND	ND	7	0.4	ND	0.11	0.10
Total Alkalinity as CaCO,	192	198	210		0.99	1.07	0.65	,	1.38		0.117	0.133
Total hardness as Caco,	8	7		180	192	208	151	,		0.65	1.01	0.25
Boron (0.01)	ND	0.1	14	22	9	16	7	,	210	151	190	20
Aluminum (0.05)	0.01	0.28	, NO	ND	NO	ND	ND	,		,	12	5.7
Arsenic (0.005)	NO.	ND	ND	ND	NO	ND	ND		0.1	ND	0.023	0.034
Barium (0.03)			0.008	NO	ND	ND	ND		0.28	ON	0.09	0.094
Cadmium (0.002)	0.04	ND	. ND	ND	ND	ND	ND.	,	0.008	ND	0.0054	0.0011
Chromium (0.01)	ND	ND	ND	ND	.003	.003	ND	/	0.04	ND	0.0314	0.0038
Copper (0.01)	ND	ND	ND	ND	ND	ND	ND		0.003	ND	6.0023	0.0005
Iron, Total (0.01)	ND	ND	ND	ND	.01	ND	0.02	,		ND	0.01	
Lead (0.01)	0.06	0.03	0.03	0.17	.07	0.04	0.06	,	0.02	ND	0.0114	0.0038
	ND	ND	ND	NO	ND	ND	ND	7	0.17	0.03	0.066	0.049
Manyanese (0.01)	0.02	0.02	CIA	ND	ND	ND		1		ND	0.01	
Mercury (0.0005)	ND	ND	ND	ND	ND	ND	ND	7	0.02	ND	0.013	0.005
Nickel (0.02)	ND	ND	ND	ND	ND	ND	ND	7		ND	0.0005	
Selerium (0.005)	ND	NO	ND	ND	ND	The state of the s	ND	7		ND	0.02	
Zinc (0.005)	0.01	0.24	0.12	0.01	.012	ND	· ND	7		ND	0.005	
Molytxderum (0.05)	ND			ND		.021	0.004	6	0.24	0.01	0.069	0.000
Uranium, U <sub>3</sub> O <sub>8</sub> , (0.001) Vanadium, V <sub>2</sub> O <sub>5</sub> , (0.05)	0.003	0.022	0.004	0.002	0.007	ND	ND	7		ND.	0.05	0.094
Vanadium, V <sub>2</sub> O <sub>5</sub> , (0.05)	NO			NO.		0.041	0.001	7	0.041	0.001	0.05	0.0145
Radium 226; PiC/L (0.5)	0.3			1.3	NO	ND	ND	7		ND		0.0149
Radium, Precision, PiC/L	10.2		10.7	±0.7	1.1	3.1	1.3	6	13		0.05	
			10.7	10.7	±0.6	±1.0	±0.5		13	0.56	3.39	4.78

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.11

Baseline Water Quality Data for Well 1 - W - 51 - 51-Sand (Revised 7/6/81)

DATE SAMPLED	6/12/80	7/18/80	10/2/80	1/22/81*	5/13/81	No. of Samples	Maximum Observed	Minimum Observed	Mean	Standard Deviation (a)
Temperature, <sup>O</sup> C. Field	12.5	14	11.0	11						
pH Units Field	8.5	8.2			11	5	14	11	17.9 8.28	1.3
ph Units Lab at 25°C	8.33		8.2 7.78	8.3	8.2	5	8,5	8,2	8.28	0.13
Conductivity when Chald Ambient	395	8.57 420		8.01	8.29	5	8,57	7.78	8.20	0.31
Conductivity umhos, Field-Ambient			443	360	360	5		360	396	37
Conductivity umhos. Lab at 25°C	410	467	500	513	385	5	513	385	455	56
IDS, Evaporation at 180°C	286	283	261	268	298	5	298	261	279	15
Sodium	108	110	90	96	107	5	110	90	102	
Potassium	4	4	3	3	3	5	4	3	3.4	0
Calcium	6	4	7	7		5	7	4	5.6	1.
Magnes i um	3	1	3	3	3	5	3	1	2.6	0.9
Sulfate	15	21	46	18	17	5	46	15	23.4	12.8
Chloride	10	10	6	. 5	7	5	10	5	7.6	2.3
Carbonate	31	22		0	20	4	31	Ö	18.3	13.1
Bicarbonate	228	224	212	266	240	5	266	212	234	21
Hydroxide										
Total Milliequivalent Major Cations	5.35	5.17	4.59	4.86	5.18					
Total Milliequivalent Major Anions	5.36	5.12	4.60	4.87	5.15					
Absolute Value, Charged Balance	0.09	0.49	0.16	0.10	0.29					
Ammonia as N	ND	0.13	ND	ND	ND ND			NO.		
Nitrate as N (0.05)	ND	0.5	ND	ND	ND	,	00.3	ND ND	0.07	0.04
Flouride (0.1)	0.36	0.75	1.68	1.24	0.65	,	1,68		0.14	0.20
Total Alkalinity as CaCO3	239	220	174	218	230	5		0.36	0.94	0.52
Total Hardness as CaCO3	28	15	30	30	222	5	239		216	25
Boron (0.01)	ND	ND	ND	ND	ND ND	5	30	15	25	6.5
Aluminum (0.05)	0.12	ND	ND	ND	ND	5		ND	0.01	
Arsenic (0.005)	ND	0.006	0.004	ND	ND ND	5	0.12	ND	0.064	0.031
Barium (0.03)	ND	ND	ND	ND	ND		0.006	ND	0.0053	0.0005
Cadmium (0.002)	ND	ND	ND	0.002	ND	5		ND	0.03	
Chromium (0.01)	ND	ND	ND	ND ND	ND ND	5	0,002	ND	0.002	
Copper (0.01)	0.01	ND	ND	ND		6		ND	0.01	
Iron, Total (0.01)	ND ND	0.01	0.08	0.03	ND	5	0.01	ND	0.01	
Lead (0.01)	ND	ND	ND	ND ND	0.09	5	0.09	NC NC	0.044	0.039
Magnese (0.01)	0.01	ND	0.02		ND	5		HD	0.01	
Mercury (0.0005)	ND	ND	ND	0.02	0.02	5	0.02	ND	0.016	0.0055
Nickel (0.02)	ND	ND	ND	ND	ND	5		ND	0.0005	
Selenium (0.005)	, ND	ND ND	ND	ND	ND	5		ND	0.02	
Zinc (0.005)	0.66	0.12		ND	ND	5		ND	0.005	
			0.01	.034	0.008	5	0.66	0.008	0.166	0.280
Molybdenum (0.05)	ND	ND	ND	ND	ND	5		ND	0.05	
Uranium, U308 (0.001)	0	0.003	0.002	< 0.001	0.002	4	0.003	<0.001	0.002	0.0008
Vanadium, V205 (0.05)	ND	ND	ND	ND	ND	5		ND	0.05	
Radium 226 PiC/L (0.5)	1.0	0.8	1.5	6.4	2.6	5	6.4	0.8	2.46	2.31
Radium, Precision, PIC/L	±0.6	±0.5	±0.7	11.5	10.6					

<sup>( )</sup> detection limit.

ND - not detected

WELL	1-M-51	
DATE SAMPLED	5/13/81	
Temperature, <sup>O</sup> C, Field	13.5	
oH, Units Field	8.3	
oH, Units, Lab at 25°C	8.25	
Conductivity, umhos, Field-Ambjent	450	
Conductivity, umhos, Lab at 25°C	472	
TDS, Evaporation at 180°C	394	
Sodium	139	
otassium		
Calcium	4 7 2 56	
Magnesium	2	
Sulfate	56	
Chloride	9	
Carbonate	14	
Bicarbonate	290	
lydroxide		
Total Milliequivalent Major Cations	6,66	
otal Milliequivalent Major Anions	6.64	
Absolute Value, Charged, Balance	0.15	
Ammonia as N	ND	
Vitrate as N (0.05)	ND	
Tuoride (0.1)	0.65	
Total Alkalinity as CaCO <sub>3</sub>	261	
Total Hardness as CaCO <sub>3</sub>	26	
Boron (0.01)	ND	
Aluminum (0.05)	ND	
rsenic (0.005)	ND	
arium (0.03)	ND	
Cadmium (0.002)	ND	
Chromium (0.01)	ND	
opper (0.01)	ND	
ron, Total (0.01)	.05	
ead (0.01)	ND	
langanese (0.01)	.02	
Mercury (0.0005)	ND	
licke1 (0.02)	ND	
Gelenium (0.005)	ND	
linc (0.005)	.010	
10lybdenum (0.05)	ND	
Jranium, U.O., (0.001)	<.001	
/anadium. V <sub>0</sub> 08. (0.05)	ND	
Jranium, U <sub>3</sub> 0 <sub>8</sub> , (0.001) Vanadium, V <sub>3</sub> 0 <sub>5</sub> , (0.05) Radium 226, PiC/L (0.5)	3.8	
Radium, Precision, PiC/L	±0.9	

Analyses reported in milligrams per liter except where noted.

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.12
Baseline Water Quality Data for Well 1-M-10 - 10-Sand (Revised 7/6/81)

DATE SAMPLED	2/11/80	6/12/80	7/24/80	10/31/80	12/17/81	1/22/81	5/8/81	No. of	Max1mum Oh	Minimum		Standard
Temperature, °C, Field	. 7.5	13.0	13	13.4	12.6	10		3cmb les	Observed	Observed	s Mean	Deviatio
pH, Units Field	8.10	8.6	7.6	8.8	9.0	8.6	10	7	13.4	7.5	11.4	2.2
pH, Units, Lab at 25°C	8.61	8.31	8.62	8.12	8.3	8.14	8.7	7	9.0	7.6	8.5	0.5
Conductivity, unhos, Field-Ambient	330	405	400		390	320	8.53	7	8.62	8.12	8.38	0.2
Conductivity, unhos, Lab at 25°C	415	464	457	477	465	487	400	6	405	320	374	39
TDG, Evaporation at 180°C	319	305	. 278	297	278	276	509	7	509	415	468	29
Sodium	117	100	102	98	104	98	311	7	319	276	295	18
Potassium	5	5	5	3	104	90	117	7	117	98	105	10
Calcium	. 5	2	6		;	3	3	1	5	3	4	
Magnesium	2		i			6	6	7	7	3	5.4	
Sulfate	12	27	26	30	27	2	2	,	á			1.6
Chloride	10		8	10	27	32	33	,	33	12	3.0	2.8
Carbonate .	39	29	31	10		4	6	,	10	12	27	,
Bicarbonate	244	198	195	244	53	0	31		53	20		2.8
Hydroxide		150	195	268	161	240	232	7	268	161	36.6 220	9.9
Total Milliequivalent Major Cations	5.63	4.91	4.95	5.38	5.05							3/
Total Milliequivalent Major Anions	5.83	5.01	5.00	5.30	5.04	4.80	5.63					
Absolute Value, Charged Balance	1.75	1.01	0.50	0.73	0.10	0.84	5.69					
Ammonia as N	0.33	0.22	0.24	ND	ND ND		0.53					
Nitrate as N (0.05)	0.10	ND	0.3	ND	ND ND	0.12	ND ND	7	0.33	ND.	0.151	
Fluoride (0.1)	0.79	0.45	0.65	1.07		ND	ND	7	0.3	ND	0.093	0.113
Total Alkalinity as CaCO,	265	211	212	220	0.61	0.99	0.45	7	1.07	0.45	0.72	0.093
Total Hardness as CaCO,	20	22	19	52	220	197	242	1	265	197	224	0.25
Boron (0.01)	ND	NO	ND		21	23	23	7	52	19	26	23
Aluminum (0.05)	0.01	(.31	· ND	2.00	ND	ND	· ND	,		ND		12
Arsenic (0.005)	ND.	0.006			0.06	NO	0.07		0.31		0.01	
Barium (0.03'	0.04	NO.	ND		ND	ND	ND	ž	0.006	ND ND	0.093	0.104
Cadmium (0.002)			ND		ND	ND	ND	2	0.04	-	0.0052	0.0004
Chromium (0.01)	ND	0.633			.003	J.002	ND	,	0.003	MD	0.031	0.0038
Opper (0.01)	ND	ND			ND	ND	ND	;		ND	0.0023	0.0005
	. ND	0.02			.01	ND	0.01		0.02	ND	0.02	
Iron, Total (0.01) Lead (0.01)	0.14	0.05			.27	0.05	0.08	,	0.27	ND O OO	0.013	0.005
	. NO				ND	ND	ND	,		0.02	0.091	0.088
Manganese (0.01)	0.06	0.01			.02	0.02	0.02	,	0.06	ND	0.01	
Mercury (0.0005)	ND	NO			ND	ND	ND	,		ND	0.023	0.017
Nickel (0.02)	ND				GN	ND	ND	,		ND	0.0005	
Selenium (0.005)	ND				ND	ND	ND		0.005	ND	0.02	
Zinc (0.005)	0.01				.035	.035	ND	,		ND	0.005	
Molytxlerum (0.05)	ND				ND	ND	NO	5	0.33	ND	0.074	0.115
Uranium, U.O., (0.001)	0.007				0.005	0.002	0.001			ND	0.05	
Varsadium, V <sub>2</sub> O <sub>5</sub> , (0.05) Radium 226, PiC/L (0.5)	NO				ND	ND	ND	,	0.008	0.001	0.0041	0.0026
Madium 226, Pic/L (0.5)	0.3				3.4	1.4	3.6	,		ND	0.05	
Radium, Precision, PiC/L	±0.2	10.6	10.2	10.8	11	±0.7	10.7	6	3.3	0.95	2.51	1.27

<sup>( )</sup> detection limit.

NO - not detected.

Table D-6.13, p.1

Baseline Water Quality Data For Stock Wells

(Revised 7/6/81)

WELL		Moor	e S.					No. of	Maximum	Minimum		Standard
DATE SAPLED	2/12/80	6/12/80	7/18/80	10/31/80	12/15/80	1/19/81	5/13/81	Samples	Observed	Observed	bserved l'ean	(a)
Temperature, <sup>O</sup> C, Field	7	13.5	13.5	13.5	13.5	13	14	!	14 8.6	7.9	12.6	2.5
pH, Onits Field	8.6	8.4	8.0	7.9	8.6	8.4	8.0			7.79	8.01	0.16
pH, Units, Lab at 25°C	8.21	7.79	8.02		7.89	7.97	8.18		8.21	420	441	25
Conductivity, unhos, Field-Ambient	420	445	480			440	420	,	480 592	453	520	56
Conductivity, unhos, Lab at 25°C	470	481	590	518	535	592	453	,		299	339	22
TIS, Evaporation at 180°C	336	335	363	299	327	359	351	1	363			
Sodium	112	113	111	98	107	120	119	1	120	98	111	7.5
Potassium	3	4	5	3	4	3	3	,		3	8.0	1.5
Calcius	8	6	10	8	9	9	6	1	10	0	2.43	0.8
Magnesium	2	4	2	2	3	2	2		123	78	107	14
Sulfate	105	108	110	78	105	123	115	1		/6	6.9	'3
Chloride	10	8	10	8	5	6	1	!	10	0	1.25	2.5
Carbonate	5				0	0	0		•			
Bicarbonate	185	190	183	185	190	.193	198	7	198	183	189	5.3
Hydroxide												
Total Milliequivalent Major Cations	5.51	5.65	5.62	4.90	5.45	5.91	5.72					
Total Milliequivalent Major Anions	5.66	5.60	5.57	4.88	5.44	5.90	5.67					
Absolute Value, Charged Balance	1.34	0.44	0.45	0.22	0.09	0.08	0.44					0.000
Amonia as N	0.31	ND	ND	ND	ND	ND	ND	7	0.31	ND	0.087	0.098
Nitrate as N (0.05)	ND.	100000	_1.2	ND	ND	ND	ND	6		ND	0.05	
Fivoride (0.1)	0.74	1.38	0.40	0.65	0.51	0.74	0.33	7	1.38	0.33	0.68	0.35
Total Alkalinity as CaCO3	160	156	150	152	156	158	162	7	162	150	156	
Total Hardness as Caco	28	32	. 33	28	35	30	23	7	35	23	29.9	4
Boron (0.01)	0.02	0.1	ND	ND	ND	CM	ND	7	0.1	ND	0.024	0.034
Aluminum (0.05)	ND	0.22	ND	ND	ND	ND	ND	7	0.22	ND	0.074	0.064
Arsenic (0.005)	0.020	0.036	0.024	0.016	.027	0.02	0.034	7	0.036	0.016	0.025	0.0075
Barium (0.03)	ND	ND	ND		NO	ND	ND	7		ND	0.03	
Cad-11m (0.002)	ND	The second	0.005		ND	0.005	ND	7	0.005	ND	0.0034	0.0015
	ND		ND		ND	ND	ND	7		ND	0.02	
Chronium (0.01)	ND.				NO	0.01	0.04	7	0.09	ND	0.027	0.030
Corer (0.01)	0.14	0.11			.09	0.23	0.18	7	0.23	0.09	0.141	0.0485
Iron, Total (0.01)	ND.14				ND	ND	ND	6		HD	0.01	
Lead (0.01)	0.06		0.03		.03	0.03	0.04	7	0.06	0.02	0.033	0.014
Nanganese (0.01)	ND.				NO	ND	ND	1.		NO	0.0005	
Mercury (0.0005)	ND				ND	ND	ND	7		ND	0.02	
Nickel (0.02)	. NEO	2.00			ND	ND	• ND	7		N)	0.005	
Selenium (0.005)	0.07	The second second			.012	0.026	0.007	7	0.43	0.007	0.099	
Zinc (0.005)	0.07 NO				ND	ND	ND	7		ND	0.05	
Molytdenum (0.05)	0.004				<0.001	<0.001	<0.001	7	0.016	<0.001	0.0053	
-Uranium, U30g, (0.001)	U. 004		C		ND	ND .	ND	7		HD	0.05	
Vanadium, 0205, (0.05)	3.7				1.2	0.8	4.0	7	4	0.5	1.00	1.3
Radius 226, PiC/L (0.5) Radius, Precision, PiC/L	.0.				1.6	+0.5	±0.9					

The underlined data are considered as outliers and are not included in the calculations.

<sup>( )</sup> Autoction limit.

ND - not detected.

TABLE D-6.]3, p.2
Baseline Water Quality Data For
Stock Wells
(Revised 7/6/81)

METT			Moore N.										Standard
DATE SAMPLED	2/12/80	6/12/80	7/16/80	10/2/80	12/15/81	12/15/80	1/19/81	5/11/81	No. of Samples	Maximum Observed	Minimum Observed	Mean	Deviation (o)
Emperature, °C, Field	7	14	16		13	10.6	10	12	7	16	7	11.8	2.9
H, Units Field	8.8	8.3	8.3		8.0	8.7	8.3	8.4	7	8.8	8.0	8.4	0.3
H, Units, Lab at 25°C	8.24	7.24	7.82	7.99	7.88	7.91	7.91	8.18	8	8.24	7.24	7.90	0.30
Conductivity, whos, Field-Ambient	380	445	500				400	410	5	500	380	427	47
Conductivity, umhos, Lab at 25°C	460	451	469	500	500	512	539	555	8	555	451	498	37
IDS, Evaporation at 180°C	320	316	310	284	287	293	320	330	8	330	284	308	17
Sodium	113	109	105	97	97	102	112	107	8	113	97	105	6
Potassium	4	4	6	3	3	4	2	3	8	6	2	3.6	1.2
Calcium	5	5	9	7	6	6	7	6		9		6.4	1.3
Magnesium	2	2	2	2	4	i	1	i	8		i	1.9	0.99
Sulfate	77	79	70	58	71	68	80	69	8	80	58	72	7.2
Chloride	10	10	10	8		6	6	7	8	10	-6	8.0	1.8
Cartonate	10					0	0	ó	4	10	0	2.5	5.0
Bicarbonate Hydroxide	195	212		207	202	203	212	215	i	215	195	207	7.0
Total Milliequivalent Major Cations	5.43		5.33	4.81	4.92	4.92	5.35	5.11					
Total Milliequivalent Major Anions	5.41	5.40		4.83	4.99	4.91	5.31	5.17					
Absolute Value, Charged, Balance	0.18	1.41		0.17	0.63	0.1	0.38	0.58					
Ammonia as N	ND	ND	0.18	ND	ND	ND	ND	ND	8	0.18	ND	0.066	0.046
Nitrate as N (0.05)	0.06			. ND	ND	ND	ND	ND	8		ND	0.051	0.004
Fluoride (0.1)	0.65			0.65	0.74	0.61	0.85	0.45	8	0.06	0145	0.73	0.29
Total Alkalinity as CaCO	177			170	166	166	174	180	8	180	166	173	5
Total Hardness as CaCO, 3	20			. 26	31	19	21	19	8	31	19	23.5	5.1
Boron (0.01)	0.02			. ND	NO	ND	ND	ND	8	0.02	ND	0.011	0.0035
Aluminum (0.05)	0.01			ND	, ND	ND	ND	ND	7	0.21	ND	0.073	0.061
Arsenic (0.005)	0.002	0.006		0.004	0.004	ND	ND	ND	5	0.008	ND	0.0058	0.0013
Barium (0.03)	NO	5		ND	ND	ND	. ND	ND	8		ND	0.03	-
Cadmium (0.002)	NI.			0.003	ND	.002	ND	ND	8	0.003	ND	0.0021	0.0004
Chromium (0.01)	N				ND	ND	ND	ND	8		ND	0.02	
Copper (0.01)	N				ND	ND	, ND	ND	8	0.02	ND	0.011	0.0035
Iron, Total (0.01)	0.20				0.11	.06	0.09	0.32	8	0.32	0.05	0.136	0.089
Lead (0.01)	**					ND	ND	ND	8	0.12	ND	0.024	0.039
Manganese (0.01)	0.1				0.02	.02	0.03	0.02	8	0.17	ND	0.041	0.053
Mercury (0.0005)	M					ND	ND	ND	8		ND	0.0005	0.000
Nickel (0.02)	N					NO	ND	ND	8		ND	0.02	
Selenium (0.005)	N					, NO	ND	ND	7		ND	0.005	
Zinc (0.005)	0.0					.013	.017	0.006	8	0.06	0.006	0.0345	0.0226
Molybdenum (0.05)		D N				, ND	ND	ND	8		ND.	0.05	
Uranium, U <sub>3</sub> O <sub>0</sub> , (0.001)	0.00		0.01			0.058	0.004	<0.001	7	0.058	ND	0.013	0.021
Vanadium, V.O., (0.05)	N					ND	ND	ND	A	-	ND	0.013	0.021
Radium 226, PIC/L (0.5)	1.					0.9	1.3	1.9	8	1.9	0.5	1.16	0.44
Radium, Precision, PiC/L	10.	3 t0.	7 t0.	10.6	10.4	±0.5	±0.7	±0.5			0.5	1.10	0.44

<sup>( )</sup> detection limit.

<sup>1</sup>D - not detected.

#### E. First Part

What is your quality assurance program, including that of any outside lab used, regarding water quality sampling and analyses?

# Response:

a. Quality Assurance Programs will be maintained by the Radiation Safety Officer of UUS, who is reporting directly to the Manager Solution Mining. All QA programs will be conducted according to the Regulation Guide 4.15. Standard QA procedures will be maintained through the operational plan.

# Laboratory

Outside labs will be contracted based upon their response to requirements of 4.15. All labs will be required to file QA documents with UUS prior to contract finalization.

In-house labs will be placed under the same QA requirements with audits, inspections, etc. as the outside labs, again following the 4.15 requirements.

All lab work will be performed using Standard Methods as required by EPA and the Clean Water.Act. Certifications and qualifications will be on file with UUS as part of the QA program. All labs will be audited through spike samples, split samples and inspections to assure quality control of data.

# E. Second Part

We note that for <u>all</u> samples split on January 21, 1981, measurable amounts of zinc were reported by NAMCO and in <u>no</u> cases did PAL report detectable amounts. In some instances PAL reports concentrations (of other elements) <u>below</u> their own published detection limits.

# Response:

As to the problem of the 21 January 1981 split samples, PAL laboratory were not satisfactory. They will not be used in the future.

F. On page D-6.19 you state "baseline groundwater quality will be defined just before start-up on the basis of average concentrations, their standard deviations and maximum and minimum values".

Please explain the exact procedure you propose for this determination.

# Response:

UUS does not propose, at this time, a procedure for baseline determination. Results of future analysis will be added to the tables until operation start-up. Data and the calculations of average concentrations, maximum and minimum values, and standard deviations made after the inclusion of the final sample prior to start-up, will then be used as criteria for baseline definition.

G. On page D-6.17 you state "elements that cannot be detected in four consecutive samples from the same well will be removed from the list of analyses required for that particular well unless a particular element should be mobilized in the leaching zone during the proposed test". Because we would require an analysis for the full suite of parameters only on a quarterly basis during leaching operations we would not permit elimination of such elements from the required list. Only the excursion parameters are required biweekly during leaching.

# Response:

Analysis for all baseline parameters will be made and reported on a quarterly basis. The excursion parameters will be sampled, analyzed and reported biweekly.

H. What are you proposing as the upper control limit for vanadium considering the fact it is listed as "not detected" in all baseline samples?

Response:

New Tables M-5 and M-6 are submitted giving an Upper Control Limit for vanadium.

Table M-5

Upper Control Limits Excursion Monitoring For Well 1-M-20 - Production Zone

	Baseline	Baseline	Baseline Std	Plus
	Mean	Maximum	Deviation (σ)	2 o
pH - Lab at 25°C	8.23	8.65	0.24	7.75-8.71
Conductivity, umhos Lab at 25°C	505	552	30.3	565.6
Total Alkalinity as CaCO <sub>3</sub> mg/l Uranium mg/l**	154	168	10	174
	0.003	0.011	0.0037	1*
Vanadium mg/l**	ND	ND	3.4	0.10
Chloride	7.9	14		14.7

Upper Control Limits Excursion Monitoring For Well 4-M-20 - Production Zone

Baseline Mean	Baseline Maximum	Baseline Std. Deviation ( $\sigma$ )	Plus 2 o
8.65	9.25	0.36	7.93-9.37
519	566	44	607
149	158	10.2	169.4
0.0113	0.028	0.0104	×
ND	ND	-	0.10
7.5	13	3.8	15.1
	Mean 8.65 519 149 0.0113 ND	Mean Maximum  8.65 9.25  519 566  149 158  0.0113 0.028  ND ND	Mean         Maximum         Deviation (σ)           8.65         9.25         0.36           519         566         44           149         158         10.2           0.0113         0.028         0.0104           ND         ND         -

Upper Control Limits Excursion Monitoring For Well 5-M-20 - Production Zone

Baseline Mean	Baseline Maximum	Baseline Std. Deviation (σ)	Plus 2 o
7.98	8.32	0.18	7.62-8.34
547	636	57	661
156 0.0095	165 0.045	0.0174	168
ND 5.8	ND 10	2.5	0.10
	7.98 547 156 0.0095 ND	Mean Maximum  7.98 8.32  547 636  156 165  0.0095 0.045 ND ND	Mean         Maximum         Deviation (σ)           7.98         8.32         0.18           547         636         57           156         165         6           0.0095         0.045         0.0174           ND         ND         -

<sup>\*</sup> Upper Control Limit for  $\rm U_3O_8$  suggested by DEQ. \*\*Uranium as  $\rm U_3O_8$ 

Mean

Mean

Vanadium as  $V_2O_5$ 

Table M-6

Upper Control Limits Excursion Monitoring For Well 1-M-10 - Lower Aquifer

				Manage
	Baseline Mean	Baseline Maximum	Baseline Std. Deviation $(\sigma)$	Mean Plus 2 g
pH - Lab at 25°C	8.38	8.62	0.2	7.98-8.78
Conductivity, µmhos Lab at 25°C	468	509	29	526
Total Alkalinity as CaCO <sub>3</sub> mg/l	224	265	23	270
Uranium mg/l** Vanadium mg/l**	0.0041 ND	0.008 ND	0.0026	0.10
Chloride	7	10	2.8	12.6

Upper Control Limits Excursion Monitoring For Well 1-M-30 - Upper Aquifer

Baseline Mean	Baseline Maximum	Baseline Std. Deviation $(\sigma)$	Plus 2 o
9.34	9.60	0.26	8.82-9.86
559	658	69	697
190 0.0114 ND 12.4	210 0.041 ND 18	0.0149 - 3.5	230 1* 0.10 19.4

Upper Control Limits Excursion Monitoring For Well 1-W-51 - Domestic Water Supply

Baseline Mean	Baseline Maximum	Baseline Std. Deviation $(\sigma)$	Plus 2 o
8.20	8.57	0.31	7.58-8.82
455	513	56	567
216 0.002	239 0.003	25 0.0008	266 1*
ND 7.6	ND 10.0	2.3	0.10
	Mean 8.20 455 216 0.002 ND	Mean         Maximum           8.20         8.57           455         513           216         239           0.002         0.003           ND         ND	Mean         Maximum         Deviation (σ)           8.20         8.57         0.31           455         513         56           216         239         25           0.002         0.003         0.0008           ND         ND         -

<sup>\*</sup> Upper Control Limit for  $\rm U_3O_8$  suggested by DEQ. \*\* Uranium as  $\rm U_3O_8$ 

Vanadium as V205

pH - Lab at 25°C

Chloride

Conductivity, µmhos Lab at 25 Total Alkalinity as CaCO<sub>3</sub> mg/1 Uranium mg/1\*\* Vanadium mg/1\*\*

I. How will use of an  $NH_4HCO_3$  eluant instead of  $NaC1/Na_2CO_3$  affect the choice of Cl as an excursion parameter?

# Response:

Uranerz U.S.A., Inc. will test both  $NaC1/Na_2CO_3$  and  $NH_4CO_3$  as eluants during the pilot plant operation.  $NaC1/Na_2CO_3$  will be used first. While this is used as the eluant, Cl is an appropriate excursion parameter.

NRC Comment 5 (6/16/81)

J. Referring to p. M-27, what do you propose as a course of action if the two analyses (split sample) obtained as excursion confirmation samples differ markedly?

# Response:

If the two analyses of a split sample differ markedly, the following procedure would be followed.

- Any unusual result would be compared to previous data to determine its potential as an outlier.
- The sample would be rerun by UUS lab and the outside lab to determine if the results were caused by a procedural error.
- Following the procedure, described on page M-27, a second control sample will be taken three days after an excursion is suspected.

K. It is not clear what water quality parameters you propose to measure during an excursion.

Response:

The water quality parameters to be measured during an excursion are listed on Tables M-5 and M-6. Upper control limits for  $HCO_3$  and  $CO_3$  will be added prior to start-up. The parameters were proposed by WDEQ.

NRC Comment 5 (6/16/81)

L. Referring to pages M-28, M-29 regarding corrective action, it is not clear what the proposed sampling schedule is after the first 2 weeks of an excursion.

Response: Add the following to paragraph 1, Page M-29.

Weekly sampling of the monitor well in excursion status, and of all other monitor wells, with analysis for all UCL parameters, will be done continuously after the first two weeks. This will continue until recovery from excursion has been achieved and maintained for a continuous period of at least one month.

M. Referring to paragraphs No. 3 and 4 on p. M-29, what is meant by a "substantial decrease" in concentration?

Response:

A 50%, or more, decrease in concentration.

Referring to your statement on page M-26, "The leak detection system will be checked daily for leakage solution during initial filling of a pond. The time intervals will later be extended to two weeks", we require leak detection systems to be checked on a daily basis.

Response:

Paragraph 2, page M-26, first sentence is revised to read:

The leak detection system will be checked daily for leakage solutions, as part of the daily walk through by the RST.

NRC Comments 7.A through 7.I (6/16/81)

Due to the complexity of and detail required to respond to Comment 7, all parts, the responses are submitted as a supplement to follow page D-6.15.

The following questions refer to hydrologic test No. 9.

A. What "borehole damage" exists in wells 5L and 6L as noted on the graphs? No mention of this exists in the text. Were or are repair measures necessary?

### Response:

Bore hole damage is caused when drilling mud or cement invade the producing formation, thus causing reduced permeability in the immediate vicinity of the completed interval. No repair measures are necessary.

B. The M-20 wells have different completion intervals than pumped well 4L. Were the data corrected for the effects or partial penetration? If not, provide justification. The subject is not addressed in the text.

#### Response:

Transmissivities appear slightly lower in the center of the proposed test area than in the outlying monitor wells. This may be due to the partial penetration of the pumped well and of those observation wells that are labeled "L". The "L" wells are located within a radius of 110 ft. of the pumped well which is twice the thickness (55 ft.) of the aguifer. Within this area vertical flow components will theoretically influence the observed drawdown readings during pump tests. The sedimentary environment in roll front aquifers is, however, so varied that differences in transmissivity have to be expected. The variations in Table D-6.5 may be an account of the varying transmissivity through the roll front. The differences, however, are small enough to be explained as well by errors that are inherent in the pumping test methods. Correcting for possible partial penetration effects would not increase the accuracy of the results. The range of transmissivity values given in Table D-6.5 describes the transmissivity at the test site in general. It is not practical to assign transmissivity values to any particular volume of the aquifer smaller than the test site.

NRC Comments 7.C, 7.E and 7.I (6/16/81)

- C. There are inconsistencies in the text regarding the log-log plot for well 4L.
  - \* p. D-6.10: The heterogeneous nature of the transmissivity can also be considered responsible for the abnormal shape of the drawdown curve of the pumped well 4L in hydro test No. 9.
  - \* p. D-6.10: The most plausible explanation for the curves shape is a change in transmissivity at a certain distance from the pumped well.
  - \* p. D-6.10: As there are not such deformities (re: obs. well curves) the conclusions can be made that there are no hydraulic boundaries within the area between the monitor wells.
  - \* p. D-6.14: 4L: The early flattening out of the drawdown curve is due to a slightly falling flow rate at the time (200-930-min). The flowrate was then readjusted.
  - \* During our site visit Mr. Froehlich stated that the declining flow rate was a deliberate measure taken to keep the water level above the level of the pump.

The following apply to part C, above.

- cl: The text needs clarification on the above items.
- c2: Why wasn't the test initially run at a lower Q to eliminate drawdown problems at the pump well?
- c3: Was the drawdown data corrected for a variable Q? If not, this should be done.

- E. On page D-6.10 and again on D-6.15 it states there were no pressure changes in the upper and lower aquifers. Data provided indicated a .5 psi reduction in the lower aquifer and a .2 psi reduction in the upper aquifer. In addition, the drawdown curve for well 4-M-20 shows a treak from the Theis curve of a nature often indicative of leakage. Provide a detailed explanation of this observation.
- Based on all parts of question 7, justify the validity of hydrologic test No. 9.

Response: 7.C, 7.E, and 7.I:

Long term pump tests like test No. 9 in this context are conducted to provide evidence on two possible hydraulic situations that would impair a solution mining project:

- A. Hydraulic boundaries
- B. Leaky aquifer conditions.

Hydraulic boundaries can be negative like tight faults or bedrock contacts. This condition would be observed as increased slopes in all drawdown curves. There is no indication of this in all the pump test data.

A positive boundary would be an area of recharge to the pumped aquifer which would be observed as a decline of the slope in all drawdown curves. Such decline has been observed in only one well (4L). Other reasons for declining slopes of drawdown curves are:

- improving hydraulics in the pumped well.
- changing transmissivity in the distance.
- declining flow rates.

These factors are extremely difficult to be quantified exactly. The need to do so would only be justified if there were doubts about the confinement of the target aquifer in an area within the monitored leaching zone. Complete confinement of the leaching zone is assured by the pumping test results as the upper and lower monitor wells did not react to the pumping of the target aquifer. The small pressure reduction in both 1-M-30 and 1-M-10 at a late point of time during test No. 9 can be explained by various other factors:

- a change in barometric pressure.
- elastic reactions to pressure changes in the 20-sand which is sancwiched between the 10- and 30- sands (Noorbergum Effect\*).

Otherwise the pressure changes are small enough to be explained by reading error:

Observation Well No.	Pressure Gauge	Marked Intervals	Readings				
1-M-10	0-60 psi	2 psi	25.5 - 25.0 psi				
1-M-30	0-15 psi	0.5 psi	8.0 - 7.8 psi				
(1 psi = 0.0703)	kp/cm <sup>2</sup> )						

If in fact the observed pressure changes were caused by a hydraulic connection between the aquifers, this connection would be outside of the monitored area of the 20-sand aquifer as the pressure changes were observed at a time when the radius of influence from the pumped well had already reached far beyond the outling monitor wells (M-20 wells). The drawdown curve 4-M-20 is considered a good approximation of the Theis-Curve within the limits of accuracy of the method.

<sup>\*</sup>Verruigt, A. 1969, Elastic Storage of Aquifers, in: Flow through Porous Media; R. DeWeist, Ed.: Acad. Press, NY, pp. 331-376.

During test No. 9 the pumping rate was held as constant as possible under field conditions in order to facilitate test interpretation. The average flow rate was 10.91 gpm  $(0.69\ 10^{-3}\ m^3\ sec^{-1})$  over a period of 2130 minutes. During that time the extremes were +1.51 gpm  $(0.063\ 10^{-3}\ m^3\ sec^{-1})(13.8\%)$  and  $-0.24\ gpm\ (0.015\ 10^{-3}\ m^3\ sec^{-1})(2.2\%)$ . This accuracy is considered adequate for this purpose. Drawdown data from the pumped well were not included into the average calculations of transmissivity and storage coefficient for this and other reasons stated above. Drawdown observations in the other wells are not affected by the slight variations in the pumping rate.

D. Why wasn't recovery data used in the analysis of test No. 9? This data should be analyzed.

#### Response:

Recovery data from test No. 9 was analyzed (see attached Graph 4L) but was not considered relevant.

NRC Comments 7 (6/16/81)

F. Why wasn't recovery data obtained for the upper and lower aquifers?

# Response:

During test No.9, water pressures in the upper and lower aquifers remained at  $\pm 2\%$  of the readings they had shown for weeks before the test and were therefore not measured during the recovery phase of the test.

NRC Comments 7 (6/16/81)

G. Why weren't water levels (or pressures) taken prior to starting of the pump test and taken into account during analysis?

# Response:

The O-minute readings of water pressures of each well were taken before start-up of the pumping tests. They are not included on the graph sheets as no attempt was made to quantify the casing capacity and skin effects which become negligible in the later parts of the curves.

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NRC Comments 7 (7/16/81)

H. Why weren't barometric data obtained prior to and during the test and taken into account during analysis?

# Response:

Barometric variations may reach extremes of 25 inches (0.635 m) of water or less than 1 psi  $(0.0703 \text{ kp/cm}^2)$ . No extreme weather situations were observed during test No. S. Any possible effects on the observed drawdown curves would have negligible extent.

Referring to figure M-7A, Fluid Flow Path, why are negative values assigned to injection wells and positive values to production wells relating to relative water level differences.

# Response:

Head pressures are given in feet drawdown. Injection pressures are therefore negative drawdown.

Submit additional information re arding the nature of the fluid flow model.

#### Response:

The computer model that was used for Figure M-7A was developed by the U.S. Bureau of Mines for the purpose of simulating uranium solution mining. Following is an abseract of their Report of Investigation No. 8479\* describing the model:

This Bureau of Mines report describes the development and application of a computer model for simulating the hydrological activity associated with in situ leaching. The model is intended to provide uranium resource developers with a description of the flow behavior of leachants and ground water during the development, production, and restoration phases of leaching operation involving an arbitrary pattern of injection and recovery wells.

Different aquifer environments are modeled, using a closedform solution to the partial differential equation that describes three-dimensional changes in piezometric head as a result of pumping from leachant injection and recovery wells. The computer program can model a maximum of 50 arbitrarily located wells.

<sup>\*</sup>Computer Modeling of Fluid Flow During Production and Environmental Restoration Phases of In Situ Uranium Leaching, US Bureau of Mines Report of Investigations 8479, Robert D. Schmidt, 1980

Numerical techniques involving difference quotients and Taylor expansions about time points are used to derive time, velocity, areal sweep, and fluid volume parameters associated with leaching hydraulics. These parameters are output by the program in graphic and tabular formats. Other numeric methods insure that the program running time is minimized without significantly affecting the accuracy of results.

(Revised 7/6/81)

Regarding your statement on page R-2 (part III, reclamation), "the purified water from these processes (R.O.) may be reinjected into the 20-sand or could be discharged to the Dry Fork of the Powder River", any such proposed discharges would have to be supported by an analysis alternatives, including the alternative of discharge to a lined evaporation pond, covering the environmental and economic impacts associated with each alternative. Prior approval by the NRC through the issuance of a special license amendment would be required. Our experience with similar matters indicates an NPDES permit would also be required.

#### Response:

Regarding your statement on page R-2 (part III, reclamation), "the purified water from these processes (R.O.) may be reinjected into the 20-sand or could be discharged to the ūry Fork of the Powder River", any such proposed discharges would have to be supported by an analysis alternatives, including the alternative of discharge to a lined evaporation pond, covering the environmental and economic impacts associated with each alternative. Prior approval by the NRC through the issuance of a special license amendment would be required. Our experience with similar matters indicates an NPDES permit would also be required.

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#### Response:

The NRC routinely requires all solid process residues to be disposed of in a licensed tailings impoundment. Any alternative proposals shall require an analysis of alternative methods as indicated by appropriate criteria of Appendix A of 10 CFR 40.

# Response:

Uranerz U.S.A., Inc. acknowledges that all solid process residues must be disposed in a licensed tailings impoundment, and will follow the proper procedures for their disposal.

Any proposal to dispose of contaminated material (clothing, spent filters, etc.) on-site would require approval of the NRC through issuance of a special license.

# Response:

The Uranerz U.S.A., Inc. procedure for the disposal of all contaminated material, including clothing, spent filters, etc.) will be in an approved NRC disposal site.

Docket 40-8783

# URANERZ U.S.A., INC.

800 Werner Court Suite 140 CASPER. WYOMING 82401

July 7, 1981



Mr. John J. Linehan, Section Leader Operating Facilities Section I Uranium Recovery Licensing Branch Division of Waste Management United States Nuclear Regulatory Commission Washington, D.C. 20555

Re: Docket No. 40-8783

Application for Source Material

License

Dear Mr. Linehan:

Attached is the material you requested in your letter of

June 16, 1981.

Please note our new address above.

Very truly yours,

URANERZ U.S.A., INC.

Dr. Christof Schmidt

Manager of Solution Mining

DOCKETED JUL 0 9 198

Attachment: As stated

cc: M. Hulbert, WDEQ

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URANERZ U.S.A., INC.

Response to:

USNRC Letter dated June 16, 1981

Docket No. 40-8783

Uranerz Source Material License Application

July 7, 1981

Submit the actual well completion data for well 7-M-20 as was done for other wells in Table D-6.4.

Response:

Revised Table D-6.4 is incl.Jed giving well completion data for well 7-M-20 and well 1-M-51.

Table D-6.4 List of Hydrologic Test Wells

Well No	Completed Interval below ground (m)		ound	Ground ft.	(m)	Hydraulic Head Elevation on 7/8/80 ft. (m)				
3L	20-Sand	502-509	(153.1-155.2)	4829.33	(1491.98)	(Now abar	ndoned)			
3L	20-3and	302-309	(155.1-155.2)	4029.33	(1451.50)	(WIII be	plugged)			
4L	20-Sand	500-507	(152.2-154.6)	4828.62	(1471.76)	4859.24	(1481.10)			
5L	20-Sand	505-511	(154.0-155.8)	4833.73	(1473.32)	4859.27	(1481.11)			
6L	20-Sand	503-507	(153.4-154.6)	4836.73	(1474.24)					
8L	20-Sand	508-519	(154.9-158.3)	4821.83	(1672.74)	4859.11	(1481.06)			
1-M-20	20-Sand	492-554	(150.1-169.0)	4828.90	(1471.85)	4858.55	(1480.89)			
4-M-20	20-Sand	517-575	(157.7-175.4)	4847.44	(1477.50)	4857.88	(1480.68)			
5-M-20	20-Sand	493-563	(150.4-171.7)	4834.91	(1473.68)	4859.85	(1481.28)			
1-M-10	10-Sand	566-666	(172.6-203.1)	4829.90	(1472.15)	4892.79	(1491.32)			
1-M-30	30-Sand	419-455	(127.8-138.8)	4836.43	(1474.14)	4856.42	(1480.24)			
1-W-51	51-Sand	85-188	( 25.9- 57.3)	4836.50	(1474.17)	4800.47	(1463.18)			
7-M-20	20-Sand	492-555	(150.1-169.3)	4822.50	(1469.90)	4859.46	(1481.16)	(6/24/81)		
1-M-51	51-Sand	87-187	( 26.5- 57.0)	4830.00	(1472.18)	4800.60	(1463.22)	(6/24/81)		

Submit results of the well integrity testing program.

Response:

Results of the well integrity testing program will be submitted after the leaching wells have been permitted and drilled. NRC Comment 3. (6/16/81):

Submit a map showing the location and extent of the uranium ore body in relation to the Ruth ISL site and hydrologic test wells.

Response:

Map is attached as Figure D-6.4-1.

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NRC Comment 4. (6/16/81):

Does Figure D-10.1 represent the radiation assessment sample location map which the text refers to as "not included"?

Response:

Figure D-10.1 does represent the radiation assessment sample location map. The text on page RA-1, paragraph 1 should be corrected by deleting the last two sentences.

#### A. First Part

There are obvious errors in Table D-6.9, p. (i), (ex: fluoride mean concentration of 154 mg/l). These should be corrected.

#### Response:

Table D-6.9, all parts, have been reviewed, proof read, corrections made as needed, and the revised table is submitted.

#### A. Second Part.

In addition, the text states (p. D-6.17) "...comparing the baseline water quality of the proposed leach field as represented by samples from wells 8L and 4L...". If baseline water quality of the ore zone is to be based on data from wells 8L and 4L the data for wells 1-M-20 and 5-M-20 should be segregated from Table D-6.9, p (i).

### Response:

Baseline data for well 8L is given on Table D-6.9, p. 6, and for well 4L on Table D-6.9, p.5. Table D-6.9 (i) is included only for general information.

B. It appears other errors exist in other parts of Table D-6.9, (ex: D-6.9, p.5, the standard deviation of total hardness is listed as 41 mg/1). These tables should be further proof read and corrections made and copies resubmitted for substitution.

#### Response:

Table D-6.9, all parts, have been reviewed, proof read, corrections made as needed, and the revised table is submitted.

NRC Comment 5 (6/16/81)

C. In Table D-6.9 (all parts) the split sample obtained on January 21, 1981, is treated as two independent samples. These are not two independent samples representative of the natural variation in water quality but are representative of the variation in lab analyses. The inclusion of both sets of data in the baseline determination will not be accepted.

#### Response:

The PAL analyses for the split sample, obtained on January 21, 1981 have been removed from Table D-6.9, all parts, and the table has been recalculated, and is attached.

D. Both the NRC and DEQ agree that all data must be screened for outliers. As an example refer to TD-6.9, p.5. The WAMCO analysis for radium (January 21, 1981), appears consistent with previous samples while PAL's analysis of the sample is rather high (even ignoring the fact this was a split sample). Excluding the high value (223.43) from baseline determination would not be an unreasonable judgement. Have all the data been analyzed for outliers?

#### Response:

Table D-6.9, and all other tables, have been examined for potential outliers. Outliers have been underlined on the tables, and have not been included in the calculations. Table D-6.9, and all other tables, are attached.

Table D-6.2

Baseline Surface Water Quality
Upstream Sampling Point
(Revised 7/6/81)

DATE SAMPLED	3/11/80	6/12/80	7/18/80	10/1/80	12/15/80	5/8/81
Temperature, OC. Field	8	20	20		0	13
oH, Unites Field	7.6	7.5	7.6		8.3	8.9
H. Units, Lab at 250	8.08	7.87	8 19	7.77	7.53	8.10
Conductivity, umhos, Field Ambiant	2000	3150	3 10	*.**	7.33	1200
Conductivity, umhos, Lab at 250	2610	2990	32.0	3635	3600	15/19
IDS, Evaporation at 180°C	2347	2852	3050	3322	3580	1163
Sodium	2347 375 12					
Potassium	3/5	422	489	503	551	125
Calcium	12	16	5	41	23	11
	235	377	257	232	405	133
lagnesium	78	68	129	161	120	37
Sulfate	1300	1750	1980	2050	2050	660
Chloride	45	45	48	38	50	12
Carbonate					0	18
Micarbonate	439	354	171	280	659	73
tydroxide	433	334	171	200	033	1.5
fotal Millieguivalent Major Cations -	35.65	43.17	44 00		****	10 41
Total Hillieguivalent Major Anions			44.82	47.74	53.63	15.40
Usolute Value, Charged, Balance	35.51	43.48	45.33	48.30	54.86	15.27
	0.20	0.36	0.57	0.59	.21	0.42
Ammonta as N	ND	ND	ND	ND	2.38	NO
Mitrate as N (0.05)	0.03	ND	0.02	ND	ND	ND
Fluoride (0.1)	0.51	0.65	0.22	0.30	0.28 -	NI
Total Alkaninity as CaCO2	360	290	140	230	540	60
Total Hardness as CaCO3	950	1220	1170	1240	1504	480
Boron (0.01)	ND	0.08	0.1	ND	ND	NC.
Aluminum (0.05)	0.02	0.07	ND	ND	ND	NII 60 484 NO NO NO
Arsenic (0.005)	ND	0.002				NU:
Bartum (0.03)			0.008	0.008	0.025	NU
Cadmium (0.002)	0.04	0.05	ND	ND	ND	NO
	NO	0.015	0.010	0.010	ND	NO NO
Chromium (0.01)	. ND	ND	ND	ND	ND	ND
Copper (0.01)	ND	0.02	ND	0.02	0.01	.05
Iron, Total (0.01)	0.15	0.04	0.04	0.11	0.12	.23
Lead (0.01)	ND	0.03	ND	NO	ND	ND
Manganese (0.01)	0.23	0.17	0.07	1.22	9.8	.19
Mercury (0.0005)	ND	ND	ND	ND	NU	ND
Mickel (0.02)	ND	0.03	ND	NO	ND	ND
Selentum (0.005)	, ND	ND	ND ND	ND ND	ND	
Zinc (0.005)	ND					ND
Molybdenum (0.05)	NU	0.39	0.07	0.04	0.021	ND
Uranium, U308 (0.001)	ND	ND	ND	ND	ND	ND
	0.058	0.025	0.046	0.149	0.045	0.006
Vanadium V205' (0.05)	NO	0.06	ND	ND	ND	ND
Rad1um 226 PIC/L (0.5)	3.8	0.34	0.5	1.3	2.5	3.2
Radium, Precision, PIC/L	±0.6	±0.3	±0.4	±0.6	20.8	10.7

Analyses reported in milligrams per liter except where noted.

<sup>( )</sup> detection limit.

NO - not detected.

Table D-6.3

Baseline Surface Water Quality
Downstream Sampling Point
(Revised 7/6/81)

DATE SAMPLED	3/13/80	6/12/80	7/18/80	10/1/80	12/15/80	5/8/81
emperature, OC Field	7	20	25		4.8	. 9
pH, Units Field	7.4	7.5	7.0		8.2	7.8
pH, Units, lab at 25°C	7.61	7.64	8.06	7.41	7.6	7.88
Conductivity umhos, Field Ambient	1900	3800	6000			1000
Conductivity, umhos, Lab at 25°C	2610	3481		5396	3425	4171
TDS, Evaporation at 180°C	2448	3328	4588	5526	3862	3947
Sodium	360	480	634	758	529	154
Potassium	9	15	33	35	15	17
Calcium	261	401	477	521	433	3/77
	95	124	203	215	73	142
Magnesium	1495	2060	2925	3475	1960	2320
Sulfate	35	52	62	60	59	50
Chloride	33	32	02	, 00	0	0
Carbonate	202	416	403	211	500	305
Bicarbonate	293	415	403	211	300	303
Hydroxide		** **	en es	77.54	51.00	55.02
Total Milliequivalent Major Cations	36.72	51.68	63.81			
Total Milliequivalent Major Anions	36.90	51.13	69.20	77.33	50.63	54.84
Absolute Value, Charged, Balance	0.24	0.53	-0.21	0.14	0.36	0.16
Ammonta as N	ND	ND	ND	ND	0.45	ND
Nitrate as N (0.05)	U.03	ND	1.0	ND	ND	ND
Fluoride (0.1)	0.27	0.54	0.24	0.74	0.23	0.27
Total Alkalinity as CaCO3	240	340	330	173	410	250
Total Hardness as CaCO3	1040	1510	2025	2184	1380	1524
Boron (0.01)	0.07	0.08	ND	ND	ND	ND
Aluminum (0.05)	0.03	0.07	CM	ND	0.06	0.16
Arsenic (0.005)	ND	0.003	0.010	.012	ND	ND
Bartum (0.03)	ND	0.09	- ND	ND	ND	ND
Cadentum (0.002)	ND	0.012	0.020	0.009	ND	0.011
	ND	ND	ND	ND	ND	ND
Chromium (0.01)	ND	0.01	ND	0.02	0.01	ND
Copper (0.01)	0.07	0.03	0.07	0.21	0.96	0.23
Iron, Total (0.01)	ND	0.03	ND	0.02	ND	ND
Lead (0.01)	2.3	1.49	2.51	0.41	4.0	0.16
Manganese (0.01)	ND	ND ND	ND ND	ND.	ND	ND.
Mercury (0.0005)	ND	0.03	ND	0.03	ND	ND
Nickel (0.02)	ND ND	ND	ND	ND	ND	cn
Selentum (0.005)	ND	0.31	0.07	0.06	0.026	0.025
Zinc (0.005)	ND		ND	ND	ND ND	ND ND
Molybdenum (0.05)		ND		0.009	0.045	0.002
Uranium U308 (0.001)	0.046	0.029	0.007		ND	
Vanadium V205 (0.05)	ND	0.23	ND	ND		ND
Radium 226, P1C/L (0.5)	0.7	0.23	0.7	1.5	2.5	1.9
Radium, Precision, PIC/L	10.2	±0.3	±0.7	+0.7	±0.8	±0.5

Analyses reported in milligrams per liter except where noted.

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.9 (i)
Baseline Water Quality Data
4L, 8L, 1-M-20, 4-M-20, 5-M-20, 7-M-20
20-Sand Aquifer (Revised 7/6/81)

DATE SAMPLED	No. of Samples	Maximum Observed	Minimum Observed	Mean	Std. ( $\sigma$ ) Deviation
Temperature, <sup>O</sup> C, Field	32	15	- 11	13.3	1.2
pH. Units Field	32	9.8	8	8.7	0.5
pH, Units, Lab at 25°C	32	9.25	7.78	8.18	0.35
Conductivity, umhos, Field-Ambjent	. 24	605	390	442	50
Conductivity, umhos, Lab at 25°C	32	636	445	523	41
TDS, Evaporation at 180°C	32	374	289	326	20
Sodium	32	121	98	108	6
Potassium	32	9	3	4.5	1.4
Calcium	32	10	1	6.4	2.0
Magnesium	32	7	1	2.5	1.7
Sulfate	32	128	68	97	16
Chloride	32	14	3	6.9	2.8
Carbonat <sup>o</sup>	24	67	0	15.5	17
Bicarbonate	32	195	22	164	35
Hydroxide					
Total Milliequivalent Major Cation					
Total Milliequivalent Major Anions					
Absolute Value, Charged, Balance					
Ammonia as N	32	0.3	ND	0.09	0.07
Nitrate as N (0.05)	30	0.21	ND	0.06	0.04
Fluoride (0.1)	31	0.85	0.14	0.51	0.16
Total Alkalinity as CaCO <sub>3</sub>	32	172	130	154	8
Total Hardness as CaCO <sub>3</sub>	32	33	7	23.9	6.0
Boron (0.01)	32	0.1	ND	0.03	0.03
Aluminum (0.05)	32	0.4	ND	0.12	0.11
Arsenic (0.005)	26	0.094	ND	0.014	0.019
Barium (0.03)	32		ND	0.03	
Cadmium (0.002)	32	0.012	ND	0.003	0.002
Chromium (0.01)	32	0.02	ND	0.01	0.002
Copper (0.01)	32	0.02	ND	0.011	0.003
Iron, Total (0.01)	32	0.2	ND	0.077	0.067
Lead (0.01)	31	0.07	ND	0.01	0.013
Manganese (0.01)	32	0.07	ND		0.013
Mercury (0.0005)	32		ND	0.0005	
Nickel (0.02)	32	0.005	ND ND	0.02	
Selenium (0.005)	30 28	0.005	ND	0.046	0.082
Zinc (0.005)	32	0.34	ND	0.05	0.002
Molybdenum (0.05)	32	0.071	<0.001	0.010	0.015
Uranium, U <sub>3</sub> 0 <sub>8</sub> , (0.001) Vanadium, V <sub>2</sub> 0 <sub>5</sub> , (0.05) Radium 226, PiC/L (0.5)	32	0.071	ND	0.05	0.015
Padium 2262 5pic/1 (0.5)	31	225	0.5	56.2	71.5
Radium, Precision, PiC/L	31	223	0.5	30.2	7113

Analyses reported in milligrams per liter except where noted.

<sup>( )</sup> detection limit.

ND - not detected.

TABLE D-6.9,p.1.

Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL		1-1	1-20							Standard		
DATE SAMPLED	2/11/80	6/12/80	7/18/80	10/1/80	12/16/80	1/21/81	5/11/81	No. of Samples	Maximum Observed	Minimum Observed	Mean	Deviation (a)
Temperature, 9C, Field	12	13	14	14	14	ĺ3	14.5	,	14.5	12	12.50	
pH, Units Field	8.3	8.4	8.2	8.5	8.7	8.8	8.7	,	8.8	8.2	13.50 8.51	0.87
pH, Units, Lab at 25°C	8.24	8.0	8.40	8.09	8.28	7.95	8.65	,	8.65	7.95		0.23
Conductivity, unhos, Field-Ambient	390	410	450		410	400	400	6	450	390	8.23	0.24
Conductivity, unhos, Lab at 25°C	460	500	509	477	512	552	525	7	552	460	505	21
TDS, Evaporation at 180°C	320	329	308	289	295	303	306	,				30.3
Sodium	110	109	104	98	101	104	108	,	329	289	307	14
Potassium	3	5	4	3	5	107	106		110	98	105	4.4
Calcium	6	5	6	5	6	6			5	3	3.7	0.95
Magnesium	3	2	,	3	1	i	;	!	6	3	5.3	1.1
Sulfate	91	115	89	68	86	88	70	1	3	1	2.0	0.93
Chloride	10	7	8	14	3	6	70	1	115	68	87	16
Carbonate	10	. 9	17		31	0	2	7	14	3	7.9	3.4
Bicarbonate	181	151	151	188	120	183	26	6	31	0	15.5	11.5
Hydroxida .			***		120	103	151	7	188		161	25
Total Milliequivalent Major Cations	5.42	5.28	5.17	4.84	4.90	4.98						
Total Milliequivalent Major Anions	5.47	5.30	5.13	4.89	4.87		5.01					
Absolute Value, Charged, Balance	0.46	0.19	0.39	0.58		5.00	. 5.01					
Amonia as N					0.31	0.2						
Nitrate as N (0.05)	0.30	ND	0.11	ND	ND	ND	ND	. 7	0.30	ND	0.09	
	0.21	ND	1.0	ND	ND	N-)	ND	6	0.21	ND	80.0	0.09
Fluoride (0.1)	0.54	0.40	0.04	0.74	0.40	0.61	0.30	6	0.74	0.3	0.498	0.07
Total Alkalinity as CaCO	165	140	152	154	150	150	168	i	168	140	154	0.162
Total Hardness as CaCO,	28	21	28	25	' 19	19	12	,	28	12		10
Boron (0.01)	0.02	0.1	ND	ND	0.06	NO	ND	'n	0.10	ND ND	22	€
Aluminum (0.05)	ND	0.40	ND	ND	.19	ND	ND	,	0.40	ND	0.031	0.035
Arsenic (0 nn5)	0.002	0.006	0.010	0.004	ND	ND	ND		0.01	ND	0.12	0.13
Barium (0.03)	ND	ND	-	ND	ND	ND	ND	2	0.01	ND	0.006	0.002
Cadmium (0.002)	ND	ND	7 7 7 7	0.005	ND	0.002	ND	,	0.005	ND	.03	
Chromium (0.01)	ND	ND		ND	NO	ND	ND	,	0.000		0.0024	0.0011
Copper (0.01)	ND	ND		ND	0.02	MD	.01	,	0.02 •	ND ND	0.01	
Iron (0.01)	0.17	0.12	0.01	0.02	.19	0.06	.08				0.0114	0.0038
Lead (0.01)	ND	ND	NO	ND	ND	NO	10		3.19	0.01	0.093	0.070
Manganese (0.01)	0.07	0.03	NO	NO	0.02	0.01	.01	,		· inD	0.01	
Mercury (0.0005)	ND	ND	ND	NO	ND.	ND			0.07	ND	0.023	0.022
Nickel (0.02)	NO	NO	NO	NO	ND	ND	ND			ND	0.0005	
Selenium (0.005)	ND			ND	ND	ND	ND	,	-	ND	0.02	
Zinc (0.005)	0.07			0.03	.033	.024	ND	6	0.005	ND	0.005	
Molybdenum (0.05)	NO				ND ND	ND ND	ND	6	0.07	ND	0.03	0.02
Uranium, U.O., (0.001)	0.003			0.003	.001	<0.001	ND	7		ND	0.05	4,02
Vanadium, \$285, (0.05)	NO.				NO.		<0.001	7	0.011	0.001	0.003	0.0037
Radium 226, PiC/L (0.5)	1.3					ND	ND	7		ND	0.05	0.0037
Radium, Precision, PiC/L	10.3				3.7	5.8	1.6	6	5.8	0.68	2.3	2.0
Marian, Frechston, Frey's	10.3		10.3	10.3	1.0	±1.4	10.5					2.0

Analysos reported in milligrams por liter except where noted. The underlined data are considered as outliers and are not included in the calculations.

TABLE D-6.9, p.2.
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL.		4-M-20						No. of	Maximum	Minimum		Standard Deviation
DATE SAMPLED	6/12/80	7/14/80	10/2/80	12/15/80	1/20/81		5/11/81	Samples	Observed	Observed	Hean	(0)
emperature, OC, Field	11.5	13.8	14.2	14.2	n		13	6	14.2	11.0	13	1.4
H, Units Field	9.6	9.6	8.9	9.8	9.4		9.0	6	9.8	8.9	9.4	0.36
H, Units, Lab at 25°C	9.25	8.56	8.61	8.25	8.36		8.85	6	9.25	8.25	8.65	0.36
bonductivity, unhos, Field-Ambient	405	500			400		450	4	500	400	439	4
conductivity, unhos, Lab at 25°C	445	494	517	547	566	1	546	6	566	445	519	4
DS, Evaporation at 180°C	343	338	305	331	345	1	320	6	345	305	330	4
octium	115	112	99	113	118		108	6	118	99	111	6.7
ocassium	7	9	3	6	4		5	6	9	3	5.7	2.1
Calcium	1	7	6	7	5		4	6	7	1	5.0	2.3
Sagnesium .	1	2	3	1	1		1	6	3	1	1.5	0.8
Sulfate	128	106	76	105	114		97	6	128	76	104	17
Chloride	9	10	13	3	6		4	6	13	3	7.5	3.8
Cartxnate	67	34	TR	31	26		19	6	67	TR	29.5	22.0
Bicartonate	22	120	185	129	132		137	6	185	22	121	54
Hydroxide											7000	
Total Milliequivalent Major Cations	5.31	5.61	4.93	5.50	5.56		5.11					
Total Milliequivalent Major Anions	5.50	5.58	4.98	5.41	5.57		5.01					
Absolute Value, Charged, Balance	-1.76	0.03	0.53	0.82	0.09		.99					
Armonia as N	0.22	0.14	ND	ND	0.12		ND	6	0.27	ND	0.11	0.0
Nitrate as N (0.05)	- ND	0.6	ND	0.05	ND		ND	5	0.05	ND	0.05	
Fluoride (0.1)	0.65	0.57	0.57	0.51	0.85		. 36	6	0.85	0.36	0.59	0.16
Total Alkalinity as CaCO_	130	155	152	158	152		144	6	158	130	149	10.3
Total Hardness as CaCO_3	7	25	27	22	16		14	6	27	7	18.5	7.0
Boron (0.01) .3	ND	0.1	ND	ND	ND		ND	6	0.1	ND	0.025	0.03
Aluminum (0.05)	0.25	ND	10	ND	ND		ND	6	0.25	ND	0.083	0.082
Arsenic (0.005)	0.008	0.014	0.008	_,004	ND		ND	5	0.014	ND	0.008	0.003
Barium (0.03)	ND	ND	NO	ND	ND		ND	6		ND	0.03	E L
Cadmium (0.002)	ND	0.012	ND	ND	0.005		ND	6	0.012	ND ND	0.0042	0.004
Chromium (0.01)	0.01	ND	ND	ND	ND		ND	6	0.012	ND	0.01	
Copper (0.01)	ND	ND	0.02	ND	0.01		ND		0.02	ND	0.0117	0.004
Iron (0.01)	0.01	0.06	0.09	0.31	.20		.17	6	0.2	0.01	0.09	0.08
Lead (0.01)	ND	ND	ND	ND	ND		ND	6		ND	0.01	0.00
Manganese (0.01)	0.01	ND	ND	.01	.01			6	0.01	ND	0.01	
Mercury (0.0005)	ND	ND	ND	, ND	ND		.01 ND	6	0.01	ND	0.0005	
Nickel (0.02)	, ND	ND	ND	ND	ND		ND	6		ND	0.02	
Selenium (0.005)	ND	NO	, ND	ND	ND		ND	6		ND	0.005	
Zinc (0.005)	0.31	0.04	0.04	.002	.013		HD	5	0.31	ND	0.082	0.12
Molybdenum (0.05)	ND	ND	NO	ND	ND		ND	6		ND	0.05	
Uranium, U <sub>3</sub> O <sub>6</sub> , (0.001)	0.020	0.005	0.007	0.007	.079		0.001	6	0.028	0.001	0.0113	0.010
Vanadium, \$785, (0.05)	NO	ND	ND	ND	ND		ND	6	0.020	ND	0.0113	0.010
Radium 226, PiC/L (0.5)	4.7	6.7	4.6	5.8	7.0		9.7		9.7	4.6	6.42	1.8
Radium, Precision, PiC/L	11.3	11.5	±1.2	11.2	±1.5		11.2			4.0	0.72	1.0

The underlined data are considered as outliers and are not included in the calculations.

<sup>( )</sup> detection limit.

ND - not detected.

TR - trace.

TABLE D-6.9. p.3
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL		5-M-20									Standard
DATE SAMPLED	6/12/80	7/15/80	10/6/80	12/15/80	1/2]/81	5/8/81	No. or Samples	Maximum Observed	Minimum Observed	Mean	Devistio (a)
Temperature, °C, Field	13	14	14.4	14.3	14	14.5					
di, Units Field	8.4	8.0	8.6	9.3	8.4	8.4	0	14.5	13	14	0.6
oH, Units, Lab at 25°C	7.93	7.78	7.92	7.94	7.96	8.32	6	9.3	8	8.5	0.4
Conductivity, whos, Field-Ambient	. 450	500			450	440		8.32	7.78	7.98	0.18
Conductivity, unhos, Lab at 250c	480	497	534	558	579	636	4	500	440	460	27
IDS, Evaporation at 180°C	349	344	347	338	342	374	6	636	480	547	57
Sodium	121	114	107	110	115	111	6	374	338	349	13
Potassium	5	6	. 5	4	113	111	6	121	107	113	
Calcium	9		10		3	3	6	6	3	4.3	1.2
Magnesium	,	3	1	2	,	4	6	10	4	7.5	2.0
Sulfate	120	108	106	105	"	3	6	3	1	2.0	0.9
Chloride	120	10	106	105	116	92	6	120	92	108	10
Carbonate	,	10	•		5	6	6	10	3	5.8	2.5
Bicarbonate	185	195	***	0	0	12	3	12	ő	4	6.9
	192	195	181	190	190	176	6	195	176		0.9
Hydroxide								193	1/0	186	7
Total Milliequivalent Major Cations	5.87	5.76	5.36	5.45	5.59	5.36					
Total Milliequivalent Major Anions	5.73	5.73	5.29	5.38	5.67	5.37					
Absolute Value, Charged, Balance	1.21	0.26	0.75	0.65	0.71	0.09					
Ammonia as N	ND	0.16	0.13	ND	ND	t:D		0.16	ND.		
Nitrate as N (0.05)	ND	0.2	ND	ND	NI.	ND			ND	0.08	0.05
Fluoride (0.1)	0.61	0.57	0.85	0.51	0.74	0.36	0	0.2	ND	0.075	0.061
Total Alkalinity as CaCO,	152	160	148	156	156	165	6	0.85	0.36	0.607	0.172
Total Hardness as CaCO,	24	32	29	28	26	22	6	165	148	156	6
Boron (0.01)	0.1	ND .	ND	ND	ND	tiD		32	22	27	3.6
Aluminum (0.05)	0.16	ND	0.29	0.08	ND	ND	0	0.1	ND	0.025	0.037
Arsenic (0.005)	0.041	0.016	0.032	.008	ND			0.29	ND	0.113	0.097
Marium (0.03)	ND	ND	ND	ND.	ND	0.012	ú	0.041	ND	0.019	0.014
Cadmium (0.002)	ND	0.003	0.004	ND	ND	tiD	6		ND		0.014
Chromium (0.01)	0.02	ND	ND OIL	ND		- 1:0	6	0.004	ND	0.0025	0.0008
Opper (0.01)	ND	ND	ND	.01	- ND	K.D	6	0.02	ON	0.0117	0.0042
Iron (0.01)	0.04	0.05	0.16	.01	ND	KD	6	0.01	ND	0.01	3400.0
Lead (0.01)	ND.O4	, O.US	ND		0.09	0.07	6	0.16	0.01	0.07	0.052
				ND	ND	KD CA	6		ND	0.01	0.032
Manganese (0.01)	0.04	ND	0.04	.03	0.01	0.02	6	0.04	ND	0.025	0.014
Mercury (0.0005)	ND	ND	ND	ND	ND	MD	6		NP	0.0005	0.014
Nickel (0.02)	100	ND	ND	ND	ND	MD.	6		ND	0.02	
Selenium (0.005)	ND	ND	ND	ND	ND	CH	6		ND	0.305	
Zinc (0.005)	0.34	0.007	0.03	.005	0.024	fier	6	0.34	ND	0.0685	0 1224
Molybdenum (0.05)	ND	ND	ND	ND	ND	KD	6	0.34	10000		0.1334
Uranium, U <sub>2</sub> O <sub>0</sub> , (0.001)	0.045	0.003	0.003	* <0.001	0.004	0.001	6		ND	C 05	
Vanadium, \$285, (0.05)	ND	ND	ND	ND	ND	t.D		0.045	< 0.301	0.0095	0.0174
Radium 226, PiC/L (0.5)	0.5	0.8	1.3	1.3	3.0	1.3	0		ND	0.05	
Radium, Precision, PiC/L	10.4	10.5	±0.7	10.6	±1.0	1.3		3.0	0.5	1.37	0.87

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.9, p. 4
Baseline Water Quality Data
20-Sand Aquifer (Revised 7/6/81)

WELL	7-M-20	(New)
DATE SAMPLED	5/8/81	
Temperature, <sup>O</sup> C, Field	15	
oH, Units Field	8.4	
oH, Units, Lab at 25°C	8.26	
Conductivity, umhos, Field-Ambjent	440	
Conductivity, umhos, Lab at 25°C	550	
TDS, Evaporation at 180°C	356	
Sodium	106	
Potassium	3	
Calcium	3 4	
Magnesium	2	
Sulfate	78	
Chloride	8	
Carbonate	10	
Ricarbonate	176	
Hydroxide		
Total Milliequivalent Major Cations	5.05	
Total Milliequivalent Major Anions	5.07	
Absolute Value, Charged, Balance	.40	
Ammonia as N	ND	
Vitrate as N (0.05)	ND	
Fluoride (0.1)	0.30	
Total Alkalinity as CaC?	161	
Total Hardness as CaCO3	18	
Boron (0.01)	ND	
Aluminum (0.05)	ND	
Arsenic (0.005)	ND	
arium (0.03)	ND	
Cadmium (0.002)	ND	
Chromium (0.01)	ND	
Copper (0.01)	ND	
Iron, Total (0.61) Lead (0.01)	.20	
Manganese (0.01)	ND	
Mercury (0.0005)	.02	
Nickel (0.02)	ND	
Selenium (0.005)	ND	
Zinc (0.005)	ND	
Molybdenum (0.05)	.015	
Iranium 11.0 (0.001)	ND	
Vanadium, V308, (0.05)	.001	
Vanadium, V <sub>2</sub> 0 <sub>8</sub> , (0.001) Vanadium, V <sub>2</sub> 0 <sub>5</sub> , (0.05) Radium 226, PiC/L (0.5)	7.8	
Radium, Precision, PiC/L	±1.1	

<sup>( )</sup> detection limit.

ND - not detected.

TABLE D-6. 9, p. 5.
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

WEIL		41.									
DATE SAMPLED	6/12/80	10/8/80	10/8/80	12/16/80	1/21/81	5/14/81	No. of Samples	Maximum Observed	Minimum Observed	Mean	Standard Deviation (o)
emperature, <sup>Q</sup> C, Field	12	14	14.6	12.0	11						
H, Units Field	8.5	8.6	8.6	8.4	8.5	13	6	14.6	11	12.8	1.4
oH, Units, Lab at 25°C	7.81	8.43	7.88	7.91	7.84	8.4	6	8.6	8.4	8.5	0.1
Conductivity, unhos, Field-Ambient	605	500		440	390	7.83	6	8.43	7.81	7.95	0.24
conductivity, unhos, Lab at 25°C	453	524	512	529		410	5	605	390	469	87
NG, Evaporation at 180°C	332	308	312		572	535	6	572	453	521	39
kodium	112	102	104	311	329	346	6	346	308	323	15
Potassium	112	6	5	107	112	112	6	112	102	108	
Calcium				4	3	5	6		102		. 5
AND THE RESERVE OF THE PARTY OF	8	7	6	8	8	9	6	0	3	4.7	1.03
Magnesium	2	3	2	1	1	2	6		0	7.67	1.03
Sulfate	110	85	75 -	96	105	117			1	1.83	0.75
Chloride	8	10	8	4	5	6	6	117	75	98	16
Carbonate		22		0	ő		6	10	4	6.8	2.2
Bicarbonate	193	142	185	185	185	0	4	22	0	5.5	11
Hydroxide					103	183	6	193	142	179	18
Total Milliequivalent Major Cations	5.65	5.19	5.11	5.23	5.43				The State of		
Total Milliequivalent Major Anions	5.69	5.17	5.03	5.14	5.35	5.61					
Absolute Value, Charged, Balance	0.35	0.19	0.16	0.87		5.60					
Amonia as N	ND	0.18	ND		0.74	0.09					
Nitrate as N (0.05)				ND	ND	ND	6	0.18		0.020	
Fluoride	ND	ND	ND	ND	ND	ND		0.10	ND ND	0.072	0.053
	0.51	0.51	0.14	0.43	0.57	0.51	6	0.57		0.05	
Total Alkalinity as Caco	159	153	152	152	151	150	6		0.14	0.445	0.156
Total Hardness es CaCO3	33	30	23	24	24	30	0	159	150	153	3
Boron (0.01)	0.08	0.1	ND	ND	ND	ND	0	33	23	27	4.2
Aluminum (0.05)	0.20	ND	ND	ND	ND	ND	0	8:88	ND	0.037	0.042
Arsenic (0.005)	0.014	0.014	0.012	0.001	ND		0		ND	0.075	0.061
Barium (0.03)	ND	ND	ND	NO	ND	0.001		0.014	ND	0.011	0.004
Cataira (0.002)	ND	ND	ND	ND	ND	0.003	6		ND	0.03	
Chromium (0.01)	ND	ND	ND	ND	ND		6	0.003	ND	0.0022	0.0004
Copper (0.01)	NO	ND	ND	ND	ND	ND	6		ND	0.01	
Iren (* 1)	0.02	0.05	0.14	.03	0.04	ND	6		ND	0.01	
Ie d	0.15	· ND	ND	ND	ND ND	ND	6	0.14	ND	0.048	0.047
Managar .01)	0.01	0.01	ND			ND	5		ND	0.01	
Mercus 3005)	NO.01	CM	ND	.01	0.01	0.02	6	0.02	ND	0.011	0.004
Nickel (v.02)	ND	ND	ND	ND	ND	ND	6		ND	0.0005	
Selenium (0.005)	ND		ND ND	ND	ND	ND	6		ND	0.02	
Zinc (0.005)		0.003		ND	ND	ND	5		ND ND	0.005	
	0.89	, NO	0.01	.009	0.037	0.006	5				
Molybdenum (0.05)	NO	ND	ND	NO	ND	ND	6	0.037	ND	0.013	0.013
Uranium, U <sub>3</sub> O <sub>8</sub> , (0.001)	0.006	0.010	0.011	0.003	0.004	< 0.001		0.011	ND	0.05	
Variadium, \$3, (0.05)	ND	ND	ND	ND	ND	ND	6	0.011	<0.001	0.0058	0.0040
Radium 226, 2PIC/L (0.5)	175	161	127	156	143	225	0		ND	0.058	
Radium, Precision, PiC/L	17	17	±7	16	±7	16		225	127	165	34

Analyses reported in milligr our liter except where noted

() detection limit.

ND - not detected.

The underlined data are considered as outliers and are not included in the calculations.

TABLE D-6.9, p. 6.
Baseline Water Quality Data For 20-Sand Aquifer (Revised 7/6/81)

MEIT		RL		The street							Standard
DATE SAMPLED	6/12/80	7/23/86	10/6/80	12/16/80	1/22/81	5/11/81	No. of Samples	Maximum Observed	Minimum Observed	Hean	Deviation (o)
Temperature, Oc, Field	11.5	14	14.4	12.0	13	.12	6	14.4	11.5	12.8	1.2
pH, Units Field	8.6	8.6	8.8	8.5	8.2	9.4	6	9.4	8.2	8.7	0.4
pH, Units, Lab at 25°C	7.82	8.25	8.12	7.98	7.90	8.48	6		7.82	8.09	0.25
Conductivity, unhos, Field-Ambient	445	500			400	420	4	8.48	400	441	43
Conductivity, unhos, Lab at 25°C	468	523	511	523	566	534	6	566	468	521	32
TDS, Evaporation at 180°C	332	299	321	310	335	328		335	299	321	14
Sodium	109	99	105	106	110	109		110	99	106	19
Potassium	5	5	5	4	110	105		110	39	4.3	
Calcium	6	6	10					10	3		0.8
Magnesium	2	4	1	1	3	,		10	0	7.2	1.6
Sulfate	98	75	99	99	108	94		108	76	2	1.3
Chloride	6	9	9		5			100	/5	94	12
Cartorate		17		o	. 0		•	,		6.2	2.3
Bicarbonate ·	193	163	178	183	185	41 127	•	.41	0	14.5	19.4
Hydroxide			-	103	103	121		193	127	172	24
Total Milliequivalent Major Cations	5.33	5.07	5.28	5, 19	5.42	5.27					
Total Milliequivalent Major Anions	5.38	5.05	5.23	5.17	5.42	5.31					
Absolute Value, Charged, Balance	0.47	0.20	0.48	0.19	0.42	0.38					
Ammonia as N	ND	0.28	0.21	ND	ND	ND		0.28	ND		
Nitrate as N (0.05)	ND	ND	ND	ND	ND	ND		0.20	ND	0.115	0.103
Fluoride (0.1)	0.43	0.38	0.51	0.43	0.65	0.27		0.65	0.27	0.05	0.039
Total Alkalinity as CaOO,	159	162	146	150	151	172		172	146	0.445	0.128
Total Hardness as CaCO,	23	32	29	24	28	21				157	10
Boron (0.01)	0.08	ND	ND	ND	ND ND	ND .		32	21	26	4.2
Aluminum (0.05)	0.38	ND	0.23	.15	ND	0.3	. 0	0.00	ND	0.022	0.029
Arsenic (0.005)	0.094	0.022	0.008	001	ND	NO NO		0.38	ND	0.19	0.14
Barium (0.03)	ND	ND	ND	ND	ND	ND	5	0.094	ND ND	0.027	0.038
Cadmium (0.002)	ND	0.004	0.008	ND	NO	ND		0.008	ND ND	0.03	0.0024
Chronium (0.01)	OM CENT	ND	ND	ND	ND	ND		0.008		0.0033	0.0024
Copper (0.01)	0.02	ND	ND	ND	ND	ND		0.02	ND	0.02	
Iron (0.01)	ND	<.01	0.14	.02	0.01	0.16	2	0.02	ND ND	0.0117	0.0043
lead (0.01)	ND	ND	ND	ND	ND	ND	6	0.10	ND	0.058	0.071
Manganese (0.01)	0.02	0.03	0.02	.01	0.01	ND	6	0.03	ND	0.01	
Mercury (0.0005)	ND	ND	ND	ND	ND	ND			ND	0.0167	0.0082
Nickel (0.02)	ND	ND	ND	ND	ND	ND	0			0.0005	
Selenium (0.005)	ND	ND	ND	ND	ND	ND	. 6		ND ND	0.02	
Zinc (0.005)	0.08	0.04	0.06	_,004	.019	ND	6	0.08	ND	0.005	0.000
Molybdenum (0.05)	ND	ND	ND	ND	ND	ND		17000	ND	0.041	0.030
Uranium, U30g, (0.001)	0.071	0.026	0.019	.019	0.003	0.008	6	0.073		0.05	
Vanadium, V.O., (0.05)	ND	- NO	ND	ND	ND ND	0.008 ND	. 0	0.071	0.003	0.024	0.024
Radium 226, 2PIC/L (0.5)	120	136	74	143	83	131-	6	143	ND 74	0.05	
Radium, Precision, PiC/L	16	17	15	16	#5	14	6	143	/4	115	29

The underlined data are considered as outliers and are not included in the calculations.

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.10

Baseline Water Quality Data for Well 1-M-30 - 30-Sand (Revised 7/6/8)

DATE SAMPLED	2/11/80	6/12/80	7/18/80	10/8/80	12/18/80	1/20/81	5/13/81	No. of	Maximum	Minimum		Standard
Temperature, *C, Field	8	13.5	13	14.6			3/13/01	Samples	Observed	Observed	Hean	Deviation
pH, Units Field	10.0	9.8	10.4	10.2		13	14	6	14.6	8	12.7	
pH, Units Lab at 25°C	9.60	9.51	9.54	9.26	9.8	9.6	9.6	7	10.4	9.6	9.9	2.4 0.3
Conductivity, unhos, Field-Ambient	410	605	600	9.26	9.14	8.88	9.43	7	9.6	8.88		0.26
Conductivity, unhos, Lab at 25°C	550	555	575		400	480	440	6	605	400		
TDS, Evaporation at 180°C	359	381	362	535	605	658	435	7	658			92
Sodium	126	135		336	378	366	326	,	381	435		69
Potassium	120		125	115	135	130	113	,	135	326 113	358	21
Calcium	,	10	13	7	7	5	5			113	100	9
Magnesium		1		2	2	3	,	4	13	5	7.7	2.9
Sulfate	1	1	1	4	1	2	i	4		1	2.3	1.0
Chloride	85	98	70	76	105	86	. 88	,	305		1.57	1.13
Carbonate	14	14	18	14	9	9	9	,	105	70	87	12
Bicarbonate	96	108	126	86	96	65		7	18	9	12.4	3.5
Hydroxide	39	22		46	39	122	67	7	126	65	92	22
			× .			142	49	6	122	22	53	35
Total Milliequivalent Major Cations	5.84	6.26	6.05	5.61	6.23	6.10						
Total Milliequivalent Major Anions	6.00	6.39	6.17	5.58	6.27	6.10	5.18					
Absolute Value, Charged Balance	.1.35	1.03	0.98	0.27		6.20	5.11					
Amonia as N	0.30	ND	0.20	ND	. 32	0.81	0.66					
Nitrate as N (0.05)	0.17	ND	0.4	ND	ND	ND	ND	7	0.3	ND	0.11	0.10
Fluoride (0.1)	1.07	1.16	0.74	1.38	NO	ND	ND	7	0.4	ND	0.117	
Total Alkalinity as CaCO,	192	198	210	180	0.99	1.07	0.65	7	1.38	0.65		0.133
Total hardness as CaCO,	8	7	14		192	208	151	,	210	151	1.01	0.25
Boron (0.01)	ND	0.1	ND	22	9	16	7	7	22	101	190	20
Aluminum (0.05)	0.11	0.28	, ND	ND	NO	ND	ND	7	0.1	***	12	5.7
Arsenic (0.005)	ND	ND	0.008	ND	NO.	ND	ND	6	0.28	ND	0.023	0.034
Barium (0.03)	0.04	ND		NO	ND	ND	NC	7	0.008	ND	0.09	0.094
Cadmium (0.002)	ND.	ND	. ND	ND	ND	ND	ND.	4	0.04	ND	0.0054	0.0011
Chromium (0.01)	ND ND	ND	ND	ND '	.003	.003	ND	<b>'</b>		ND	0.0314	0.0038
Opper (0.01)	ND	ND	ND	ND	ND	ND	ND	,	0.003	ND	0.0023	0.0005
Iron, Total (0.01)	0.06		ND	ND	.01	ND	0.02	,	0.00	ND	0.01	
Lead (0.01)		0.03	0.03	0.17	.07	0.04	0.06	,	0.02	ND O	0.0114	0.0038
Manganese (0.01)	ND	ND	ND	ND	NO	ND	ND	,	0.17	0.03	0.066	0.049
Mercury (0.0005)	0.02	0.02	ND	ND	ND	ND	ND	,	0.00	ND	0.01	
Nickel (0.02)	ND	NO	ND	ND	ND	ND	ND	,	0.02	ND	0.013	0.005
Selenium (0.005)	ND	ND	ND	ND	ND	ND	ND	,		ND	0.0005	
	ND	ND	CM	, ND	NO	ND		,		ND	0.02	
Zinc (0.005)	0.01	0.24	0.12	0.01	.012	.021	ND 0.004	7		ND	0.005	
Molytxlerum (0.05)	ND	ND	ND	ND	NO.	ND ND	0.004	6	0.24	0.01	0.069	0.094
Uranium, U <sub>3</sub> O <sub>8</sub> , (0.001) Vanadium, V <sub>3</sub> O <sub>5</sub> , (0.05)	0.003	0.022	0.004	0.002	0.007	0.041	ND	7		ND	0.05	0.034
Variation, V <sub>2</sub> O <sub>5</sub> , (0.05)	ND	ND	NO	ND	ND ND	ND ND	0.001	7	0.041	0.001	0.0114	0.0149
Radium 226, PiC/L (0.5)	0.3	0.56	13	1.3	1.1		ND	7		ND	0.05	0.0143
Radium, Precision, PiC/L	±0.2	±0.4	±0.7	±0.7	±0.6	3.1 ±1.0	1.3	6	13	0.56	3.39	4.78

<sup>( )</sup> detection limit.

NO - not detected.

Table D-6.11

Baseline Water Quality Data for

Well 1 - W - 51 - 51-Sand

(Revise 7/6/81)

DATE SAMPLED	6/12/80	7/18/80	10/2/80	1/22/81*	5/13/81	No. of Samples	Maximum Observed	Minimum Observed	Mean	Standard Deviation (a)
Temperature, <sup>O</sup> C, Field	12.5	14	11.0	n						T-TI
ph Units Field	8.5	8.2	8.2	8.3	11	,	14	.11	11.9	1.3
pH Units Lab at 25°C	8.33	8.57	7.78	8.01	8.2 8.29		8,5	8,2	8.28	0.13
Conductivity umhos, Field-Ambient	395	420	443	360	360	5	8.57	7.78	8.20	0.31
Conductivity umhos, Lab at 25°C	410	467		513		•		360	396	37
IDS. Evaporation at 180°C			500		385	5	513	385	455	56
odium	286	283	261	268	298	5	298	261	279	15
	108	110	90	96	107	5	110	90	102	5
Potassium			3	3	3	5	4	3	3.4	0.6
Calcium	6		7	,		5	7	4	5.6	1.5
Magnesium	3		3	3	3	5	3	1	2.6	0.9
Sulfate	15	21	46	18	17	5	46	15	23.4	12.8
Chloride	10	10	6	. 5	7	5	10	5	7.6	2.3
Carbonate	31	22		0	20	4	31	0	18.3	13.1
Bicarbonate	228	224	212	266	240	5	266	212	234	21
Hydroxide										
Total Hilliequivalent Major Cations	5.35	5.17	4.59	4.86	5.18					
Total Milliequivalent Major Anions	5.36	5.12	4.60	4.87	5.15					
Absolute Value, Charged Balance	0.09	0.49	0.16	0.10	0.29					
Ammonia as N	ND	0.13	ND	ND	ND		0.12	ND	0.07	0.04
Nitrate as N (0.35)	ND	0.5	ND	ND	ND	:	00.5	ND	0.07	0.04
Flouride (0.1)	0.36	0.75	1.68	1.24	0.65	2	1,68	0.36		0.20
Total Alkalinity as CaCO2	239	220	174	218	230	,	239	174	0.94	0.52
Total Hardness as CaCO3	28	15	30	30	22	2	30	15	216	25
Boron (0.01)	ND	ND	ND	ND	ND	9	30	ND	25	6.5
Numinum (0.05)	0.12	ND	ND	ND	ND	2	0.12	ND	0.01	0.001
Arsenic (0.005)	ND	0.006	0.004	ND	ND	:	0.006	ND ND	0.064	0.031
Barium (0.03)	ND	ND	ND	ND	ND	:		ND	0.0053	0.0005
Cadmium (0.002)	ND	ND	ND	0.002	ND	,	0,002	ND	0.03	
Chromium (0.01)	ND	ND	ND	ND	ND	2		ND	0.002	
Copper (0.01)	0.01	NO	ND	ND	ND	0	0.01	ND	0.01	
ron, Total (0.01)	ND	0.01	0.08	0.03	0.09	2	0.09		0.01	
ead (0.01)	ND	ND	ND	ND	ND	2	0.09	UN ND	0.044	0.039
tagnese (0.01)	0.01	ND	0.02	0.02	0.02	,	0.02		0.01	
Mercury (0.0005)	ND	ND	ND	ND	ND	2	100000000000000000000000000000000000000	ND ND	0.016	0.0055
tickel (0.02)	ND	ND	ND	ND	ND	2		ND ND	0.0005	
Selentum (0.005)	, NO	ND	NO	ND	ND ND	2	* * * * * * * * * * * * * * * * * * * *	ND	0.02	
Zinc (0.005)	0.66	0.12	0.01	.034	0.008	2			0.005	
Molybdenum (0.05)	ND	ND	ND	ND		,	0.66	0.008	0.166	0.280
Uranium, U308 (0.001)	0	0.003	0.002	< 0.001	ND 0 003	•	0.002	ND OO	0.05	
Vanadium, V205 (0.05)	ND	ND	ND	ND	0.002		0.003	<0.001	0.002	0.0008
Radium 226 PiC/L (0.5)	1.0	0.8	1.5	6.4	ND	5		ND	0.05	N' Y I I I I
Radium, Precision, PiC/L	±0.6	±0.5	±0.7	11.5	2.6	5	6.4	0.8	2.46	2.31
Addraw, Frecision, Fic/L	10.0	10.5	10.7	21.5	±0.6					

<sup>( )</sup> detection limit.

ND - not detected

WELL	1-M-51	
DATE SAMPLED	5/13/81	
Temperature, <sup>O</sup> C, Field	13.5	-
pH, Units Field	8.3	
pH, Units, Lab at 25°C	8.25	
Conductivity, µmhos, Field-Ambjent	450	
Conductivity, umhos, Lab at 25°C	472	
TDS, Evaporation at 180°C	394	
Sodium	139	
Potassium		
Calcium	7	
Magnesium	4 7 2 56	
Sulfate	56	
Chloride	9	
Carbonate	14	
Bicarbonate	290	
Hydroxide		
Total Milliequivalent Major Cations	6,66	
Total Milliequivalent Major Anions	6.64	
Absolute Value, Charged, Balance	0.15	
Ammonia as N	ND	
Nitrate as N (0.05)	ND	
Fluoride (0.1)	0.65	
Total Alkalinity as CaCO <sub>3</sub> Total Hardness as CaCO <sub>3</sub>	261	
Total Hardness as CaCO <sub>3</sub>	26	
Boron (0.01)	ND	
Aluminum (0.05)	ND	
Arsenic (0.005)	ND	
Barium (0.03)	ND	
Cadmium (0.002)	ND ND	
Chromium (0.01)	ND ND	
Copper (0.01)	ND .05	
Iron, Total (0.01) Lead (0.01)	ND	
Manganese (0.01)	.02	
Mercury (0.0005)	ND ND	
Nickel (0.02)	ND	
Selenium (0.005)	ND	
Zinc (0.005)	.010	
Molybdenum (0.05)	ND	
Uranium, U <sub>3</sub> 0 <sub>0</sub> , (0.001)	<.001	
Vanadium, $V_{2}^{3}0_{5}^{8}$ , (0.05)	ND	
Radium 226, 5PiC/L (0.5)	3.8	
Radium, Precision, PiC/L	±0.9	

Analyses reported in milligrams per liter except where noted.

<sup>( )</sup> detection limit.

Table D-6.12
Baseline Water Quality Data for Well 1-M-10 - 10-Sand (Revised 7/6/81)

DATE SAMPLED	2/11/80	6/12/80	7/24/80	10/31/80	12/17/81	1/22/81	5/8/8:	No. of Maximum	Minimum		Stanc
Temp rature, °C, Field	. 7.5	13.0	13	13.4	12.6	10		Samples Observed	Observed	Mean	Devia
pH, Units Field	8.10	8.6	7.6	8.8	9.0	8.6	10 8.7	7 13.4	7.5	11.4	2.1
pH, Units, Lab at 25°C	8.61	8.31	8.62	8.12	8.3	8.14		7 9.0	7.6	8.5	0.5
Conductivity, whos, Field-Ambient	330	405	400		390	320	8.53	7 8.62	8.12	8.38	0.7
Conductivity, unhos, Lab at 25°C	415	464	457	477	465	487	406	6 405	320	374	0.2 39 29
TIS, Evaporation at 180°C	319	305	, 278	297	278	276	509	7 509	415	468	29
Sodium	117	100	102	98	104		311	7 319	276	295	18
Potassium	5	5	. 5	30	104	98	117	7 117	98	105	16
Calcium	. 5	2	6	;		3	3	7 5	30	105	
Magnesium	2		,			6	6	, ,	3		
Sulfate	12	27	26	, ,		2	2	, ,		5.4	1.6
Chloride	10		8	30	27	32	33	7 33		3.0	2.8
Carbonate	39	8		10	3	4	6	7 10	12	27	7
Bicarbonate		29	31		53	0	31		3	7	2.8
Hydroxide	244	198	195	268	161	240	232	7 268	29 161	36.6 220	9.9
Total Milliequivalent Major Cations	5.63	4.91	4.95	5.38	5.05	4 90					
Total Milliequivalent Major Anions	5.83	5.01	5.00	5.30	5.04	4.80	5.63				
Absolute Value, Charged Balance	1.75	1.01	0.50	0.73	0.10	0.84	5.69				
Ammonia as N	0.33	0.22	0.24	ND	ND	0.12	0.53				
Nitrate as N (0.05)	0.10	ND	0.3	NO	ND	ND ND	ND ND	7 0.33	ND	0.151	0.113
Fluoride (0.1)	0.79	0.45	0.65	1.07	0.61	0.99	ND	7 0.3	ND	0.093	0.093
Total Alkalinity as CaCO,	265	211	212	220	220	197	0.45	7 1.07	0.45	0.72	0.25
Total Hardness as CaCO,	20	22	. 19	52	21		242	7 265	197	224	23
Boron (0.01)	ND	NO		ND	ND ND	23	23	7 52	19	26	
Aluminum (0.05)	0.01	0.31	· ND	ND	9.06	ND	. ND	7	ND	0.01	12
Arsenia (0.005)	ND	0.006	ND	0.004		ND	0.07	6 0.31	ND ND		
Barium ( 3)	0.04	ND.			ND	NO	ND	6 0.006	ND	0.098	0.104
Cadmium (J. J2)	ND.	0.003			ND	ND	ND	7 0.04	ND	0.0052	0.0004
Chromium (0.01)	ND	ND			.003	J.002	ND	7 0.003	ND	0.031	0.0038
Copper (0.01)	, ND	0.02			ND	ND	ND	7 0.003	ND	0.0023	0.0005
Iron, Total (0.01)	0.14	0.02			.01	, ND	0.01	7 0.02	ND	0.02	
Lead (0.01)	ND.				.27	0.05	0.08	7 0.27	0.02	0.013	0.005
Markgarese (0.01)	0.06	NO			ND	ND	ND	, 0.27		0.091	0.088
Mercury (0.0005)		0.01			.02	0.02	0.02	7 0.06	ND	0.01	
Nickel (0.02)	NO	NO			ND	ND	ND	7 0.06	ND	0.023	0.017
	ND				ND	NO NO	ND	;	ND	0.0005	
Selenium (0.005)	ND				ND	ND ND	ND	6 0.005	ND	0.02	
Zinc (0.005)	0.01				.035	.035	ND		ND	0.005	
Holytxlerum (0.05)	NO				ND	ND	ND	7 0.33	ND	0.074	0.115
Uranium, U <sub>3</sub> 0 <sub>8</sub> , (0.001) Vanadium, V <sub>3</sub> 0 <sub>8</sub> , (0.05)	0.007				0.005	0.002	0.001		nD	0.05	
Vanadium, V205, (0.05)	NO				ND	ND	ND	7 0.008	0.001	0.0041	0.0026
Radium 226, PiC/L (0.5)	0.3				3.4	1.4	3.6	,	ND	0.05	-
Radium, Precision, PiC/L	10.2	10.6	10.2	10.8	11	±0.7	±0.7	6 3.9	0.95	2.51	1.27

<sup>( )</sup> detection limit.

ND - not detected.

Table D-6.13, p 1
Baseline Water Quality Data For
Stock Wells (Revised 7/6/81)

WEIL		Moore	e S.					No. of	Maximum	Minimum		Standard
DATE SAMPLED	2/12/80	6/12/80	7/18/80	10/31/80	12/15/80	1/19/81	5/13/81	Samples	Observed	Observed	l'ean	(a)
Temperature, OC, Field	7	13.5	13.5	13.5	13.5	13	14	1	14	1	12.6	2.5
pH, Units Field	8.6	8.4	8.0	7.9	8.6	8.4	8.0	1	8.6	7.9	8.3	0.3
pH, Units, Lab at 25°C	8.21	7.79	8.02		7.89	7.97	8.18	6	8.21	7.79	8.01	0.16
Conductivity, unhos, Field-Ambient	420	445	480			440	420	5	480	450	441	25
Conductivity, whos, Lab at 25°C	470	481	590	518	535	592	453	1	592	453	520	56
TIS, Evaporation at 180°C	336	335	363	299	327	359	351	7	363	25,9	339	22
Sedium	112	113	111	98	107	120	119	7	120	98	111	7.5
Potassium	3	4	5	3	4	3	3	7	5	3	3.6	0.8
Calcium	8	6	10	8	9	9	6	7	10	6	8.0	1.5
Magnesium *	2	4	2	2	3	2	2	1	4	2	2.43	0.8
Sulfate	105	108	110	78	105	123	115	7	123	78	107	14
Chloride	10	8	10	8	5	6	1	7	10	1	6.9	3
Carbonate	5				0	0	0	4	5	0	1.25	2.5
Bicarbonate	185	190	183	185	190	.193	198	7	198	183	189	5.3
Hydroxide					100					100	1	
Total Milliequivalent Major Cations	5.51	5.65	5.62	4.90	5.45	5.91	5.72					
Total Milliequivalent Major Anions	5.66	5.60	5.57	4.88	5.44	5.90	5.67					
Absolute Value, Charged Balance	1.34	0.44	0.45	0.22	0.09	0.08	0.44					
Ammonia as N	0.31	ND	ND	ND	NO	ND	ND	7	0.31	ND	0.087	0.098
Nitrate as N (0.05)	ND.	4.000	1.2	ND	ND	ND	ND	6		ND	0.05	
Fluoride (0.1)	0.74	1.38	0.40	0.65	0.51	0.74	0.33	,	1.38	0.33	0.68	0.35
Total Alkalinity as CaCO3	160	1.	150	152	156	158	162		162	150	156	
Ivial Hardness as CaOO3	28	32	. 33	28	35	30	23				29.9	
Boron (0.01)	0.02	0.1	ND	ND	ND	ND	ND		35 0.1	23 ND	0.024	0.034
Aluminum (0.05)	ND	0.22	ND	ND	ND	ND	ND	and the state of the state of	0.22	ND	0.024	0.064
Arsenic (0.005)	0.020	0.036	0.024	0.016	.02?	0.02	0.034	,	0.036	0.016	0.025	0.0075
Barica (0.03)	ND ND	100 100 100 100	ND	· ND	ND	1.0		,	0.030	ND ND	0.023	0.0073
Cad-ium (0.002)	ND		0.005	0.003	ND	0.005	ND	,	0.005	ND	0.0034	0.0015
Chronium (0.01)	ND		NO.	ND ND	ND	ND ND	ND		0.003	ND	0.02	0.0013
Corser (0.01)	ND.		ND	0.02	NO	0.01	ND 0.04	,	0.09	ND	0.027	0.030
Iron, Total (0.01)	0.14		0.11	0.13	.09			,	0.23	0.09	0.141	0.0485
				ND		0.23	0.18		0.23	ND	0.01	0.0403
Lead (0.01)	ND		ND		ND	ND	ND				0.033	0.014
Manganese (0.01)	0.06		0.03	0.02	.03	0.03	0.04		0.06	0.02		0.014
Mercury (0.0005)	ND			ND	NO	ND	ND	1		NO	0.0005	
Nic'el (0.02)	ND				ND	ND	ND	1		ND	0.02	
Selenium (0.005)	, NE		(8.990		ND	ND	• ND	1	0.43	ND O OO?	0.005	0.149
Zine (0.005)	0.07				.012	0.026	0.007		0.43	0.007		0.145
Molybdenum (0.05)	ND				ND	ND	ND	1	0.014	ND OO	0.05	0.0057
-Uranium, U308, (0.001)	0.004		-		<0.001	<0.001	<0.001	7	0.016	<0.001		0.005/
Variatium, 0205, (0.05)	NO				ND	ND	ND	7		ND	0.05	
Radium 226, PIC/L (0.5)	3.2				1.2	0.8	4.0	7		0.5	1.00	1.37
Radium, Precision, PiC/L	±0.4	1 10.5	10.4	10.6	1.6	+0.5	20.9					

( ) detection limit.

The underlined data are considered as outliers and are not included in the calculations.

TABLE D-6.13, p.2
Baseline Water Quality Data For
Stock Wells
(Revised 7/6/81)

TEST			Moore N.										Standard
DATE SAMPLED	2/12/80	6/12/80	7/16/80	10/2/80	12/15/81	12/15/80	1/19/81	5/11/81	No. of Samples	Maximum Observed	Mirimum Observed	Mean	Deviation (σ)
emperature, <sup>Q</sup> C, Field	7	14	16		13	- 10.6	10	12	7	16	7	11.8	2.9
H, Units Field	8.8	8.3	8.3		8.0	8.7	8.3	8.4	7	8.8	8.0	8.4	0.3
H, Units, Lab at 25°C	8.24	7.24	7.82	7.99	7.88	7.91	7.91	8.18	8	8.24	7.24	7.90	0.30
onductivity, unhos, Field-Ambient	380	445	500				400	410	5	500	380	427	47
conductivity, unhos, Lab at 25°C	460	451	469	500	500	512	539	555		555	451	498	37
DS, Evaporation at 180°C	320	316	310	284	287	293	320	330		330	284	308	17
odium	113	109	105	97	97	102	112	107	8	113	97	105	6
otassium	4	4	6	3	3	4	2	. 3	8	6	2	3.6	1.2
alcium	5	5	9	7	6	6	,	6	8	9	5	6.4	1.3
Agnesium	2	2	2	2	4	i	i	1	8	4	1	1.9	0.99
Sulfate	77	79	70	58	71	68	80	69	8	80	58	72	7.2
Chloride	10				7	6	6	7	8	10	6	8.0	1.8
Cartxonate	10		1			0	0	0	4	10	0	2.5	5.0
Bicarbonate	195	212		207	202	203	212	215	7	215	195	207	7.0
Hydroxide													
Total Milliequivalent Major Cations	5.43	5.25	5.33	4.81	4.92	4.92	5.35	5.11					
Total Milliequivalent Major Anions	5.41	5.40	5.27	4.83	4.99	4.91	5.31	5.17					
Absolute Value, Charged, Balance	0.18	1.41	0.57	0.17	0.63	0.1	0.38	0.58					
Amonia as N	ND	) NE	0.18	ND.	ND	ND	ND	ND	8	0.18	ND	0.066	0.046
Nitrate as N (0.05)	0.06	NE.				ND	ND	ND	8		ND	0.051	0.004
Fluoride (0.1)	0.65	0.51	1.38	0.65		0.61	0.85	0.45	8	0.06	0145	0.73	0.29
Total Alkalinity as CaCO	177	1 174	176			166	174	180	8	180		173	5
Total Hardness as CaCO, 3	20	2				19	21	19	8	31	19	23.5	5.1
Boron (0.01)	0.02					ND	ND	ND	8	0.02	ND	0.011	0.0035
Aluminum (0.05)	0.01					ND	ND	ND	7	0.21	ND	0.073	0.061
Arsenic (0.005)	0.002	2 0.000				NO	ND	ND	5	0.008	ND	0.0058	0.0013
Barium (0.03)	N	D N				ND	. NO	ND	8		ND	0.03	-
Cadmium (0.002)	M					.002	ND	ND	8	2.003	ND	0.0021	0.0004
Chromium (0.01)	14	D N				ND	ND	ND	8		ND	0.02	
Copper (0.01)	N					ND	ND	ND	8	0.02	ND	0.011	0.0035
Iron, Total (0.01)	0.2					.06	0.09	0.32	8	0.32	0.05	0.136	0.089
Lead (0.01)	N					ND	ND	ND	8	0.12	ND	0.024	0.039
Manganese (0.01)	0.1	7 0.0				.02	0.03	0.02	8	0.17	ND	0.041	0.053
Mercury (0.0005)	N	7.5	D N			ND	ND	ND	8		ND	0.0005	
Nickel (0.02)	N	D N	D N			ND	ND	ND	8		ND	0.02	-
Selenium (0.005)			D 0.00			, ND	ND	ND	7		ND	0.005	
Zinc (0.005)	0.0					.013		0.006	8	0.06	0.006	0.0345	0.0226
Molybdenum (0.05)		D t		D N		, ND		ND	8		ND	0.05	
tranium, U.O., (0.001)	0.00	)3	0.01			0.058	0.004	<0.001	7	0.058	ND	0.013	0.021
Vanadium, 78, (0.05)		-		IO N		ND		ND	8		ND	0.05	
Radium 226, PIC/L (0.5)	1.		.5 0.			0.9		1.9	8	1.9	0.5	1.16	0.44
Radium, Precision, PiC/L	±0.	.3 t0	.7 t0.	.5 ±0.	6 10.4	±0.5	±0.7	20.5			771 717		

<sup>( )</sup> detection limit.

tD - not detected.

E. First Part

What is your quality assurance program, including that of any outside lab used, regarding water quality sampling and analyses?

#### Response:

a. Quality Assurance Programs will be maintained by the Radiation Safety Officer of UUS, who is reporting directly to the Manager Solution Mining. All QA programs will be conducted according to the Regulation Guide 4.15. Standard QA procedures will be maintained through the operational plan.

#### Laboratory

Outside labs will be contracted based upon their response to requirements of 4.15. All labs will be required to file QA documents with UUS prior to contract finalization.

In-house labs will be placed under the same QA requirements with audits, inspections, etc. as the outside labs, again following the 4.15 requirements.

All lab work will be performed using Standard Methods as required by EPA and the Clean Water.Act. Certifications and qualifications will be on file with UUS as part of the QA program. All labs will be audited through spike samples, split samples and inspections to assure quality control of data.

#### E. Second Part

We note that for <u>all</u> samples split on January 21, 1981, measurable amounts of zinc were reported by WAMCO and in <u>no</u> cases did PAL report detectable amounts. In some instances PAL reports concentrations (of other elements) <u>below</u> their own published detection limits.

#### Response:

As to the problem of the 21 January 1981 split samples, PAL laboratory were not satisfactory. They will not be used in the future.

F. On page D-6.19 you state "baseline groundwater quality will be defined just before start-up on the basis of average concentrations, their standard deviations and maximum and minimum values".

Please explain the exact procedure you propose for this determination.

#### Response:

UUS does not propose, at this time, a procedure for baseline determination. Results of future analysis will be added to the tables until operation start-up. Data and the calculations of average concentrations, maximum and minimum values, and standard deviations made after the inclusion of the final sample prior to start-up, will then be used as criteria for baseline definition.

G. On page D-6.17 you state "elements that cannot be detected in four consecutive samples from the same well will be removed from the list of analyses required for that particular well unless a particular element should be mobilized in the leaching zone during the proposed test". Because we would require an analysis for the full suite of parameters only on a quarterly basis during leaching operations we would not permit elimination of such elements from the required list. Only the excursion parameters are required biweekly during leaching.

#### Response:

Analysis for all baseline parameters will be made and reported on a quarterly basis. The excursion parameters will be sampled, analyzed and reported biweekly.

H. What are you proposing as the upper control limit for vanadium considering the fact it is listed as "not detected" in all baseline samples?

Response:

New Tables M-5 and M-6 are submitted giving an Upper Control Limit for vanadium.

Table M-5

Upper Control Limits Excursion Monitoring For Well 1-M-20 - Production Zone

Baseline Mean	Baseline Maximum	Baseline Std Deviation ( $\sigma$ )	Mean Plus 2 o
8.23	8.65	0.24	7.75-8.71
505	552	30.3	565.6
154	168	10	174
	0.011	0.0037	1*
ND	ND		0.10
7.9	14	3.4	14.7
	8.23 505 154 0.003 ND	Mean     Maximum       8.23     8.65       505     552       154     168       0.003     0.011       ND     ND	Mean         Maximum         Deviation (σ)           8.23         8.65         0.24           505         552         30.3           154         168         10           0.003         0.011         0.0037           ND         ND         -

Upper Control Limits Excursion Monitoring For Well 4-M-20 - Production Zone

Baseline Mean	Baseline Maximum	Baseline Std. Deviation $(\sigma)$	Plus 2 σ
8.65	9.25	0.36	7.93-9.37
519	566	44	607
149	158	10.2	169.4
0.0113	0.028	0.0104	1*
ND	ND		0.10
7.5	13	3.8	15.1
	Mean 8.65 519 149 0.0113 ND	Mean Maximum  8.65 9.25  519 566  149 158  0.0113 0.028  ND ND	Mean         Maximum         Deviation (σ)           8.65         9.25         0.36           519         566         44           149         158         10.2           0.0113         0.028         0.0104           ND         ND         -

Upper Control Limits Excursion Monitoring For Well 5-M-20 - Production Zone

	Baseline Mean	Baseline Maximum	Baseline Std. Deviation (σ)	Mean Plus 2 σ
pH - Lab at 25°C	7.98	8.32	0.18	7.62-8.34
Conductivity, µmhos Lab at 25°C	547	636	57	661
Total Alkalinity as CaCO <sub>3</sub> mg/l Uranium mg/l**	156 0.0095	165 0.045	0.0174	168 1*
Vanadium gm/1** Chloride	ND 5.8	ND 10	2.5	0.10

<sup>\*</sup> Upper Control Limit for  $\rm U_3O_8$  suggested by DEQ. \*\*Uranium as  $\rm U_3O_8$ 

Mean

Vanadium as V<sub>2</sub>O<sub>5</sub>

Table M-6

Upper Control Limits Excursion Monitoring For Well 1-M-10 - Lower Aquifer

Baseline Mean	Baseline Maximum	Baseline Std. Deviation $(\sigma)$	Plus 2 σ
8.38	8.62	0.2	7.98-8.78
468	509	29	526
224	265	23	270
0.0041	0.008	0.0026	1*
ND	ND		0.10
7	10	2.8	12.6
	8.38 468 224	Mean     Maximum       8.38     8.62       468     509       224     265       0.0041     0.008       ND     ND	Mean         Maximum         Deviation (σ)           8.38         8.62         0.2           468         509         29           224         265         23           0.0041         0.008         0.0026           ND         ND         -

Upper Control Limits Excursion Monitoring For Well 1-M-30 - Upper Aquifer

Baseline Mean	Baseline Baseline Std.  Maximum Deviation (σ)		Plus 2 o	
9.34	9.60	0.26	8.82-9.86	
559	658	69	697	
190 0.0114 ND 12.4	210 0.041 ND 18	0.0149 - 3.5	230 1* 0.10 19.4	

Upper Control Limits Excursion Monitoring For Well 1-W-51 - Domestic Water Supply

	Baseline Mean	Baseline Maximum	Baseline Std. Deviation $(\sigma)$	Mean Plus 2 σ
pH - Lab at 25°C	8.20	8.57	0.31	7.58-8.82
Conductivity, µmhos Lab at 25° Total Alkalinity	455	513	56	567
as CaCO <sub>3</sub> mg/1	216	239	25	266
Uranium mg/1**	0.002	0.003	0.0008	0.70
Vanadium mg/1**	ND	ND		0.10
Chloride	7.6	10.0	2.3	12.2

<sup>\*</sup> Upper Control Limit for  $\rm U_3O_8$  suggested by DEQ. \*\* Uranium as  $\rm U_3O_8$ 

\*\* Uranium as  $U_3O_8$ Vanadium as  $V_2O_5$ 

pH - Lab at 25°C Conductivity, μmhos Lab at 25° Total Alkalinity

as CaCO mg/l Uranium mg/l\*\* Vanadium mg/l\*\*

Chloride

Mean

I. How will use of an NH<sub>4</sub>HCO<sub>3</sub> eluant instead of NaCl/Na<sub>2</sub>CO<sub>3</sub> affect the choice of Cl as an excursion parameter?

#### Response:

branerz U.S.A., Inc. will test both  $NaC1/Na_2CO_3$  and  $NH_4CO_3$  as eluants during the pilot plant operation.  $NaC1/Na_2CO_3$  will be used first. While this is used as the eluant, Cl is an appropriate excursion parameter.

## NRC Comment 5 (6/16/81)

J. Referring to p. M-27, what do you propose as a course of action if the two analyses (split sample) obtained as excursion confirmation samples differ markedly?

## Response:

If the two analyses of a split sample differ markedly, the following procedure would be followed.

- Any unusual result would be compared to previous data to determine its potential as an outlier.
- The sample would be rerun by UUS lab and the outside lab to determine if the results were caused by a procedural error.
- Following the procedure, described on page M-27, a second control sample will be taken three days after an excursion is suspected.

K. It is not clear what water quality parameters you propose to measure during an excursion.

Response:

The water quality parameters to be measured during an excursion are listed on Tables M-5 and M-6. Upper control limits for  $HCO_3$  and  $CO_3$  will be added prior to start-up. The parameters were proposed by WDEQ.

NRC Comment 5 (6/16/81)

L. Referring to pages M-28, M-29 regarding corrective action, it is not clear what the proposed sampling schedule is after the first 2 weeks of an excursion.

Response: Add the following to paragraph 1, Page 1-29.

Weekly sampling of the monitor well in excursion status, and of all other monitor wells, with analysis for all UCL parameters, will be done continuously after the first two weeks. This will continue until recovery from excursion has been achieved and maintained for a continuous period of at least one month.

M. Referring to paragraphs No. 3 and 4 on p. M-29, what is meant by a "substantial decrease" in concentration?

Response:

A 50%, or more, decrease in concentration.

Referring to your statement on page M-26, "The leak detection system will be checked daily for leakage solution during initial filling of a pond. The time intervals will later be extended to two weeks", we require leak detection systems to be checked on a daily basis.

Response:

Paragraph 2, page M-26, first sentence is revised to read:

The leak detection system will be checked daily for leakage solutions, as part of the daily walk through by the RST.

NRC Comments 7.A through 7.I (6/16/81)

Due to the complexity of and detail required to respond to Comment 7, all parts, the responses are submitted as a supplement to follow page D-6.15.

The following questions refer to hydrologic test No. 9.

A. What "borehole damage" exists in wells 5L and 6L as noted on the graphs? No mention of this exists in the text. Were or are repair measures necessary?

#### Response:

Bore hole damage is caused when drilling mud or cement invade the producing formation, thus causing reduced permeability in the immediate vicinity of the completed interval. No repair measures are necessary.

B. The M-20 wells have different completion intervals than pumped well 4L. Were the data corrected for the effects or partial penetration? If not, provide justification. The subject is not addressed in the text.

#### Response:

Transmissivities appear slightly lower in the center of the proposed test area than in the outlying monitor wells. This may be due to the partial penetration of the pumped well and of those observation wells that are labeled "L". The "L" wells are located within a radius of 110 ft. of the pumped well which is twice the thickness (55 ft.) of the aguifer. Within this area vertical flow components will theoretically influence the observed drawdown readings during pump tests. The sedimentary environment in roll front aquifers is, however, so varied that differences in transmissivity have to be expected. The variations in Table D-6.5 may be an account of the varying transmissivity through the roll front. The differences, however, are small enough to be explained as well by errors that are inherent in the pumping test methods. Correcting for possible partial penetration effects would not increase the accuracy of the results. The range of transmissivity values given in Table D-6.5 describes the transmissivity at the test site in general. It is not practical to assign transmissivity values to any particular volume of the aquifer smaller than the test site.

# NRC Comments 7.C, 7.E and 7.I (6/16/81)

- C. There are inconsistencies in the text regarding the log-log plot for well 4L.
  - \* p. D-6.10: The heterogeneous nature of the transmissivity can also be considered responsible for the abnormal shape of the drawdown curve of the pumped well 4L in hydro test No. 9.
  - \* p. D-6.10: The most plausible explanation for the curves shape is a change in transmissivity at a certain distance from the pumped well.
  - \* p. D-6.10: As there are not such deformities (re: obs. well curves) the conclusions can be made that there are no hydraulic boundaries within the area between the monitor wells.
  - \* p. D-6.14: 4L: The early flattening out of the drawdown curve is due to a slightly falling flow rate at the time (200-930-min). The flowrate was then readjusted.
  - \* During our site visit Mr. Froehlich stated that the declining flow rate was a deliberate measure taken to keep the water level above the level of the pump.

The following apply to part C, above.

- cl: The text needs clarification on the above items.
- c2: Why wasn't the test initially run at a lower Q to eliminate drawdown problems at the pump well?
- c3: Was the drawdown data corrected for a variable Q?

  If not, this should be done.

- E. On page D-6.10 and again on D-6.15 it states there were no pressure changes in the upper and lower aquifers. Data provided indicated a .5 psi reduction in the lower aquifer and a .2 psi reduction in the upper aquifer. In addition, the drawdown curve for well 4-M-20 shows a break from the Theis curve of a nature often indicative of leakage. Provide a detailed explanation of this observation.
- Based on all parts of question 7, justify the validity of hydrologic test No. 9.

Response: 7.C, 7.E, and 7.I:

Long term pump tests like test No. 9 in this context are conducted to provide evidence on two possible hydraulic situations that would impair a solution mining project:

- A. Hydraulic boundaries
- B. Leaky aquifer conditions.

Hydraulic boundaries can be negative like tight faults or bedrock contacts. This condition would be observed as increased slopes in all drawdown curves. There is no indication of this in all the pump test data.

A positive boundary would be an area of recharge to the pumped aquifer which would be observed as a decline of the slope in all drawdown curves. Such decline has been observed in only one well (4L). Other reasons for declining slopes of drawdown curves are:

- improving hydraulics in the pumped well.
- changing transmissivity in the distance.
- declining flow rates.

These factors are extremely difficult to be quantified exactly. The need to do so would only be justified if there were doubts about the confinement of the target aquifer in an area within the monitored leaching zone. Complete confinement of the leaching zone is assured by the pumping test results as the upper and lower monitor wells did not react to the pumping of the target aquifer. The small pressure reduction in both 1-M-30 and 1-M-10 at a late point of time during test No. 9 can be explained by various other factors:

- a change in barometric pressure.
- elastic reactions to pressure changes in the 20-sand which is sandwiched between the 10- and 30- sands (Noorbergum Effect\*).

Otherwise the pressure changes are small enough to be explained by reading error:

Observation Well No.	Pressure Gauge	Marked Intervals Readings	
1-M-10	0-60 psi	2 psi	25.5 - 25.0 psi
1-M-30	0-15 psi	0.5 psi	8.0 - 7.8 psi
(1 psi = 0.0703	kp/cm <sup>2</sup> )		

If in fact the observed pressure changes were caused by a hydraulic connection between the aquifers, this connection would be outside of the monitored area of the 20-sand aquifer as the pressure changes were observed at a time when the radius of influence from the pumped well had already reached far beyond the outling monitor wells (M-20 wells). The drawdown curve 4-M-20 is considered a good approximation of the Theis-Curve within the limits of accuracy of the method.

<sup>\*</sup>Verruigt, A. 1969, Elastic Storage of Aquifers, in: Flow through Porous Media; R. DeWeist, Ed.: Acad. Press, NY, pp. 331-376.

During test No. 9 the pumping rate was held as constant as possible under field conditions in order to facilitate test interpretation. The average flow rate was 10.91 gpm  $(0.69\ 10^{-3}\ m^3\ sec^{-1})$  over a period of 2130 minutes. During that time the extremes were +1.51 gpm  $(0.063\ 10^{-3}\ m^3\ sec^{-1})(13.8\%)$  and  $-0.24\ gpm\ (0.015\ 10^{-3}\ m^3\ sec^{-1})(2.2\%)$ . This accuracy is considered adequate for this purpose. Drawdown data from the pumped well were not included into the average calculations of transmissivity and storage coefficient for this and other reasons stated above. Drawdown observations in the other wells are not affected by the slight variations in the pumping rate.

D. Why wasn't recovery data used in the analysis of test No. 9? This data should be analyzed.

## Response:

Recovery data from test No. 9 was analyzed (see attached Graph 4L) but was not considered relevant.

NRC Comments 7 (6/16/81)

F. Why wasn't recovery data obtained for the upper and lower aquifers?

# Response:

During test No.9, water pressures in the upper and lower aquifers remained at  $\pm 2\%$  of the readings they had shown for weeks before the test and were therefore not measured during the recovery phase of the test.

NRC Comments 7 (6/16/81)

G. Why weren't water levels (or pressures) taken prior to starting of the pump test and taken into account during analysis?

#### Response:

The 0-minute readings of water pressures of each well were taken before start-up of the pumping tests. They are not included on the graph sheets as no attempt was made to quantify the casing capacity and skin effects which become negligible in the later parts of the curves.

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NRC Comments 7 (7/16/81)

H. Why weren't barometric data obtained prior to and during the test and taken into account during analysis?

Response:

Barometric variations may reach extremes of 25 inches (0.635 m) of water or less than 1 psi  $(0.0703 \text{ kp/cm}^2)$ . No extreme weather situations were observed during test No. 9. Any possible effects on the observed drawdown curves would have negligible extent.

Referring to figure M-7A, Fluid Flow Path, why are negative values assigned to injection wells and positive values to production wells relating to relative water level differences.

Response:

Head pressures are given in feet drawdown. Injection pressures are therefore negative drawdown.

Submit additional information regarding the nature of the fluid flow medal.

## Response:

The computer model that was used for Figure M-7A was developed by the U.S. Bureau of Mines for the purpose of simulating uranium solution mining. Following is an abstract of their Report of Investigation No. 8479\* describing the model:

This Bureau of Mines report describes the development and application of a computer model for simulating the hydrological activity associated with in situ leaching. The model is intended to provide uranium resource developers with a description of the flow behavior of leachants and ground water during the development, production, and restoration phases of leaching operation involving an arbitrary pattern of injection and recovery wells.

Different aquifer environments are modeled, using a closedform solution to the partial differential equation that describes three-dimensional changes in piezometric head as a result of pumping from leachant injection and recovery wells. The computer program can model a maximum of 50 arbitrarily located wells.

<sup>\*</sup>Computer Modeling of Fluid Flow During Production and Environmental Restoration Phases of In Situ Uranium Leaching, US Bureau of Mines Report of Investigations 8479, Robert D. Schmidt, 1980

Numerical techniques involving difference quotients and Taylor expansions about time points are used to derive time, velocity, areal sweep, and fluid volume parameters associated with leaching hydraulics. These parameters are output by the program in graphic and tabular formats. Other numeric methods insure that the program running time is minimized without significantly affecting the accuracy of results.

Regarding your statement on page R-2 (part III, reclamation), "the purified water from these processes (R.O.) may be reinjected into the 20-sand or could be discharged to the Dry Fork of the Powder River", any such proposed discharges would have to be supported by an analysis alternatives, including the alternative of discharge to a lined evaporation pond, covering the environmental and economic impacts associated with each alternative. Prior approval by the NRC through the issuance of a special license amendment would be required. Our experience with similar matters indicates an NPDES permit would also be required.

#### Response:

Uranerz U.S.A., Inc. acknowledges that an analysis covering the environmental and economic impacts must be made for any alternative disposal of water during restoration, and, that appropriate permits and amendments would need to be obtained.

The NRC routinely requires all solid process residues to be disposed of in a licensed tailings impoundment. Any alternative proposals shall require an analysis of alternative methods as indicated by appropriate criteria of Appendix A of 10 CFR 40.

#### Response:

Uranerz U.S.A., Inc. acknowledges that all solid process residues must be disposed in a licensed tailings impoundment, and will follow the proper procedures for their disposal.

Any proposal to dispose of contaminated material (clothing, spent filters, etc.) on-site would require approval of the NRC through issuance of a special license.

#### Response:

The Uranerz U.S.A., Inc. procedure for the disposal of all contaminated material, including clothing, spent filters, etc.) will be in an approved NRC disposal site.