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M-ZONE RESTORATION

1.0 Introduction

The initial M sand five-spot pattern was drilled and completed in the third and fourth quarters of 1979. This original pattern was laid out on an approximately 60' x 40' rectangle and the wells were drilled to an average depth of ~350 feet. Surface insulated piping was used to connect the wells to the flow distribution center. The pattern was placed in production January 22, 1980. Routine mining and test work continued to July 12, 1980 when mining was suspended in order to install additional five-spot patterns. Two 5-spot patterns contiguous to the original M-1 pattern were drilled within the permit area. These patterns were designated M-3 and M-5 and expanded the field dimensions to 40' x 182'. (See Figure 1.)

Mining was reinitiated August 8, 1980 in the M sands and continued to February 24, 1981. At this point, it was determined that adequate mineral extraction had occurred and due to economic considerations, the M-zone patterns were placed in restoration.

1.1 M-Zone Mining - Technical Discussion

During the mining phase, 28×10^6 gallons were recovered from the zone containing about 12,000 lbs. $\rm U_3O_8$ at an average 51 mg/l $\rm U_3O_8$. Average recovery flow was 34 gpm prior to the expanded pattern operation and 69 gpm during the final mining operation. Injection flow to the zone totalled 27.1 x 10^6 gallons which represented a bleed volume of 0.9 x 10^6 gallons and an overrecovery ratio of 3%. The bleed volume generated

was diverted to the solar evaporation ponds. Utilizing a pore volume determined from the actual wellfield area within the injection wells, average porosity and average total sand thickness within that area (969,951 gallons), 28.9 pore volumes were required to mine the zone to 63% extraction.

During the mining phase, certain parameters were expected to rise significantly above the zone baseline. The major lixiviant parameters including sodium and bicarbonate were expected to rise along with the soluble uranium concentration. Chloride ion increased due to the ion exchange circuit utilized for uranium recovery within the process plant. Calcium, magnesium and radium increases were noted due to a combination effect of sodium forced clay ion exchange and the Co₂ induced pH reduction altering zone equilibrium. Side reactions between H₂O₂ and O₂ and the host ore were evidenced by increased levels of sulfate, arsenic, selenium, manganese and iron. As a net result of the mining process, total dissolved solids peaked at nearly 3,200 mg/l at recovery or roughly 6 times the 483 mg/l baseline level (TDS determined by summation of major parameters). Section 1 - Table I lists the chemical concentrations of recovery and restoration monitor wells at the inception of the restoration program.

SECTION 1 - TABLE I

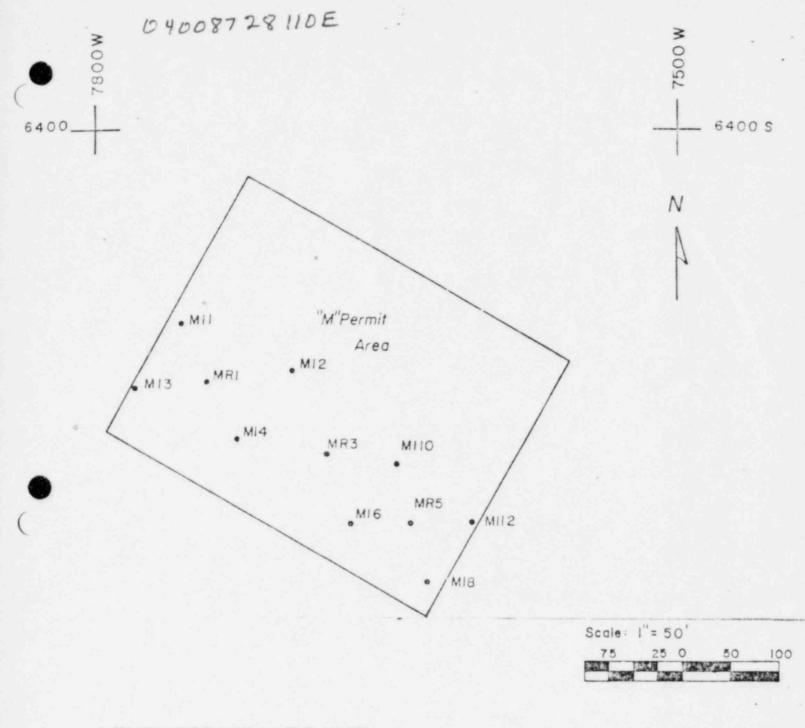
M-ZONE AFTER MINING BEFORE RESTORATION

UNC TETON EXPLORATION DRILLING, INC.

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	MR-1	MR-3	MR.5	301	7	1	
JATE SMPLE	2-19-81	2-19-81	2-19-81	2-19-8	306	308	MEAN
ANALYSIS	2-23-81	2.23.81	2.23.81	2-23-81	The same of the sa	2-23-81	1 STO DE
DATES	+	1	1	1	1	2-24-81	
x +	14.1.81	4-1-81	4-1-81	4-1-81	4-1-81	4-1-81	
HCO3 . mg/1	1747	1 100 5	1	1	_		
CO3 mg/1	48	1885	1640	1348	760	1128	1418 1 424
C1 mg/1	81.6	.0.	9.6	32.6	.0.	.0.	15 1 20.
SO ₄ mg/l	4 75	103.5	86.4	66.4	58	103	78.2 ± 28.
Anion eq.	42.44	444	4 3 3	418	233	362	394 2 87
Ca++ mg/1	244	43.07	38.66	33.77	18.10	28.94	32,20,
Mg++ mg/1	57	224	214	224.	225	/22	209 1 44
Na+ mg/1	556	54	54	44	44	36.7	48.3 1 7.9
K ⁺ mg/1		611	549	428	70	+29	440 196
Cation eq.	22.5	23.5	23.5	19.5	12.5	19.5	20.24 4.2
-/+balance	41.70	42.87	39.67	33.98	18.28	28.31	1 4. 2
Sum TDS	101.76	100.47	97.46	99.38	99.03	102.22	
Cond um/cm	3231	3345	3010	2581	1373	2200	2623 - 746
	3030	2930	2920	2530	1400	2400	2535 1 409
TDS mg/l pH unit	2114	2188	2006	1868	1034	1630	
	7.3	7.1	7. 2	7.5	7.4		1807 1427
mg/1	25.4	3.8	12.8	53.6	33.4	7.5	7.3 ± 0.2
1 mg/1						1.6	21.8 ± 19.9
1 mg/1 mg/1	0.08	0.08	0.05	<0.05	₹0.05	10.05	
	₹0.10	<0.10	< 0.10	<0.10	<0.10		0.06 20.02
As mg/1	0.011	0.005	0.012	0.009	0.010	<0.10	40.10
Ba mg/1	40.10	10.10	< 0.10	20.10	<0.10	0.016	0.011:0.00
B - mg/1	40.25	₹0.25	₹0.25	₹0.25	₹0.25	10.10	<0.10
Cd - mg/1	(0.01	10.01	₹0.01	<0.01	<0.0)	< 0.25	< 0.25
Cr mg/1	₹0.05	10.05	< 0.05	₹0.05	<0.05	20.01	<0.01
Cu mg/1	<0.05	10.05	< 0.05	10.05	10.05	< 0.05	<0.05
mg/1	0.28	0.17	0.18	17.39		10.05	< 0.05
e mg/l	0.08	₹0.05	< 0.05	20.05	0.28	0.33	0.27 +0.09
b mg/1	<0.05	₹0.05	< 9.05	<0.05	< a. 05	<0.05	0.05
in mg/1	0.21	0.18	0.31	0.24	<0.05	< 0.05	₹0.05
lg mg/1	40.001	<0.001	< 0.001	< 0.001	0.17	0.06	0.18 2 0.06
fo mg/1	< 0.1	< 0.1	<0.1	< 0.1	50.001	<0.001	40.001
i- mg/1	< 0.05	<0.05	< 0.05	₹0.05	<0.1	×0.1	< 0.10
102/NO3"	0.42	0.30	0.34	0.26	<0.05	×0.05	< 0.05
e mg/1	0.050	0.029	0.029	0.014	0.17	0.37	0.31 2 0.09
mg/1	₹0.10	<0-10	0.7		<0.005	₹0.605	0.02220.017
n mg/1	< 0.05	0.08	<0.05	0.2	<0.16	<0.10	0.22 10.24
		11 /1 8 -1 -1	-0.03	<0.05	70.05	< 0.05	0.05
6 pci/1	2055.5	188	949.5				
pci/l	69	70	71	2704.9	2598.5	282.19	463.1 1137
ross A "		1 - 4 - 5		72	. 5	5	48.7 2 33.8
ross B "							

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R & D WELL FIELD

Date: 8/6/80

SEC. 1 FIG. I



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2.0 Determination of M-Zone Baseline and Restoration Goals

Restoration goals for chemical parameters were set at the inception of the R & D project and are included in the Source Material License Applications under Table IV.1.02 page IV-5. These goals were to conform to the recommended public water supply criteria or the mean baseline of wells 301, 306 and 308, whichever was higher in value. Table IV.1.02 is attached to this report. (Section 2 - Table I.)

Although the goals seemed realistic and achievable, Teton was concerned that goals based on a three-well survey might not adequately represent the entire affected aquifer area. In order to verify the baseline survey, an additional water quality survey was performed utilizing 12 additional monitor wells drilled and completed either prior to mining or during the period from July 12 to August 7, 1980. The analyses selected were chosen based on a +/- 5% cation/anion balance criteria. The 15-well survey is attached as Section 2 - Table II and the supporting, selected raw data is in Appendix "D." Analyses selected are asterisked on the individual raw data sheets.

As a result of this exercise, it was determined that there was only minor variation in water quality throughout the zone in the permit area. The original restoration goals were verified based on the survey and Teton was able to determine major parameter baseline levels to use as indicators of restoration progress.

LICENSED RESTORATION GOALS

Ground Water Restoration Goals for R & D Test
(All units in mg/l except as noted.)

Chemical Parameter	M Aquifer Restoration Goal
рН	
Ammonia (NH ₃)	5.0-9.0
NO,/NO, Total	.5
Bičarbonate	mps1
Carbonate .	TDS TDS
Calcium	TDS
Chloride	250
Boron	1
Fluoride	1.4 to 2.4
Magnesium	TDS
Potassium	TDS
Sodium	TDS
Sulfate	250
Aluminum	.332
Arsenic	.05
Barium	1.0
Cadmium	.01
Chromium	.05
Copper	1.0
Iron	.73
Lead	.05
Manganese	.063
Mercury	.001
Molybdenum	.202
Nickel	
Radium 226	236.5
Selenium	.01
Uranium	5
Vanadium	.34
Zinc	5
TDS .	500

- The concentration of this parameter shall be at a level such that the restoration concentration for TDS is not exceeded. There is no known recommended Public Water Supply criteria for this parameter.
- No Public Water Supply Criteria exists. Average values shown are determined from wells PN5-L301, PN5-L306, and PN5-L308 in M Aquifer and wells PN5-L302, PN5-L312, PN5-L317, PN5-572, PN5-L573, PN5-L574 in N Aquifer.
- Baseline value (Table II.6.04) exceeds Public Water Supply Criteria. Average values shown are determined from wells PN5-L301, PN5-L306, & PN5-L308 in M Aquifer and wells PN5-6302, PN5-L312, PN5-6317, PN5-572, PN5-L573, PN5-L574 in N Aquifer.

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1915-0			244	.0.	5.6	1	5	7.2	57	6	+	+	8	482.3 4	1	+	+	4.70	H	. 60.0	4.70	-		+	+	4.05	+	+	* 05	+	-	× 05	-	-	4.005 4.0	*	Y	920
MM-7	8.22.80		224 8	.0.	4.5	97.5	5.85	44.5	3		-	5.94	4	413.5	400	-		0		0.70	-	2000	+	+	+	50.4	+	2/6	+	-	-			+	8	+	4.05	165.6
9-W	7.22.80		257	.0.	4.8	113.5	2, , 2	7/4	2.01	23.3	B.fa	6.63		206	* 004	397	7.31	4.10		4.05	+	+	4.10	+	10.4	+	+	0.05	-	-		-	-	+	+	* .03	+	980.4
RM-5	7.8.80		227.1	-	4.8	120	25.3	73.3	200		11.3	00.00	4 77 6			986	7.59	4.10	1	-	+	1	10	+	+	4.05	-	0.52				-	* 050 *	+	5 00	†	0.92	52,92
MIN-14	7.5.80		373.5	. d.	+		2.42	28.0	27	5 0	£ 61.	101.3	424.2		519	324	7.40	4.10	-	8,0	07	+	0/	2000	+	4.05		13			4.001	+	+	+	+	240	+ 7	220
MIS-2	7.77.80	417.	3/60		7:3	4 74	878	11. 3	26.5	8 4	5.62	102.14	427.8		165.8	348	2.4	4.10	-	4.05	0	+	+	10.	-	4.0.5	-		-	<.05	+	+	+	+	+	-	0	3.98
1-44	5.13.80 7.76.80 70.6.80 70.6.80	. v. c		4 8	104.9	5.83	47.6	12.4	28.4	8.2	5.85	100.34	442.4		480	357.8	7.54	4.10	**	+	0 7	+	+	4.05	H		-	+	4.05	+		+	+	4.005	+	0.5		9.5
97.5	4.6.81 6.39.79 5.13.80 7.14.80	224	.0.	90	100	3.98	20	15.3	28.4	8.5	40.0		-		A 7 to	930	7.63	4.10	200	4.10	*.00%	+	4.25	-	-		+	+	+	+	+	20.7	+	+	+	A 20. A	H	30.36 16.
575	3. 13. 23. 13. 13. 13. 13. 13. 13. 13. 13. 13. 1	2+7	.0.	8.8	103	5.94	2.03	14.8	27.54	3.4	5.93	100117	444.7	1	476	000	1.5	01.10	4.0.8	0.73	0.00%	+	+	-		*.05	+	6	+	0 1	+	20 7	100	500	01.10	50.	1	7.41 3
308	50 K-1 m	- 2	-0-	80	246	7.4.7	10.00	a	2.2	0/	7.48	99.9	244		715	13.1	0.0	7/000	40.0	4.10		+	10.0		-	4.0.1	+	+	+	*0.0	+	-	*.0.*			, v.o.o	+	102
202	00.00.00	234	.0.	6.3	323	10.76	113	43.4	26.3	10.3	10.03	101.32	755.0		2/2	0000	40.0		4.05	0.13	-	-	20.2		-	90.*	+	+	+	1000	-	+	-			4.05		4.67
306	6-11-73 6-11-73 5-13-80	234	.0.	0.9	94.7	6. 9.9	59.7	+1.4	ca:	8.3	5.84	+	4 4 9		163	200	200		0,3%	0.13				+	4.10	+	0.18	+		000	50	-	-	0.1	0.5	Vi G		262.0
305	3.13.75	2 6.8.3	.0.	7.3	124.5	7.20	77.1	3.2	30.8	T	7	-+-	532.1	+	777	r	01.4		4.10	-		-	-	¥.01	+	+	4 0	+	+	. 000	-	-		A	0.44	+	,	2 2 2
yat	1-10-79	214.7	.0.	60	100.0	200	61.3		3	1	+	+	224.2	-	830	NIN		H		-		+	10	+	200	+		+	0.05	-	-		0.0.0	5	+		420	+
4.7.6	SATES O	HC03 re/1	17/10	100	1779	(a) (b)	1000		K + 4.4	E 20	9	SULT BR	2	umtro/cm	1/24	th unit	01/25		A1 TC() (8)	19 1/2	86/1 (61	201/32	Pre/1 (5)	200	10 () () () ()	80/1	1/24	80/16	mc/1 (5)	FE/1 (B)	10/16	601/22	502 (F)	(J) // W	V 10 1/20 V	0 2 100	24 226 per 1 163 A	pc1/169

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3.0 Restoration Plan

Per Section IV.1.2, pages IV5a-IV5c of the Source Material License Application, Teton agreed to perform restoration by ground water sweep. As this technology was successfully employed in the Upper Zone (N sands) and the option was presented to test alternate methods for restoration, Teton decided to employ the electrodialysis process and additional water treatment technology in the M sand restoration project.

3.1 Determination of Affected M-Zone Aquifer Volume

The logical first step in planning an aquifer restoration program was to identify the area affected by leach solutions. This determination was made utilizing data relative to the area geology, hydrological characteristics, operational mass chemical balances, and involvement of restoration monitors during mining.

The basic premise involved in determining the affected aquifer volume was that the volume could be determined by noting mass addition of a foreign trace element to the aquifer during mining and by assaying its final equilibrium concentration. The specie added to the zone during mining that was not susceptible to loading on clays and was not present in the zone prior to mining to an appreciable degree, was the chloride ion.

The source of chloride ion injected to the zone was the IRA-430 strong base anion exchange resin used for extracting soluble uranium from solution during mining. The mechanism involved is represented by the following equation:

Recovered Solution
$$\rightarrow$$
 Resin \rightarrow Injected Solution
$$SO_4 = SO_4 \\ UO_2(CO_3)_2 . 2H_2O^{=}(UDC) + R-C1^{-} \rightarrow R UDC + C1 \\ HCO_3^{-}$$

The total amount of chloride ion that was available for addition to the zone via ion exchange was determined by noting the total ion exchange capacity of the resin and accepting the theory that resin elution reconverts all sites to chloride form. The expected chloride ion increase to the extraction circuit was calculated to be ~3,500 lbs.

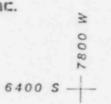
The actual chloride mass lost to the zone during mining was determined by daily accounting of injection minus recovery chloride pounds. The actual mass of chloride residing in the zone at the inception of restoration was 2,554 lbs. The determination of affected volume and area was a two-part effort and results and data bases are shown on Section 3 - Figures I and II.

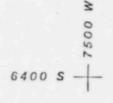
By assuming that all the chloride residing within the wellfield boundary was at equilibrium recovery levels, it was determined that 817.5 lbs. of the total was within the wellfield. This indicated that 1,736.5 lbs. chloride had diffused outward from the three patterns. The chloride concentration in the externally affected area would decrease linearly from the wellfield perimeter to the unaffected area and would therefore be approximately one-half the field concentration as an average. By noting the actual chloride mass external to the wellfield and its expected mean concentration, the affected volume including the wellfield volume was determined to be 5,089,136 gallons. With a wellfield pore volume of 969,951 gallons, 4,119,185 gallons were expected to be affected adjacent to the patterns.

UNC TETON EXPLORATION DRILLING, INC.

Leuenberger Project

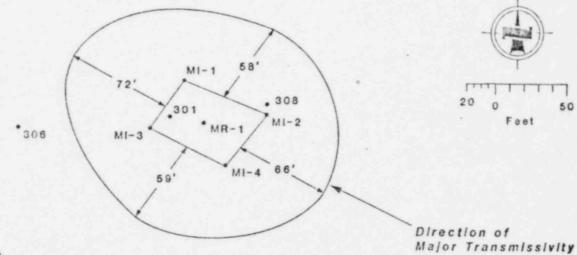
Sec. 3 Fig. I





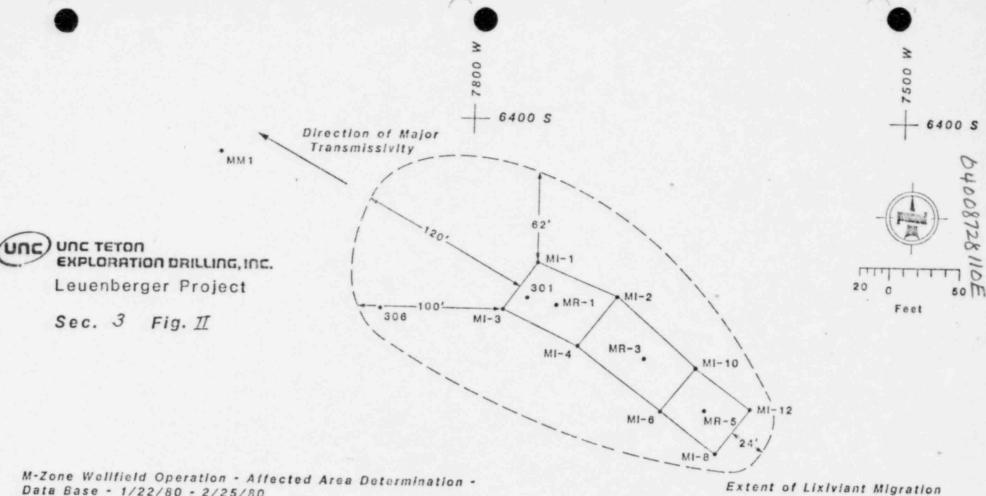
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*MM1



Determination of Leach Affected Area M-I Pattern Operation 1/22/80 - 7/11/80

Welf	Gallons A/I	% O.R.	% to Tot.	Lbs Cl Lost	CF Conc. 7-11-80	Lbs Cl* Inside	Lbs Cl ⁻ Outside	Sand Thickness	Porosity	Gallons Affected	F12 Affected
M-1 Pattern	8,110,786(1)	14 A	NA	574.5	NA	111.1	463.4	70'	24.8%	2,776,380	21,381
MR-1	8,254,153(R)	1.74%	NA	NA	46	NA	NA	80'	NA	NA	NA
MI-1	2,034,185	NA	25 08	144.1	NA	NA	116.2	68' .	NA .	696,192	5,362
M1-2	2.073,928	NA	25.57	146.9	NA	NA	118.5	80'	NA	709,972	5,468
M1-3	2,004,986	NA	24.72	142.0	NA	NA	114.6	57'	NA	686,606	5.288
M1-4	1,998.498	NA -	24.64	141.6	NA	NA	114.2	65'	N.A.	684,209	5,269



Data Base - 1/22/80 - 2/25/80

	Gallens Inj/Rec	Field Dimensions	Field Area/Fi ²	Sand Thickness	Field Volume/Fi ³	Porosity	Reservoir Volume/Gal	Lbs CI ⁻ Inj-Rec	Lbs CI" in Fleid	Lbs CI* Ext Area	Gal/F12	Affected Area Ext/Ft ²	Affected
M-E	20,204,884(R	60.5'x43'	2,562	70"	179,354	24.8%	332,709		200 .			Total Carret	* 010m87G1
M - 3	5.067,319(A	72.5'x42'	3,000	72.6"	217,764	24.8%			280.4		129.85		
M-5	2,726,833(R	49.5'x39.5'	1,926	65.3'	125,755		403,961		340.5		134.67		
				20,0	123,733	24.8%	233,281		196.6		121,10		
MI-1	5,270,011(1)			68'				480.5		332.5		1	
M1-2	4,291,421(1)			80"				377.5			129.85	6,076	788,957
M1-3	5,360,729(1)			57'						266.7	132.26	4,785	632,826
MI-4	6,718,998(1)			281				490.9		338.9	129.85	6,193	804,143
M1-6	2,411,642(1)							632.4		429.8	132.26	7,711	1,019,830
M1-8	513,926(1)			62'				250.7		161.2	127.89	2,991	352,496
M1-10	2,006,213(1)			66,				53,4		34.4	121.10	674	81,624
M1-12				17.17				208.6		134.1	127.89	2,488	318,193
				60*		1		59.8		38.4	121.10	752	91,116
Total	27,147,776(1)	182.5'x 40.5"	7,488	69.3*	518,918	24.8%	969,951	2,554	817.5	1,736.5	129.54	31,670	4.119.185

M-ZONE RESTORATION DETERMINATION OF LEACH AFFECTED AREA

In order to determine the approximate location of the affected volume several factors including duration of well operation, sand thickness and porosity, injected volume, and transmissivity directions were utilized. With the knowledge of pounds chloride injected to each well during operations and by assuming that simple diffusion was responsible for field flaring, a radial influence for each injection well was developed. Well-to-well radial influence overlaps were summed in the direction of major transmissivity to determine an overall affected area approximation. (See Section 3 - Figure II.) It was assumed that the entire M sand thickness was involved in the leach effect.

3.2 Restoration Process

In order to remove aquifer volume constituents while maintaining minimal process bleed, a plan was needed which would concentrate undesirable recovery chemical parameters in a reduced volume. The two processes investigated were reverse osmosis and electrodialysis. Due to economic considerations, reversing polarity electrodialysis was chosen as the base unit for the restoration plant.

The basic process employed for the M-Zone restoration incorporated the following:

Process	Purpose
A. Filtration of recovered solutions	Remove clay and solids prior to further treatment.
B. Ion exchange treatment	Removal of uranium.
C. Reversing polarity electro- dialysis	Concentrating constituents in IX effluent in a reduced volume - clean product generated was used to dilute IX effluent to baseline water quality prior to reinjection.
D. Reinjection of diluted solution	Dilute parameters in leach affected area. Hydrologically guide affected waters to recovery wells for

treatment.

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The following diagram (Section 3 - Figure III) illustrates the general flow sheet for the restoration plant:

Wellfield Unit Function Recovery Recovery Ion Exchange Surge Feed Tank Sand Filtration to Filters 25 µm Primary Uranium Ion Exchange Removal Secondary Uranium Ion Exchange Removal Liquid CO2 EDR Feed Vessel pH Control EDR Feed Feed Tank Surge EDR Power/ 10 um Filtration AC/DC Conversion Flow Unit Flow Control Ion Separation EDR Membrane Stack Injection Injection Surge Surge Tank Brine to Waste WELLFIELD INJECTION

	Flow	Solution
#	Rate	Conductivity
	GPM	Limhos/cm
1	52.1	1,289
2	52.1	1,289
3	25.4	1,289
4	30.8	1,748
5	26.7	1,289
6	5.4	3,907
7	21.2	182
8	4,2	5,956
9	47.9	856

- EDR BASED RESTORATION - FLOW DIAGRAM

The report attached as Appendix "A" describes the electrodialysis process and summarizes actual operational data gathered during the restoration program. Additional data relative to the electrodialysis operation is available on Table I, Section 4-1, M-Zone Restoration Data.

3.3 Wellfield Operation

Due to the knowledge that the leach area involved restoration monitor well 306 (Note see Section 3, Figures I and II) and that approximately 12 months were required for the field to diffuse to a distance of >85 feet in the direction of major transmissivity, approaching restoration in the same manner as mining relative to wellfield flow patterning would require excessive time.

It was suspected that operating the field exclusively with external injection wells would ultimately leave a high TDS halo around the patterns. In order to pull the halo to recovery wells a program was developed which utilized some injection wells as recovery wells while injecting baseline quality water elsewhere in the field to provide hydrological barriers. A phased program which is discussed in the following section was implemented.

3.4 Restoration Plan

3.4.1 Phase 1 - The initial phase at M-zone restoration was designed to reduce chemical parameters within the wellfield confines, remove uranium and other constituents which had been subjected to recent oxidation and allow time to de-bug the

electrodialysis unit and develop a comprehensive restoration plan. Phase 1 was to consist of terminating chemical injection to the zone, treating a recovery split with the EDR unit, and operating the wellfield in a usual fashion.

3.4.2 Phase 2 - Phase 2 was designated to begin a directional sweep approach which was designed to remove the solution external to the patterns. The overall program consisted of recovering from triangular patterns of two injectors and one recovery well, while injecting into the center of the field to reduce recovery from the field internal area.

Phase 2 was designed to remove and treat leach affected solution adjacent to the M-5 pattern (see M-5 sweep area, (Section 3, Pigure IV) while maintaining a draw on the M-1 sweep area.

The following pumping patterns were to be used:

Reovery wells - MR-5, M1-8, M1-12, 301
Injection wells - M1-10, M1-6, M1-2, M1-4

3.4.3 Phase 3 - Phase 3 was designed to remove and treat solution adjacent to the M-3 pattern and complete any withdrawal in the M-5 area near the injectors. A continuous draw on the M-1 pattern was also anticipated.

Recovery wells - M1-10, M1-6, MR-3, 301
Injection wells - M1-2, M1-4, M1-1, M1-3

0400 872 8110E

3.4.4 Phase 4 - The final phase of M restoration was to be the sweep of the M-l pattern. Reinjection of baseline water quality to the already restored field area was planned to balance the recovery flow.

Recovery wells - M1-1, M1-3, MR-1, 301

Injection wells - M1-2, M1-4, M1-6, M1-8, M1-10, M1-1

3.5 Restoration Schedule

The means of determining the restoration schedule was based on the expected chloride removal rate provided by the EDR and an estimation of the area that would be affected by the directional sweep approaches.

The sweep areas are shown on Section 3, Figure IV, and Section 3, Table I, outlines the scheduling justification. The major premise involved in the scheduling was that in removing the noted trace parameter to background levels, the affected volume and other elevated parameters would also be reduced to acceptable levels. An assumption was also made that by the selective injection, little injected solution would be directly recovered.

SECTION 3 - TABLE I RESTORATION SCHEDULE

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Expected Initial Cl Conc. Expected Final Cl Conc.	107	103	111	99	NA 6
Average Recovery Cl Conc. EDR Feed Gallons	50.5 43200	48.5 43200	52.5 43200	46.5 43200	NA 43200
Lbs. Fed/Day % Cl Rejection	18.2 75%	17.5 75%	18.9	16.8 75%	NA 75%
Lbs. Cl_ Removed/Day	13.7	13.1	14.2	12.6	NA
Lbs. C1 in Sweep Area Days Required for Removal	817.5 60	127.9	226.4 16	1382.2	2554 196

4.0 M-Zone Restoration Results

4.1 Phase 1 - Results and Discussion

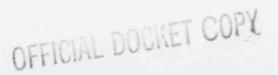
Phase 1 of M-Zone restoration was initiated February 25, 1981 with the completion of installation and debugging of the electrodialysis unit. Chemical injection to M-zone had been terminated February 17 and prerestoration samples of operating recovery wells, injection streams and restoration monitors were collected between February 15 and February 23. (See Appendix "B.")

This phase consisted of routine wellfield operation

(Section 4, Figure I for injection and recovery wells) without chemical injection and partial removal of recovered constituents via ion exchange and electrodialysis.

Phase I was successful in reducing recovery TDS by an average 57% at the four recovery wells. As expected, rapid cleanup of the internal wellfield area was noted; however, restoration monitor 306 showed only minor reductions as a result of 301 pumping. In addition, it was necessary to treat the EDR feed with hydrochloric acid to prevent CaCO₃ scaling in the stack. This reduced the chloride removal efficiency of the phase to ~20% of expected.

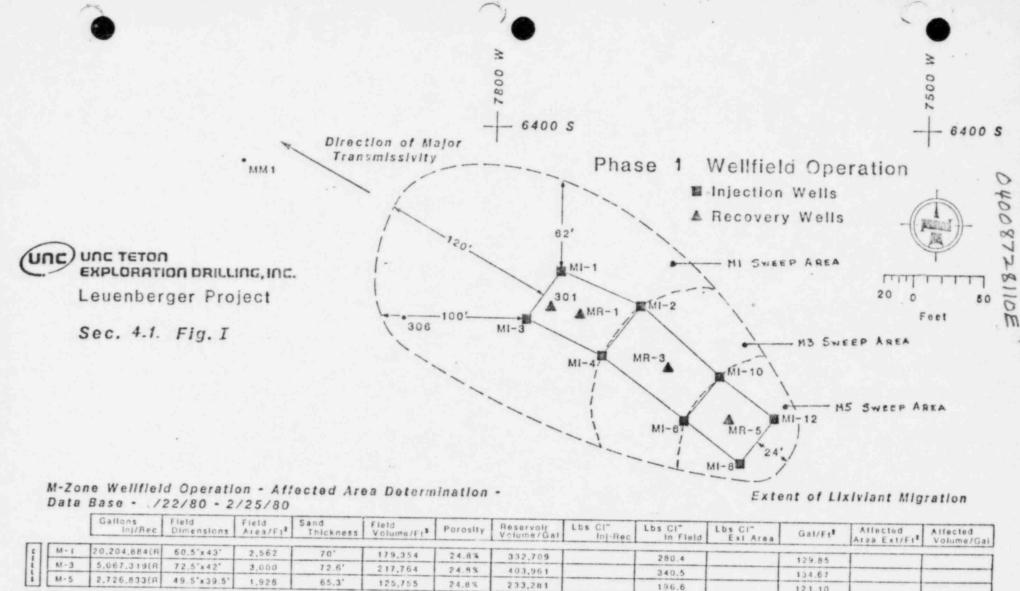
In order to assure recovery and treatment of solution that had diffused laterally from the operating fields, the directional area sweep approach outlined in Section 3.4 was implemented on schedule April 21, 1981.



During the initial phase 6,456,750 gallons were recovered from the four operating wells and \$\overline{3}\$,989,750 gallons of diluted injection were reintroduced to the zone. A total of 2,012,315 gallons of the IX treated recovery solution were fed to the EDR, which produced 1,636,277 gallons of product for reinjection and rejected 376,038 gallons of brine to waste. The EDR unit provided an 80.3% water recovery and 85.1% salt rejection. No wells were completely restored during this phase; however, recovery parameters were reduced to a point where CO₂ was substituted for the hydrochloric acid pH adjustment on EDR feed.

Attachments:

- A. Section 4.1, Table I M-Zone Restoration Data Base
- B. Section 4.1, Figure II Phase 1 Wellfield Operation
- C. Section 4.1, Figures I-VII Phase 1 Analytical Trends



	Gallons Inj/Rec	Fletd Dimensions	Field Area/Fi ²	Sand Thickness	Field Volume/Fi ³	Porosity	Reservoir Volume/Gal	Lbs CIT Inj-Rec	Lbs CI* In Field	Lbs Cr Ext Area	Gal/Ft*	Affected Area Ext/F12	Affected Volume/G
M - 1	20,204,884(R	60.5'x43'	2,562	70'	179,354	24.8%	332,709		290.4		100.00	1	
M - 3	5,067,319(A	72.5'x42'	3,000	72.6'	217,764	24.8%	403,961		340.5		129.85	-	
M-5	2,726,833(R	49.5'x39.5'	1,926	65.3	125,755	24.8%	233,281		196.6		134.67		
811-1	5,270,011[1]		1	68'									
M1-2	4,291,421(1)			80*				480.5		332.5	129.85	6,076	788,957
M1-3	5,360,729(1)			57'				377.5		266.7	132.26	4,785	632,826
M1-4	6,718,998(1)			65'				490,9		338.9	129.65	6,193	804,143
M1-6	2.411,642(1)			71'				632.4		429.8	132.26	7,711	1,019,830
M1-8	513,926(1)							250.7		161.2	127.89	2,991	382,496
MI-10	2,006,213(1)	-		62.				53.4		34.4	121,10	674	81,624
MI-12				66.				208.6		134.1	127.89	2,488	318,193
W1.15	574,836(1)			60'	1			59.8		38.4	121.10	752	91,116
Total	27,147,776(1)	182.5'x40.5'	7,488	69.3'	618,918	24.8%	969,951	2,554	817.5	1,736.5	129.54	31,670	4,119,185

04008728110E * % of REC - % of RECOVERY TREATED BY EDR UNIT E 0 8 Prounts % of 16 14. 83.7 4 83 85.1 0 68 52.0 69.9 85.0 89.4 27.3 4.15 40.0 8758392 428 56 5 3462493 31.2 1636277 47.5 2967679 8 +6 - 63 TABLE E KIC 55.0 46.3 SECTION .. CALLERS VOIGE SEED 2012315 4034010 10463863 060 3543215 808317 FLECTRODIALYSIS 68.0 0.12 5 4 0 1.76 631523 116374 376038 581536 1705471 # Lb. CI EXT. " Pounds CI" Law EXTRACTED 7.23 0,0 8 20 8 42 12.8 9.45 NOTECTION CAULDES MISKEN D 6457270 148 1809 20455761 5989 150 1966475 6462820 344470 2223246 426263 344567 4602437 2822826 4327549 481613 2107296 858570 1454860 849219 416902 2271895 684647 723236 1328894 739627 345921 547288 722071 1101225 2103351 1+101+1 240476 755512 151487 706514 DATA BASE - ABBREVIATIONS 8/10/81 - 9/1/81 mi i 2/25/81-+/20/81 2125161 - 4/20181 8/10/81-9/1/81 4120le1 4120181 2/25/61-4/20/81 2/25/81-4/20/81 7 25 181 - 4 120 181 4/21/81 - 8/10/81 8110181-911181 2/25/et-4/26/81 1/21/81 - 8/10/81 4/21/81 - 8/10/81 8/10/81-9/1/81 9/1/81-12/20/81 9/1/81-12/8/81 4/21/81 - 8/10/81 11/11/181-12/20/81 9/11/81-12/20/81 9/1/81 - 13/14/8/ 911/81-12/8/81 911181 - 12114181 1, 3.3.4 PHASE . 1.2. 3.4 PHASES 1,2,4 1,3,4 1,3,4 0 PHASES 1,3,4 +.-OPERATE TOTALS TOTALS WELLFIELD TOTALS TOTALS TOTALS HT 3 2125/81 PHASES PHASES ME 10 PHASES PHASES RESTORATION WILLS 11.6 HI 12 HI Z HE 2 0) - 114 01.11 MI-1 HI 3 41.16 10 2625029 2.71 551.5 21.4 11-10 500 100 HI 12 12 ING. 9.14 MI-10 MI.2 4 14 11.8 111-12 10.60 #1.2 H1.3 2 111 0 11 8 IH 0 M -TU 111 , 12 % 1 60 3.5 2.4 1 12 1.39 2404 10.2 1295 50.7 8.8 0.4 2.6 33.3 4.7 . 13 0.7 8.0 2.69 313.2 12.3 153.9 6.3 0.7 0.1 10.2 6.3 23, 29 2285 89.5 0.32 17.6 0.7 DEF Lb Ci 186356 0.19 25.8 2842563 2.93 270 2 979295 1.01 1192 61.5 G. 641 140.0 7.48 1295 0.45 71.5 243.2 159.9 0. 92 17.6 0.85 21.0 7.64 634.1 2.55 102.7 18.6 - TOTAL 2.08 218.7 7.53 849.9 0.3 2.51 66.4 3.12 29% 2606 NO 0.2 1 1 * [TOS]I - BUITIAL CALCULATED TOS HEADING 3 NO Z 0 2.542 2.28 27.0 0.27 0.05 GALLONS PORE 11.11 1.39 1.11 WAS 6750 7251711 336280 1832753 262662 341 532 390582 734 30.4 1345119 1436101 634 780 307365 2467701 808791 10,6 3801 148876 7413145 2472592 2431635 2014449 3028319 2604607 22591848 52133 7304060 PHASE 4 5011 Σ 5011 307365 1345119 1077541 52 8 3 6 9 - 8 57 0 - 8 . % 80 m 34.1 2 6.9 53.6 90.5 2773 530 809 2.6+-23.8 34.3 1028 -4.5 19.0 42.8 21.4 78.5 76.4 77.8 1140 5.8 347 -1.7 54.6 1096 658 40.0 28.8 39.3 4.04 30.4 34.1 1.1 10 RECOVERY - PHASE 1 THROUGH 1 1 1 2 1 0 35 w 243 + 124 0 32 + 2773 H 94 53 0 2572 H 94 714 470 80.8 553 230 2004 1208 263 581 682 520 121 612 859 36,7 518 89.4 2572 553 88.2 2347 553 58.1 585 714 1137 17.0 72.4 10.55 37.0 35.1 1232 1216 17.0 68 5 1083 17.0 25.1 -47.4 484 38:1 -25.6 361 2+8 3000 -5.0 365 50.4 1016 52.1 884 396 15.0 -36.4 398 14.2 20.0 158 515 49.7 IOE4 884 1055 1083 6 136 181 - 8 10 181 28 0 9 0 67 9 6 1 9 NED. 34.4 47.2 60.00 50 00 MA-5 4/21/81 - Eliofet 670 13.0 804 1.0 726 34.4 WELLFIELD 0 3 *[Ci-] I - INITIAL CI CONCENTRATION 27.3 6 ... 58.0 19.0 29.4 36.5 9/1/81-12/20/61 34.1 14.8 13.4 + "11 13.4 12.9 8/10/81-8/13/81 9.0 11.3 11.9 10.9 10.5 10.9 3 3 5 3 + 11 21.9 112.9 00 67 87 101 83 9/1/81 - 12/20/81 4 120/81 'n 1.1 4/21/81 - 8/10/81 18. * 11. * REC. WELLS - RECOVERY WELLS 8/10/81 - 9/1/81 ZONE RESTORATION 57.0 [6,1] 54.0 26.0 31.1 12.6 E 6 8/11/81 - 9/11/81 18 O 29.4 0.11 100 16 101 103 101 5 4 5 9 28 46 181-4 /20/81 4121/81-8/10/81 4121181-6125181 MH 3 2/25/81 - 1/20/81 4/21/81-7/25/EI 2725/81-4/20/81 91:181 - 3190761 13:1818: - 13:11181 91:18: - 9:18:18: 8/14/81- 9/1/81 8/10/81-5/1/81 8110181-9/1/81 91:181-11 liulas 5/8/81-12/8/81 12/2/81-12/8/6/ 1, 3, 4 1.2.4 sizsiei 1.2.4 2.3.4 DATES PHASES 1,4 3.4 TOTALD TOTALD PHABES PHASES PHASES TOTALS TOTALS PHASES PHASES PHASE PHASE PHASE PHASE 4 PHASE ! PHASE PHASE PHASE - 0) 60 0 0 0 0 0 0 0 0 2-114 SI- 1H E 31 HI-1 HI.4 in it 331 11.3 HI-12 HE-1 11.3 301 301 30 E 2- 1W HI.8 1-11-1 + 11 5

FRUSECI

LEUENDENGER

UNILLING

* " of INJ - EDR PRODUCT RATIO TO INJECTION

Y % SALT NET - % TOS REMOVAL BY EUR

PEFERS TO CE TON LOST DURING MINING - 2554 IS.

THE DESIGNATION OF SOUND ONLY

* PLUE VOL. REG - PORE VOLUMES RECOVERED

* [TOS]F-FIRME CALCULATED TOS 115/1

1/6 m

*[CI]F - FIRST CI CONCENTRATION "5/1

0/0 BED - 8/0 GEDING #100

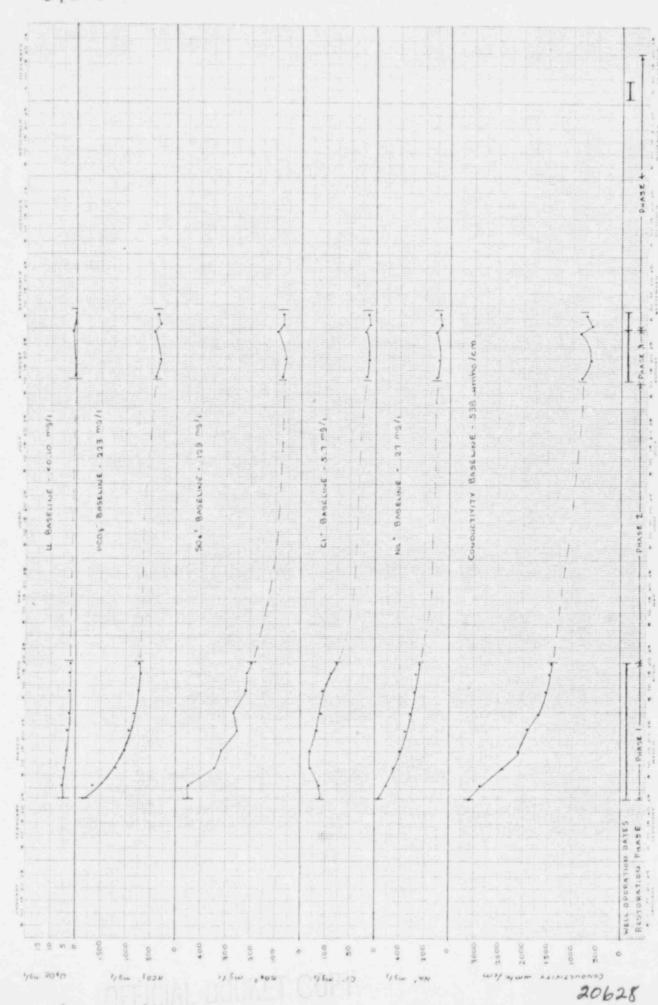
% CI EXT. - % CI TON EXTRACTED YA * 960 R - 06 WELLERED OVER PECCUTELY

* " WATER CIT . FUR. LEGISLIS T. 1511

WELL MR.3

ANALYTICAL TRENDS

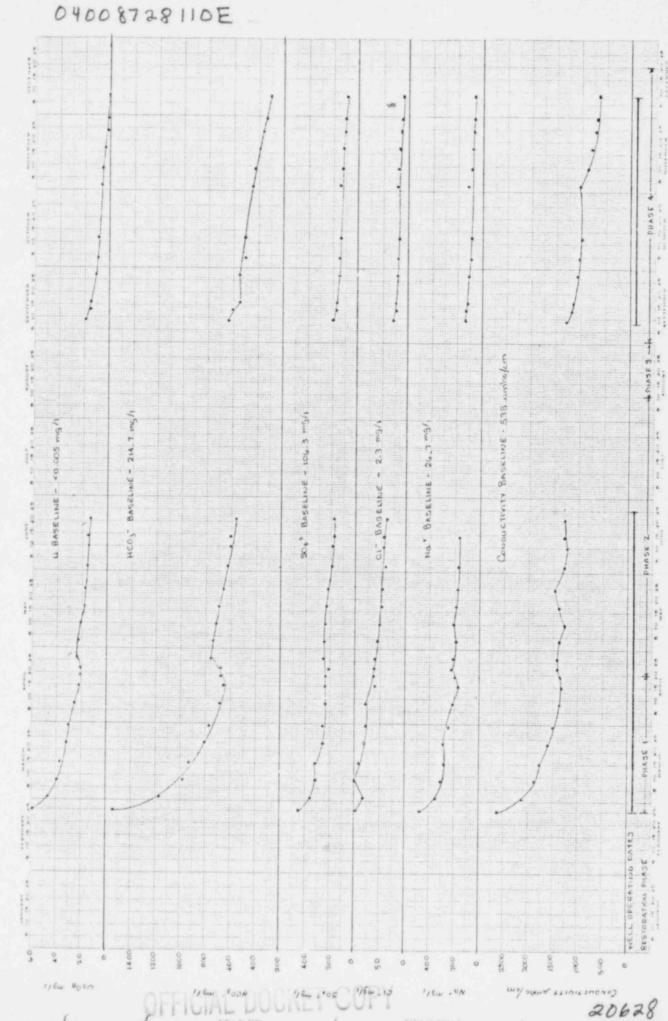
UNC-TETON EXPLORATION DELLING COMPANY INC.



WELL MR-5 UNC-TETON EXPLORATION DRILLING COMPANY INC. SECTIONAL! FIGURE IV 1/6m 01.0> 5.7 mg/1 27 WELL OPERATION DATES 20628

UNC-TETON EXPLORATION DRILLING COMPANY INC.

SECTION A.1 FIGURE V



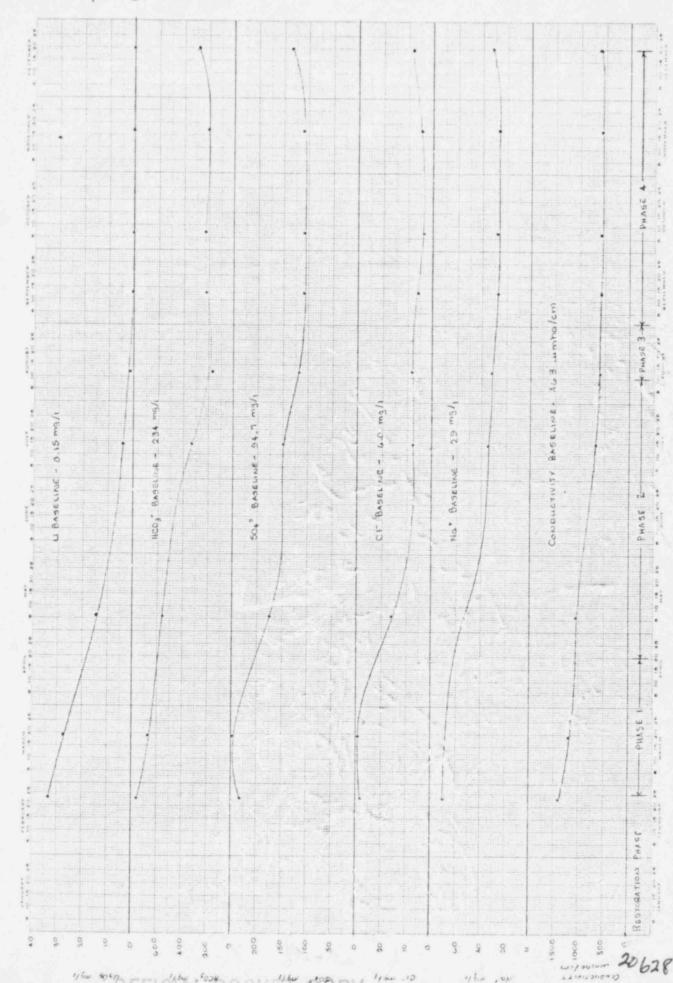
NETT 306

UNC-TETON EXPLORATION DRILLING COMPANY INC.

M ZONE RESTORATION

LEUENBERGER PROJECT

SECTION 4.1 FIGURE VI



ANALYTICAL TRENDS

UNC-TETON EXPLORATION DRILLING COMPANY INC.

SECTION 4.1 FIGURE VII

4.2 Phase 2 - Results and Discussion

The M-5 area directional sweep program was initiated April 21, 1981 with wells M1-8, M1-12 and MR-5 serving as recovery wells in the area. Due to the slow response of restoration monitor 306 noted during Phase 1, wells 301 (4/21-8/10) and M1-3 (6/26-8/10) were utilized as recovery wells in the M-1 sweep area. Dilute reinjection was introduced to wells M1-2, 4, 6 and 10 during the entire phase. A total of 7,251,711 gallons were recovered during Phase 2 with 3,636,100 gallons derived directly from the M-5 sweep area.

Phase 2 required from April 21 until August 10, 1981 in order to reduce chemical parameters at the three recovery wells to near baseline levels. During the phase 1,295 lbs. of chloride ion (50.7%) were recovered and extracted from the zone, 621 lbs. of which were derived directly from the M-5 recovery wells. Considering that only 19 lbs. Cl had been recovered from the M-5 area during Phase 1, it was suspected that 306.5 lbs. Cl were residing in the area. Obviously, additional areas had been affected through the phase which was evidenced by the nearly total clean-up in the M-3 sweep area.

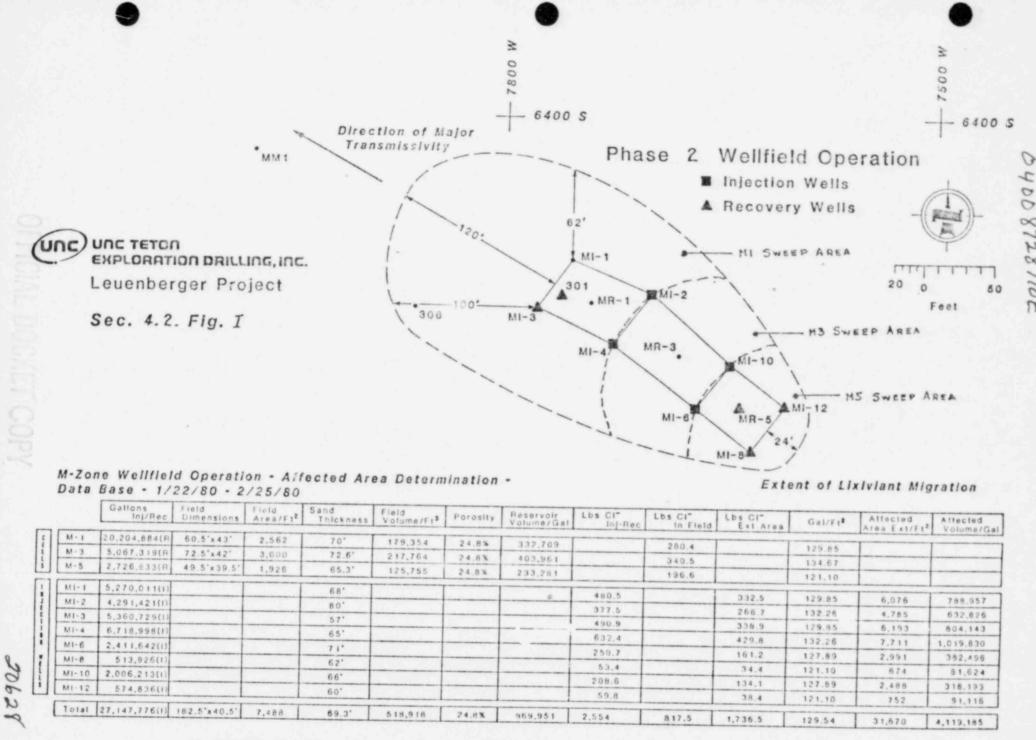
Of the total recovery fluid, 4,094,016 gallons were fed to the EDR unit which provided a 89.9% salt rejection with an 84.6% water recovery. A total of 3,462,493 product gallons were reinjected to the field and 631,523 gallons were bled to the evaporation ponds as brine.

The purpose of running Phase 2 to 111 days (as opposed to the scheduled 10) was to reduce the east end of the wellfield to near baseline level prior to moving forward. This was to facilitate having a restored wellfield area in which to reinject clean water without risking excursion of an unrecovered portion of the "halo."

To the end of Phase 2, a total of 14.1 wellfield pore volumes had been recovered and treated and only 1.04 pore volumes had been bled as process brine. A total of 1,455 lbs. Cl or 57% of the chloride lost during mining had been recovered.

Attachments:

- A. Section 4-2, Figure I Phase 2-Wellfield Operation
- B. Section 4-2, Table I M-Zone Restoration Data Base
- C. Section 4.2, Figures II-VIII Phase 2-Analytical Trends



M-ZONE RESTORATION DETERMINATION OF LEACH AFFECTED AREA

04008728110E * 0/0 of REC - % of RECOVERY TREATED BY EUR UNIT S 3462493 520 69 9 64.4 83.7 53 6 3 851 0.69 51.4 89.0 4.69 004 428 Proposet 8758392 6.91943 F S S 47.9 46.3 CRITICE VOIS GRICONS 1.74 10463863 40.54 016 2012315 0 40 3549215 ELECTAODIALVS15 98.0 116374 0.12 0 .5 376038 820 631523 581536 1705471 * Lb. CI Ext. - Busins CI tou Extracte D 0/0 7.23 8 42 12.8 9.45 NOITCEN 6657270 20455761 CALIDAD UNIVERSITY OF 148 1809 1966475 5983 150 227:895 2223246 462820 6602437 2107296 358570 45586 344470 426263 344567 2822926 723236 4327249 1328896 4816.13 739627 349219 206714 1365451 1419141 547288 1222071 1101225 2103351 100,514 755512 151487 - ABBREVIATIONS Slicies - Silias 11.1 2/25/81-4/20/81 91:181-12/20181 2125181 - 4120181 HI 8 2/25/81-4/20/81 Blicies - 9hilbs 4120781 #1 4 2125 fat - 4 120781 2/25/81-4/20/91 MI 12 2/25/81-4/20/81 M1-10 4121/81 - 8/10/81 8110181-911181 911181-12/20181 9/1/81-12/8/81 MS 2 4/21/81 - 8/10/81 MS 4 4/21/81 - 8/10/81 1.11 159.5 4.3 111.40 4/21/81 - 8/10/81 Bho!#1-9/1/81 11/17/81-12/20/81 9/1/81-12/14/81 911181-12114,81 31:181-1218181 MI 10 PHASES 1, 2, 3,4 PHASES 1.2.3.4 OPFRATED PHASES 1,2,4 1,2,4 PHASES 1,3,4 1.3.4 +,1 TOTALS WELLFIELD TOTALS PHASES MI PHASES 9-111 WC112 8 111 71 10 71-12 2842563 2.93 270.2 10.6 11.2 111 2 F11 3 40-111 4.0 MI-1 H1 3 8.31 141.10 186.5 m1.3 4.11 9.14 9 14 111.12 111.8 "C C" 1.02 (92.5 + 8 1.39 2404 10.2 * [TOS] I - PUTTAL CALCULATED TOS "5/1
* [TOS] F - FINAL CALCULATED TOS "5/1
KFONT VEL. REC - PORE VOLUMES RECOVERED 2625029 2.71 551 5 21.4 11.6 -0.7 8 4.7 5.0 2.4 2.40 9.00 33.3 12.3 748 295 50 7 0 2 1469742 1.52 136.1 5.3 7.44 694.1 27.2 0.32 17.6 0.7 1.39 2404 10.2 HEADING DEF Lb.Ci 1.01 119.2 61.5 G. Gal 140.0 0.65 71.5 0.85 21.0 243.2 0.32 17.6 - TOTAL 2.55 102.7 2.08 218.7 7.53 849.9 2.69 313.2 1.11 159.5 18.6 3.12 296 HO 0.2 2.28 0.83 0.17 2.54 0.27 SALLONS 7251711 1832753 10.45 6.750 336280 34.1 1077541 307365 979295 2467701 808 791 262662 17.0 12 6 1055 134 30 4 134 5113 634.730 2491695 2604607 166 3801 148874 52133 2472592 2014449 3028 919 22591348 1105 7304050 PHASE 4 5011 307365 1345119 1077541 52.8 49.1 5.45.5 · 0/0 868 -26.9 67 9 884 341 592 121 39.3 658 AD.O 101 11.9 38.2 2434 520 78.6 1028 -4.5 535 -43.5 2004 1208 53.6 23.8 37.0 35.1 1232 1140 5.8 19.8 42.8 51.4 80.9 284 76.4 37.8 39.3 -25.6 361 347 -1.7 28.8 30.4 34.1 3.3 PHASE I THROUGH RECOVERY 34 39.2.2347 1107 35.6.2434 124.0 32.4.2773 1194 33.0.2572 1107 [100] [103] 855 17.0 68 5 1083 714 220 C 1 5 581 230 553 347 575 88 2 2347 553 -24.1 1084 290 9/1/81 . 12/20/61 34 1 14 8 56.6 1090 43.3 1137 89.4 2512 12 16 \$0.01 0.02 2773 1084 87.9 2604 5 to 273 -5.0 845 884 8 S E 10.55 68.5 1083 15.0 -34.4 398 18.0 14.2 20.0 158 52.1 0/0 36.4 1.0 80.5 49.7 11.3 -25.6 34.4 12.6 470 13.0 80.4 0 0 13.4 4124131 - 8110181 28 0 9 0 10.5 10.9 4.11 13.4 6.11 + ... 0.61 0.83 8 hales - 8 hales | 9.0 | 11. 3 11. 9 6.0 14 8 5 m 3 911181 - 12/20/81 ŗ 4/21/81 - 8/10/81 25.4136 80 -* REC. WELLS - RECOVERY WELLS 8/10/81 - 9/1/81 ZOUE RESTORATION 570 54.0 26.0 11.0 31.1 12.8 m cd 29.4 103 16 111 5 4 101 Ø1 28 518 181 - 12 18 181 31 161 - 31 30 781 51 161 - 31 30 781 51 178 - 31 8 181 5/81-4/20/81 4/2:/81-8/10/81 4121181-6125181 MA-S 4/21/81 - 8/10/81 A 121/81-7/29/E. 2125/61 - 4/20/81 2725/81-4/20/81 2/25/81 - 4/20/81 8/14/81- 9/1/81 311181-11116181 8/10/81-9/1/81 8/11/81 - 9/11/81 8/10/81-5/1/81 1, 3, 4 12/3/81-12/8/6/ 2125181 DPERATED PHASES 1.4 TOTALS PHASES TOTALS PHASES PHASES PHASES PHASE TOTALS PHASES PHASE PHASE PHASE PHASE 2 4 PHASE 2 2 Z Z ME-3 7 H P. 3 I. IM 7 B. 4.1.4 N S. C. e a a a a 301 HI.B ī

SECTION 4.2 TABLE

PHOJECT

LEUENBERGER

DATA BASE

RESTORATION

CO. , 111C.

ZONE RE

710

EXILOGRAT

10101

20628

*[CIT] F . FIRM CT CONCENTRATION 1961

* [Co.] I - INITIAL CI CONCENTRATION

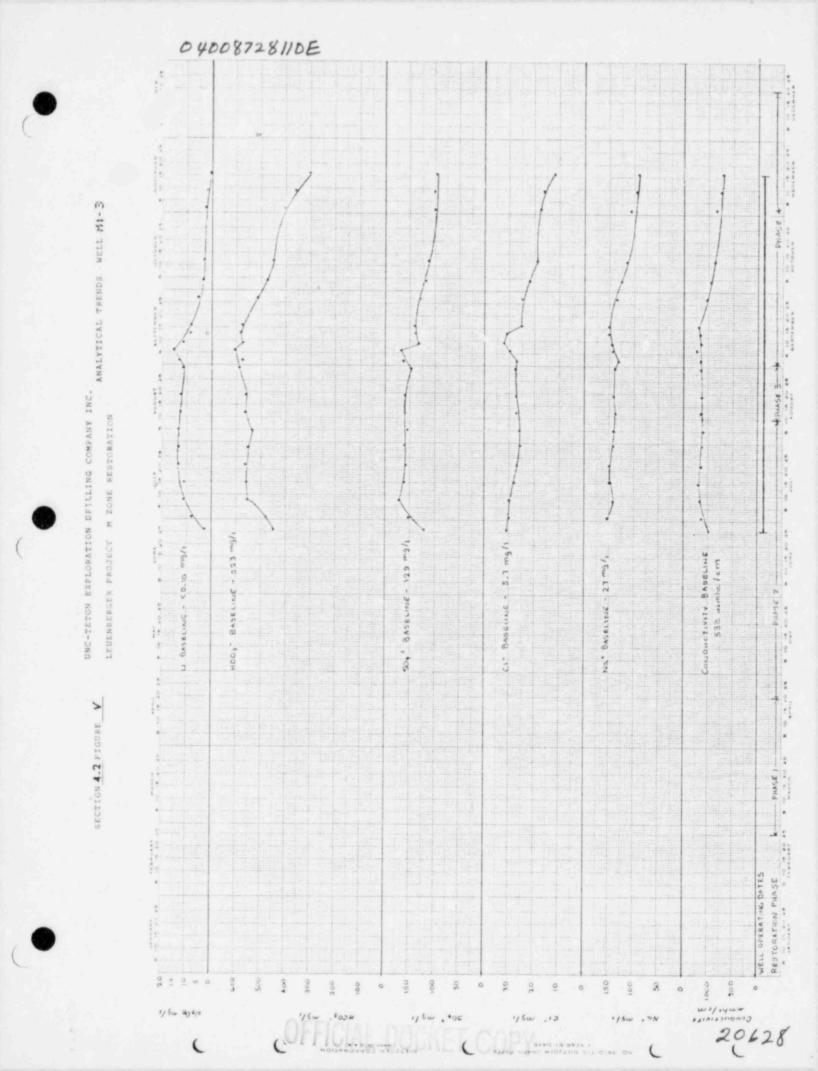
* % of INJ - EDR PRODUCT RATIO TO INJECTION

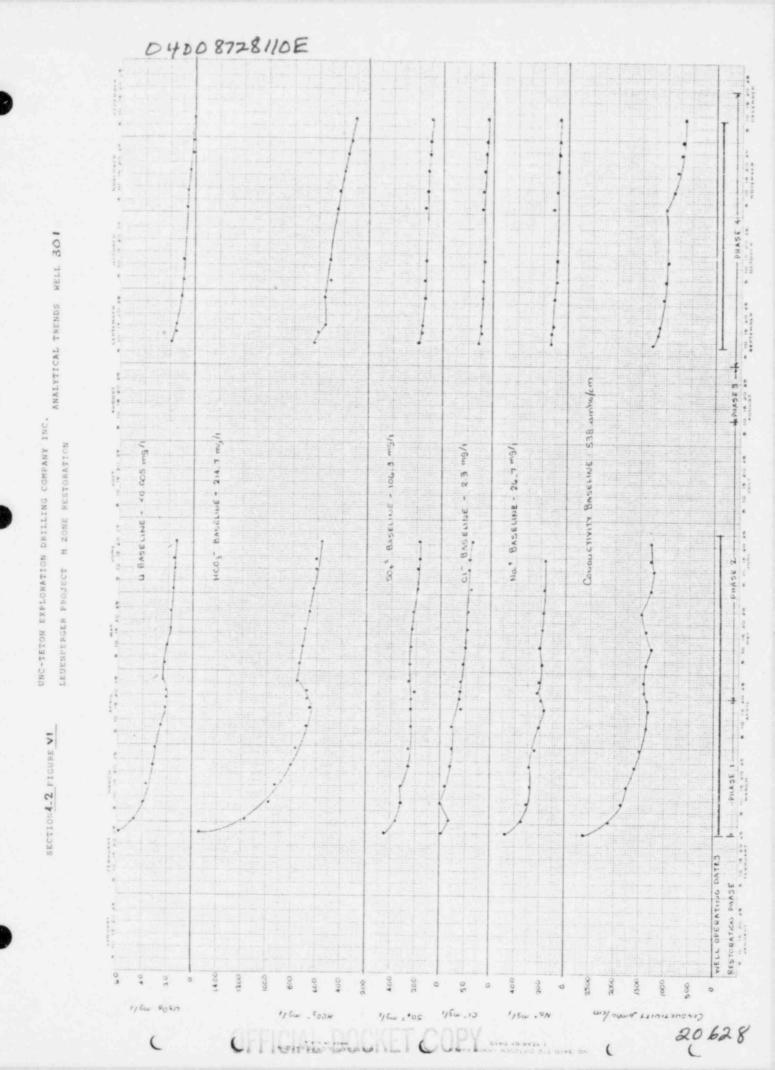
1/6 SALT REJ - 1/6 TDS REMOVAL BY EUR

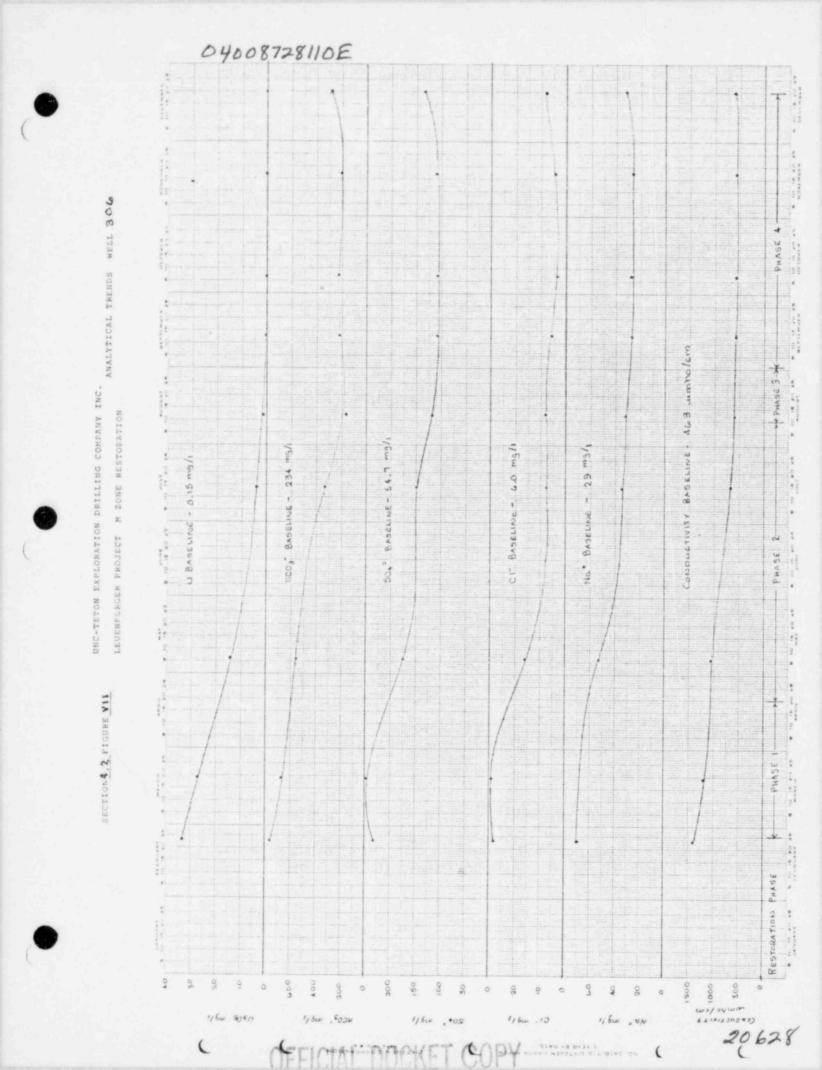
PEFERS TO CI' ICH LOST DURING MINING - 2554 ID.

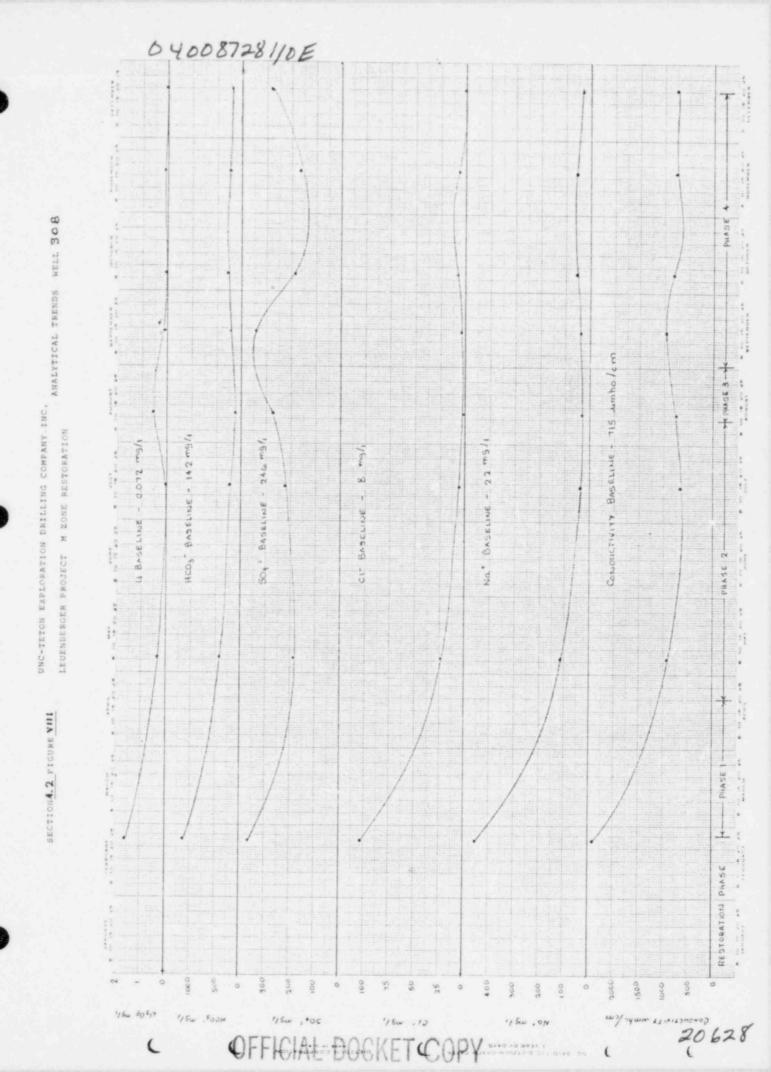
% CI EXT. % CI ION EXTRACTED * % O B - Of MELLERIND OVER BYCOVERY











4.3 Phase 3 - Results and Discussion

The M-3 directional sweep program due to the extensive time required for completion of the M-5 area, was altered from the plan. As it was suspected that some 315 lbs. of Cl had been recovered from the M-3 area during Phase 2, and that the possibility existed that additional pounds had been recovered at the M-1 area, it was decided to focus recovery nearer the M-1 end of the wellfield. M-3 area recovery wells designated were M1-2, M1-4 and MR-3 and injection was diverted to M1-6, 8, 10 and 12. M-1 area recovery wells included M1-1 and M1-3.

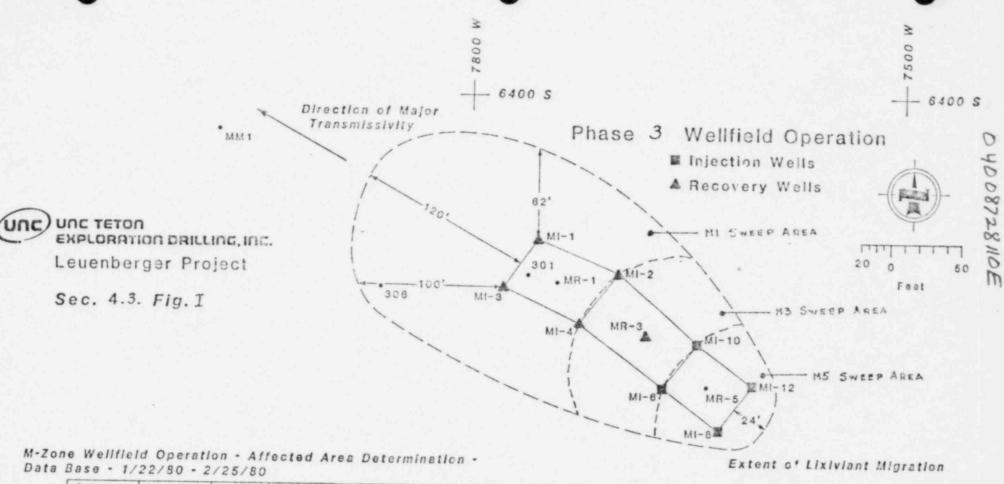
Phase 3 was operated from August 10, 1981 through September 1, 1981 or 22 days. Although this compared favorably with the proposed schedule of 16 days, only 39 lbs. Cl of an expected 207 lbs. were recovered directly from the M-3 pattern. A total of 136 lbs. Cl were recovered and removed from the total zone and each of the M-3 recovery wells were restored to near baseline levels.

A total of 1,469,742 gallons were recovered from the zone and after IX and EDR treatment, 1,345,921 gallons of baseline quality water were reinjected. Of the total recovery, 808,317 gallons of IX effluent was diverted to the EDR unit for treatment and 691,943 product gallons were generated. The unit provided an 85.6% water recovery and 89.0% salt rejection. A total of 116,374 gallons were rejected as EDR brine.

To September 1, 1981, a total of 1,123,935 gallons or 1.16 wellfield pore volumes had been bled from the restoration process while circulating 15.66 pore volumes through the restoring wellfield.

Attachments:

- A. Section 4.3, Figure I Phase3-Wellfield Operation
- B. Section 4.3, Table I M-Zone Restoration Data Base
- C. Section 4.3, Figures II-VI Phase 2-Analytical Trends



	Gallons Inj/Rec	Field Dimensions	Field Area/Fi ²	Sand Thickness	Field Volume/Ft ³	Porosity	Reservoir Volume/Gal	Lbs CI"	Lbs CI"	Lbs CI* Ext Area	Gal/Fi*	Affected Area Ext/Ft ²	Affected
M - 1	20,204,884(A	60.5'x43'	2,562	70'	179,354	24.8%			,			INTER EXTINE	votome/Ga
M-3	5,067,319(A	72.5'x42"	3,000	72.6'	217,764		332,709		280.4		129.85		
M - 5	2.726,833(R	The second secon	1,926	65.3'		24.8%	403,961		340.5		134.67		
	T		1,020	00.3	125,755	24.8%	233,281		196.6		121,10		
851- I	5,270,011(1)			68'				480.5		7227		1	
M1-2	4,291,421(1)			80'				377.5		332.5	129.85	6,076	788,957
M1-3	5,360,729(1)			57"				-		266.7	132.26	4,785	632,826
M1-4	6,718,998(1)			65'				490.9		338.9	129.85	6,193	804,143
M1-6	2,411,642(1)			71'				632.4		429.8	132.26	7,711	1,019,830
141-8	513,926(1)			62'				250.7		161.2	127.89	2,991	382,496
MI-10	2.006,213(1)			66'				53.4		34.4	121.10	674	81.624
M1-12	574,836(1)			60'				208.6		134,1	127.89	2,488	318,193
				90	1			59.8		38.4	121.10	752	91,116
Total	27,147,776(1)	182.5'x40.5'	7,488	69.3	518,918	24.8%	969,951	2,554	817.5	1,736.5	129.54	31,670	4,119,185

M-ZONE RESTORATION DETERMINATION OF LEACH AFFECTED AREA

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* 400 PEC - % OF RECOVERY THEATED BY EDR UNIT + % of INT - EDR PROBUCT RATIO TO INJECTION 4 % WATER REC. FOR DROUGE TO CLEY HAT

I FIELD POWE VOLUME = 94.9951 GAL. (TIG. 2) * % O. R - 06 WELLFIELD OVER RECOVERY

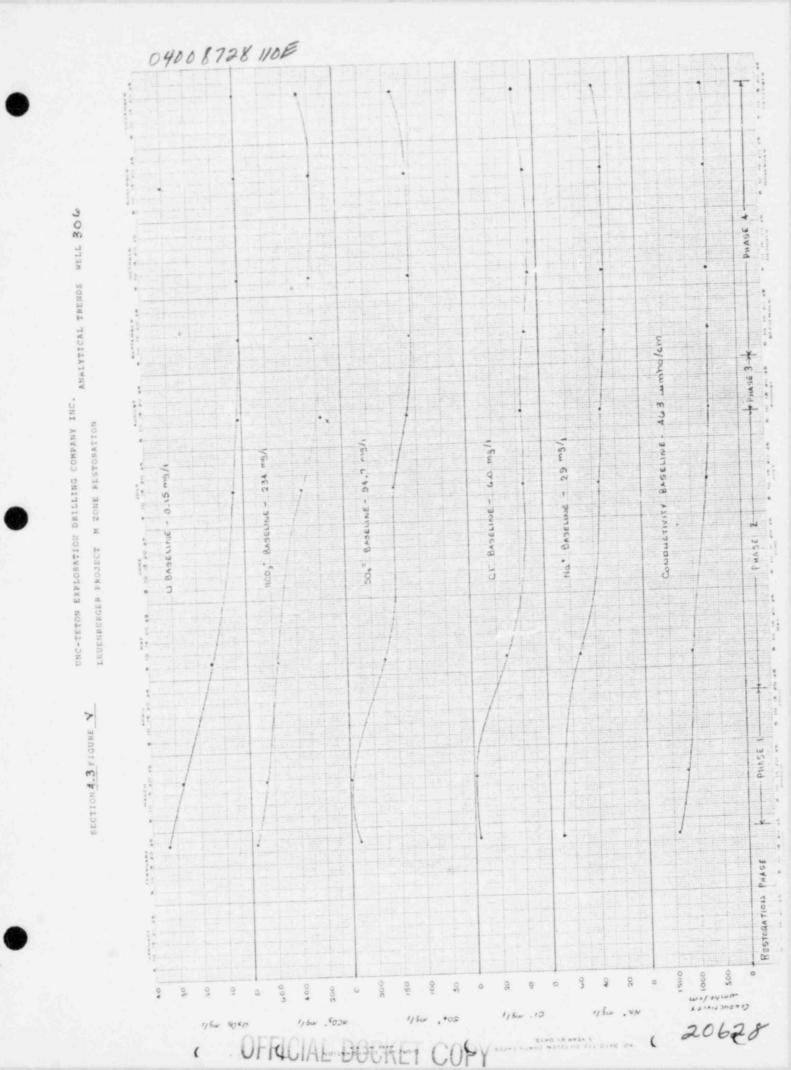
04008728110E ********** # 10 0k gen att WELL MR. 3 ANALYTICAL TRENDS PANSE 3-16 UNC-TETON EXPLORATION DRILLING COMPANY INC. M ZONE RESTORATION BASELINE - 538 SO4" EASELINE - 128 ms/1. 1/ Sw L2 1/5w L.S. 223 60.10 BASELINE BASELINE No. 7 10 (6 p.c #8 SECTION 4.3 FIGURE 11 PHASE I. RESTORATION PARES 0 to 0 1/64 20 FM 20,628



WELL MI-3

UNC-TETON EXPLORATION DRILLING COMPANY INC.

SECTION 4.3 FIGURE IV



04008728110E U BASELINE - 0.072 mg/1 SECTIONA.3 FIGURE VI RESTORATION PRASE 20628 040087281108

4.4 Phase 4 - Results and Discussion

The final phase of M-Zone restoration was initiated September 1, 1981 and consisted of withdrawing solution from M-1 area wells, M1-1, M1-3 and MR-1 while injecting to M1-2, 4, 6, 8, 10 and 12. Well 301 was brought on-line as a producer September 8, 1981 and Well M1-3 was converted to an injector November 17, 1981. Due to the directional sweep approach utilized and consistently injecting "behind" the affected area as restoration progressed, it was determined that the balance of leach affected solution could be recovered through the M-1 area.

A total of 1,591 lbs. C1 or 62.3% of that lost during mining had been recovered and removed in Phases 1-3 which left .963 lbs. available for a total C1 removal. Between September 1 and December 20, 1981, 694.1 lbs. C1 were actually removed by the EDR unit which represented a total 89.5% removal rate.

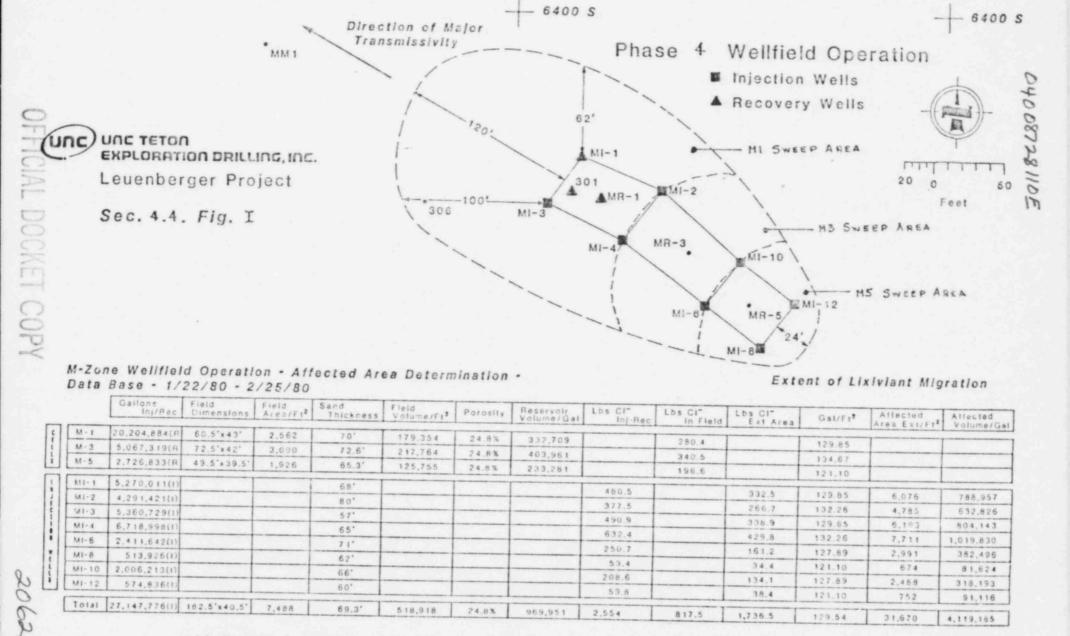
Phase 4 required 111 days for completion which closely matched the 110 day schedule. As wells began showing baseline water quality, they were withdrawn from service. From December 8 to December 20 M1-1 was the sole M-1 area recovery well. Each of the original recovery wells was pumped for a several day period to insure that all leach affected water had been treated in the other sweep areas.

A total of 7,413,145 gallons were recovered and treated during Phase 4. Of the total 3,549,215 gallons were fed to the EDR unit

which provided 2,967,679 product gallons for reinjection to the zone. Injection flow totalled 6,462,820 gallons during the phase. The EDR unit was capable of a 89% salt rejection with an 83.6 water recovery. Brine flow totalled 581,536 gallons or 0.60 wellfield pore volumes.

Attachments:

- A. Section 4.4, Figure I Wellfield Operation
- B. Section 4.4, Table I M-Zone kestoration Data Base
- C. Section 4.4, Figures II-VII Analytical Trends



M-ZONE RESTORATION DETERMINATION OF LEACH AFFECTED AREA

500

LEGENDENOSE PROJECT

2125/81-4/20/81 57 2/25/81-4/20/81 101 2/25/81-4/20/81 101 2/25/81-4/20/81 101 2/25/81-4/20/81 101 2/25/81-4/20/81 101 2/25/81-4/20/81 101 2/25/81-4/20/81 101 2/25/81	225 (6.13) 9/6 * FRINE FOWE FFED % of Connects 225 (6.13) 927 7236 8570 8570 8570 8570 8570 8570 8570 8570
	3 376038 0.39 2012315 0 820 (331523 0.5 4034016
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	3.3.2.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3
	3.23 3.74038 0.39 2012315 8.20 4.31523 0.45 46.34 0.16
10.14.5 10.1 10.8 34.4 24.0 12.0 53.6 14.5 17.5	3.23 3.74.038 0.39 2012315 8.20 4.31523 0.45 46.34.014
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	842 116374 0.12 806317
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9/18/19/20/20/20/20/20/20/20/20/20/20/20/20/20/	3246
9/8/8/1-12/8/8/8 31.1 1.4 633 1.37 553 51.4 246.7701 2.54 243.2 3.5 71.4 9/1/8/1-12/30/8/8 13/1/8/8 13/1/8/8	33246
1312 1313 12.8 11.3 1.0 1682 520 23.8 808751 083 61.5 2.4 11.6 51181-12/14/18/18/19/19/18/19/19/19/19/19/19/19/19/19/19/19/19/19/	2071
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* REC. WELLS - RECOVERY WELLS

* [Co.] I - INITIAL CI CONCENTRATION MS/I # [Co.] F - FINAL CI CONCENTRATION MS/I # 9/A QCO - 9/A QCONCITON

* HEADING DEFINITIONS - ABBREVIATIONS * [TOS]I - INITIAL CALCULATED TOS "15/1 * [TOS]F - FINAL CALCULATED TOS "5/1 KFUHE VOL. REC - PORE VOLUMES RECOVERED

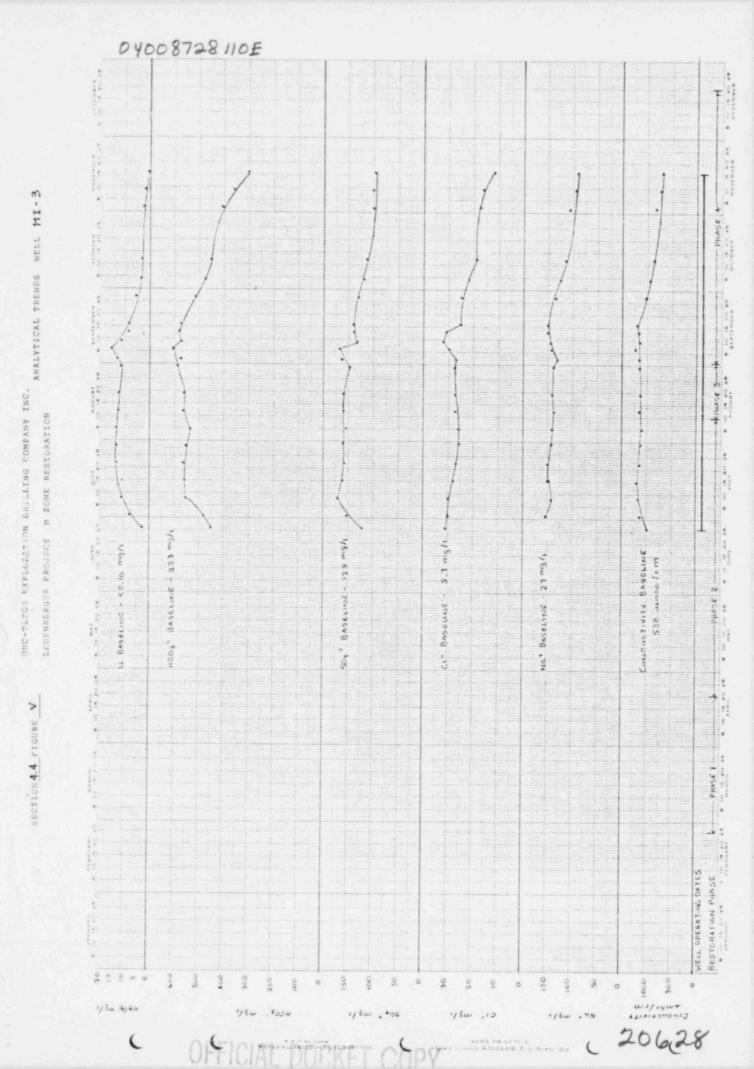
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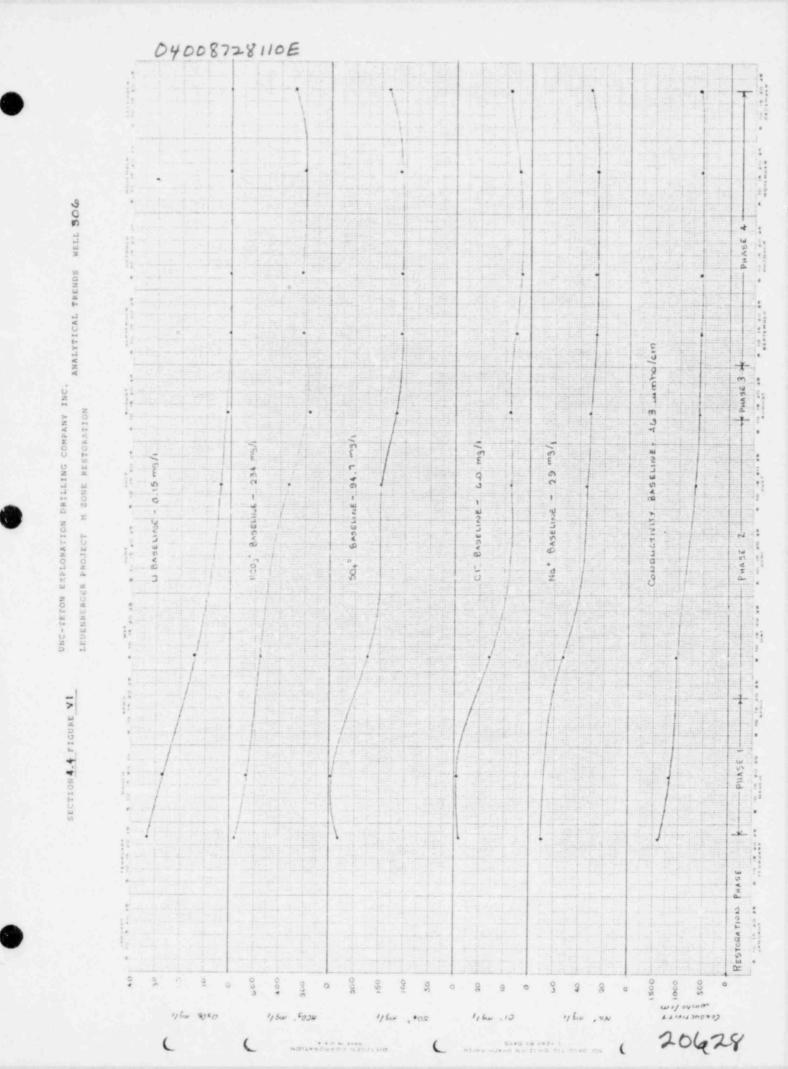
[103]F. Final Calculated Tos "S/1 # % CI Ext." " CA CI Ton Extracted * % of Inst. EDR PRODUCT RATIO TO INSECTION WHITE PROPERTY RES. " CA CI TON ENTRY TO INSECTION TO INSECTION THE TORONTO TO INSECTION TO INSECTION THE TOTAL RES. " CA CONTROL OF TO CALCULATE TO INSECTION TO THE TOTAL CALCULATE TO THE TOTAL CALCULATE

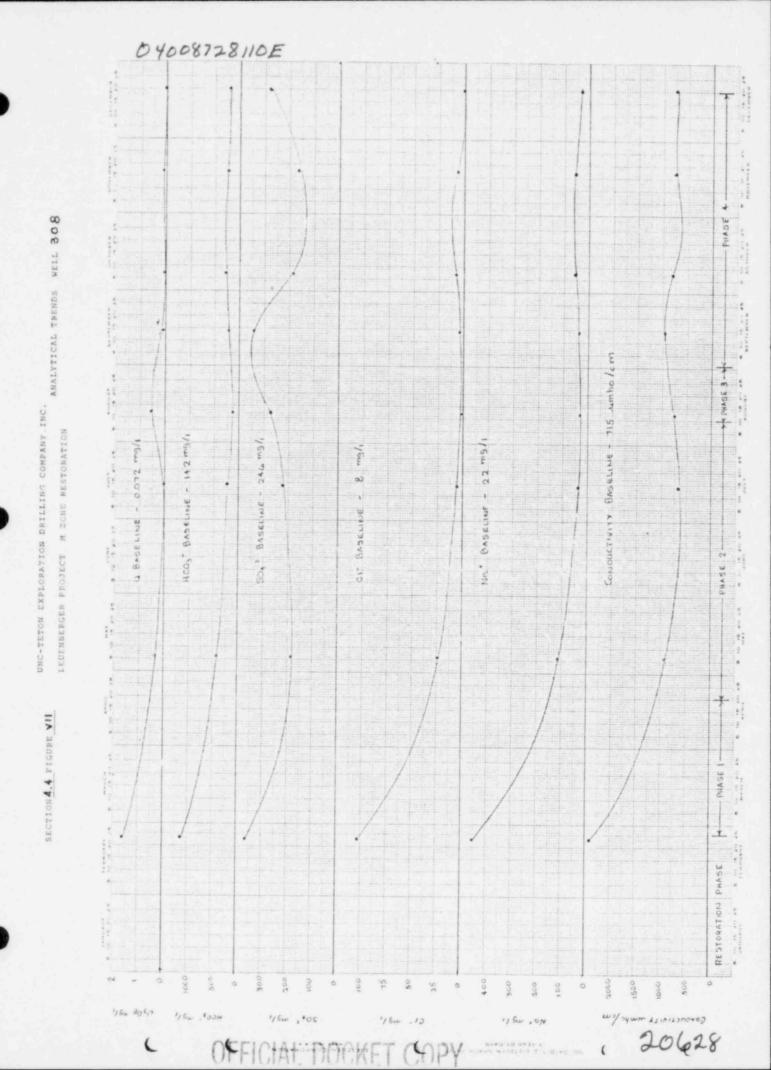
04008728110E WELL MR-1 SECTION 4.4. FIGURE I 20628

SECTIONA.4. FIGURE IV

WELL MI.I







4.5 - M-Zone Restoration - Summary

The overall M restoration program was initiated February 25, 1981 and terminated December 20, 1981. The program had been scheduled to operate for 196 days based upon expected electrodialysis unit performance and hydrological flow patterns, and actually required 299 days. The project was designed to ensure recapture of all solution affected by leach constituents as a result of diffusion.

between injection and recovery for chloride ion introduced during mining. It was determined that 2,554 pounds of chloride ion had been introduced to the zone and that at equilibrium concentrations 4,119,185 gallons (31,670 ft. 2) outside the actual wellfield confines had been affected. The means of calculating the affected area was supported by the involvement of restoration monitor 306 and the timing of the involvement.

As it had required over a year of operation for diffusion to extend the leach affected area over 85 feet in the direction of major transmissivity, it was decided a directional sweep approach would be more effective in recovering affected solution than would be collapsing that area solely through increased overrecovery. As a result, a phased program which utilized injection wells and recovery wells to recover solutions outside the wellfield confines along with injection sites designed to block recovery of already restored solutions was implemented.

A total of 22.6 x 10⁶ gallons were recovered and IX treated for uranium removal during the project. With a wellfield pore volume calculated to be 969,951 gallons, this represented wellfield circulation of 23.3 pore volumes. Of the 22.6 M gallons of IX effluent, 10.46 M gallons were fed to the EDR unit for treatment. The unit successfully concentrated 89.4% of dissolved solids fed into 1.71 M gallons of brine which was diverted to the solar evaporation ponds and/or eventually transferred directly to a licensed disposal facility. The 8.76 M gallons of low TDS product generated were used to dilute the injection stream to baseline water quality. Total injection to M-Zone during the restoration process was 20.46 M gallons which represented an over-recovery of 9.45%. Effectively all of the overrecovery was EDR brine and this totalled 1.76 wellfield pore volumes.

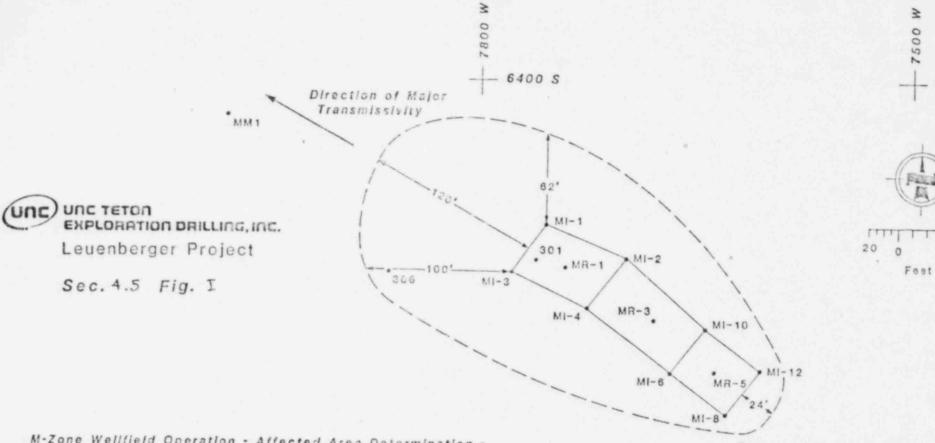
The completeness of restoration was demonstrated both by the operating wells achieving the appropriate goals and the recovery of nearly 90% of the trace parameter introduced during mining. Of the 2,554 lbs. Cl lost during mining, 2,285 lbs. were effectively removed by the EDR unit. The residual 269 lbs., assuming that they are equally distributed in the total affected area would represent an increase of 6.3 mg/l above the 5.7 mg/l baseline or 13 mg/l. The average final restoration chloride concentration at monitored wells was actually 12.1 mg/l.

04008728 110E

At the point of terminating the restoration program, all operation and restoration monitor wells were at or below the restoration goals presented in Section 2. Of the wells, one showed anomalous behavior after shutdown and prior to the January 1982 initial restoration sampling. Well MI-1 decreased from a summation TDS of 659 on December 20 to 166 mg/l by January 12, 1982. As M1-1 was the last well providing water to the restoration process plant and the EDR was treating nearly all of the recovered solution, reinjection to wells Ml-2, Ml-3, and Ml-4 was exceptionally dilute (<100 mg/1 & TDS). It is suspected that in the process of M1-1 recharging after pump shutdown, that solution from those injection wells was irawn to the well bore area. This is also supported by decreases of >100 mg/l TDS at non-pumping wells between the December 20, 1981 restoration end and the initial sampling. (MR-1, MR-3, M1-3, 301) See Table I, Section 4.5, for final values for wells chosen as restoration monitors.

Attachments:

- A. Section 4.5, Figure I Leach Affected Area Det.
- B. Section 4.5, Table I M-Zone Restoration Data Base
- C. Section 4.5, Table II Post Restoration Analytical Values
- D. Section 4.5, Figure II Indicator Parameter Analytical Trends



M-Zone Wellfield Operation - Affected Area Determination - Data Base - 1/22/80 - 2/25/80

Extent of Lixiviant Migration

6400 S

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	Gailons Inj/Rec	Field Dimensions	Field Area/Fi ²	Sand Thickness	Field Volume/Fi3	Porasily	Reservoir Volume/Gai	Lbs CIT Inj-Rec	Lbs CI ⁻ In Field	Lbs CIT	Gal/Fit	Affected Area Exi/Fiz	Affected Volume/Ga
M-1	20,204,884(FI	60.5'x43'	2,562	70"	179,354	24.8%	332,709					I CA CALLET	v 010me/02
м-3	5,067,319(A	72.5'x42'	3,000	72.6"	217,764	24.8%	403,961		280.4		129.65		
M-5	2,726.833(R	49.5'x39.5'	1,926	65.3"	125,755	24.8%	233,281		340.5		134.67		
M1-1	5,270,011(1)						1 233,601		196.6		121.10		
111-2	4,291,421(1)			68'				480.5		332.5	129.85	6.076	788,957
M1-3	5,360,729(1)			57'				377.5		266.7	132.26	4,785	632,826
M1-4	6.718,998(1)			65"				490.9		338.9	129.85	6,193	804,143
M1-6	2,411,642(1)			71'				632.4		429.8	132.26	7,711	1,019,830
M1-8	513,926(1)			62'				250.7		161.2	127.89	2,991	382,496
M1-10	2,006,213(11)			66.		-		53,4		34.4	121.10	674	81,624
Mt1-12	574,836(1)	-		60'				208.6		134.1	127.89	2,488	318,193
*	1							59.8		38.4	121,10	752	91,116
Total	27,147,776(1)	182.5'x40.5'	7,488	69.3	518,918	24.8%	969,951	2,554	817.5	1,736.5	129.54	31,670	4,119,185

M-ZONE RESTORATION DETERMINATION OF LEACH AFFECTED AREA

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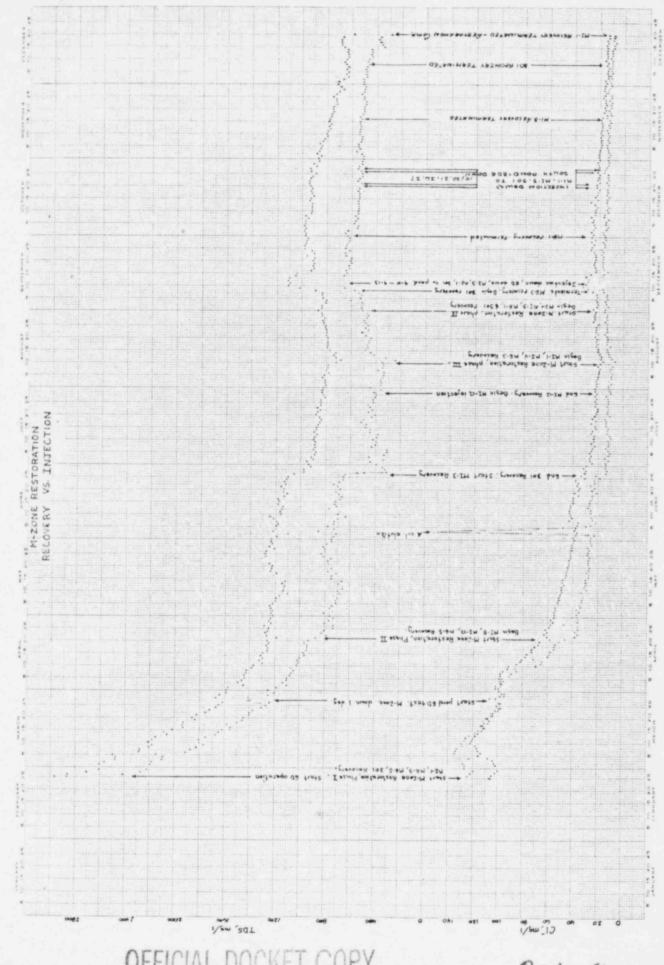
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FIGURE SECTION 4.5,

UNC TETON EXPLORATION DRILLING, INC.

RESTORATION PROJECT SITU LEACH LEUENBERGER PROJECT

ANALYTICAL INDICATOR PARAMETER



5.0 M-Zone Restoration Stability Plan

5.1 Agency Requirements

Although the R & D permits as accepted by the DEG and NRC specified a four-month restoration stabilization monitoring period, it was determined that a longer period was required. Wells 301, 306 and 308 were baselined and designated as restoration monitor wells; however, additional wells were required for adequate post restoration monitoring.

The period required by the licensing agencies was extended to 13 months after the end of restoration with sampling to be performed monthly for six months and quarterly for the duration.

Wells being sampled during the stability period are MR-1, MR-3, MR-5 Ml-1, Ml-6, Ml-10, 301, 306 and 308.

5.2 Well Sampling

The monthly and quarterly sampling was to be performed by means designed to collect representative samples of aquifer solution. In the field operation wells and 301, sampling is performed utilizing one-half HP Grundfos stainless steel submersible pumps hung on 170 feet of chemically inert plastic pipe. A minimum of 1.5 casing displacements on each well is pumped to waste prior to sampling.

Wells 306 and 308 were completed with two-inch PVC casing, which restricts the use of downhole pumping devices. These wells are sampled by air lifting solution from the well with a 100 cfm air compressor and >200 feet of chemically inert plastic pipe. Each well is air lifted for a minimum of three hours prior to sampling.

5.3 Sample Treatment and Preservation

Samples drawn from the wells are placed in unused polyethylene containers for shipment to the Casper laboratories. Samples are treated with chemicals as designated by EPA methods for sample preservation.

5.4 Sample Analysis

Treated samples are analyzed utilizing EPA and Standard Methods Procedures at the Teton Central Research Laboratory and/or WAMCO Laboratory (Casper, Wyoming) or other accepted commercial laboratories. Results are checked for quality both by Standard Quality Assurance Methods and by ionic balance procedures.

5.5 Attached as Appendix "E" is stability data on the designated sample wells to date.

6.0 Implications to Commercial Scale Restoration

6.1 Introduction

In addition to performing restoration on the M-Zone patterns for license compliance, environmental safety and site decommissioning purposes, the implications to commercial scale restoration were studied. The following section expands the knowledge gained in M-Zone R & D level restoration to commercial scale wellfield restoration.

The R & D restoration effort was actually a "worst case" operation due to the following factors:

- a) All injection wells utilized during mining were external injectors which precluded directional or selective wellfield overrecovery and provided the maximum diffusion rate external to the patterns.
- the rate of diffusion would be expected to be greatest in the direction of major transmissivity and this was the case in the R & D patterns. Although this was detrimental in the case of an isolated R & D pattern, the diffusion effect would be beneficial to the Leuenberger commercial wellfield operation. Fluid migrating or chemical parameters diffusing in the direction of major transmissivity would generally be migrating into the next scheduled mining unit, thereby, creating the possibility of recapturing desirable leach chemicals for subsequent mining. The volume of affected area that would

necessarily be addressed by a single mining unit restoration program would be reduced. Several knowledge areas gained from the R & D restoration program and made commercial restoration projections possible. These areas included:

- 1) The rate of dissolved solids generation during restoration as a result of lixiviant action in the affected area ore.
- 2) Development of a means to determine affected aquifer volume after mining through quantifiable means.
- 3) The actual operating efficiency of the electrodialysis unit and overall restoration process.

The following commercial scale restoration analysis also utilizes several "worst case" as imptions in order to present the maximum expected restoration time spans and process bleed requirements.

6.2 Dissolved Solids Generation During Restoration

As was noted in the R & D effort, one of the more difficult goals to achieve was TDS reduction to required levels. It is believed that due to the effect of oxidant and pH adjusters in the lixiviant, TDS was actually generated during restoration.

Because the internal portion of the wellfield was saturated with these chemicals during mining, it was hypothesized that wellfield TDS generation and equilibration occurred during the mining phase.

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The source area of the TDS generation would therefore be the affected area. This hypothesis was supported by the relatively extended recovery requirements from wells M1-3 and M1-1 and those parameters which showed marked elevation at 306 prior to restoration.

Section 6, Table I is a determination of the TDS generation rate in the affected area. This rate will be applied to the commercial wellfield affected area.

The TDS generation rate was 38.13% which means that one can expect to remove ~40% more constituents from the affected area during restoration than would be normally expected.

6.3 Determination of Commercial Wellfield Affected Area

The commercial wellfield affected area is defined as that area affected by horizontal flaring due to natural diffusion. In order to determine this linear distance, the average M-Zone R & D pattern flaring distance was used. This distance is justified by the fact that not only will chemical constituents be similar in the commercial operation, but injection well flow rates and pressures will be similar. This flaring distance is another "worst case" assumption because directional overrecovery will be utilized in a commercial wellfield pattern.

Section 6, Table II summarizes the assumptions and geologic/ hydrologic data used in determining the "average" mining unit affected area. This data illustrates the "worst case" nature of

the R & D restoration operation. The ratio of affected volume to pore volume for the R & D pattern was 5.25 to 1 and the expected commercial field ratio would be less than or equal to 1.52 to 1.

6.4 Determination of Post Mining Water Quality

The lixiviant strength and composition was efficient in the R & D operation; therefore, Teton anticipates using the same solution make-up for commercial mining. For the purpose of this report, the assumption that post mining water quality within the commercial wellfield will approximate that in the R & D operation will be adopted. This too, is a "worst case" assumption as the R & D pattern: a) operated more than one year, and b) excessive pore volumes were circulated in the R & D due to the small field size which promotes chemical spirals in such parameters as Cl , SO₄=, Ca⁺⁺, and Na⁺. The expected TDS in the post mining wellfields of mining unit I & II would be 3.0 gm/l. The assumption is made that TDS would decrease linearly from the field boundary to baseline at the unaffected area.

6.5 Restoration Process - Mine Plan & Schedule

In order to reduce the post mining TDS in the wellfield area prior to restoration, initiate the leach in subsequent fields and preserve leach chemicals, a water transfer from a mined out unit to a new unit will start the restoration cycle. Assumptions made include:

- a) The water transfer will approximate a blend of the new unit baseline water quality and the post mining water quality from the transfer unit. This would leave both units half way between baseline and post mining quality.
- b) As progression through the units occurs, post mining TDS will increase as a function of the initial transfer. This straight line increase is a "worst case" assumption as leach chemical injection demands would decrease after unit transfers.
- c) The transfer could be performed in the wellfield itself, thereby bypassing plant circuits. Assuming a 43.4 x 10⁶ gal. standard wellfield unit pore volume, 60 days at 500 gpm would be required for the transfer. As there would be no overrecovery on the transfer, the assumption is made that only the internal unit is affected, leaving the external affected area at post mining TDS levels.

Section 6, Table III determines the prerestoration TDS at each of the wellfield units following the water transfer. The table also determines time requirements for the electrodialysis unit to remove the required dissolved solids from solution. EDR efficiencies were determined in the R & D operation and the unit in the commercial flow sheet will treat 200 gpm from the anticipated 500 gpm restoration flow.

As Section 6, Table III demonstrates, between 337 and 456 days/mining unit will be required for complete restoration. Considering the number of "worst case" assumptions used in generating these time requirements, actual time may be reduced by 10 to 20%.

The restoration unit flow would be approximately 500 gpm and that flow would be diverted through an ion exchange system to remove oxidized uranium. A split of 200 gpm would be taken from the barren ion exchange effluent and fed to the electrodialysis unit. The EDR would provide 170 gpm of low TDS water which would be used to dilute the remaining 300 gpm of IX effluent. The total 470 gpm would be reinjected to the field.

In order to draw in the affected area, directional overrecovery would be used in the restoring field (high overrecovery at outer field edge with balanced flows in field center).

Section 6, Figure 1 demonstrates the mine plan and schedule based upon this restoration plan.

SECTION 6, TABLE I

DETERMINATION OF TDS GENERATION RATE

R & D Original TDS - Baseline	482.6 m	g/1
Total R & D Affected Volume	5,089,136	gals.
Lbs. TDS in Affected Volume - Baseline	20,496	lbs.
R & D Wellfield Pore Volume	969,951	gals.
Affected Area Volume	4,119,185	gals.
Wellfield TDS at 2/25/81	2.965	g/1
*Affected Area Average TDS at 2/25/81	1.724	g/1
Lbs. TDS in Wellfield Area	24,000	lbs.
Lbs. TDS in Affected Area	59,265	lbs.
Total TDS Lbs. in M Area	83,265	lbs.
TDS Lbs. in M Area at 0.5 g/l	21,235	lbs.
TDS Lbs. Requiring Removal to 0.5 g/l	62,030	lbs.
Actual TDS Lbs. Removed by EDR	86,324	lbs.
Final Average M Zone TDS	0.460	g/1
Excess TDS Lbs. Removed	1,699	lbs.
Lbs. Requiring Removal to 0.5 g/l	84,625	lbs.
Lbs. TDS Generated During Restoration	22,595	lbs.
TDS Generation Rate in Affected Area	38.13	8

^{*}Assumes linear decrease from 2.965 g/l at wellfield boundary to 482.6 mg/l at edge of affected area.

SECTION 6, TABLE II

DETERMINATION OF COMMERCIAL WELLFIELD VOLUME AND AFFECTED AREA

As well flow rates would be similar to the R & D Phase, lateral diffusion would be roughly equal.

Based on noted distance of lateral diffusion in the R & D patterns, a nominal linear distance of 70 feet is assumed.

The average wellfield perimeter is assumed to be a rectangle of \mathbf{X} . $2\mathbf{X}$.

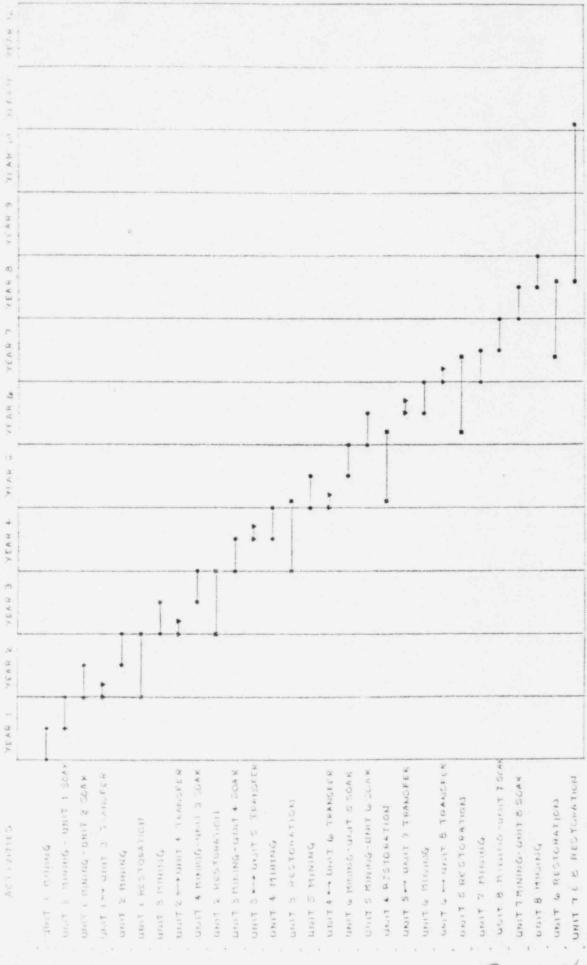
Average Mining Unit Area	400,000 ft. ²
Average Sand Thickness	58 ft.
Average Mining Unit Volume	23.2 x 10 ⁶ ft. ³
Average Porosity	25%
Average Wellfield Pore Volume	5.8 x 10 ⁶ ft. ³
Average Wellfield Fluid P.V.	43.4×10^6 gals.
Average Mining Unit Perimeter	447 ft. x 894 ft.
Expected Max. Diffusion Distance	70 ft.
Affected Area 587 ft. x 1,034 ft.	606,958 ft. ²
Affected Volume Fluid	65.8 x 10 ⁶ gals.
Volume Outside Wellfield Perimeter	22.4 x 10 ⁶ gals.

SECTION 6, TABLE III
PRE-RESTORATION TDS DETERMINATION

	Fields 1 & 2	Fields 3 & 4	Fields 5 & 6	Fields 7 & 8
	0.482 g/1	1.741 g/1	2.371 g/1	2.685 g/l
Pre-mining TDS (Post-transfer)			4.889 g/1	5.203 g/1
Post-mining TDS (Pre-transfer)	3.00 g/1	4.259 g/1		
Pre-restoration TDS (Post-transfer)	1.741 g/1	2.371 g/1	2.685 g/l	5.203 g/l
Affected Area TDS	1.741 g/1	2.371 g/l	2.685 g/1	2.843 g/1.
Wellfield Volume	43.4 x 10 ⁶ gals.	43.4 x 10 ⁶ gals.	43.4×10^6 gals.	43.4 x 10 ⁶ gals.
Affected Area Volume	22.4 x 10 ⁶ gals.	22.4 x 10 ⁶ gals.	22.4×10^6 gals.	22.4 x 10 ⁶ gals.
Lbs. TDS Wellfield	630,573	858,753	972,481	1,894,256
Ibs. TDS Affected Area	325,457	443,228	501,926	531,462
Lbs. TDS Wellfield & Affected Area	956,030	1,301,981	1,474,407	2,425,718
Lbs. TDS @ 0.5 g/1 Wf. & Aff. Area	274,563	274,563	274,563	274,563
Lbs. TDS Generated in Aff. Area (40%)	130,183	177,291	200,770	212,585
Lbs. TDS Requiring Removal to .5 g/1	811,650	1,204,709	1,400,614	2,363,740
Ave. TDS Feed During Restoration	1.112 g/1	1.427 g/1	1.584 g/1	2.452 g/l
GPD Feed to EDR	288,000	288,000	288,000	288,000
TDS Lbs. Feed/Day	2,673	3,430	3,807	5,893
Percent Salt Rejection	90%	90%	89%	88%
TDS Brine Lbs/Day (Removal Rate)	2,406	3,087	3,388	5,186
Days Required/Wellfield	337	390	413	456
Percent Water Recovery	85%	85%	85%	85%
Brine Generated/Wellfield (Gals.)	14.6 x 10 ⁶ gals.	16.8 x 10 ⁶ gals.	17.8 x 10 ⁶ gals.	19.7×10^6 gals.

LEGENBERGER COMMELLIAL IN SITCH CHARMON MAINES PROJECT MODING AND AGUNT & BESTONATION SITUATED

SECTION - FIGURE



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APPENDIX "A"

EVALUATION OF ELECTRODIALYSIS FOR PROCESS WATER TREATMENT FOR IN SITU MINING

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EVALUATION OF ELECTRODIALYSIS FOR PROCESS WATER TREATMENT FOR IN SITU MINING

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INTRODUCTION

Since the infancy of in situ uranium mining, a growing number of hydrometallurgical processes have been incorporated into pilot and commercial scale flowsheets. Although initial design efforts were geared toward maximizing uranium recovery and minimizing plant and wellfield flow circuit maintenance, recent emphasis has shifted to improved means of water conservation and aquifer restoration. As mining units approached depletion, evaporation ponds reached minimum freeboard, and state and federal agencies demanded proof of groundwater restoration, processes including mixed bed and conventional ion exchange, reverse osmosis and electrodialysis were adopted by the industry. These units served the additional function of reducing process bleed flows during mining in states where the deep disposal well permitting ice remains unbroken.

This report concerns the use of electrodialysis as an alternative to the more conventional processes used in in situ mining. In addition to a brief history and description of the process, a comparison to reverse osmosis and operational data derived from testing an Ionics, Inc. $1.31 \times 10^{-3} \, \mathrm{m}^3/\mathrm{s}$ (30,000 gallon/day) unit at the Teton-Nedco Leuenberger Research and Development pilot will be presented.

HISTORY

Commercially practicable electrodialysis was contingent upon the development of synthetic ion exchange membranes in 1940's. In 1952, Tonics Inc. demonstrated that the process was amenable to the treatment of salt and brackish water and, in 1954, made their first commercial sale. The following decade saw several major electrodialysis unit sales which were generally targeted for use on private or municipal potable water treatment. Major increases in membrane desalting unit capacities, facilitated by technological advances in the reserve osmosis industry, were noted during the 1970's. The development of polarity reversing electrodialysis equipment which reduced feed pretreatment requirements, increased water recovery rates, and simplified unit operation, kept Ionics Inc. competetive in the water treatment industry. Engineering advances which incorporated automated equipment, non-corrosive construction materials, and improved ion exchange membranes allowed the electrodialysis process to compete in industrial waste treatment among other commercial markets.

PROCESS AND APPARATUS DESCRIPTION

The electrodialysis process utilizes direct electrical current passed across a stack of alternating cation and anion selective membranes in order to achieve an electrochemical separation of ionized materials in an aqueous solution. The membrane stack

has the appearance of a plate and frame filter press and auxilliary equipment includes solution pumps, electrically actuated valves, filters, piping and a direct current power source. The ion separation membranes are thin sheets of synthetic cation or anion selective resins. Attaching sulfonate or quaternary ammonium groups to the cross linked copolymer structure determines the ion selectivity of the membrane. The membranes are separated from each other in the stack by non-conductive spacers that house flow channels which route the flow tortuously and parallel to the membranes. Direct electrical current passing perpendicularly to the membranes and solution passages attracts cations toward the cathode and anions toward the anode (Figure 1). As the ions from the feed stream pass through the ion selective membranes, they become concentrated in the adjacent brine channel and are retained there by the combined attractive force of the electrode and the repelling force of the next membrane toward the electrode. Limiting factors on the degree of demineralization possible include chemical solubilities in the brine flow and the current density that will produce an unacceptable degree of polarization (Figure 1). Feed or brine solution treatment with complexing agents or acids has been successfully applied to prevent membrane scaling. Polarization can occur when sufficient current density is applied to dissociate water in the ion depleted region of the diluting compartments near the membrane surfaces. Significant polarization is evidenced by large electrical resistances across cell pairs and notable pH differences between diluting and concentrating streams. Limiting current densities have been increased in U.S. manufactured equipment by utilizing tortuous flow paths of relatively high linear velocities thereby promoting continous solution mixing. Energy consumption is due to separating electrolytes and solutions, oxidation and reduction reactions occurring in electrode compartments, overcoming electrical resistance, conversion from AC to DC power, solution pumping and auxiliary equipment actuation.

A major improvement to the basic electrodialysis process was applied in 1970 which resulted in frequent, automatic cleaning and descaling of membrane surfaces. The process, polarity reversal, incorporates alternating the cathode and anode on a periodic basis while exchanging product and brine flow channels via electrically actuated values. The reversal reduces the potential of stack plugging with CaCO₃ (calcite), CaSO₄ (gypsum), and colloidal materials and, in most waters, eliminates feed pre-treatment requirements. For approximately two minutes during and following the reversal, off spec. water is flushed to waste or reintroduced to the feed supply. The usual feed treatment on polarity reversing electro-

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dialysis equipment (EDR) consists of filtration of particulates exceeding 10 µm (micron).

EDR COMPARED TO REVERSE OSMOSIS (R.O.)

The tool widely adopted by the ISL industry for process bleed reduction and groundwater restoration has been reverse osmosis (R.O.). R.O. units utilize excessive pressure exerted across semi permeable spiral wound cellulose acetate or hollow fiber polyamide membrane elements in order to reverse the natural osmotic process. The net result is similar to electrodialysis in that dissolved solids in feed water are concentrated into a reduced volume and relatively high "clean" water recoveries are noted.

There are several dissimilarities between the processes that suggest significant advantages to the EDR operator. Due to the microscopic pore size of the R.O. membrane, more chemical pretreatment and filtration is required than for the 1 mm flow channels in the EDR stack. Pre-softening or complexing EDR feed is not generally required and the membranes withstand silica scaling. ED membranes can be operated in the pH 1-10 range and exhibit stability to 316 K(110 F). R.O. membranes typically operate only in relatively small pH and temperature ranges. Materials of construction and maintenance costs are reduced for EDR due to the comparatively low feed pressures.

Perhaps the greatest single advantage to the EDR process is the stability and accessibility of the ion exchange membranes. Although ED and BO are similar in that the ion exchange media represents a large proportion of the initial capital cost of the unit, ED is unique because of the long term stability and maintainability of the membranes. Due to the low pressura feed and nature of the process, ED membranes do not suffer from the gradual compaction noted on R.O. membranes, and, as a result have demonstrated working lives in excess of 10 years. Formation of Caso, scale that can result in RO membrane failure or plugging, is restricted in EDR operation due to polarity reversal and the commercial stack cleaning circuit. In contrast to R.O. membranes, ED membrane stacks may be physically disassembled and membranes may be individually scrubbed if scaling cannot be controlled or dissolved by the "clean in place" circuit.

Based on recent quotes from both RO and EDR manufactures, capital equipment costs are comparable and range from \$175,000 to \$250,000 for $1.26 \times 10^{-2} \, \mathrm{m}^3/\mathrm{s}$ (200 gpm) units. Operating costs for EDR units have historically been equal to lower than comparably size RO units (when feed TDS remains below 5000 mg/l) and EDR feed pretreatment costs are typically lower.

PILOT TEST RESULTS

In late 1980, Teton Exploration and Ionics, Inc. initiated an agreement to perform a three month test with a commercially sized EDR unit on the ISL circuits at the Leuenberger pilot project located near Glenrock, Wyoming. An Aquamite V-M 1.31 x 10 m/s (30000 gallon/day) unit was received, installed, and operating continuously by 2-25-81. The dual stage unit was expected to produce 665 mg/l TDS water from a feed of 2650 mg/l with a product water recovery of 380%.

Installation of the three ton, two piece unit required skid placement, plumbing unit feed, product and brine lines, and providing a peak 1.26 x 10 J (35 KVA) power source. Electrical power was provided by the plant three phase diesel generators. Overall dimensions of the unit including reasonable mainte-

nance clearance are 4.27 m (14 ft) \times 6.1 m (20 ft) \times 3.65 m (12 ft H).

The unit was to be tested on feed solutions comparable to those anticipated during the commercial operation including ion exchange barren effluent, mining zone restoration fluids, and impounded bleed.

Continuous operation began 2/25/81 with a 2.9 g/l TDS feed split from the ion exchange barren effluent stream. Due to the high initial Ca⁺⁺ and HCO₃ concentrations (0.25 g/l and 1.7 g/l respectively), pH adjustment of the feed flow to pH 5.8 to 6.0 with 35% hydrochloric acid was required to prevent CaCO₃(g) precipitation in the brine stream. As feed parameters reduced from the effect of field restoration, CO₂(g), introduced in gaseous form to the feed tank, replaced HCl as the pretreatment chemical.

Pretreatment costs during the test were \$0.80/3785 L (1000 gal) for HCl and \$0.91/3785 L (1000 gal) for CO₂(g). Although costs were ~14% higher for CO₂(g) pretreatment, the addition was continued in order to prevent reintroduction of Cl ion to the restoring mining zones.

Ionics Inc., testwork indicated that membrane life would not be significantly reduced by feeding elevated levels of free chlorine which allowed recirculation of electrode compartment flows to the feed sqlution. This reduced brine flow from $\frac{1}{2}.5 \times 10^{-4}$ m/s (8000 gallons/day) to $\frac{1}{2}.5 \times 10^{-4}$ m/s (5700 gallons/day).

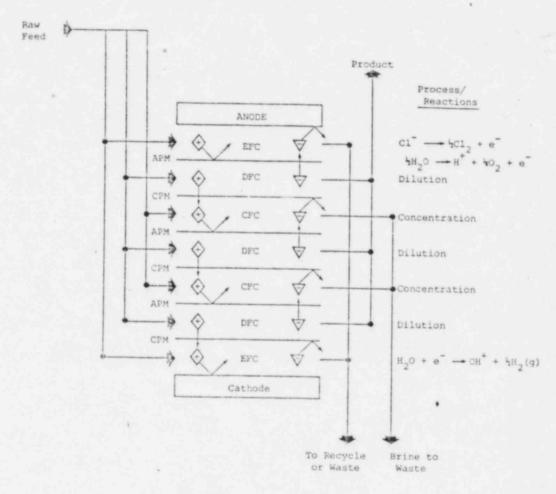
During the evaluation period, 1.25×10^7 L (3.31 \times 10^6 gal) were fed at an average TDS of 2.35 g/l, and 1.02×10^7 L (2.7 \times 10^6 gal) product at 0.35 g/l TDS and 2.24×10^6 L (5.8 \times 10^6 gal) of brine were generated representing a salt rejection of 87.5% and water recovery of 81.5%. Chemical results from the final month of the test are presented in Table 1.

The unit operated 96% of the time available requiring only four cleaning cycles and no stack disassembly. Cleaning downtime was necessitated by operator error in neglecting to maintain flow to the feed tank during polarity reversals. The off specification water generated during the reversals continually enchances raw feed parameters by %55%.

Routine operating costs averaged \$1.02/3785 L (1000 gal) and broke down into pH adjustment chemicals (\$0.86/3785 L (1000 gal)) and power requirements (\$0.149/3785 L (1000 gal)). Approximately four manhours/day were required for data collection and unit operation and one manhour/day was needed for site analytical work.

A single day, 52,900 L (14000 gal) test was performed on feed from impounded bleed derived from an earlier groundwater restoration sweep. This test was designed to determine the feasibility of reducing water storage volumes by concentrating dissolved solids in a reduced volume and creating a product that met state surface discharge criteria. Test results indicated that the 3.1 g/l TDS feed could be split to provide 78% product water recovery at 0.66 g/l TDS. Additional pre-or-post treatment of the product to further reduce Ra-226 levels would be required to meet discharge quality.

Analyses performed over the duration of the test period showed a divalent ion rejection of 90.5% and a monovalent ion rejection of 84.8%. Radiometric and detectable trace elements showed feed to product splits equivalent to major constituents (Table 1).



APM - Anion Permeable Membrane

CPM - Cation Permeable Membrane DFC - Diluting Flow Chamber

CFC - Concentrating Flow Chamber

EFC - Electrode Flow Chamber

Cation
Anion

FIGURE 1: ELECTRODIALYSIS PROCESS DIAGRAM

Wellfield Unit Function Recovery Recovery lon Exchange Surge Feed Tank Sand Filtration to Filters 25 µm Primary Uranium Ion Exchange Removal Secondary Uranium Ion Exchange Removal Liquid CO2 EDR Feed Vessel pH Control EDR Feed Feed Tank Surge (1) 10 µm Filtration EDR Power/ AC/DC Conversion Flow Control Flow Unit Ion Separation EDR Membrane Stack Injection Injection Surge Surge Tank Waste WELLFIELD INJECTION

	Flow	Solution
#	Rate	Conductivity
	GPM .	limhos/cm
1	52.1	1,289
2	52.1	1,289
3 1	25.4	1,289
4	30.8	1,748
5	26.7	1,289
6	5.4	3,907
7	21.2	182
8	4.2	5,956
9	47.9	856

FIGURE 2 - EDR BASED RESTORATION - FLOW DIAGRAM

TABLE 1 EDR TEST/ANALYTICAL MEANS

PARAMETER	FEED	BRINE	PRODUCT	REJECTION
Major Parameter	mg/l	mq/1	mg/1	
HCO3	573	2,384	106	81.5%
C1	432	1,884	61	85.9%
so,"	363	1,656	23	93.75
Ca ⁺⁺	191	826	° 16	91.6%
Na *	337	1,464	61	81.9%
Mg *+	44	208	6	84.6%
х*	20	88	2	90.0%
Traces				
As	.022	0.104	0.009	59.1%
Ва	0.15	0.23	<0.1	>50%
NO3+NO2	1.9	8.0	0.44	76.8%
Se	0.11	0.19	0.02	81.8%
U	9.15	21.4	1.80	80.3%
Radiometrics	pCi/L	pCi/L	pCi/L	
Ra 226	667	2,904	64	90.4%
Th 230	54	415	10.0	81.5%
Gross 4	735	3,294	149	79.78
Gross 8	2,182	4,390	379	82.6%

CONCLUSION

Based on the results of the three month test period, Teton-Nedco purchased the Aquamite V-M unit for the pilot restoration and decommissioning project. We feel that the EDR process has satisfactorily proven its amenability to HCO. leach ISL water treatment requirements and this and a larger unit have been incorporated into the commercial scale flow sheet. Ease of operation, mechanical availability, capital and operating costs comparable to alternate systems, the units ability to provide >80% water recovery at >80% salt rejection, and the cooperation of the manufacturer were all factors in the decision to use EDR at the commercial level.

The anticipated uses of EDR under commercial operation include:

- 1) Provision of a source of low TDS process water for Na_CO, makeup, slurry product washing and post elution resin rinsing. The unit feed would be the 0.5 to 2% field overrecovery fluid.
- 2) Commercial scale wellfield restoration would be accomplished using an Aquamite 20 1.26×10^{-2} m /sec. (200 gpm) unit.
- 3) Process bleed reduction may be attempted by reducing product radiometric levels to a point where the solution is usable for construction water, dust control, drilling, plant washing or, with appropriate approvals, surface discharge.

At this Sime, the Aquamite V-M unit continues to operate and a "state of the art" pilot scale wellfield restoration is nearing completion.

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TETON EXPLORATION DRILLING, INC.

LEUENBERGER PILOT

IONICS AQUAMITE V-M OPERATING RESULTS

FEBRUARY 25, 1981 - SEPTEMBER 1, 1981

% MECHANICAL AVAILABILITY	>98%
FEED VOLUME	6.9 x 10 ⁶ GALLONS
FEED TDS	1.72 G/L
BRINE VOLUME	1.1 x 10 ⁶ GALLONS
BRINE TDS	9.5 G/L
PRODUCT VOLUME	5.8 x 10 ⁶ GALLONS
PRODUCT TDS	0.20 G/L
% SALT REJECTION	88.37%
% PRODUCT WATER RECOVERY	84.06%

TETON EXPLORATION DRILLING, INC.

LEUENBERGER PILOT

IONICS AQUAMITE V-M TEST RESULTS

FEBRUARY, 1981 - MAY, 1981

EXPECTED RESULTS:

FEED TDS 2.65 G/L

PRODUCT TDS 0.655 G/L

% PRODUCT WATER RECOVERY 80%

ACTUAL RESULTS:

% MECHANICAL AVAILABILITY 96%

FEED GALLONS 3.3 x 10⁶ GALLONS

FEED TDS 2.35 G/L

BRINE GALLONS 580,000 GALLONS

PRODUCT GALLONS 2.7 x 10⁶ GALLONS

PRODUCT TDS 0.35 G/L

% SALT REJECTION 87.5%

% PRODUCT WATER RECOVERY 81.5%

OPERATING COST \$1.01/1000 GALLONS

APPENDIX "B"

WATER QUALITY ANALYTICAL RESULTS OF RESTORATION PROGRESS

UNC TETON EXPLORATION DRILLING, INC.

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C1 - mg/1	81.6	11.4	1				
SO4 mg/1	475	169					1
Anion eq.	42.44	8.73				12.4	1
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Mg++ mg/1	57	15.9	Total variation of			A 1 1 3	11
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Cation eq.	41.70	8.42				1 2 2 2 2 2	
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- mg/1	**0.05	<0.05					
mg/l	0.40	₹0.05				R III	
mg/1	40.001	NA					
mg/1	10.10	<0.10					
- mg/1	10.05	10.05					
/NO2 " -	0.30	0.50					
mg/1	0.021	<0.01			*	1 2 2 2 2 1	
mg/1	0.2	<0.50		*** *** ***		1 1 1	
mg/1	< 0.05	1001		-			
26 pci/1		345 1 9					
pci/I		345.5					
SS A "				* 6 *d			
ss B "							

UNC TETON EXPLORATION DRILLING, INC.

WELL 5	MI-8	men	ALYTICAL WE	7 8 77 414 4 7			
DATE SMPLO	2.0.01		7:1	7	1 1 1 1 1 1 1 1		
	2-19-81	8-12-81	1 1 1 1 1 1 1 1 1				
ANALYSIS					7	-	-
DATES		All Control			11: ::	H MAG	11
*****	****				The Market		
HCO3 mg/1	1562	324	1	7	7 7 7 7		
CO3 mg/1	38.4	-0-		-			7
C1 - mg/1	80.4	20		-	I HIP YOU	July States	
SO4 mg/1	466	88	1				1
Anion eq.	38.84	7.71			1 1 2 1		
Carr ng/1	215	41					
Mg Tr mg/1	58.5	1 19	Warrage .		7 × 1×	L. Lung	1
Na ⁺ mg/1	529	8.9		-	HIN SE		1
K ^T mg/1	22.0	1 9	-			1 1 1 1 1 1 1	
Cation eq.	39.19	7.73	3 945 4 1	1 14 14			1
-/+balance	99.17	99.48	-				
Sum TDS	2971	590			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
Cond um/cm	2800	734	-			1 1 1 1 1 1 1 1	
DS mg/1	1920			1			1
H unit	7. 2	458					
mg/1	0.2	6.58	-		1	4. 10	
		1.670	***				
1 mg/1	< 0.05						
HZ - mg/1	<0.10	0.12					
s mg/l	0.009	<0.05	1 1 1 1 1 1 1 1				
a mg/1	* <0.10	0.033		J			
mg/1	*0.25	<0.10	* * ·	11242 -			
d mg/1	*O.01	0.11-		***	N .		
mg/1	**** < 0.05	0.007	* * * * * * * * * * * * * * * * * * * *	F-89-8 - 12-	1.00	*	-
1- mg/1	The second second second second second	40.01	100000	14.14.41			-
mg/1	<0.05	40.01	1 1 KH1	24 - 127 , 1 2	-		-
mg/1	-0.30	0.38					-
mg/1	10.05	₹0.01		**			
mg/1	*******	10.05	** **	7 74 45 1 I			-
mg/1	0.40	<0.01		1 2 2			1 8/41 1
mg/1 mg/1	₹0.001	<0.0002	14				-
mg/1 -	10.10	<0.10	-				
2/NO2 "	<0.05	10.02		1.			-
mg/1	0.30	<0.05		113 2	-		
mg/1	0.021	0.010	1 + 4 -4	- 12 44			
	0.2	< 0.10					
mg/1	< 0.05	0.005	4				
226 pci/1							
The second second		20018		* * *			
pci/l		1. 19. 11.61					A Real
ss B "							* * *

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UNC TETON EXPLORATION DRILLING IOC

And the same of th	MI-12	10 10 N	7.7 3.44 4.41	HISTORI			Seking dalah
DATE SMPLE	2-19-81	Harris.	11		7		12-14
ANALYSIS DATES					-	-	-
	****	1		- 11		. [1]	
HC05 mg/1			Part and and	O TANKS AND IN			
CO3 mg/1	1562		de capille	7	7	7	****
C1 - mg/1	38.4	1	1000		1	11 (0134.1	
SO ₄ mg/1	80.4		1				- 0
Anion eq.	4/2/0		I I I I I I I I I I I I I I I I I I I		1	-	
Ca ^{TT} mg/1	38.86			1	1		
77	215		* * **	111 40 04			
	58.5	1.5	the end is	1		-	I de la c
	529	A	7.1 ***.		-		1
K' mg/1 Cation eq.	. 22.0	7 1 HC 104		The Table of	1	1 1 1 1 1 1 1	
-/+balance	39.19		1. 100.00		1		
Sum TDS	99.17	2 2 22	1		1	-	
Cond um/cm	2971				-	-	
	. 3800	11. 8.4	* 1 44 3	11.		12 12 17 7	
DS mg/1	1920	22 .	1		-		
	7.2		1 4 4 3 .		1		
mg/l	0.2		2 44.1			10.82	
1				1	-		
1 mg/1 HX mg/1	< 0.05						Mary II
	<0.10						
s mg/1	0.009					10 / 10 PH	
a mg/1	×0.10				1		
mg/l	1 < 0.25		N 74 34				
d " mg/l	10.02						
mg/1	*** < 0.05	3.9				* 7 * 27	
1- mg/1	10.05		- A	A 173 1 1	200		1 × × 1
- mg/1	-0.30						
	*** 40.05						1 20 1
mg/1	**0.05	111111				1 17 3 1	
mg/1	0.40	-			7 1	2. 2.1 C.	4 600
mg/1	-0.001						
mg/1	*0.10						
mg/1	· <0.05		1 / 2 / N / N /				
2/NO3 "	0.30		-				
mg/1 -	0.021	4.00	1 × × 14		-		
mg/1	0.2		77.7				
mg/1	< 0.05		2 H				
226							
226 pci/1							
BU pci/I							100 0
SS A "				"			
oss B "							

UNC TETON EXPLORATION DRILLING, INC.

WELL &	1		2.00 4.00			** ** *	
DATE SMPL	2-19-81	5-6-81	9.9.81	1			7
ANALYSIS					-		
DATES		1		III and			
****	- I					11	
HCOF, mg/1	7	7		1	the of the later to		
CO3 mg/1	32.6	719	659				7 [
C1 mg/1	1010.4	.0-	-0-				1
SO4 mg/1	418	47	28.1			1	
Anion ea.	33.77	248	229				1
Ca ^{††} mg/1	224	16.28	16.37				
Mgtr mg/1	44'	130	141.9	1			
Na ⁺ mg/1	4-2.8	33.	33.0	2.50	Table 1		1
K ⁺ mg/1	19.5	203	139	18.1	1		1
Cation eq.	33.98	13.0	13.5		I La Latery	PETERS E	
-/+balance	29.38	18.41	16:23	-			
Sum TDS	2581	99.29	100.84	1000	1 2 4		
Cond um/cm	2530	1303	1244	1000000		P. Santa	
TDS mg/1	1868	1400	1283	2875 1 9 71	11-4-52		
H unit	7.5	8001	935	12.00			
mg/1	53.6	40.7	7.00	19 18 X	I have been a	Harris Salte and	E
		19.7	19.8				
1 ng/1	₹0.05	0.00				A STATE OF THE STA	
17 ng/1	<0.10	×0.10	20.5				
s mg/l	0.009	0.125	<0.10			1 S. O. S.	The same
a mg/1	20.10	*0.50	0.644				
mg/1	×0.25	0.28	< 0.10				
d - mg/1	×0:01	<0.01	<0:01	7. XY. 1			
r - mg/1	×0.05	< 0.05	10.01	7		E 99.32	-
u- mg/1	1005	₹0.05	< 0.0.5	_ A 10 MOVE		W-3	
mg/1	0.39	0.36	10:05				
e' - mg/1	₹0:05	1.07	0.45		10 10 10 10 10	1 1 1 2 1	
mg/1	<0:05	<0.05	0.94		2.4.4		
mg/1	0.24	6.13	<0.05	1 10 11			
mg/1	<0.001	≺0.001	0.133				
mg/1	40.10	<0.10	<0.10				
- mg/1	20.05·	<0.05	-				
2/NO3 "	0.26	0.28	<0.05			187	
mg/1	0.014	*0.005	10.01				
mg/1	0.2	<0.10	×0.50	111 7 4 4 4 4			T X I V
mg/1	< 0.05	-0.05	-				
		0.00	<0.01				
226 pci/1		139 1 20	1510 1.0				
30 pci/1		100 - 10	1549 19	-			[2] [[2]
SS A "		- MENTY		45, 79.84 T		*	100
oss B "							

UNE TETON EXPLORATION DRILLING, INC.

CELL V	300	AN	ALYTICAL WE	LL HISTORY		-1112,111	
	7		The second			6 41 11 1	***
DATE SMP	LD 2-23-81	5-6-81	1-14-81	6-12-81	1	7	7
ANALYSIS					-	-	
DATES	11-1113			100 307 14			
****	La Transaction of the Contraction						
HC07 mg/1	760	559			1		-
CO3 mg/1	0	160	328	11010		1	
C1 - mg/1	28	160	14	-0-			
SO4 mg/1	233	174	150	8			
Anion eq.	18.10	13.77		118			
Ca ^{TT} mg/1	225	125	9.19	5.41	-		
Mg ⁺⁺ mg/1	44.	The state of the s	25	51.	Carlot Fred	1	
Nat mg/1	and programme and the same of	53	35	17			TI ST.
K ⁺ mg/1	and the second of the second	11.1	9	32			
Cation eq.		12.42	8.64	5.54	-		
-/+balance	7	110.88	106.47				
Sum TDS	1373	997	665	97.61			
Cond um/cm	1400	1050	667	399		1 101088881	
TDS mg/1	1034	822	498	352 .		-	
pH unit	7.4	7.4	7.8	7.78			
mg/1	33.4	14.5	4.5	1.386		A CALIFORNIA	
				1.366			
-	40.05	0.17	0.10	×0.10	-		
	< 0.10	1 0.10	40.70	0.22			
As mg/1	0.0.0	0.013	₹ 0.005	0.005			Tropies and
Ba mg/l	*<0.10	40.50	0.20	40.10			
B mg/1 Cd mg/1	<0.25	₹0.25	₹0.25	*0.01			
	×0:01	10.01	0.02	0.003			-
	K.O. 02	10.05	< 0.0°5	10.01			-
	×0:05	<0:05	< 0:05	-<0.01			
	0.28	0.28	0.36	0.61			
Pb - mg/1	×0.05	0.39	0.06	10.0×			20.00
Mn mg/1	<0.05	140.05	<0.05	<0.05			
Hg mg/1	0.17	0.10	80.0	<0.01			
Mo mg/1	< 0.001	< 0.001	<0.001	<0.0002			
Ni mg/1	<0.10	₹0.10	10.10	₹0.10			
NO2/NO3 "	0.17	10.05	10.05	<0.02	4. 4		
Se mg/1		0.23	20.10	< 0.05			
V - mg/1	< 0.005	≺0.005	< 0.005	<0.001			
Zn mg/1	< 0.10	<0.10	70.10	<0.10			
-5/4	0.05	<005	∠0.05	0.007			
R=226 pci/1	2598.5 \$ 8.34	222					
TO pci/1	5	2530: 24	1074 160	879:16			
buss A "			* * * * * * * * * * * * * * * * * * * *	#			
Gross B "		711640		21 - 1			
		L					

UNC TETON EXPLORATION DRILLING, INC.

MELL V	308	AN	ALYTICAL WE	ELL HISTORY			
DATE SMP	CD 2-23-81	5-6-81	7.14.81	8-12-81	1	7	
DATES							-
			No transport			Martin i	11
HCO3 mg/1	7	1	A PER	of the second of the second	-		
CO3 mg/1		609	538	137	1	7	
C1 mg/1		14	19	-0-			
SO ₄ mg/1		2.4	to	2		1	-
Anion eq.	-	185	224	272		-	
Carr mg/1	122	11.70	9.37	7.97		1	-
Mg ⁺⁺ mg/1		77	100	100.		1	-
Na+ mg/1		'24	22	17		-	-
K+ mg/1		112	38	3.2		1	
Cation eq.		11.0	9			1	-
-/+balance		11.00	8:72	8:04			1
Sum TDS		106.37	197.51				-
Cond um/cm	2500	85%	656	569			
TDS mg/1		940	672	745	into a		
pH unit	-	450	524	546			-
U mg/1	7.5	7.55	7.8	7.80			
•	1.6	0.30	< 0.10	0.568			
41 mg/1	×0.05						
mg/1	1	0.25	₹0.10	10.10			
As mg/1	<0.10	<0.10	0.15	0.12			
Ba mg/1	0.016	0.033	< 0.005	0.025			
B mg/1	< 0.10	<0.50	0.20	×0.10	-		
	<0.25	0.34	< 0:25	×0.01			
Cr - mg/1	20:01	×0.01	0.02	0.003			
Cu- mg/1	<0.05	10.05	₹0.05	10.05		Danie a 12 12	-
F mg/1	<0.05	<0.05	X0.05	10.05			
7e mg/1	0:33	0.29	0:36	0.65			
	<0.05	0.33	0:24	(0.01			11 × × × ×
	<0.05	'<0.05	< 0.05	<0.05		- 1 1 1 1 X	-
	0.06	0.03	0.07	<0.01			7
Hg mg/1 Mo = mg/1	100.0>	₹0.001	< 0.001	<0.0008			-
Ni - mg/1	<0.10	<0.10	< 0.10	×0.10			
NO2/NO2"	<0.05	<0.05	< 0.05	140.02			
Se mg/1	0.37	0.26	₹0.10	40.05			
V mg/1	<0.005	₹0.005	< 0.005	<0.001			
Zn mg/1	<0.10	< 0.10	20.10	<0.10			
1 1 1 1 1 1 1	<0.05	< 0.05	<0.05	<0.005			
Ra226 pci/1	282.1912.74	68:4	12 01 0				
T pci/I	5	30.4	13.91.8	56++			
JSS A "		77 JH K A 1					
Gross B "						-	
		\		1		* ***	
	francisco de la constante de l			KET COPY		-	
			JUG IAID	ALL I			20628
		ULF	11/1/12				- 0000.

APPENDIX "C"

M-ZONE RESTORATION PROCESS MONITORING ANALYTICAL RESULTS DRILLING COMPANY, INC. TETON EXPLOR.

RESTORATION ZONE

ANALYTICAL HISTORY

08728110E

7.20 27 7.30 7.25 7.62 7.49 unit ЬH 3828 1364 2026 2347 1644 1446 33 405 523 919 SUM mg/ 22 53 9 1669 1305 2160 1255 839 umho 2715 1830 COND 2710 2340 1+10 753 774 755 613 613 718 99.2 48.4 5.401 9.66 5 104.9 1001 10 121.3 92.7 2.96 m BAL 110. 101 99. 98. MATION 31.09 31 7.63 33,93 22.93 8.33 8.10 19.37 4.83 8.49 17.71 8.35 6.60 med 23. mg/1 14.5 9.5 9.8 9.0 1.6 8.2 6.9 7 13 25 61 16 0 259 Na+ mg/l 306 73.8 246 215 427 320 488 4 90 84 86 92 88 313 74 84 ++ bW mg/1 29.3 12.9 30.5 15.0 12.8 13.2 13.0 10.3 49 25 43 28 11.7 63.9 62.7 206 49.5 52.8 158 891 124 201 92 96 62 Ca 63 101 7 + 1 NIONS 37.48 50.63 27.82 21.47 18.31 4.82 med. 8.17 7.97 7.97 68.7 14.91 8.75 9.51 14.9 16.6 11.8 103 13.1 13.7 138 120 11.9 113 8 9 101 601 101 11.7 9 mg/1 267 248 445 9++ 362 284 1+3 106 SO4 328 217 000 98 011 86 86 95 HCO_ 4) 1410 275 4101 333 333 333 83 586 275 1171 803 793 372 348 3 152 58 3 CO3 .0. .0. 0. .0. .0. .0. .0. 0. .0. .0. .0. 0. 0 0 0. 0. mg/1 23.1 17.3 4.0 12.8 6.3 0.3 9.0 0.5 0.3 a 3.3 0.6 4.0 0.3 1m' 3 HR. DATE 2.25 9.27 12-14 3.23 3.30 9.16 13-8 3.6 3.8 4.8 3.3 HASE 4 4 + +

DRILLING COMPANY, INC. TETON EXPLORAT UNC

RESTORATION Z

MR.3

ANALYTICAL HISTORY

04008728 110E 7.03 7.09 7.40 7.46 7.31 7.17 unit bH 156 2330 /bw 2015 SUM 15051 1639 7601 563 2007 62 4 COND umho 2860 2400 3080 1520 2095 1680 1455 1915 1410 1+8 118 431 602 +11 116.25 0.801 0.66 97.0 BAL 37.6 1001 94.0 101.5 N 97.1 94.6 98. CATION 25.08 34.13 30.77 20.42 9.08 med 22.95 19.53 7.80 9.62 4.34 8.10 mg/1 + 15.5 27 3.8 8.5 1.6 23 17 91 10 15 01 Na+ mg/1 508 571 150 397 240 354 2 79 314 601 63 26 115 78 11 4+ bW mg/1 29.8 12.2 31.1 10.5 47 34 51 38 13 17 10 Ca++ mg/l 1+3 209 134 128 67.7 43.5 106 104 07 06 100 16. 20 73 NIONS med. 33.68 30.46 27.07 9 19.80 18.36 8.86 6.76 22.2 7.38 9:16 7.95 C1 mg/l 6.91 a 113 130 130 13.5 103 19.8 m 118 111 101 0) 17 13. 14. 00 mg/1 446 448 345 S04 254 220 9 714 317 46 861 76 63 8 7 20 73 HCO_ mg/1 1659 1854 9611 1025 744 939 830 695 720 302 369 415 316 442 mg/l .0. .0. .0. 0. .0. .0-.0--0-0. -0-.0. .0. 0 0 U308 mg/1 00 S 9 3.6 " 2.3 4 2.2 2.1 5 0.2 1.4 0.1 3 4 2 m 0 6 2-25 DATE 3-15 3.23 3.30 3.1 3-8 8.30 4-8 4-15 61-+ 3.6 8.3 HASE ` 3 6 3 +

UNC - TETON EXPLORATION DRILLING COMPANY, INC

M ZONE RESTORATION

WELL: MR-5

ANALYTICAL HISTORY

04008728110E

7.26 7.57 7.43 7.27 unit 7.2 mg/1 2679 1625 1992 SUM 1430 226 1288 1093 1072 872 936 836 1381 123 198 577 2630 COND 2860 1340 umho 2260 2050 820 1445 1030 06+1 1405 1335 2001 1095 1076 1055 921 945 840 767 306 112.43 98.53 4 110.5 98.9 101.3 90.06 BAL 98.6 54 5 104.6 97.1 81.2 36.2 91.2 90 93. 92. 93 ATION 24.25 30.16 19.28 31.74 22.53 18.61 med 17.98 16.35 14.05 14.26 12.47 10.03 11.69 11.51 49 8 mq/1 14.9 26 12.3 + 1 11.2 0 12 11.2 +1 7 13. 9.3 15 13 a 9 11. 7 Na+ mg/1 303 +2+ 408 360 336 253 511 1 196 209 1 178 25 00 3 140 121 22 41 18 + 10 Mg++ mg/l 0 31.9 27.0 52 49 3+ 30. 31. 29 23 9/ 61 11 11 13 7 Ca++ mg/l 156 140 30 23 0 +11 110 801 102 72 10 13 46 84 80 88 09 58 57 10 + 9 74 NIONS 35.69 med. 26.79 23.72 21.00 19.70 16.63 18.00 16.13 14.24 13.78 11.25 10.50 13.11 10.50 7.02 C1mg/1 103 +01 101 36 100 58 3 46 0+ 17 73 36 17) 38 23 78 34 28 18 8 9 m 1/611 S04 4+3 356 339 254 302 0 217 196 33 160 1+16 130 177 103 139 86 3 90 87 61 101 74 CI mg/l 1132 1+1+7 6 83 805 1501 74.4 586 110 647 620 586 500 404 104 404 390 303 0) 451 451 403 00 9 CO3 mg/1 . 0. .0. 0. Ö .0. 0. 0. .0-.0. -0-.0. .0. .0. .0. -0-.0. .0. .0. 0. 0 0mg/l 0308 13.2 2.3 8.1 5.4 0.+ 9.0 m 2 9.0 3 11. 1.8 9 1.0 0.3 0.2 a 1.0> 0.3 0.3 m SY 0 0 0 DATE 2.25 3.30 4.26 4-22 5.10 4-15 4.8 61-+ 01.9 41.9 5.3 6.28 6.2 6.31 1.1 HASE • -~ a 3 a 5 a 3 2 a CV n a

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UNC - TETON EXPLOS... I DRILLING COMPANY, INC.

M ZONE RESTORATION

WELL: MR-5

ANALYTICAL HISTORY

04008728 110E mit bH mg/1 SUM 516 510 503 497 493 515 COND umho 612 583 598 577 574 611 102.1 104.9 102.4 6.66 97.9 BAL 95.4 giO. MOITE 6.14 6.69 6.43 6.41 med 6.54 6.53 * mg/l + 7.2 7.3 8 00 Θ 8 Na+ mg/1 76.3 69 17 74 18 74 ++ 6M mg/1 11.2 0 01 10 6.6 11 Ca++ mg/l 1.5.1 42 0 ++ 42 +3 NIONS meg. 6.62 44.9 4.56 6.24 69.0 6.33 C1mg/l 103 3 13 13 7 12 mg/l S0# 58 00 00 3 93 28 HCO_3 mg/1 308 236 302 293 286 271 CO3 mg/1 .0-.0. .0. .0. -0-.0. U308 mg/1 40.1 1.0. 0.3 1.0 1.0 0.1 DATE 7.29 7-15 7.22 13.8 1-8 8.5 PHASE N 4 a 2 2 7

UNC - TETON EXPLO. ..T | DRILLING COMPANY, INC.

M ZONE RESTORATION

ANALYTICAL HISTORY

04008728110E unit Ho 1045 8001 1052 1088 / But g 39 124 1148 1108 7101 300 934 887 120 827 111 737 12 COND umho 1202 1188 1376 1402 1316 1446 1348 1305 1383 122 1217 1012 1177 1101 8 854 305 770 20 95.64 102.64 103.19 92.74 98.54 103.44 1001 103.6 97. C BAL 104.3 100.0 102.6 100:3 1.08.4 102.5 8.+01 95. CATION 14.02 13.86 14.85 14.85 14.44 13.98 13.63 med 16.44 16.21 15.55 14.33 13.12 11.87 10.80 12.40 10.34 9.40 mg/1 10.3 13.0 11.5 00) 0.11 + 11.9 13 8.11 11.5 13.0 12.0 13 10.5 11.5 11.2 10.6 0 1 Na+ mg/1 179 186 206 681 192 210 112.3 176 193 105.4 161 173 125 148 133 170 16 Mg++ mg/1 17.6 23.4 21.9 21.2 22.8 21.1 23.3 22.1 22.6 7 20.7 22.3 21.6 61 19.6 17.9 19.61 Ca++ 82.4 808 mg/1 1.001 93.5 107 86.9 90.2 87 9 001 83.6 1.68 83 80.3 77.0 63 0 14 NIONS med. 13.41 13.40 15.36 14.26 15.32 16.04 13.77 15.41 116.11 14.94 14.46 13.13 12.53 12.17 10.83 9.63 11.11 C1-32.4 mg/1 35.3 37.4 34.1 40.1 3 41.4 34.1 a 0 7.10 30. 8 23.7 19.4 17.5 14.8 35. 15.1 20 28. 23. mg/1 86 205 192 206 S02 661 206 C 216 310 188 180 167 193 159 18 172 146 135 HCO_ mg/l 525 647 521 400 650 0 662 605 558 416 595 506 360 531 493 445 24 479 390 mg/l .0. .0 .0. .0. .0-.0. 0-0. .0. .0. 0. .0. -0-0-0 .0. 0 0 -U308 mg/1 4.0 6.5 9 4.6 8.4 3.6 9 0.01 0 3 3 S 7.9 6.2 6.5 4.1 3.0 10 3 10. 10 6 8 ATE 8.30 31.8 8-19 9.27 10-12 9.13 9-16 2 9.6 6.6 11-17 12.20 17-14 11-2 11.24 11.29 ò HASE 3 67 + 4 4 + 4 4 4 4 +

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COMPANY, DRILLING EXPLO. . . TETON

RESTORATION

ZONE

HISTORY ANALYTICAL

unit 1034 mg/l 1042 1030 945 1052 1037 SUM 9101 1000 1112 PDG 2101 613 842 792 650 N 103 103 102 +11 +0/ 57 1138 COND umho 1139 1159 985 1180 1104 1139 1711 1243 1166 1182 1145 1401 879 1150 37 705 +11 956 737 113 8 102.4 0) 3 103.1 100.4 91.0 105.9 100.5 102.7 2 0 101.2 102.3 102.6 4.001 104.1 BAL 6 101.5 105.1 102. 104. già 66 98. 98. 95. ATION. 24 12.74 13.07 12.93 13.70 14.21 13.13 12.76 13.01 13.19 12.86 13.35 med 13.30 13.20 10.61 4.79 11.52 9.15 8.13 7.63 13. 11.3 14.6 13.1 13.8 13.5 12.4 + 11.60 13.8 11.7 n mq/ 13 01 8.6 9.5 13 11.6 11 13 11 " 8 Na+ mg/l 4 4 6+1 1.56 41.4 6+1 37 143 1+1 151 131 145 150 1+1 140 125 1+4 134 101 115 15 * Mg++ mg/1 27.5 22.8 22.9 + 21.9 12.4 0 21.6 16.2 12.3 19.0 0.41 3 2 22 22 6 25 23 3 24. a 10 5 5 ~ Ca++ mg/1 1.68 1.68 69.3 10 88 +8.4 6 -4 0) 51.7 63 108 06 47 103 16 16 62. 8 98 8 75. 10 59. 8 NIONS meg. 14.28 13.62 38 11.90 13.49 13.27 13.12 12.78 13.51 14.27 13.05 13.31 13.05 13.36 11.79 10.88 8.46 7.31 10.28 9.18 13. C1. mg/l 27.3 31.4 29.7 32.1 27.5 27.1 21.9 25.1 0.61 17.5 11.6 28 0 3 5 0 26 R 27 27 25. Ci 3 m 16. 0 /Bu 162 159 154 160 170 160 101 164 > 139 133 129 148 0+1 13 118 100 101 = 3 96. S 9/ HCO. mg/1 555 558 561 564 576 400 552 541 58C 575 476 360 589 403 572 303 48 512 451 47 53 CO3 /bu .0. .0. .0-.0. -0--0-.0. .0. 0 .0. .0. -0-.0. 0-.0. -0-.0. 0. 0. 0. .0. U308 6 8.1 13.5 13.2 13.3 / bu 8 13.1 11.11 3 3.6 3.4 2.3 13.4 11.9 15.5 4 1.8 1.0 3.1 8 3 13 11. 8. 8 DATE 6.28 7-15 7-22 7.29 8-12 8.19 8.30 1.1 is 3-6 9.17 4.0 10-12 9.3 71-11 8 9.6 9.16 6-11 1 HASE 0 N N 3 7 7 CE 3 . 4 3 3 + 4 + + 4 +

20628

01008728110E

UNC - TETON EXPLOR. . I DRILLING COMPANY, INC.

M ZONE RESTORATION

WELL: MI-4

ANALYTICAL HISTORY

04008728110E unit mg/1 462 548 502 SUM COND umho 548 631 6 76 98.2 89.3 101.3 BAL CATION 4.00 7.57 7.50 med mg/l + 9 8 -Na+ mg/1 69 + 8 83 Mg++ mg/l 11.1 9 * Ca++ mg/1 43 505 15 NIONS meg. 7.40 4.76 5.89 mg/1 C1. 13.8 13.3 14.0 mg/1 S0 = 62 72 HCO3 mg/1 271 310 348 C03 mg/1 .0. .0. .0. mg/1 1.0> 1.0> 0,2 8-19 DATE 8.12 8.30 PHASE 3 6 3

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DRILLING COMPANY, INC. EXPLORATI TETON

UNC

RESTORATION ZONE

WELL: MI-8

HISTORY

04008728110E Hd I/bu 1390 1166 1493 1641 1255 1042 947 138 138 132 016 858 78: 1380 COND umho 1455 1366 1345 1380 1410 1425 1540 1430 1380 1305 1266 +111 959 1008 1801 8 95.4 0.001 0.66 9 9 5 104.6 BAL 3 97.1 6.16 98.4 9 99.9 102. 98. 98. 1001 96. 99. CATION 19.83 18.36 19.46 19.26 17.98 05 41 17.46 13.03 med 14.85 12.24 10.6 18. 11.11 10.3 16. 12.6 13.8 12.6 mg/ + m 11.2 13 12 13. 13 12 13 12 0 1 13 Na+ mg/1 5 217 216 189 138 123 22 1961 180 m 151 115 66 +6 111 H4 5W mg/1 5 35 30 35. 22.4 37 33 200 35 33 33 25 10 20 4 Ca++ mg/l 9 130 134 136 132 122 130 120 130 105 144 126 7 130 63 101 100 83 NIONS 18.09 19.603 19.47 18.03 16.45 17.89 med. 19.04 16.96 13.65 13.63 11.09 12.22 10.05 11.61 Cl mg/1 10 1 7 から +8 46 460 460 4 36 22 +2 27 20 22 18 19 mg/1 S0= 207 2+1 228 199 217 208 173 125 154 1+0 170 156 152 114 101 117 HCO3 720 769 733 6 756 756 659 108 108 407 586 525 484 65 5 4 452 C03 mg/l0. .0. .0. 0 0. 0 -0--0--0-0. 0. .0. 0. 0. .0. 0 mg/1 8 0 9 4.3 00 0 N 8 1.9 5.0 4.0 2.5 +.1 a 7.6 1.2 CA 1.7 a m' 40 9 4 3 9 DATE 4.22 4.26 5.3 5-17 5.24 6.28 6.2 41.9 01.9 6.21 7-22 7.29 57 8 HASE N d a a 3 a N CX a N 9 a a a a 7 a

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20628

DRILLING COMPANY, INC. EXPLO, f TETON UNC

RESTORATION

WELL: MI-12

ANALYTICAL HISTORY

04008728 110E unit Hd T/bu 1245 1215 1085 1218 ++11 1041 8001 803 796 813 749 COND umho 0001 1160 1132 1170 5811 1183 1265 1160 1135 1160 1007 8 + 2 930 831 1110 1087 1001 85.2 8.86 93.2 1001.3 1.66 BAL 92.5 3 101.7 103.0 4.7 4.001 r 9 ATION 16.38 14.75 15.93 16.15 14.62 14.93 13.79 13.00 12.54 10.26 med 11.28 10.48 mg/l 12.3 11.11 11.8 + 10.6 11.9 11.3 13 13 12 0 12 Na+ mg/l 222 192 145 1+1 143 135 1 + 1 105 118 46 a 66 Mg++ mg/l 27.7 23.6 0 200 0 33 34 36 22 + 20 m 3 m 77 Ca++ mg/1 145 134 140 103 96 901 0 120 103 86 102 63 08 85 6 83 NIONS 13.56 med. 15.61 11.50 14.98 15.96 16.40 13.42 11.00 13.22 11.62 10.30 9.40 C1. mg/1 50 37 48 45 9 34 0 4 8 30 35 1+ 20 61 2 m mg/1 166 S04 192 +61 169 177 1+2 801 122 137 m 124 106 131 16 13 10 HCO3 mg/1 622 634 549 010 586 1107 671 573 537 573 512 461 427 4 98 513 427 COS mg/1 0 -0-.0-.0. .0. .0-.0. .0. .0. 0. .0. .0. .0. .0. 0 . 0. mg/1 0.1 1.0 2.0 1.5 1.6 2.1 0.3 1.6 1.5 1.6 1.2 6.1 6.1 +.0 1.5 4.0 DATE 5-10 5-17 4.26 5.3 5.24 6.21 6-28 7-29 01.97 7-22 6.2 +1.9 7-15 7.8 HASE N n a 2 a a CK CV C a a 9 a a a 7

C - TETON EXPLORATI DRILLING COMPANY, I

M ZONE RESTORATION

ANALYTICAL HISTORY

mg/l mg/l mg/l mg/l mg/l mg/l mg/l mg/l	PHASE	DATE	030	co3	HCO3	30g	C1_	ANIONS	S Ca++	+ Wg++	+ Na+	+ ×	CATION	N BAL	COND	-	p.H.
1 3.25 59.2 10.7 3.69 83 3.92 43 3.50 30 31.4 4.02.1 31.0 32.55 33 4.13 4.02 30 30.2 4.2 43 3.50 30 31.7 30.0 31.0			mg/1	mg/1	1	1	1	meq.	/bu	1	mg/1	/bw	те	00	ohmu	TDS mg/1	unit
3-8 3-9 8-3 39,02 78,2 43 39,02 78,2 43 39,02 78,4 78,02 30 17 32,10 100.9 43,12 100.9 31,10 100.9 43,12 100.9 17 32,10 100.9 43,12 17 35,10 100.9 43,12 14 34 17 35,10 100.9 43,12 14 34 17 35,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 100.9 13,10 <t< td=""><td>\</td><td>2.3</td><td>59.</td><td>0</td><td>1537</td><td>451</td><td></td><td></td><td>212</td><td></td><td>474</td><td>-</td><td>-</td><td></td><td>2615</td><td>Share and salar laboration in the salar laboration in</td><td>7 2 2</td></t<>	\	2.3	59.	0	1537	451			212		474	-	-		2615	Share and salar laboration in the salar laboration in	7 2 2
3-6 3-6 0.0 0.16 3-16 0.06 0.5-40 0.56 4.2 0.09 0.7 0.5-10 0.0-9 0.75-50 0.5-10 0.0-9 0.75-50 0.5-10 0.0-9 0.75-50 0.5-7	,	3.1	+7.3	0	11711	959	83	29.02	18	43	350	20	28.4	-	-	2366	7.32
3-15 34.7 .0. 927 326 91 34.43 144 34 218 17 33.56 193.7 170 186.8 13 32.1 .0. 805 254 82 176 1.6 2.85 14 21.32 94.3 14.95 157	,	3-8	39.6	0	976	316	100	25.40	156	42	309	17	25.17	-	-	1956	7.59
4.18 3.2.1 .0. 30.5 2.54 82 716 3.85 4.6 716 3.85 716 3.85 717 718	,	3-15		.0.	927	320	16	24.43	164	34	278	11	23.56	103.7	1770	1868	7.27
3.30 30.4 .0. 74.9 35.4 71.0 50.4 31.3 24.5 14 21.33 17.5 35.3 24.5 14 21.33 17.7 18.50 97.0 13.60 14.13 4.48 26.5 .0.5 24.2 6.0 77.54 73.2 37.3 73.7 78.0 97.0 73.60 74.13 4.49 20.6 .0. 6.83 23.2 6.2 77.54 73.2 73.3 73.2 73.0 73.6 73.0 73.6 73.0 73.0 73.0 73.0 73.0 73.0 73.0 73.0 73.0 73.0 73.0 73.0 74.15 73.0 73.0 74.15 73.0 73.0 74.15 73.0 74.15 73.0 74.15 73.0 74.15 73.0 74.15 74.2 74.1 74.2 74.2 74.2 74.2 74.2 74.2 74.2 74.2 74.2 74.2 74.1 74.1 74.1 <	-	3.23	32.		805	254	82		116		285		-		1595		1
4.18 25.5 .0. 68.8 23.7 78 18.33 /27 35.3 21.3 /13.7 /18.90 97.0 /13.60 /14.13 4-19 20.6 -0. 68.9 24.2 60 /17.54 /13.2 32. /14.5 /13. /14.7 /14.6 /13.5 /1	-	3.30	-	.0.	74.9	10	78	20.10	154	31.3	245	14	1.3	94.3	14.95	1 1	m
4-15 21.9 -0. 6.89 24.2 6.0 77.54 135 32 16.5 13 76.77 104.6 135 4-19 20.6 -0. 6.83 23.6 6.2 77.57 14.2 37.8 23.2 73.5 14.15 4-22 24.0 -0. 6.83 23.2 6.2 77.57 14.2 37.8 23.2 73.5 14.15 1-24 24.0 -0. 756 358 6.0 19.46 14.2 36.7 21.3 17.1 17.1 17.1 17.1 17.1 17.1 17.1 17.1 17.1 17.1 17.1 17.1 17.2 17.1 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2 17.1 17.2	`	4.8	25.5	.0.	683	m	7.8	8.3	127	5	2/3	3.	18.90	97.0	1360		
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4.26 24.0 -0. 68.3 23.2 62. 17.57 14.2 37.8 23.2 17.57 14.2 37.8 23.2 17.57 14.2 37.8 23.2 14.15 14.5 <	,	4-19	20.6	.0.	683	236	62		136		196				1350		The state of the s
6.73 23.0 -0. 756 4.946 14.2 36.7 31.3 19.3 19.13 19.13 19.13 19.13 19.13 19.13 19.13 19.11 19.10 <td>2</td> <td>4.33</td> <td>1</td> <td>.0.</td> <td>683</td> <td>a</td> <td>62</td> <td>17.57</td> <td>143</td> <td>37.8</td> <td>222</td> <td>12.5</td> <td>20.22</td> <td>86.3</td> <td>1415</td> <td>1402</td> <td>***************************************</td>	2	4.33	1	.0.	683	a	62	17.57	143	37.8	222	12.5	20.22	86.3	1415	1402	***************************************
5-10 21.4 -0. 744 248 56 18.94 133 30 191 12 1711 106.95 1375 5-10 21.4 -0. 720 240 52 18.37 140 32 206 12 18.93 94.5 1275 5-17 18.0 -0. 6.95 335 49 17.61 120 30 186 17.6 17.6 17.9 17.9 14.9 17.7 138 97.8 14.70 60 14.6 10.55 124 31 17.9 17.9 12.8 97.8 14.70 138 14.70 138 14.70 17.7 138 14.70 138 14.70 12.3 12.3 10.9 14.9 14.9 17.7 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9	n	4.26	24.0	-0-	756	258	09		142	36.7	213	12.3	19.73	98.61	1410	1502	
5-10 21.4 -0. 40.5 18.37 140 32 206 12 18.93 94.5 1275 5-17 18.0 -0. 695 235 49 17.67 120 30 186 11.2 14.81 104.7 1380 6-2 17.4 -0. 634 151 40 17.67 31 179 12.3 14.88 97.8 1470 6-2 16.1 -0. 634 151 40 15.50 109 24 171 13 15.2 101.9 14.90 6-10 14.6 15.50 102 24 171 13 15.42 100 12.3 101.9 14.90 100.9 14.10 13 16.5 101.9 14.90 100.9 14.11 14.91 10.2 10.9 14.10 14.91 10.2 10.9 14.10 11.11 11.11 11.11 11.11 11.11 11.11 11.11 11.11 11.	7	5.3	23.0	-0-	744	248	56	18.94	133	36	161	13	17.71	106.95	1375	1436	-
5-17 (8.0 -0- 6.95 335 49 77.67 (720 30 786 11.2 16.87 (04.7 1380 5-24 17.4 -0- 6.59 21.2 46 16.52 124 31 179 12.3 16.88 97.8 1470 6-2 16.1 -0- 6.34 151 40 15.50 109 24 171 13 15.22 101.9 126.3 6-10 14.6 45 -02 -02 -0 176 44 14.91 104 27 16.5 10.8 14.90 100.9 129.5 6-21 13.5 -0- 6.0 176 44 14.91 104 27 16.5 10.8 14.90 100.1 129.5 6-21 13.5 -0- 6.3 16.9 15.42 129 31.2 13.5 19.3 10.1.2 129.5 9-9 19-3 -0- 6.0 171 23.0 14.11	n	5-10	21.4	.0-	730	240	53	18.27	140	32	206	13		96.5	1275	/423	
5.24 17.4 .0 6.53 212 46 16.52 124 31 179 12.3 16.88 97.8 1470 6.2 16.1 191 40 15.50 109 24 171 13 15.22 101.9 1263 6.10 14.6 45 .02 .02 .0 .0 12.35 100.9 14.90 10.0 12.35 100.9 14.90 100.9 14.90 10.0 12.35 100.4 19.9 12.93 12.93 12.3 16.0 19.9 14.11 116 27.3 13.5 12.2 15.23 100.4 19.9 14.99 14.99 14.90 </td <td>n</td> <td>5.17</td> <td>18.0</td> <td>.0.</td> <td>695</td> <td>235</td> <td>6+</td> <td></td> <td>120</td> <td>30</td> <td>186</td> <td>11.2</td> <td>16.87</td> <td>104.7</td> <td>1380</td> <td>/344</td> <td></td>	n	5.17	18.0	.0.	695	235	6+		120	30	186	11.2	16.87	104.7	1380	/344	
6.2 16.1 -0. 634 191 40 15.50 109 34 171 13 15.22 101.9 1263 6.10 14.6 .0. 6.10 186 45 10.2 102 105 105 101.9 1263 6.14 15.6 .0. 6.10 176 44 14.91 104 27 165 10.8 14.90 100.1 1290 6.21 13.5 -0. 56.1 183 38 10.2 129 31.2 135 12.2 15.23 101.2 1293 9.9 19.3 -0. 6.35 200 29.7 15.42 129 31.2 135 12.2 15.23 101.2 1293 9.13 15.2 .0. 6.04 171 23.0 14.11 116 27.3 130 12.7 14.05 100.4 1198	n	5.24	17.4	.0.	653	212	4 (0	16.53	124	31	179	/2.3	14.88	97.8	1470	1280	
6.10 14.6 .0. 6.10 186 45 102	n	6.3	16.1	-0-	489	181	0+	15.50	109	74	171	13		101.9	1263	1188	
6.14 15.6 .0- 610 176 +4 14.91 104 27 165 10.8 14.90 100.1 1290 6.21 13.5 -0- 561 183 38 10.2 129 31.2 135 12.3 15.33 101.2 1293 9.9 19.3 -0- 635 200 29.9 15.42 129 31.2 135 12.3 15.33 101.2 1293 9.13 15.2 -0- 604 171 23.0 14.11 116 27.3 130 12.7 14.05 100.4 1198	2	01-9	14.6	.0.	019	186	45		102						1335		
6.21 13.5 -0. 561 183 38 102 135 13.2 135 12.3 101.2 1293 9.9 19.3 -0. 6.35 200 29.9 15.42 129 31.2 135 12.3 15.23 101.2 1293 9.13 15.2 -0. 6.04 171 23.0 14.11 116 27.3 130 12.7 14.05 100.4 1198	~	41.9	15.6	-0-	610	176	++	14.91	104		165	10.8	14.90	1.001	1290	1153	
9.9 19.3 -0. 635 200 29.9 15.42 129 31.2 135 12.3 15.23 101.2 1293 9.13 15.2 -0. 604 171 23.0 14.11 116 27.3 130 12.7 14.05 100.4 1198	2	16.31	13.5	.0.	361	183	38		102			The same of the sa		and the supplement of the same	1295	-	***************************************
9-13 15.2 -0. 604 171 23.0 14.11 116 27.3 130 12.7 14.05 100.4 1198	+	9.6	19.3	-0-	635	200	29.3	15.42	129	31.2	135	12.2	15.23	101.2	1	1611	
	+	9-13	15.2	0	409	171	23.0	14.11	116	27.3	130	12.7	14.05	1001	4	0000	-

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UNC - TETON EXPLOR ... I DRILLING COMPANY, INC.

M ZONE RESTORATION

ANALYTICAL HISTORY

04008728110E unit Hd mg/1 1036 854 897 643 566 161 615 77 0 0 COND umho 3901 867 1150 185 796 1015 726 1101 650 655 104.4 3 97.9 106.7 100.9 102.0 106.0 1001 BAL 103. 113. 97. dip ATION 12.24 13.58 11.53 11.24 11.24 7.36 med 61.01 9.18 8.03 7.66 13.0 11.7 + 11.5 10.6 11.11 10.4 4.6 8.6 8.3 0 8 Na+ 601 130 87.7 75.9 71.3 72.2 117 16 82 85 Mg++ 27.0 mg/1 25.1 20.4 24.1 23.5 21.8 15.8 18.7 15.4 14 Ca++ 102.3 83.6 85.8 1.001 63.8 60.5 100 73.7 57.2 116 NIONS 13.28 12.70 12.04 med. 12.74 10.98 10.28 8.56 9.37 7.36 8.12 24.8 22.7 Cl mg/l 20.8 19.0 16.2 14.3 11-4 18.1 14.1 +-11 mg/1 SOF 172 6+1 140 147 901 143 128 911 104 00 0 HCO_ mg/l 5+6 363 543 396 512 512 121 4 33 305 339 mc/1 0. .0. .0. 0 0-0 0. 0. 0. ò 0308 mg/1 6.41 5 9.3 + . 1 4.7 6.1 2.0 1.0 1.3 6 ATE 9.16 9.27 +-01 11-17 11-24 11.29 11.2 6-1 17-8 HASE + 4 + 4 + + 4 4 थ +

DRILLING COMPANY, INC. - TETON EXPLO. . f. UNC

RESTORATION ZONE

WELL:

ANALYTICAL HISTORY

8.22 8.19 7.78 7.4 7.8 7.4 mg/1 1373 997 665 399 SUM 469 472 453 COND umho 584 66.7 597 1400 1050 590 570 99.03 106.5 97.6 0 95.9 4.06 1.86 BAL 110 ATION 18.28 12.42 8.64 5.54 45.9 6.53 6.21 med 12.5 mg/1 11.1 4.8 + 7.9 7.2 0 -Na+ mg/1 28.4 27.2 27.0 32 53 35 20 H4+6W mg/1 16.6 16.7 25 43 44 Ca++ mg/1 6.69 73.7 225 73. 125 36 2 NIONS med. 4.29 60.9 18.10 13.77 4.27 9.13 5.41 mg/l 28 6.1 16 4.1 4.8 00 0 mg/1 333 174 150 112 SO 1 118 108 110 219.4 HCO_1 2 13.7 mg/1 760 99 226 583 328 CO3 4.8 .0. .0. 6.7 16 +-10 33.4 0308 mq/11.39 14.5 0.35 0.24 0.20 4.5 306 DATE 2-23 5-6 e-12 7-14 9-13 11-17 10-7 HASE N N 3 + 4 +

04008728/10E

DRILLING COMPANY, INC. UNC - TETON EXPLOR...I

M ZONE RESTORATION

ANALYTICAL HISTORY

#50 19.5 29.22 99.03 #50 19.5 29.22 99.03 112 11.0 11.00 106.4 38 9 8.72 107.5 32 9 8.04 99.13 36.9 10.6 11.12 96.95 53 8.6 8.50 95.04
19.5 29.22 11.0 11.00 9 8.72 9 8.04 10.2 8.81 8.6 8.50
11.0 11.00 9 8.72 9 8.04 10.2 8.81 8.6 8.50
9 8.72 9 8.04 10.2 11.12 10.2 8.81 8.6 8.50
9 8.04 10.2 11.12 10.2 8.81 8.6 8.50
10.2 8.81 8.6 8.50
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8.6 8.50

WELL:

APPENDIX "D"

RAW DATA FOR M-ZONE BASELINE DETERMINATION

Annual de Principal de la Contraction de la Cont					7		ÿ	~	9	1911 La	18.11-7
	0.23	10.99	4- 2.478	7.12.664	52	4.713-	20.				
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A color of the second s	580,50	1760.10 2	476.50 3	461.64	5.43	6.00		5,85	7.0	8.11	CAT
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MAP NUMBER PRS-305

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18	STDV		0	2.8	49.18	0.31	2	64.34	3	20.32	0.1.0	6.19	8.83	1.42	4	22,32	0.03	0.00	0 01	0.03	0.00	0.40	99.00	.000034	0.15	0.02	3, 15	0.00		60.03	-	3	82.24		1.48		
8-20-h	MEAN		7.57	12,60	481,67	0.23	0.26	241	70 07	40.74	15	0.51	15.81	0	29.92	met ;	0.07	0.01	0.01	0.04	0.03	0.48	0.37	.00084	0.11	0.07	1.58	Cal	40	23	5.	10,1	387.73 488 84	6.1	-\$	3	
TE TON 2339 Ø11381	es.	0	7.24		485	0.10	0.100-	217	4.0	7	0.250-	0,40	21.10	9.20	2.5		W. 63.63	0.10	6.010-	0.050-	0.050-	0.34	0.050-	-00100	0.100-	-000.0	NA NA	0.003-			0,100-	7000	.30	. 20	5.85	2.87	
TETON 1761 100600 100700	n	8		12.50		0.100-		S. BOW	W.:	9	0.250-	0.46	12	7.70	53	103	D 0000	0.100-	0.010-	0.030-	0.00.0	D 07.03-	0.050-	-00100	0.100-	- 000 cm	1.30	0.095-	2,20	0.100-	6. 100-	74.0	39.70 4	42.0	400	4.442-	
7F TON 1358 071608 071688	S	~	8-	17.50		W. 1889-	10.38	6.000	53	7	0.250-	69.00	12,60	7,60	121	0110	B. 0005-	0.050-	0.010-	0.050-	-000.0	0.050-	0.050-	-00100	0. 100-	B. 19	0.84	0.005-	0,40	0.109-	0.050-	335	49.20 4	5.65	60.9	3.785-	
STATISTICAL CALCUL. TETON TETON 225 1077 9-011480-051380 8	S	9	7.70	NA	000	0.100-	012	0.000	60	L	203		16	CD 12	50	٠,				, è	0.00.00			. 00100	. 1			0.005-			6.030-		425 4	. 72	m .	- 800.c	The second second
ATISTICAL TETON 225 011480 0	n	'n	7.45	NA	9000	1 40	211	0.000	64	3.60	0.050-	0,40	11.30	00.7	688	0.100-	0.005-	0.050-	0.050-	0.050-0	0.08				0.030-			, i	NA.	- 1470	0.050-			5.70	1		The cast and a second second
S 127	9	4	AN:	I I	0.14	0.040	NA	0.000.0	60	NA.	0.010-	50.00	10	7.1	VIV	0.100-	Ť,	. 1		0.100-		0.010-	1	00100-		11.50		1000		-		MA	4		NA.	141	
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CON MORTHERNAMENCO 031379 040579 NA NA NA NA	í,	eu j	5 12	THA THE				6	72	500		17.	a	33	136	į.				Ŧ		-000	-	0.020-0			116	114				365	-	0.00	-	00.	
1 NK 1575	יי	- <	114	NA.	900.	0.13		0.000	# . U.S.	2 10	20.00	20.30	01	35.38	134	ï		0000					0.079 00000	*		10	003- 0		0.012			463		6.47		10	
ರಹಕಾ .							m.				-	-53									3	0	000	.0	.0		0		0.		3		5		1.6	USER CODE	
198	5	2 7 7	10	GD .	MH3	NO3	HC	503	2	d d	i le	MG	×	FIA	504	AL.	E C	200	CR	00	FE	a :	H	E SE	111	RA	SF	H	ח	>	NZ.	200	CAT	KILL	CE	2	

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11: 2:11

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04008728/10E WATER QUALITY WELL NAME 305 (Chemical units in mg/l except as noted)

ate Sampled	4-6-81	6-19-81	1/14/81	7/14/81	10-5-81		
Kilinity ppm as CaCo3			200		172		
(Units)	7.6		7.32	7.2	7.89		
onductivity (umhos/cm)	564		459	494	552		
mmonia (NH3 as N)	<.1		.32	Lell		-	1
al N02/N03 (as N)	<.1			<.1			
carbonate (HCO3) 3	3 232		244	214	210		1
arbonate (CO3)	0		-0-	-0-	-0-		1
alcium (Ca)	1 . 62		64	65	638		
.hloride (Cl)	23 8		14	4.	4.2		
oron (B)	1.25		14.01	1.25			
'luoride (F)	.48		.74	-45			
lagnesium (Mg)	56 18.7	Man 4	17	16.	15.4		
otassium (K)	21 8.3		8	7	8.0		
odium (Na)	26 29	1-11-1	26	28 .	26		
ulfate (SO4)	88		92	102	102		
.luminum (Al)	1.05	1000	<-1	.3.	4.10		
menic (As)	1.005		(.001	1-005	1		
arium (Ba)	1.5		<.1	<.1	4.10		
dmium (Cd)	<.01		<.002		4,01		
hromium (Cr)	1.05		1.01				
Copper (Cu)	(.05		4.01				
Iron (Fe)	-37		.43	.20			
Lead (Pb) :	1.05		1.05	1.05	<105		
Manganese (Mn)	.09		.04	1.05	4,05		
dercury (Hg)	(.00)		K-000Z				
Molybdenum (Mo)	<-1		(.10	۲.1	4.10		
lickel (Ni)	1.05		1.02	4.05	2.05		
adium 226 (Ra) pCi/1		6.0-2.5	8.3-1.4	12 ± 6			
elenium (Se)	4.005		<.001	1.005	4.5		
horium 230 (Th) pCi/1							
ranium (U) pom	<.1		.006	<.1			
anadium (V)	(.)		<.1	4-1	4,5		
inc (Zn)	1.05		.005	4.05	4.01		
	368		399	324	336		
210 pCi/L		- 1.4	FILE	2 % 1			
litrate (NO3) as N			1.05				
itrite (NO2) as N			1.001				

	ML	-	4 5	9-0	177	ci	P- 1													N U		1		er e	1 -2		04	o r	- 1	. 1		~		9 -	
	7	4	2 4	0 0	9	9	9	0	2 4	40	-9	-9	7	9	0 4	0 6	9	-9	0.	1 4	19	-9	-9	19	1-9		-9	-9	0 4	49	3	-9	4	6-6	
	Ä	4	1 4	m	Ci	1	41	, 4	0 0		-0	4	۳,		- r	, 0	-7	1		7 1	i.	-	1	5 -	. 04		7	5. *		0.00	4	-	4		
	M	-9	9	1-0	-9	9	0	0 4	19	19	10	-9	9.	0 -	6 4	0 -0	-0	10	-0	0 4	9	-9	9.	0 4	1.9		10	1 1		1	14	8		, 0	
	MAX	7.96	12,50	1405	0.17	1.20	(60)	204	30	0.25	53	57,80	C4	DEC.	0.05	0.01	0.41	0.02	0.10	4.46	0.12	0.17	00100	0.10	1127		0.01	- 10	0.1	3	103		18,21	101	
	MIN			410			177	3 25		0.01		15	- 66	1 =	0.05	0.01	6.03	0.00	0.01	0.05	0.01			6.02			0000	0.03	0.05	0.02	323	4	2,35	0.03	
	d.	7	4	1	7	1	1	. ~	1	7	-	1	1	1	. 1	1	7	~ 1	7	7	1	7			S	,	I	2 10	9	1	1-1	1	7 1	7	
	NSM						-								. *:	-								1								-			
8 .	- VOTS	2.3.		457.20		4 1.5	0.1	74		-	9 4	25: 15	1 1	1600	3.4	400						0.04				60 5360	8.93	13.29	0.03	50 :	327.43	î .	4.83	3.80	
5-6	MEAN	7.69	11	737.14	0 57	345,85	0	83.57	m	0.18	26.91	0 0	41	140	0.34	0.01	5.19	0.03	0.05	1.41	80.05	000003	0.14	0.05	591.03	0.01	8.73	7.43	0.00	60.04	4 4	B. 48	8.99	3,53	
7ETON 2584 622381 022481	97	7.40	NIN	1400	0.17	7.50	0.000	223	C .	W. 238-	44	12.50	7.0	233	0.638-	0.010	0.100-	0.030-	0.050-	0.050-	0.050-	-00100-	0.100-	0.020-	2574,30	0.003-	5	33,40	-	-000	504	1	18.10	0.32	
7E10N 2403 012081 012281	9 9			0.100-	. 0		0.000			. 5	57.80		74	174	0.030-	6.805-	0 010	0.030-	0,050-	000	0.00.00	.00100	0.10	0.050-	NA.	0.003-		18,30				-	13.59	ments.	
TETON 1778 100999 100980	9 10	7.30	44.00	0.100-	B. 100-	284	0.000	72	0 050	0.50	19	7.40	31	119	8.95	G 1002-	O 010	0.050-	0.050-	4.46	0.070	-00100-	-001.0	0.050-	18	0.005-		0.100-			522.40			2.853-	
TETON 1414 072480 072980	9	7,95	414	0,100-	0.100-	227	0.00g	25	2000	0.45	17	7.20	25	106	4 300 0	0.090-	0.010-	0.050-	0.050-	0 000	0.050	-00100.	6.100-	0.050-		0.005-	4.40	0.100-	0.000	303	445.20	5.35	6.15	6.983-	Address of the Party of the Par
1078 851380 051380	910	7.69	410		0.11	14	6,000	00	0.000	0.51	18.20	1	31		D. 12		0.010			- 4			3:			0.005-	2.80	0.100-	0.050-	340	0.7	26	0	~	The second second
PALS 061179 NA	4001	7.90	0.77	Prod.	1.20	70.46	100	201	0.14	0.37	1.7	16	34	100	0.70	0.460-	0.020-	0.103-	7 400	0.010-	0.190-	-00100-	0.500-	29, 49	NA	0.010-	2.6	9	0.000	360		5, 98	6.5	100.00	
MANCO PALS 051179 061	0	7,96	510	1.00	0.050-		0.400	101	0.010	53	17	m	01.0	070 0	D. DON-	0.41	-200.0	0.010-	0.010	0.12	0.050		00000	649	7	0.005-	NA POST	D. 07.00	0.030	324	433	5,75		0.11	î
LAB Jos DS	WN SPN	TU		MH3	NO3	HC03	5 V	T			10		SIA	AL		BA									PAER	2 4 4 1					7.05		F	SER	ď

done by Ball Lab 2-3381 2598,50 +-8.34

OFFIGIAL DOCKET GOBY 20828 4.02.81

051279 IIA

0£0179 NA

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0.4	INF		21	-	40														c	**				. 1	200		1	4	-	17									19			
	1.1		1	-1		- 1	- 1	1	7-	1	7-	7	7-	7-	7-	7-	7-	7-	7-	7-	1	7-	77-	7	7-	7-	7-1	7-	7-1	7-		7-	7-	7-	17-	7-	7-	1	1-	1-	1-	
N. V. S. S.	V 1017	O	0.	0100	000	1.65	1.40	107	CAT	188	01	0.25	0.55		12,50	6.6	347	09.00	0.01	0.40	0.05	0.10	0.10	1.20	0.43	0.21	.000000	0.50	0.10	11.90		0.05	2.68	01.0	05.0	0.19	766	811	11.89	11.33	7.22	
212		7 40			A C3 A	10.00	70.	17.0	21	0.3	-	0.01	*		0-	18	294	0.01	0.00	0.03	00.00	0.01	0.03	0.03	0.02	0.04	05000	60.02	6.02	3,84		0.61					146	4	9.85		120	and the same of
NSMP		7	10	7		7			1		- 1		- 1	7	7	7	7	7	7	7	7	7	7	7	7	7	1	7	1 - 1	9		,	זכ	1	çı	1	7	7 7		1	,	
STDV		6.27		99,86	0,35	0.51	20.00	4 54	74 40	0000	0.00	20.00	00.00	76.67	1.28	15, 18	17,69	0.22	00.00	0.14	0.02	0.03	0.02	6.42	6.13	0.09	.00193	60.16	0.02	5.89									0.73			
MEAN						0.34					01.13	CA 67	00.00	10 03	10.87	37,85	329.43	6.15	00.00	0.13	0.02	0.03	0.02	0.32	0.16	60.00	.00164	10.14	20.00	0.01	0.01	1 67	000	0 18	0.13	10.00	770 70	10 00	10.00	5 20	7	
7	1	8.01	9.50	7.6	0.100-	0,15	242	0000	133	8	0.250-	07.40	00 00	11 70	14:	1000	222	to conse	- 000 - 0	5	0.010-	- BCG - G	6.636-	-0000-0	0.000	07070	000000	O 1000	-050 ·0	100	0.005-	NA	- WO 1 10	6 100-	0001 00	307	734 00		10.05	* 742		7
7	9	7.90	12	835	0.23	0, 10	31.03	0.000	63	5	0.250-	8.44	7.6	9.80	01	27.7	CA CARCA	CA CADA	1007	CA CASCA	00000	BCD O	. 0000 · 00	W. 18	0.000	W. W. W.	-00100	C C C C C C C C C C C C C C C C C C C	11 500	2.10	0.046	2,20	0.100-					18 43		2.159-		-
7	0	7,75	MA			0,23	. 4	0000.0	130		0.250-	3.5	4	10.10		128	0000 0	D. 005-	67 69 70	0 010	0 0000	0.00	1000.00	W 0450	0.020	DOMESTIC	0 100-	0 050-	2 4 2	1.04	-500	2.60	-100-				300.10	11.72	11.02	3.69		*
1	4	7.63	NA	740	0.00	0.26	0500	0000.0	133	cı	0.070	0.55	(C)	12.50	57	34.0	0.650	0.005-	0 0150-	- W WIGH-	0 650-	D DSD	0000	D 04.00	0.650-	50100-	0.050-	0.050-	5.26	0.82	0.005-	0.20	0.100-	0.050-	0.050-	766	908,50	9.65	11.38	7.222-		
K-1	7	7.40	B const	-	1 100 1	D + 1		0.000	180	-7	0.050-	0,38	3,20	11	34	338	0.30	0.005-	0.050-	0.0%	0.050-	0.090-	01.50	D. 4.7	0.21	-00100	6.100-	0.050-	3.84	411	0,005-	NA	0.100-	0.50	0.19	724	7	11.01	0.33	3.17		
7.0	ř.	6.04	11000	0.00	2000	0.8	202		132	4	0.010+	0.32	29	12.	6.0	330	0.60	0.004	0.40	0.020-	0.100-	0.10	1.20	0.030	0.12	-00100-	0.50	0.100-	5.50	14.5	0.005		6:0:0		0.000	758	and .	1	11.19	3,05	100.00	
	0 404	0	D74	2001 0	D. 1861.18	977	8-5	0000	1.50	-	0.010	1	95	0-	30	294	0.010	6,005-	0.030	0.002-	0.010-	0.000	0.10	0.000	0.040	-02000.	0.050-	0.020-	Œ	0.70			8,8,2	0.080-	0.010	658	691	10.46	10.40	87.08	CODE	+
SPR	Piri	10	200	11111	2.014	1000	2000	500	33	100	L t		510	7	FIA	*05	AL.	AS	BA	00	CH	2	LU L	CG.	1114	5)+	40	11	Part .	AER	E :	I.			7.	50	TDS	747	111	100	USER	

20628

OFFICIAL DOCKET COPY .

1008728110E 73.0 0.03 1.60 0.10 0.11 0.11 2.065 3322.20 43.22 38.67 17.63 7.50 111 0.15 0.05 142 4 0.01 0.07 0.03 0.03 197 544 7.68 7.68 LEVELS THEN NSHIP 14.34 82.24 6.12 6.13 18.32 18.32 6.75 6.01 6.01 6.01 6.02 6.03 6.03 6.03 6.03 6.03 6.03 0.01 0.83 0.03 0.03 867.73 1264.23 1764.23 STDV do .00. DETECTABLE LI STATISTICAL 7.88 11.33 10.56 750.75 11.33 11.33 72.50 0.15 0.15 0.15 0.15 0.19 0.01 'n MEAN 0.01 0.88 0.08 0.06 1127 684.60 25.31 21.05 2500.20 41.32 28.93 17.63 352 0.050-0.016 0.010-0.050-2585 BELOW Dr. THE 0.005-1.60 0.050-0.050-2025-3025-38-07 0.14 0.005 0.22 0.020 0.050 0.050 0.050 0.050 0.050 0.050 0.050 0.050 2389 0.26 0.050-0.11 616 659 3 8.70 9.40 3.864-0.15 LIMIT 0, 10 0, 12 20 12 12 30 30 260 1, 50 C61179 NA 0.0 PALS DETECTION PARAMETE 8.04. 111. 7.15. 0.100-0.000-0.010 0.010 0.010 0.010 246 0.010 0.020 0.020 0.010 0.110 0.110 0.020 0.00 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.0 053179 NA 2.46 0.030 0.030 197 544 7.68 7.67 0.039 MAMICO USER

Dowe By Rell -23.81 N

AMALYSES FOR WELL IND TUBER PNS-575

1755 2341 4.06.001 1000000 0.250 7 7 7 1000000 0.250 7 7 100000 0.250 0.350 0.450 0.250 0.
10 10 NEAN STD 12 7.50 7.48 7.75 0.12 12 11 11.25 0.10 0.100 0.100 0.11 0.03 0.50 0.100 0.35 0.11 0.03 0.50 0.100 0.35 0.15 0.000 0.000 0.50 0.35 0.000 0.000 0.25 0.000 0.000 0.25 0.000 0.250 0.25 0.250 0.250 0.14 0.
0.256- 0.250- 0.14
7.50 7.48 7. 12 11 11. 505 485 502. 0.100- 0.100- 0. 1.50 0.100- 0. 1.93 220 213. 0.000 0.000 0. 57 60 67. 6 8.
505 0.100 0.50 193 0.600 0.250 0.250
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220 215 220 215 200 0,000 62 67 7 7 .050- 6.250-
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20624

FROM BOCKET CSP's > >

O40087281/0E WELL NAME 575 (Chemical units in mg/l except as noted)

ate Sampled	4-06-81	6-19-81	7-15-81	7-15-81	10-5-81		
Olinity ppm as CaCo3			200		171		
(Units)	7,5		7.26	7.6	7.77		
onductivity (umhos/cm)	488		025°C	496	552		
mumonia (NH3 as N)	1.1		-14	<-1			
otal N02/N03 (as N)	1 4.1		<.01	<.1			
icarbonate (HCO3) 3 72	227		244	216	209		
arbonate (CO3)	0		-0-	-0-	0		
cium (Ca) 3.75	63		64	67	67.1		
.loride (Cl)	10	W-TE	5	5	5.2		
oron (B)	1.25		<.01	<.25			
'luoride (F)	.51		.92	.44			
tagnesium (Mg) 1.35	16.2		12	16	16		
otassium (K)	8.4		8	8	8.1		
odium (Na)	26	162 % 17	26	25	26		
ulfate (SO ₄) / 20	9/		68	10%	102		
.luminum (Al)	1.05		.18	01	×.10		
rsenic (As)	1.005		1.001	4.005	<.01		
Mium (Ba)	1.5		1.1	< 1	<.10		
dmium (Cd)	1.01		1.002	5.01	2.01		
Chromium (Cr)	1.05		1.01	<.05	4.05		
Copper (Cu)	1.05		.01	<-05	<.05		
iron (Fe)	.18		1.26	.39	0.13	+ 41-5	
Lead (Pb)	1.05		<.05	4.05	×.05		
Manganese (Mn)	.08		.06	<.05			
Mercury (Hg)	K.001		1.0002	4.001			
40lybdenum (Mo)	1.1		€.1.	<.1	<,/0		
Nickel (Ni)	1.05	EHIT	<.2	<.05	4.05		
Radium 226 (Ra) pCi/1		6.8+1.8	7.321.4	*3.8 = 2.9			
Selenium (Se)	14.005		10001	4.005	<,01		
Phorium 230 (Th) bCi/1			><				
Jranium (U) ppm	<.1		.011	< -1			
Janadium (V)	1.1		(.1	< .1	<.5		
Zinc (Zn)	1.05	17- 1, 1	.016	< .05	<.01		
~	362	Lat.	370	358	354		
210 pCi/L	1		5 15 1				
vitrate (NO3) as N							
itrite (NO2) as N	Pris 11						

OFFICIAL DOCKET COPY

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2 3
THE DETECTION LIMIT IS USED IN THE STATISTICAL CALCULATIONS LAB WANCO TETCH TE
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RESENT AT BELOW DETECTABLE LEVEL IS USED IN THE STATISTICAL CALCY TETON TO DS1350 071680 100580 011540 051360 071680 100580 011540
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NEAN	7.53	13,13	495	0.25	6,36	212			7.07	0.14	0.48	12.57	8.32	28.67	76.67	60.03	0.01	60.03	0.02	0.04	0.04	13, 18	0.04	0.00	24000	D. DC	50 07					0.15	0		34.			
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LEVELS THEM CALCULATIONS

18.00.4

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ELS THEU	18-70-4
DETECTABLE LEV STATISTICAL CA	7-16-80
IF A PARAMETER IS PRESENT AT BELOW DETECTABLE LEVELS THEN THE DETECTION LINIT IS USED IN THE STATISTICAL CALCULATIONS TO THE PROPERTY OF THE STATISTICAL CALCULATIONS TO THE S	1758 7 2334 188888 811281 108788 011381
IF A PARAMETER IS PER THE DETECTION LINIT LAB TETON LETON	051380 100580 051380 100780
A FARANGE DETECT	011760

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STDV	0.45		79.06	6.44	6.66	33.26	5.86	17,94	2,30	6.12	0.00	9.83	2.30	9.57	25.49	0.03	0.02	0.03	0.02	0	8	0,10	0	000000	0 00 m	7 5		Z. D3	6	1 6.4		30 0	-				6.93	3.95
MEAN	7.80		460	27.00	00.00	178.75	2,50	60.50	5.40	0.15	0.43	12,90	9.38	27.75	74.50	0.09	6.03	00.00	0.03	0.05.	0.02	0.17	0.60	00100	00.00	0.05	4 50	0.4	0.01	2.10	0.10	0.19	0.0%	325		. *	5.03	4.12
רע אי	7.46	01	DB4	10.00	2000	0.00	0.000	n n	9	0.258-	0.37	22.60	9,30	19	96	0.050-	6.023	6.100-	0.010-	6.650-	0.030-	0000	G 040	-00100-	0.100-	0.050-	AIA	NA	0.005-	MA		0.100-		341	24.90 3	400	5.77	2.263-
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i ci	8,43	24.5	00.10	0.100-	150	1.01	7.7	10		d. 050-	0.43		12.50	41	- 9				. II.		- 4		X.				χ		0.005-		1	0.050-	0.050-	579	26.50	4.35	3,94	D. E.
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WATER QUALITY

(Chemical units in mg/l except as noted)

Data Sampled	7-17-80	4-06-81	6-19-81	7-14-81	7-14-81	10-5-81
inity ppm as CaCo3				200		170
oh (Units)	7.9	7.5		7.27	7.7	7.99
Conductivity (umhos/cm)	385	508		0 25°C 469	1	535
Ammonia (NH3 as N)	<.1	1.1		.21	14.1	
Cotal NO2/NO3 (as N)	<.28	.15			(./	
Bicarbonate (NCO3)	3"190	234		244	216	208
Carbonate (CO3)		-0-		-0-	-0-	
Calcium (Ca)	57	3.63		63		64.9
Chloride (C1)	28	228		5	5	4.1
Boron (B)	1 <.25	1.25		1.01	1.25	
'luoride (F)	.48	.48		.60	.46	
tagnesium (Mg)	7.3	177.4		17	15	15.2
otassium (K)	39.1	28.3		8	8	8.2
odium (Na)	3531	1328		26	25	25
ulfate (SO ₁)	1291	20498		88	118	99
luminum (Al)	(.05	1.05		<.1	5.1	2.1.
rsaic (As)	.1068			1.001		
arium (Ba)	1.1	5.		<.1	4.1	2.10
acunium (Cd)	5.01	4.01				
hromium (Cr)	<.05	1.05		<.002	- 01	<.01
opper (Cu)	1.05	1.05		<.01	- <.05.	
ron (Fe)	-57	16		4.01	1.05	2.05
ead (Pb)	1.05	r.05		•27	.32_	
anganese (Mn)	.06	1.05		(.05		
ercury (Hg)	1.00/				_ < .05	~.05
olybdenum (Mo)	1.05	(.001		<.0002		
ickel (Ni)	1.05				_ <-1 _	
adium 226 (Ra) pCi/1	3.08 ± 0.59		, F+, ×	4.2-1.1	X -05	×.05
elenium (Se)		1.005	1-5-1.21			1
horium 230 (Th) pCi/1		1.005		1.001	1.005	<.01
ranium (U)	53.8 7.8	11				
anadium (V)	<./	(.1		.025		
inc (Zn)	1.05	7./		<-1	<.1	4.5
256	7.01	1.05		.013	1.05	
10 pci/L	335	368		410	340	344
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 IF A PABANETER IS PRESENT AT BELOW DETECTABLE LEVELS THEN

 THE DETECTION LIMIT IS USED IN THE STATISTICAL CALCULATIONS

 LAB TETON
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 JOB 1347
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 DS D71180
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7.30 7.41 0.18 3 7.30 7.62 13 14.33 2.31 3 13 17 479 513.67 41.74 3 479 560	3 0.10 0.15 16-3 3 0.11 0.29 16-3 3 0.11 0.29 16-1			27.36	ខ្≕លស្ខ	0.05 0.05 16-3 0.05 0.06 16-3 0.05 0.05 16-3 0.05 0.05 16-3	1 6.01 16- 3 1.83 16- 0.10 16-	0.05 0.05 16-3 0.01 0.02 16-1 390 401 16-1 11.40 511.90 16-1 6.54 6.66 16-2 6.24 6.87 16-1
16 NEAN STDV NSMP MIN 7.30 7.41 0.18 3 7.30 13 14.33 2.31 3 13 479 513.67 41.74 3 479 0.100- 0.12 0.01			4 8	0.485=4	3=សហគ	nnann.	0.01 1.83 1.83	6.05 6.05 511.76 6.65
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1116	THE PERCIT	M TIMIL I	SENT AT BELOW DETECTABLE LEVELS THEM S USED IN THE STATISTICAL CALCULATIONS
LAM	1ETON	TETON	TE TOM
JOB	1312	1522 -	
DS	070760	000180 0	082280
DA	070380	092280 1	882560

	*** 6/1/2/21	002200	697368		De tour and the						-
1464	17	17		MEAN	STDV	2 100000					
SPN	1	***	3	LICHIA	SIDV	NSMP	MIN	M-M	MINL	MAXL	100,000
PH	7.60		7.15			A 100 TO					
TC	13	14.50	16				7.15	7.00	17- 3	17- 1	-
CD	530			420		3		16	17- 1	17- 3	
11113	0.100	- 0.100	- 0.100				300	530	17- 2	17- 1	-
N03	0.29			70.00			0.10	0.10	17- 3	17- 3	
HC03	219.60	268		0.20	200 00 000 000		0.11	0.29	17- 3	17- 1	
C03	0.000		0.000			3	219.60	268	17- 1	17- 2	
CA		Ø . 1000	0.000	0	.0	5.7	Ø	(0)	17- 3	17- 3	NAME OF TAXABLE PARTY.
CL	- 70	5.3	53	65.33	4.04	3	63	70	17- 3	17- 1	
B	0.250	0.000	4	4.33	0.58	3	4	15	17- 3	17-1-	-
F	0.52	0.230	0.250		13	3	0.25	0.25	17- 3	17- 3	
MG		0.45		0.47		. 3	24 2 700			17- 1	
K	15.20	16	14	15.07	1.01	3	14	1.6	17- 3	17- 2	
NA	7.70	11	10	9.57	1.69	3	7.70	11	17- 1	17- 2	-
504	24.30	29	29	27.43	2.71	3	24.30	29	17- 1	17- 3	
AL.	99	94	96	95.33	2.52	3	94	0.52 16 11 29 99	17- 2	17- 1	-
	0.20	1.13		0.B4	0.56	3	0.20	1.20	17- 1	17- 3	
AS)	0.005-			Ber 8 - Ber 36	0.00	3	0.01	0.01	17- 2	17- 3	
BA	0.100-			0.10	0.00	3	0.10		17- 3	17- 3	
CD	0.010-			0.01	0	3	0.01	0.01	17- 3		
CR	0.050-				0.02	3	0.01	0.05	17- 3	17- 3	
CU	0.050-			0.05	0.00		0.05	0.05	17- 3	17- 1	-
FE	1.72	2.45		2.26	0.47	3	1 70	2.60		17- 3	
P.B.	0.050-	70. 2. 30. 30. 30.	0.050-	0.05	0.00	3				17- 3	
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	0.050-		0.050-	0.05	0.03 0.00 6.86	7	0.03	0.10	17- 1	17- 3	
PA	187	191.50	178.10	185.57	6.86		170 10	0.05	17- 3	* 1	
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TH	0.35		NA	0.35	(A		0.01	0.01	17- 3	17- 3	
U	0.100-			0.10	0.00	1 7	0.35	0.35	17- 1	17- 1	
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CTDS	440.80	495	1.1.1	1.67 0.7		4.0	341	402	17- 3	17- 1	
CAT	6.00	6.00	5.81	5 94	24.16		440.60	485	17- 1	17- 2	
411	5.80	6.45	5 88	4 04	0.11	3	5.81	6.00	17- 3	17- 2	Mental of April 16
CB	1.66	3.688-	0 507	6.05	1.57	3	5.80	6.46	17- 1	17- 2	
		100.00	0.20/-	1.78	1.57	3	0.59	3.69	17- 3	17- 2	****

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The principal If NS PRESENT AT BELOW DETECTABLE LEVELS THEN JUNE 19 19 19 19 19 19 19 19				XX							-			_	-							-	-	***	51.	65	77.1	10	19	19									-	-	
THE ACTION OF THE PRESENT AT BELOW DETECTABLE LEVELS THEN JONE 154 (1990) DA 071180 082580 082780 FETON THE STATISTICAL CALCULATIONS DS 07180 082580 082780 FETON THE STATISTICAL CALCULATIONS DS 07180 082580 082780 FETON THE STATISTICAL CALCULATIONS DS 07180 082780 FETON				117	3		u*	0	0	14		į		0.00		10.	- 0	101	0.1	0.0	0.1	0.0	0.0	0.0	0.00	0.00	80130	0.10	0.05	920	-	0.01	10.92	0.10	0 000	707	SOM	6.39	6.81	9.32	
THE PURIOD IN PERENT AT BELON DETECTABLE LASS TELEM TETON TETON THE STATISTICAL JOSE 1344 1531 1600 1 1510	THEN			Z	7.50	13.50	295	0.10	0.11	162	0	49	CA 554	200	2000	B. 704	25	116	0.05	0.01	6.10	0.01	0.01	50.00	25.05	0.05	00100	0.05	6.65	27.56	(3 (3)	0.00	27.00	0.65	0.01			1			
THE PETRICAL HILLY IS PRESENT AT BELOW DETECTABLE JOB 1714-10 1531 16.00 DA 071160 032500 082760 DA 071160 032500 082760 SFH 7.55 8.60 7.50 7.95 8.74 TC 15 16.50 7.50 8.00 TC 15 10.00 TC 15 10.	CALCU		ALC: UNIVERSITY	MODIA	3	177	2	m	ro :	7 (*	7 7	7 6	M	m	m	m	2	m	M	m	n	m r	2 1	2 17	o m	3	5	n	9	3 4	1	i									
THE DETECTION LINE IS PRESENT AT BELOW LAB 1344 1531 1600 DS 071050 055350 082780 1 1500 WM 19 19 19 19 19 19 19 19 19 19 1510 TC 556 5250 082780 1 1510 TC 556 5250 082780 1 1500 TC 566 5250 082780 1 1500 TC 18 16.50 13.50 7.95 TC 56 56 57 50 7.95 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC	I CAL.				47	0-	¥1. f	9 .	75												1							7 900 4													Name of the last
THE DETECTION LINE IS PRESENT AT BELOW LAB 1344 1531 1600 DS 071050 055350 082780 1 1500 WM 19 19 19 19 19 19 19 19 19 19 1510 TC 556 5250 082780 1 1510 TC 556 5250 082780 1 1500 TC 566 5250 082780 1 1500 TC 18 16.50 13.50 7.95 TC 56 56 57 50 7.95 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC 18 16.50 13.50 7.95 TC 7.55 8.60 7.75 TC	STATIST STATIST		STDA		0.7	61	134.7	0.0	31.0	13.6	5.2	1.07	2	0.02	4.80	4.05	2.10	6.43	0.03	00.00	0.05	0.00	0.00	0.13	00.00	0.03	. 000000	0.03	067.00		0	0	00.00	0.03	0.02	77.00	22.14	6.45	6.18	+0	transmitted transmit
THE DETECTION LIMIT IS PRESENT AT 198 198 158 1600 1500 1500 1500 1500 1500 1500 1500			MEAN		7.95	417 77	413.33	0.10	228.67	8	7.00	5.20	0,25	0,40	12.17	11.43	26.63	000.00	0.07		0.01	0.02	0.05	0.41	0.02	0.07	00100	0 05	57.35		0.01						1		- 1		-
THE DETECTION LIMIT 1, 18 PBB 15 PB 15 PBB 1	SENT AT 3 USED FETON	62560 62560 182780	0.1	7 603	13.50	385	0.100-	0.12	250	0.000	74	9	-057.0		27		-										*		40		, 1		-001	-001	1000		1		1		
THE DESCRIPTION LAB TE FOR 17 19 STR 13-4 TC 18 CD 52-6 TH 7.55 TC 18 CD 52-6 TH 7.55 TC 18 CD 52-6 TH 8.56 TH 8.66	FPE I I I		19	2 50 50	16.50	295	0.100-	0.11	192	5.	59	4 200	0.41	7	1.6	0.00	ĵ.				Ų	.3				1.7			-76		Ŧ		9 5	3 5	2		1		1		
THE DAY OF			6.	- 17													-		2										-	*	.0	13	2	3			37	6.	9.3	1001	
LABBUNAS PARER SERVINE NAS PAR	PETEC TE FOR	07100		7.		in .	0.10	0	5.4	70.00	2	0.35	0.4	15.5	8	25.57	110	0.070	0.00	0, 100	0.010	00000	0.55	0.020	0.030	00100	0.050	0.050	0.7	CI O	0.92	0.100-	0.050-	0.010-	482	32,30	69	6.45	.243-	ODE	7
	THE LAB	DS	NIV	FH	10	g .	78H.3	H03	003	240	CL	ai ai	L	NG	×	FIA	504	AL.	0 40		0.0	123	ш	6	121		0.		200	T I			ì			4			10.6.00		
1 11 1 11 11 1ha W -											1	T	F	1		1												P	Y	e un	1.	0	>	12	T	5	3	AL.	3		

1970 1670 1670 1670 17 17 17 17 17 17 17 17 17 17 17 17 17							
07.3160 080280	90	Calculation and the control of the c					
Z 3 BEAN STE	D NEAN STE	EAN STE	and his		NSMP	MIM	NVX
17 NA 19 50	NA 19 ER D	7,37 8.	e c	CI C	m	7.30	7.50
445 530 485 42.	530 485 42.	465 42.	ici	727	v m	44.5	000
0.100- 0.100- 0.10	0.100- 0.10	. 10	.03	600	m	0.10	6, 16
0.13 0.15 0.21 0.	0.15 0.21 0.	0.21 0.	0.	80	23	0, 15	0.30
0.003 0 000 0.00	0 000 210.67 9.	10.67	6	37	10	204	221
58 54 55.67 2.	54 55.67 2	5.67 2.		88	7 1	S 7 2	5 0
2 1.93 0.	2 1.93 0.	1.93 0.		12	2 10	1.80	9 (1)
0.256- 0.250- 0.25	0.250- 0.25	.25		0	n	0.25	0.25
0.49 0.49 0.49	0.49 B.49 B.	0.49 0.	0.	0.1	3	84.0	0.49
10.50	16 15.53	5.53	5	2	2	-	20.40
27 08 07 123	67.70	7 27	2 5	n c	י מי	7	7.50
101 100 98	98	000	9 4	36.	3	27	29
0.056- 0.050- p.ps	.050- M.05	1 5	0	000	2 1	5.7	101
0.005-0.005-0.01	.005- 0.01	01		0	2 1	0.00	0.03
0.105- 0.056- 0.	.050-0.09	60	8	0	M	0.05	0.11
0.010- 0.010- 0.0	0.0 -010-	9		.0	2	0.01	0.01
0.000 0.010- 0.04	0.04	274	0	.02	m	0.01	0.03
0.050- 0.12 0.39	0.00	200	3 0	20.00	יז ניז	0.03	60.02
0.050- 0.050-	0.05	35	3	A. M.	2 1	00.00	I W
0.050- 0.18 0.10	0.10	103	-	7.07) M	0 05	0.00
	0. 00100.	0. 00	.00	000	m	. 00100	.00100
0.050 0.050 0.050	80.02	15	2	.00	m	0.05	0.02
4. 6.4 0.00 - 0.00	6.05	02.03	31	00.	m	0.03	0.03
NA. 141. 28. 22	28.22	B. 22	3	99	n	24,23	
0.005- 0.01	.005- 0.01	.01		0	1	0 00	
1th 1th 0.67	TIN 0.67	67		1 2 2	1	0.01	0.01
- 0.100- 0.100- 0.10 -	100- 610 0	10		2 5	- 1	10.07	19.67
0.050- 0.100- 0.02	100- 0 07	0.7				0.10	0.10
0.019- 0.050- 0.07	040- 0.07	00 00	- 10	m i	n	0.05	6.16
7.10 7.0 7.0 7.1	7.00 7.00 1.7	0.00		70	2	0.01	60.02
412 30 411 60 411 77 -	1 50 228.67 1.	79.67		n	n	328	17.1
4,00	410.37	10.37	- 100	29	3		
5.55 5 48 6 5 5	46 5.43 Ø.	5 5 5 6 6 6 6 5 6 5 6 5 6 5 6 5 6 5 6		22	2	5.09	5.78
371- 0 643- 5 .e.	543- 5.53 B.			90	5	5,48	
2,13 1,	2,13 1,	-	-	9/6	3	-	*

APPENDIX "E"

M-ZONE RESTORATION STABILITY
ANALYTICAL DATA

ANALYTICAL WELL HISTORY

Lmm	INITIAL	1	1	MONTH 3			
ATE SMPLD	1	2.1.82		3-29-82			
ANALYSIS	1.12.82	2-3-83	3.3.82	3-30-82			-
DATES	2-16-82	3-15-82	4-16-82	1	1 +	1 1	
Av				5-28-83	2 5.28.82		
HC03 mg/1	93	1/2.2	7 7 7 7 7			7 1 1 2 7 7 7	
CO3 mg/1	.0.	1 .0.	/31.3	/34.9	143.5	157.4	
C1 mg/1	NO		-0-	.0.	-0-	-0-	
SO4 mg/1	28	40.0	3.4	3.8	3.4	4.3	
Anion eq.	2.11		49.0	56.0	50.2	59.0	
Ca ⁺⁺ mg/1	15	2-72	3.27	3.49	3.49	3.93	
Mg ⁺⁺ mg/1	3	19.8	22.0	24.2	24.6	27.5	
Na+ mg/1	25.0	4.73	5.4	5.9	6.1	6.8	1
K+ mg/1		30.0	34.1	36.3	36.8	41.60	
Cation eq.	2.14	3.1	3.9	4.4	3.9	5.2	
-/+balance		2.77	3.13	3.39	3.44	3.88	
Sum TDS	98.60	98.19	104.36	102.73	101.62	101.21	
Cond um/cm	166	211	249	366	269	302	
TDS mg/1	240	275	314	338	349	395	
pH unit	119	150	424	110	220	148	
U mg/1	7.44	7.1	6.92	6.93	7.22	7.33	
mg/1	0.007	0.25	0.32	0.35	0.28	0.34	
mg/1	77	92	107.6	110.6	117.6	129.0	
NHT mg/1	₹ 0.05	1 40.10	0.13	10.10	10.10	10.05	
4 0	*0.05	× <0.05	¥ <0.05	* 40.05	1 .0.05	1 0.22	
	₹0.005	7 0.030	* 0.044	4 0.056	+ 0.021	+ 0.020	
-	₹0.03	<0.10	<0.10	<0.10	<0.10	10.10	
	40.01	* < 0.01	* 0.50	+ 0.10	1 0.23	* 0.13	
	<0.002	40.01	<0.01	10.01	₹0.0/	10.01	
Cr mg/1	*0.01	<0.05	< 0.05	< 0.05	10.05	10.05	
Cu mg/1	<0.01	<0.05	<0.05	10.05	10.05	10.05	
F mg/1	0.27	* 0.36	* 0.45	w 0.30	+ 0.24		
re mg/1	<0.01	0.22	0.29	0.20	0.17	0.22	
Pb mg/1	10.01	₹0.05	₹0.05	10.05	40.05	10.05	
Mn mg/1	0.01	< 0.05	<0.05	₹0.05	₹0.05	0.05	
Hg mg/1	< 0.0005	4 < 0.0005	× <0.0005	+ 40.0002	* < 0.0002		
Mo mg/1	₹0.05	<0.10	< 0.10	<0.10	<0.10	* 40.0002	
Ni - mg/1	<0.02	<0.05	₹0.05	₹0.05	10.05	10.10	
102/NO3 "	< 0.05	* < 0.05	. 0.33	. 40.05	* 40.05	<0.05	
Se mg/1	₹0.005	< 0.001	. 0.018	* 0.006	+ 10.001	* 40.05	
mg/1	<0.05	<0.10	< 0.10	< 0.10	<0.10	* 10.001	
n mg/1	< 0.005	< 0.10	<0.01	<0.01	<0.01	20.10	
226 pci/1	75+-				0.01	0.01	
Po pci/1	75:5	72 15	1124 16	*117 + 6	+112 = 6	+117 ± 5.3	
ross A "	2.5 -0.8	+ 2.7 ± 1.0	* 2.7±1.2	+ 20.7 = 2.8	4 13.3 2.3	4	
ross B "	NA	NA .	NA	NA	NA	NA -	
71.055 B	NA	NA	NA	NA	NA	NA	

ANALYTICAL WELL HISTORY

	INITIAL	MONTH 1	7 [200 200 0		_	2 5 1	
ATE SMPLE		2-1-82	3.2.82		1.12.11		
ANALYSIS	1-12-82	2.2.82	3.3.82	3-29-82	the same of the sa	Control of the latest	
DATES	4	1	1	1	4-27-82	5.25.82	
	2-16-82 *	3-30-82	4-16-82	5.28.82	5-28-82	1 +	
100= /-1			-				
103 mg/1	240	244.0	241.8	244.5	253.8	250.3	
03 mg/1	-0.	.0.	-0-	.0.	.0.		
21 mg/1	8	8.5	8.0	9.2	8.3	-0.	
04 mg/1	77	76.1	77	80	84.1	8.8	
nion eq.	5.76	5.83	5.79	5.93	6.16	82	
a ⁺⁺ mg/1	54	44.0	46.2	46.2	49.5	6.06	
g++ mg/1	4	11.2	11.1	11.2	11.7	44.0	
a ⁺ mg/1	59	61.0	59.3	58.0	59.2	10.9	
+ mg/1	5	5.8	4.3	6.4		60.9	
ation eq.	5.72	5.93	5.97	5.93	6.0	7.4	
/+balance	100.70	98.16	94.97	100.09	6.18	5.95	
um TDS	447	451	450	457	99.73	101.92	
ond um/cm	500	565	573	574	473	464	
DS mg/1	328	330	552	290	588	583	
H unit	7.17	7.0	6.93		370	306	
mg/1	0.036	0.62	0.59	0.54	7.15	7.51	
mg/;	197	200.0	198.2		0.50	0.37	
mg/1	40.05	<0.10	<0.10	200.4	208.0	205.2	
4 mg/1	<0.05	* <0.05	* <0.05	+ <0.05	0.44	40.05	
mg/1	< 0.005	+ 0.014	+ 0.050		\$ 40.05	* 0.22	
mg/1	₹0.03	< 0.10	<0.10	4 0.046	* 0.063	* 0.174	
- mg/1	< 0.01	* < 0.01	+ 0.26	<0.10	₹0.10	10.10	
mg/1	40.002	<0.01	<0.01	× 0.18	* 0.28	* 0.11	
mg/1	<0.01	<0.05	<0.05	<0.01	40.01	<0.01	
mg/1	<0.01	<0.05		₹0.05	< 0.05	<0.05	
mg/1	0.30	* 0.36	* 0.40	<0.05	10.05	<0.05	90
mg/1	<0.01	0.10		+ 0.36	+ 0.24	4 0.27	
mg/1	<0.01	<0.05	<0.05	0.08	0.32	0.21	
mg/1	0.01	<0.05	<0.05	< 0.05	40.05	<0.05	_ N NAME
mg/1	10.0005	*<0.0005	*0.05	₹0.05	0.07	0.08	
mg/1	<0.05	<0.10	× <0.0005	* 10.0002	¥ < 0.0002	* < 0.0002	
- mg/1	< 0.02	<0.05	₹0.10	₹0.10	<0.10	40.10	
2/NO3 "	0.30	* 0.34	<0.05 ★ 0.09	*0.05	₹0.05	10.05	
mg/l		* 0.009	+ 0.29	* 0.14	* <0.05	* 40.05	
mg/1	*0.05	<0.10	* 0.026	+ 0.014	4 40.001	+ 0.002	
mg/1	<0.005	0.02	20.10	< 0.10	<0.10	<0.10	
		0.02	40.01	<0.01	₹0.01	₹0.01	
226 pci/1	326 - 10	275 + 0					
1		275 ± 9	* 338 10	* 238 ! 8	* 278 ± 9	* 362 = 9.4	L ,
oss A "	NA I	10.8 1.9	3 0.9 21	+21.8:2.8	*24.1 +2.9	+	
oss B "		NA	NA	NA	NA	NA -	
	NA	NA	NA	NA	NA	NA	

WELL & MI-10 ANALYTICAL WELL HISTORY

TATE SMPLE	1.8.82	MONTH 1	MONTH 2		The state of the s	MONTH 5	
	1-12-82	2-1-82	3-2-82	The contract of the contract o		5.24.82	
ANALYSIS DATES	4.	1	3-3-82	3.30.82	4.27.82	5-25-82	
PALES	2-14-82 *	3-30-82	4-16-82	5-28-82	5.00.00	1	
	1641	N. 4		1 13 10.02	5-28-82		
HCO3 mg/1	236	238.9	239.9	244.2	7 7 7 7 7		
CO3 mg/1	-0-	-0.	-0.	.0-	246.9	247.4	
C1 mg/1	6	7.9	7. 2	8.5	-0.	-0.	
SO_4^- mg/1	82	76.1	79	85	8.3	8.4	
Anion eq.	5.74	5.72	5.78	4.01	85.1	86	
Catt mg/1	44	46.2	46.2	46.2	6.05	4.08	
1g++ mg/1	10	11.0	11.0	10.9	47.3	44.0	
la ⁺ mg/l	61	40	59.3	57.3	11.2	10.6	
(* mg/1	5	6.0	6.7	6.6	58.4	60.1	
ation eq.	5.80	5.99	5.98	5.88	6.0	7.6	
/+balance	98.97	95.58	96.74	102.30	5.99	5.89	
Sum TDS	444	446	449	459	101.06	103.28	
ond _m/cm	490	555	566	572	463	464	
DS mg/1	324	330	570	282	579	576	
H unit	7.32	6.9	6.94	7.14	372	296	
mg/1	0.015	0.51	0.48	0.41	7.07	7.99	
m9/1	193	195.8	196.6		0.35	0.28	
mg/1	<0.05	<0.10	0.25	200.2	202.4	202.8	
.7 mg/1	< 0.05	4 = 0.05	* < 0.05	10.10	₹0.10	< 0.05	
s mg/l	<0.005	* 0.014	w 0.045	* <0.05	× 40.05	* 0.33	
a mg/1	<0.03	< 0.10	10.10	* 0.054	* 0.034	* 0.108	
mg/1	40.01	+ <0.01	+0.21	<0.10	40.10	<0.10	
i mg/1	<0.002	<0.01		× 0.18	* 0.22	× 0.16	
mg/1	10.01	<0.05	<0.01	< 0.01	<0.01	<0.01	-
1- mg/1	<0.01	<0.05	<0.05 <0.05	₹0.05	<0.05	40.05	
mg/1	0.30	*0.36		< 0.05	<0.05	<0.05	
mg/1	<0.01	0.22	× 0.36	+ 0.33	* 0.93	¥ 0.27	AX U
mg/1	<0.01	<0.05	0.30	0.40	0.36	10.05	
mg/1	0.01	0.05	<0.05	< 0.05	40.05	<0.05	* 161
mg/1		<0.0005	× 40.0005	0.10	0.10	0-11	
mg/1	<0.05	<0.10		* <0.0002	* + 0.0002	+ < 0.0002	
mg/1	<0.02 ·	20.05	<0.10 <0.05	< 0.10	<0.10	×0.10	
2/NO3 "	-	+ 0.11		₹0.05	₹0.05	<0.05	
mg/l	< 0.005	*0.00%	4 0.21	* 40.05	* 40.05	4 40.05	
mg/1	<0.05	<0.10	4 0.014	* 0.006	* < 0.001	* <0.0001	
mg/l	< 0.005	₹0.01	<0.10	₹0.10	< 0.10	<0.10	
			<0.01	< 0.01	<0.01	40.01	
226 pci/1	199 ± 8	* 223 ± 8	* 2 * 4 * 10				
0 pci/1		* 1.8 ± 0.8	* 376 ± 10	¥ 419±11	* 394 111	¥ 321 ± 8.8	7
JSS A "	NA I		* 2.8 = 1.2	* 12.6 ± 2.2	¥10.8±1.9	4	- "
oss B "	NA	NA	NA	NA	NA	NA -	- 1 A 11
		NA	NA	NA	NA	NA.	

^{*} ANALYZED BY CUTSIDE LABORATORY DOCKET COPY

ANALYTICAL WELL HISTORY

OLL V	MR-I		The second				
ATE SMPL		2-1-82	MON7H 2	MONTH 3	The second second second	MONTH 5	
1	1-12-82	2.2.82	3-2-82	3-29-82			
ANALYSIS DATES	1	1	1	3-30-82	4-27-82	5-25-82	
DAILS	2-16-82	9 3 30 -87	4 -16-82	5-28-82	5-28-82	1 +	1 -
	1				11	J	
HCO3 mg/1	244	236.7	239.1	246.4	263.3		
CO3 mg/1	.0.	.0-	-0-	-0-	.0.	257.9	-
Cl mg/l	7	7.1	8.5	7.7	7.8	-0.	
SO ₄ mg/1	82	87.8	93	96	95.4	7.8	
Anion eq.	5.91	5.91	6.10	6.26	4.53	101	
Ca ⁺⁺ mg/1	40	44.0	47.3	46.2	49.5	6.55	
Mg++ mg/1	11	10.7	10.6	10.3		47.3	
Na ⁺ mg/1	64	61	64.9	62.4	11.4	11.2	
K ^T mg/1	5	6.1	6.7	4.8	63.8	45.1	
Cation eq.	5.81	5.90	6.24	6.06	6.7	6.8	
-/+balance	101.72	100.16	97.48	103.32	6.37	6.30	
Sum TDS	453	453	470		102.47	103.95	
Cond um/cm	500	577	589	476	498	497	
TDS mg/1	339	340	570	328	626	618	
pH unit	7.02	7.0	6.78	6.79	392	342	
U mg/1	0.007	0.15	0.15	0.18	7.09	7.39	
mg/,	200	194.0	196.0	202.0	0.20	0.15	
^1 mg/1	<0.05	1 <0.10	1 < 0.10	<0.10	2/5.8	211.4	
mg/1	<0.05	× <0.05	* 0.24	4 0.24	40.10	₹0.05	
As mg/1	10.005	¥ 0.020	* 0.025		¥ < 0.05	* 0.36	
Ba mg/1	₹0.03	0.10	10.10	* 0.034 <-0-10	40.008	+0.025	
B - mg/1	< 0.01	V 40.01	4 0.23	¥ 0.12	<0.10	₹0.10	
Cd mg/1	<0.002	<0.01	<0.01	×0.01	* 0.42	¥ 0.16	
Cr - mg/1	<0.01	<0.05	<0.05	<0.05	10.01	<0.01	
Cu mg/1	<0.01	₹0.05	10.05	<0.05	₹0.05	<0.05	
F mg/1	0.30	* 0.33	* 0.30	+ 0.40	<0.05	<0.05	
Fe mg/l	< 0.01	0.77	1.13		* 0.30	₩ 0.30	
Pb mg/1	<0.01	₹0.05	₹0.05	1.54	2.05	0.70	
Mn mg/l	0.02	0.06	0.10	<0.05	₹0.05	< 0.05	1
Hg mg/1	<0.0005	+<0.0005	×<0.0005	0.09 + 4 0.0002	0.70	0.11	
Mo mg/1	<0.05	₹0.10	40-10		# < 0.0002	*<0.0002	
Ni mg/1	<0.02	<0.05	<0.05	< 0.10 < 0.05	40.10	<0.10	
NO2/NO3 "	0.10	*<0.05	¥ < 0.05	* <0.05	< 0.05	<0.05	
Se mg/1	< 0,005	4 0.018	* < 0.001		* <0.05	* 10.05	
V mg/1	< 0.05	<0.10	<0.10	4 0.004	*0.006	* 0.003	Y 2.
Zn mg/l	< 0.005	₹0.01		10.10	₹0.10	10.10	
		R THE	10.01	(0.01	₹0.01	< 0.01	
Ra ²²⁶ pci/l	391 ± 11	*462 + 12	* 5(-A + 10	n 150 4			
TO pci/1	8.011.4	+ 7.4 + 1.6	* 564 - 12	4 453 11	4 491 12	¥641±12.5	
GLUSS A "	AU	NA	* 3.6 1.4	* 24.3:3.0	¥20.4 ± 2.8	*	17. 4
Gross B "	NA	NA	NA	NA	NA	NA ·	
			NA	NA	NA	NA .	

WITTUINE COUNTY COPY

	INITIAL	MONTH 1	MONTH 2	7 1	7	_	
ATE SMPL	0 1.8.82	2-1-82	3-2-82				
NALYSIS	1-12-82	2.2.82	3.3.82				
ATES	4.	1	11 4	1	1	5-25-82	
****	2-16.82*	3-30-82	4-16-82	5.28.82	5.28.82		
1CO3 mg/1	268	T 54 9 9	1	7	¬	1 30	
00 mg/1	.0.	260.8	254.2	263.5	269.6	260.6	
1 mg/1	8	.0.	.0.	.0.	-0.	-0.	
07 mg/l	82	8.1	8.2	8.6	9.6	9.1	1
nion eq.	6.34	84.9	88	87	85.1	86	
a ⁺⁺ mg/l		6.27	6.23	6.37	6.46	6.32	
g++ mg/1	42	44.0	44.0	44.0	46.2	42.9	
a^+ mg/1	10	10.1	9.9	9.6	10.1	9.8	
+ mg/1	74	70	71.8	68.5	69.7	69.3	
ation eq.	6	7.3	8.0	8.1	7.7	8.0	
/+balance	6.29	4.27	4.35	6.19	6.38	6.18	
um TDS	100.95	100.00	98.11	103.05	101.31	102.28	
ond um/cm	490	485	484	489	498	486	
-	540	407	614	603	621	604	
OS mg/1	358	362	526	332	386	334	
t unit	7.12	7.0	4.98	7-18	7.46	7.96	
	0.002	0.13	0.10	0.11	0.08	0.05	
mg/,	220	213.8	208.4	216.0	221.0		
1 16/1	<0.05	₹0.10	10.10	10.10	10.10	213.6	
14 mg/1	< 0.05	4 < 0.05	¥ < 0.05	* <0.05	* <0.05	* 0.22	
mg/1	<0.005	* 0.020	₹ 0.019	+ 0.030	+ 0.012	4 0.025	
mg/l	<0.03	₹0.10	<0.10	<0./0	<0.10	<0.10	
- mg/1	<0.01	# < 0.01	40.22	* "0.12	* 0.24	¥ 0.17	
mg/l	<0.002	< 0.01	10.01	<0.01	<0.01	40.01	
mg/1	<0.01	< 0.05	<0.05	₹0.05	<0.05	<0.05	
mg/1	40.01	< 0.05	40.05	*0.05	<0.05	-	
mg/1	0.33	+ 0.33	+ 0.30	¥ 0.30	* 0.27	<0.05	
mg/1	<0.01	<0.05	<0.05	< 0.05	0.08	* 0.24	-
mg/1	<0.01	< 0.05	<0.05	×0.05	< 0.05	<0.05	
mg/1	0.03	< 0.05	10.05	<0.05	0.08	<0.05	
mg/1	<0.0005	* < 0.0005	4 < 0.0005	4 < 0.0002	* < 0.0002	₩<0.0002	
mg/1	<0.05	< 0.10	<0.10	10.10	40.10	<0.10	
mg/1	₹0.02	< 0.05	<0.05	¥0.05	<0.05	<0.05	
mg/1	0.10	* 0.08	¥ 0.07	v <0.05	* *0.05	¥ <0.05	
The same of the last of	20.005	* 0.026	* <0.001	+ 0.026		-	
mg/1	<0.05	< 0.10	<0.10	< 0.10	40.10	+0.005	
mg/1	₹0.005	₹0.01	<0.01	<0.01	<0.01	<0.10	
226 poi/1					3.01	- 0.01	
PCTIT		17 t 2	4 15.5 1 2.1	×16.3 ± 2.2	¥ 15.3 ± 2.2	¥ 18.5±2.3	V
pci/I		10.5 = 1.9	* 3.5±1.4	·21.6 +2.8	u	*	
	NA	NA	NA	NA	NA	NA -	
oss B "	NA	NA	NA	NA	NA	NA	

ANALYTICAL WELL HISTORY

The second second		MONTH 1	MONTH 2	MONTH 3	The same of the sa	7	
ATE SMPLE	Printed States of the State of	2-1-82		1		I TOTAL S	
ANALYSIS	1-12-82	2-2-82	3-3-82	THE RESERVE AND PERSONS ASSESSMENT ASSESSMEN			
DATES		1	11 +	11 1	1	5.25-82	
	3-16-82 W	3-30-82	4-16-82	5-28-82	5.28.82	1	
HC03 mg/1		1	1				
$\cos_3 - \frac{mg}{1}$	268	243.8	264.7	266.7	267.2	274.7	7
$\frac{1}{21}$ mg/1	.0.	-0.	-0-	-0.	-0-	.0.	
	9	10.1	10.9	10.3	10.4	10.0	1
	82	90.7	94	95	53.7	93	1
nion eq.	6.36	6.50	4.61	4.64	6.63	6.72	1
interest	43	47.3	47.3	48.4	49.5	47.3	-
g++ mg/1	10	11.4	10.7	10.9	11.0	11.0	-
a ⁺ mg/1	72	7/	73.0	69.1	69.3		1
mg/1	6	7.9	8.0	8.1	7.6	69.9	
ation eq.	6.25	6.60	6.64	6.54		7.8	-
/+balance	101.76	98.40	99.54	101.55	6.60	6.52	-
um TDS	490	502	509	509	100.40	103.10	-
ond um/cm	550	633	628	633	509	514	-
OS mg/1	364	374	530		646	634	-
I unit	7.02	7.0	6.83	350	402	356	-
mg/1	0.005	0.18	0.29	7.26	7.50	7.65	
m9/1	220	216.2		0.19	0.15	0.11	
mg/1	< 0.05	10:10	217.0	218.6	2/9.0	225.2	
mg/1	< 0.05	* < 0.05	< 0.10	<0.10	10.10	10.05	
mg/1	<0.005	*0.022	*<0.05	¥ <0.05	* 40.05	¥ 0-27	
mg/1	<0.03		4 0.078	* 0.150	* 0.059	¥ 0-108	
- mg/1	₹0.01	<0.10	<0.10	20.10	₹0.10	10.10	
- mg/1	₹0.002	*<0.01	* 0.19	W 0.11	¥ 0.18	* 0.08	
- mg/1	<0.01	<0.01	<0.01	< 0.01	40.01	₹0.01	
mg/1	×0.01	<0.05	<0.05°	10.05	₹0.05	<0.05	
		+0.05	<0.05	<0.05	₹0.05	<0.05	
mg/1	0.27	▶0.33	* 0.27	4 0.27	# 0.27	* 0.27	
mg/1 mg/1	<0.01	10.05	₹0.05	0.32	0.34	0.09	
	<0.01	₹0.05	€0.05	10.05	<0.05	₹0.05	1
mg/1 mg/1	0.02	0.06	0.08	0.09	0.10	0.09	-
-	< 0.0005	**0.0005	*<0.0005	¥ <0.0002	*< 0.0002	*<0.0002	
mg/1	<0.05	₹0.10	₹0.10	< 0.10	40.10	₹0.10	
mg/1	₹0.02	< 0.05	<0.05	< 0.05	<0.05	<0.05	
2/NO3 "	< 0.05	¥ < 0.05	* < 0.05	* <0.05	* <0.05	× <0.05	
mg/1	< 0.005	¥ 0.014	*<0.001	× 0.013	* <0.001	* 0.005	
mg/1	<0.05	₹0.10	₹0.10	₹0.10	40.10	10.10	
mg/1	< 0.005	<0.01	<0.01	< 0.01	< 0.001		-
106					0.001	<0.01	-
	215 + 8	* /74. + 7	+ 164 + 7	×169 ±6.9	* 171 = 7	# 100 to 1	
pci/1	5.5 ± 1.1	* 2.5 1.0	. O.8 ta.8	*16.9 + 2.6		+ 192 = 7.4	-
ss A "	NA	NA	NA		* 12.4 12.2	*	-
oss B "	NA	NA	NA	NA I	MA	NA .	
Annyers	By Our s			L NA	NA	NA	20629

ANALYTICAL WELL HISTORY

	INITIAL	MONTH 1	MONTH 2	TIMO	T Feet Total	71	
ATE SMPLD	-	2-1-82	3.2.82	3-29-82			
ANALYSIS	1-12-82	2-2-82	3.3.82	3.30.82	mental processors and appropriate to the	5-24-82	-
DATES	2-16-82+	3.30-82	4.16-82	1	1 1	1 1	
				5-28-82	5.28-82		
HC03 mg/1	211	T	7	7			
CO3 mg/1	.0.	207.6	211.8	2/0.3	217.2	218.9	
C1 mg/1		.0.	.0.	.0.	.0.	-0-	
50% mg/1	84	7.8	8.3	8.2	8.3	8.2	
Anion eq.	5.38	85.9	96	97	92.7	98	
la ⁺⁺ mg/l		5.41	5.71	5.70	5.73	5.86	
ig++ mg/l	45	39	44.0	44.0	45.1	44	
a ⁺ mg/1	6	10.3	10.5	10.6	10.5	11.0	
# mg/1	57	58	57.1	55.4	54.60	56.9	
ation eq.	5	6.2	6.4	6.4	5.9	6.3	
/+balance	5.35	5.49	5.72	5.66	5.66	5.75	
Sum TDS	100.56	98.61	99.73	100.77	101.25	101.90	
ond um/cm	4/4	+15	434	432	434	443	
	470	541	553	558	554	561	
	3//	320	456	302	348	316	
-	7.45	7.0	6.87	7.33	7.43	7.59	
mg/1 mg/1	0.008	0.34	0.33	0.30	0.38	0.30	
The state of the s	173	170.2	173.6	172.4	178.0	179.4	
4 46/1	₹0.05	<0.10	1 40.10	₹0.10	<0.10	<0.05	
-	*0.05	* 0.20	*<0.05	* <0.05	4 40.05	+ 0.20	
mg/1	<0.005	4 0.031	¥0.052	+ 0.284	4 0.095	+ 0.150	
mg/1	< 0.03	< 0.10	< 0.10	<0.10	40.10	<0.10	
- mg/1	₹0.01	10.01	40.24	+ 0.30	+ 0.23	4 0.07	
mg/1	10.002	<0.01	<0.01	<0.01	10.01	40.01	
mg/1	10.01	<0.05	<0.05	<0.05	×0.05	₹0.05	
mg/1	₹0.01	₹0.05	10.05	₹0.05	10.05		
mg/1	0.30	× 0.27	* 0.36	* 0.36	¥ 0.30	* 0.30	
mg/1	10.01	0.79	1.25	0.99	1.19	-	
mg/1	10.01	₹0.05	< 0.05	< 0.05	<0.05	40.05	
mg/1	0.02	0.05	0.06	0.06	0.08	0.08	7,50
	< 0.0005	*<0.0005	* <0.0005	* < 0.0002	*<0.0002	4<0.0002	
mg/1	<0.05	<0.10	<0.10	40.10	<0.10	<0.10	
- mg/1	<0.02	<0.05	< 0.05	< 0.05	40.05	<0.05	
2/NO3 "	0.10	*<0.05	4<0.05	+ 40.05	* < 0.05	* 10.05	
mg/1	<0.005	100.0>*	* <0.001	* < 0.001	**0.001	¥ <0.001	
mg/1	<0.05	×0.10	₹0.10	₹0.10	<0.10	<0!0	
mg/l	< 0.005	< 0.01	<0.01	<0.01	10.01	20.01	
226 pci/1 .	709 15	786±15	1 787110				
1		4.3 1.5	* 787±15	* 836 ± 15	* 431-14	* 824 ± 15.2	9 1 4
uss A "	NA		* 23 ± 3	v16.2 12.5	+ 16.7±2.6	*	-
oss B "	-	NA	NA.	NA .	NA	NA -	
ANALYZED 8	NA	NA	NA	NA	NA	NA NA	

OFFICIAL DOCKET COPY

UNC TETON EXPLORATION DRILLING, INC.

ANALYTICAL WELL HISTORY

DATE SMPL	INITIAL	MONTH I	The second section of the second seco	MONTH 3	MONTH 4		-
		2-1-82	and the same of th	3-29.8	4-26-8		
NALYSIS	1-12-82	11 1	3-3-82	3 - 30 - 8 :		5-24-82	
ATES	1 2-16-82	# 3-30-82	4-16-82	1	1	1	11-15
*****	201		14-10-82	5.28.82	5.28-8:	2	Heri
1003 mg/1	281	322.8	7 7 7 7			1 7 7 10 10	a kar kar
103 mg/1	-0-	9.1	317.2	317.7	303.5	309.4	
1 - mg/1	8	8.5	9.4	7.9	11.5	8.6	
$0\frac{\pi}{4}$ mg/1	135	/24.9	8.0	9.3	8.5	8.0	I MAN
nion eq.	7.50	8.44	/28	/29	121.8	124	
art mg/1	85	90	8.41	8.42	8.14	8.17	
gtt mg/1	20	24.2	100.1	99.0	95.7	92.4	
a ⁺ mg/1	32	33	23.0	22.8	33.3	22.4	
mg/1	7	8.7	31.5	32.6	32.3	32.1	
stion eq.	7.45		8.8	8.7	8.7	8.5	
/+balance	100.67	103.21	8.52	8.49	8.35	8.10	
um TDS	568	621	98.69	99.19	97.39	100.83	
and um/cm	600	743	626	629	605	605	
OS mg/1	428	476	752	744	730	728	
unit	7.84	8.2	570	432	458	424	
mg/1	0.093	1.64	8.21	8.19	8.32	8.23	Diam'r.
mg/,!	230		1.51	1.56	1.36	1.30	
mg/1	₹0.05	279.8	275.6	273.6	268.0	268.0	
7 mg/1	₹0.05	0.10	0.28	0.20	0.10	<0.05	
mg/1	₹0.005	4 40.05	1 40.05	* :0.05	¥ <0.05	¥ 0.20	
mg/1	₹0.03	× 0.009	* 0.014	* 0.036	* 0.012	* 0.021	
mg/l	×0.01	#40.01	40:10	10.10	<0.10	10.10	
- mg/1	<0.002	10.01	× 0.24	* 0.12	+ 0.10	+ 0.08	
mg/1	<0.01		10.01	₹0.01	<0.01	<0.01	
mg/1	<0.01	10.05	<0.05	<0.05	<0.05	₹0.05	
mg/1	0.57	<0.05	<0.05	₹0.05	<0.05	<0.05	
mg/1	< 0.01	0.57	* 0.51	* 0.65	+ 0.45	* 0.51	
- mg/1	10.01	0.44	0.19	0.42	0.53	<0.05	
mg/1	₹0.01	20.05	<0.05	< 0.05	₹0.05	<0.05	17 300
==/11	<0.0005	×<0.0005	0.08	0.08	0.09	0.06	
mg/1	<0.05	₹0.70	**0.0005	4 < 0.0002	* <0.0002	* < 0.0002	
- mg/1	< 0.02	<0.05	40.10	<0.10	<0.10	<0.10	
/NO3 "	10.05	*< 0.05	40.05	₹ 0.05	< 0.05	₹0.05	
mg/1	< 0.005	440.001	¥ < 0.05	¥ <0.05	4 <0.05	* <0.05	
mg/1	<0.05	₹0.001	* 0.009	* < 0.001	*40.001	* <0.001	
mg/1	10.005		<0.10	<0.10	₹0.10	₹0.10	
		40.01	20.01	10.01	<0.01	<0.01	
26 pci/1	1229:20	* 1175 ± 18	**************************************				
0 pci/1	4.7 2 1.3		*1203 ± 18	*1267±17	*1164 = 19	* 926±16.2	
SS A "	NA NA	* 8.1 ± 1.7	* 5.4 ± 1.6	* 14.4 + 2.4	¥ 16.2 ±2.6	*	
ss B "	NA	NA	NA	NA	NA	NA -	* 1 A -
ANALYZ	n Av Curs	NA J	L NA	NA	NA	NA	
ANALYZE	0 By Ours	DE LABOR	DOOKET (2062

UNC TETON EXPLORATION DRILLING, INC.

DIST TO	INITIAL	MONTH I	MONTH	2 Maria	2 7		
DATE SMPLD	-	2-1-82	3.2.82			1000	
NALYSIS	1-12-82	2.2.82	3-3-82		2 4-26-83		
ATES	2-16-82	3-30-82	1	1 1	11. 1	2 5-25-82	
nexes while a	****	7 1 3 30 8 8	4-16-8	2 5-28-82	5.28.82	*	1
HC03 mg/1	211	7/ 000/	7	7		de la	-
103 mg/1	.0.	207.4	209.1	211.8	2/2.0	216.9	
1 mg/1	NO	11.5	7.0	9.8	4.7	7. 2	1
10 mg/1	280	1.5	1.8	1.8	2.5	2.0	
nion eq.	9.28	298.5	323	3/9	3/2.5	3//	-
a ⁺⁺ mg/l	123	10.04	10.44	10.50	10.28	10.33	-
g++ mg/1	20	128	128.7	129.8	129.8	129.8	-
a ⁺ mg/1	32	27-8	26.4	27.4	27.2	27.5	
+ mg/1	9	33	32.1	33.6	32.1	33.4	
ation eq.	9.40	10.8	10.6	10.5	10.3	10.2	
/+balance	98.72	10.43	10.30	10.50	10.42	10.50	
um TDS	475	96.32	101.35	99.92	98.69	98.44	
ond um/cm	750	7/9	739	744	733	738	
OS mg/l	569	931	921	933	917	917	
I unit	7.88	656	760	608	6064	624	
mg/1	0.004	8.3	8.16	8.17	8.26	8.22	
mg/,	173	1.69	0.12	0.33	0.09	0.04	
mg/1	10.05	189.2	183.0	190.0	185.0	/89.8	
mg/1	×0.05	0.10	2.10	0.85	0.44	10.05	
mg/1	<0.0005	4 40.05	* < 0.05	₩ <0.05	* <0.05	¥ <0.05	
mg/1	< 0.03	*0.002	* < 0.005	+ 0.014	+0.003	* 0.007	
mg/1	× 0.01	< 0.10	₹0.10	4.0.10	40.10	< 0.10	
-	40.002	**0.01	4 0.22	4.0.10	# 0.25	* 0.13	
- mg/1	₹0:01	₹0.01	< 0.01	₹0.01	40.01	40.01	
mg/1	<0:01	₹0.05	10.05	10.05	<0.05	₹0.05	
mg/1	0.65	10.05	10.05	<0.05	<0.05	<0.05	
mg/1	40.01	×0.74	+ 0.65	* 0.65	* 0.65	+ 0.65	
- mg/1	<0.01	0.33	2.39	1.73	0.24	< 0.05	
mg/1	0.02	×0.05	₹0.05	< 0.05	10.05	<0.05	
	0.0005	0.06	0.10	0.10	0.09	0.06	
mg/1	₹0.05	*40.0005	×<0.0005	*<0.0002	*<0.0002	* <0.0002	
- mg/1	10.02	10.05	<0.10	<0.10	<0.10	<0.10	
/NO2 "	₹0.05		40:05	20.05	<0.05	<0.05	
14	0.005	*40.05	+ 0.06	* 40.05	* <0.05	* 0.20	
mg/1	< 0.05	* < 0.001	* 0,006	+ 40.001	* < 0.001	*<0.001	
	0.005	<0.10	10.10	<0.10	<0.10	<0.10	
	.003	<0.01	0.068	0.01	<0.01	×0.01	
26 pci/1	13.1 ± 2.1	* 9 = 1 . =				The second	
0	2.5 ± 0.8	* 9.5:1.7	* 52 1 4	+32±2.9	+ 11.711.9	¥33.6±3.1	
ss A "	NA NA	* 7.2 1.6	* 9.5 +0.6	*17.1 = 2.6	+ 14.3 ± 2.4	+	
ss B "	NA	WA .	NA	NA	NA	NA -	10 10 1
NALYZED B	-	NA	NA	AMA	NA .	NA	

WAMCO LAB

P.O. BOX 3632 • CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY: TETON EXPLORATION DRILLING, INC.

DATE: February 16, 1982

WAMCO NO.	SAMPLE DESCRIPTION			1	1	1	Mg/L
2981	Water	6	7	8	9	10	Detection
	Analysis reported in Milligram	s Per Li	ter excep	t where	noted:		Limit
	Total Dissolved Solids *	569	532	498	339	358	1
	Sodium (Na)	31	38	37	64	74	
	Potassium (K)	8	9	8	5	6	
	Catcium (Ca)	112	96	93	40	42	tra to
	Magnesium (Mg)	26	23	21	11	10	
	Sulface (SO4)	270	254	245	82	82	
	Chloride (C1)	5	2	0	7	8	
•	Cartonate (CO3)	0	0	0	0	0	
	Bicarbonate (HCO3)	224	203	187	244	268	1
	Hydroxide (OH)						1
	pH, Units	7.79	8.13	7.67	7.02	7.12	
	Conductivity, Micrombes \$2500.	730	700	680	500	540	
	Total Milliequiv, Major Cation	9.28	8.56	8.18	5.81	6.29	
	Total Millieguiv, Major Anions	9.42	8.67	8.16	5.91	6.34	
	Absolute Value, Charged Bal.	0.75	64	0.12	85	40	
	Ammouria (NH3 as N)	LT.05	LT.05	LT.05	LT.05	LT.05	
	Nitrate (NO ₃ as N)	0.5	LT.05	LT.05	0.1	0.1	0.05
	Nitrite (NO ₂ as N)	LT.001	LT.001	LT.001	LT.001	LT.001	0.001
	Floride (F)	0.74	0.40	0.51	0.30	0.33	0.1
	Total Alkalinity as CaCO3	183	167	153	200	220	
	Total Hardness as CaCO3	387	334	319	145	146	1
	Boron (B)	LT.01	LT.01	LT.01	LT.01	LT.01	0.01

REMARKS:

Determined by evaporation # 180° C

6. 570 7. 574 8. 317

9. MR-1

10. MR-3

* Samples received

W A MCO

04008728110E

WAMCO LAB

P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY:

TETON EXPLORATION DRILLING, INC.

DATE: Pebruary 16, 1982

WAMCO NO.	SAMPLE DESCRIPTION	1510	1 574	1317	1	1	1
2981	Water	6	7	1 8	9	10	Mg/1
	Analysis in Milliorams per L	iter excer	t whom	natadi			Detection
	Aluminum (Al)	LT.10	1	LT.10	LT.10	LT.10	Limit
the first con-	Arsenic (As)		7	1LT.001	LT.001	-	0.10
	Sarium (Ba)	LT.10	-	LT.10	LT.10	LT.10	0.001
	Cadmium (Cd)	LT.00	The same of the sa	ZLT.002	LT.002	LT.002	0.10
	Chromium (Cr)		LT.01	LT.01	LT.01	LT.01	0.002
Maria de la companya	Copper (Cu)	LT.01	-	LT.01	LT.01	LT.01	0.01
	from (Fe)	LT.01	The Person Name and Person	LT.01	LT.01	LT.01	0.01
9	Lead (Pb)	LT.01	1	LT.01	LT.01	LT.01	0.05
	Manganese (Mn)	0.01	0.05	0.07	0.02	0.03	0.03
	Mercury (Hg)	LT.0002	LT.0002	LT.0002	-		0.0002
	Nickel (Ni)	LT.02	-	LT.02	LT.02	LT.02	0.02
	Sclenium (Se)	LT.001	LT.001	LT.001	-	drone was made and	0.001
	Zinc (Zn)	1		LT.005	The same of the sa	processor and the same of the	0.005
	Molybdenam (Mo)	LT.10	LT.10	LT, 10	LT.10	LT.10	0.10
	Uranium (U308) PPB	2	28	44	7	2	1 PPR
	Vanadium (V205)	LT.10	LT.10	LT.10	LT.10	LT.10	0.10
	Radium (Ra-226) piC/1 : Prec.	2.8 ±	46 ±	738 ±	391 ±	18.6 ±	0.2 pic/
		.9	4	15	11	2.4	0.2 0107
	Thoriûm-230	12.3 ±	17.2 ±	9.2 ±	8.0 ±	9.2 ±	
		1.7	2.0	1.5	1.4	1.5	

REMARKS:

Analysis performed according to EPA Manual, 1979 and/or Standard Methods for Examination of Water and Wastewater, 14th Edition.



04008728110E



WAMCO LAB

P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY: TETON EXPLORATION DRILLING, INC. DATE: February 16, 1982

WAMCO NO.	SAMPLE DESCRIPTION				1	1	Mg/L
2981	Water	11	12	13	14	15	Detection
	Analysis reported in Milligram	s Per Li	ter excep	t where	noted:		Limit
	Total Dissolved Solids *	364	119	328	324	311	
	Sodium (Na)	72	25	59	61	57	
	Potassium (K)	6	2	5	5	5	
	Calcium (Ca)	43	15	54	44	45	
	Magnesium (Mg)	10	3	4	10	6	
	Sulfate (SO4)	82	28	77	82	84	
	Chloride (C1)	9	0	8	6	6	
	Cartonate (CO3)	0	0	0	0	0	
(Bicarbonate (HCO3)	268	93	240	236	211	
	Hydroxide (OH)						1
	pH. Units	7.02	7.44	7.17	7.32	7.45	
	Conductivity, Micromhos 9250c.	550	240	500	490	470	
	Total Milliequiv, Major Cation	6.25	2.14	5.72	5.80	5.35	
	Total Millicquiv, Major Anions	6.36	2.11	5.76	5.74	5.38	
	Absolute Value, Charged Bal.	87	0.71	35	0.52	28	
	Ammonia (NH ₃ as N)	LT.05	LT.05	LT.05	LT.05	LT.05	
	Nitrate (NO3 as N)	LT.05	LT.05	0.3	0.1	0.1	0.05
	Nitrite (NO ₂ as N)	LT.001	LT.001	LT.001	LT.001	LT.001	0.001
	Floride (F)	0.27	0.27	0.30	0.30	0.30	0.1
	Total Alkalinity as CaCO3	220	77	197	193	173	
	Total Hardness as CaCO3	149	50	151	151	137	
	Boron (B)	LT.01	LT.01	LT.01	LT.01	LT.001	0.01

REMARKS: Determined by evaporation # 180° C

11. MR-5 12. MI-1

13. MI-6

14. MI-10 15. 301

* Samples received on 1/12/82



04008728110E

WAMCO LAB

P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY:

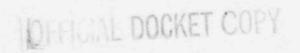
TETON EXPLORATION DRILLING, INC.

DATE: February 16, 1982

JAMCO NO.	SAMPLE DESCRIPTION	1	1		1	1	1
2981	Water	1 11	12	13	14	15	Ma/1
	Analysis in Milliagens and I		1			1 13	Detecti
	Analysis in Milligrams per Li Aluminum (Al)	1	The second second				Limit
	Arsenic (As)	7	LT.10	LT.10	LT.10	LT.10	0.10
	Barium (Ba)	1	1LT.001	-	LT.001	LT.001	0.001
	Cadmium (Cd)	1	LT.10	LT.10	LT.10	LT.10	0.10
	Chromium (Cr)		2LT.002	7	LT.002	LT.002	0.002
		1	LT.01	LT.01	LT.01	LT.01	0.01
	Copper (Cu)	LT.01		LT.01	LT.01	LT.01	0.01
A	Iron (Fe)	1	LT.01	LT.01	LT.01	LT.01	0.01
	Load (Pb)		LT.01	LT.01	LT.01	LT.01	0.05
	Manganese (Mn)	1 0.02		0.01	0.01	0.02	0.01
	Mercury (Hg)	1	LT 0002	LT.0002	TT.0005	LT.0002	0.0002
	Nickel (Ni)	-	LT.02	LT.02	LT.02	LT.02	0.02
	Scienium (Se)	LT.003	LT.001	LT.001	LT.001	LT.001	0.001
	Zinc (Zn)	LT.005	LT.005	LT.005	LT.005	LT.005	0.005
	Molybdenum (Mo)	LT.10	LT.10	LT.10	LT.10	LT.10	0.10
	Uranium (U308) PPB	5	7	36	15	8	0.10
	Vanadium (V205)	LT.10	LT.10	LT.10	LT.10	LT.10	1 PPB
	Radium (Ra-226) piC/1 = Prec.	215 ±	75 ±	326 ±	199 ±	709 ±	0.10
		8	5	10	8	15	0.2 pic
	Thorium-230 pCi/1	5.5 ±	2.5 ±			5.5 ±	
		1.1	0.8	1.8	1.0	1.1	

REMARKS:

Analysis performed according to EPA Manual, 1979 and/or Standard Methods for Examination of Water and Wastewater, 14th Edition.





D4008728110E

WAMCO LAB

P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY: TETON EXPLORATION DRILLING, INC. DATE: February 16, 1982

WAMCO NO.	SAMPLE DESCRIPTION				Mg/L
2981	Water	16	17		Detecti
	Analysis reported in Milligram	s Per Li	ter excep	t where noted	The second secon
	Total Dissolved Solids *	428	569		
	Sodium (Na)	32	32		
	Potassium (K)	7	9		
	Calcium (Ca)	85	123		
	Magnesium (Mg)	20	20		
	Sulfate (SO4)	135	280		
	Chloride (C1)	8	0		
	Carbonate (CO3)) 0	0		
	Bicarbonate (HCO3)	281	211		
	Hydroxide (OH)				
	pH. Units	7.84	7.88		
علاو حيد خالا	Conductivity, Micrombos 9250c.	600	750		
	Total Milliequiv, Major Cation	7.45	9.40		
	Total Milliequiv, Major Anions	7.50	9.28		
	Absolute Value, Charged Bal.	33	0.64		
	Ammonia (NH4 as N)	LT.05	LT.05		
	Nitrate (NO ₃ as N)	LT.05	LT.05		0.05
	Nitrite (NO ₂ as N)	LT.001	LT.001		0.001
	Floride (F)	0.57	0.65		0.1
	Total Alkalinity as CaCO3	230	173		
	Total Hardness as CaCO ₃	294	389		
	Boron (8)	LT.01	LT.01		0.01

REMARKS:

Determined by evaporation @ 180° C

16. 306

17. 308

* Samples received







WANGO LAB

P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY: TETON EXPLORATION DRILLING, INC.

DATE: February 16, 1982

WAMCO NO.	SAMPLE DESCRIPTION			
2981	Water	16	17	Mg/1
	Analysis in Milligrams per Li			Detection
	Aluminum (A1)	1		Limit
	Arsenic (As)	LT.10	LT.10	0.10
Line in	Barium (Ba)	TT.001	LT.001	0.001
	Cadmium (Cd)	LT.10	LT.10	0.10
	Chromium (Cr)	LT.002	LT.002	0.002
	Copper (Cu)	LT.Ol	LT.01	0.01
	Iron (Fe)	LT.01	LT.01	0.01
•	Lead (Pb)	LT.01	LT.01	0.01
	Manganese (Mn)		LT.01	0.05
	Mercury (Ha)	LT.01	0.02	0.01
	Nickel (Ni)	LT.0002		0.0002
	Selenium (Se)	LT.02	LT.02	0.02
	Zinc (Zn)	LT.001		0.001
		LT.005	LT.005	0.005
	Molybdenum (Mo)	LT.10	LT.10	+
	Uranium (U308) PPB	93	4	0.10
	Vanadium (V205)	LT.10	LT.10	1 PPB
	Radium (Ra-226) piC/1 z Prec.	Street, Square or other Desirement of the last of the	13.1±	0.10
		20		0.2 pic/
	Thorium-230 pCi/1	6.7 ±	2.1 2.5 ±	1
		1.3	0.8	

REMARKS:

Analysis performed according to EPA Manual, 1979 and/or Standard Methods for Examination of Water and Wastewater, 14th Edition.



04008728110E WAMCO LAB

P. O. Box 2953 - Casper: WY 82602

ANALYSIS REPORT

COMPANY: Teton Exploration Drilling Co. DATE: March 30, 1982

Sample type Water

W. O. No. 3026

Analysis in Milligrams per Liter except where Noted

Sample No.		2	3	4	5
Ammonia (NH3 as N)	· 5.20	4.05	4.05	<.00	0.00
Nitrate (NO3 as N)	< . 05	<.05	< . Ø5	0.05	0.34
Nitrite (NO2 as N)	<.001	<.001	<.001	<.001	.001
Floride (F) .	0.27	0.57	0.74	0.36	0.36
Arsenic (As)	0.031	0.009	0.002	0.030	0.014
Barium (Ba)	<.10	<.10	C. 10		<.10
Mercury (Hg)	<.0002	<.0002	<.0002		
Selenium (Se)	<.001	<.001	<.001		0.009
Radium-226 pCi/L +- Pres	786+-15	1175+-18	9.51.7	724-5	
Thorium-230 pCi/L +- Prec	6.3+-1.5				10.8+-1.9
Sodium (Na)	58	33	33	30	1.2
Calcium (Ca)	39	90	128	20	61

Sample Description

3026-1	301	2-1-82
3026-2	306	2-1-82
3026-3	308	2-1-82
3025-4	MI-1	2-1-82
3026-5	141-6	2-1-82

04008728110E WAMCO LAB

P. O. Box 2953 - Casper: WY 82602

ANALYSIS REPORT

COMPANY: Teton Exploration Drilling Co. DATE: March 38, 1982

Sample type Water

W. O. No. 3026

Analyzis in Milligrams per Liter except where Noted

Sample No.	6	7	Ð	9
Ammonia (NH3 as N) Nitrate (NO3 as N) Nitrite (NO2 as N) Floride (F) Arsenic (As) Barium (Ba) Mercury (Hg) Selenium (Se) Radium-226 pCi/L +- Prec Thorium-238 pCi/L +- Prec	. <.05 0.11 <.001 0.36 0.014 <.10 <.0002 0.006 223+-8 1.6+-0.8		<pre></pre>	0.014 174+-7
Sodium (Na) Calcium (Ca)	60 49	61 43	70 51	71 47

Sample Description:

3026-6	M1-10	2-1-82
3026-7	1412-1	2-1-82
3026-8	MR-3	2-1-82
2026-9	MR+5	2-1-82

04008728110E WAMCO LAB

P. O. Box 2913 - Casper: WY 82600

ANALYSIS REPORT

COMPANY: Teton Exploration Drilling Co. DATE: April 16, 1987

Sample type Water

W. O. No. 3089

Analysis in Milligrams per Liter except where Noted

Sample No.	4	2 2		4	
Anno ita (Ni/3 as N)	0.24	C. 05	. 23	-2,05	< .85
Mitrate (NO3 es N)	. 05	0.07	.03	0.05	C. 05
Nitrite (NO2 as N)	<.001	<.001 <	. 0001	4.001	<.001
Floride (F)	0.30	0.30	.27	0.36	0.51
Arsenic (As)	0.251	0.019 0	.078	0.052	0.014
Boron (B)	0.23				
Mercury (Hg)	<.0002	<.0002 <	.0002	. <. 2000 ·	<.0002
Selenium (Se)	< .001	< 001	.001	<.001	0.009
Radium-226 pCi/L +- Prec	564+-12	15.5+-2.1 16	44-7	797+-15	1203+-18
Thorium-230 pCi/L Pred	3.54-1.4	3.5+-1.4 0.8	races a E	23+-3	5.41.0

Sample Description

A	ark a	
039-1	MR-1	
3069-2	MR-3	3-2-82
3089-3	MR-5	3-1-62
3089-4	301	
1978/05/05 a Rt.	7710-4	

04008728110E WAMCO LAR

P. O. Box 2953 - Casper: WY 82602

ANALYSIS REPORT

COMPANY: Teton Exploration Drilling Co. DATE: April 16, 1731

Sample type Water

W. O. No. 3089

Analysis in Milligrams per Liter except where Noted

Sample No.	6	7	8	9
Ammonia (NH3 as N) Nitrate (NO3 as N) Nitrite (NO2 as N) Floride (F) Arsenic (As) Boron (B) Nercury (Hg) Selenium (Se) Radium-226 pCi/L +- Pre Thorium-230 pCi/L +- Pre	* 0.05 0.06 0.001 0.65 0.001 0.22 0.000 0.006	<.05 0.33 <.001 0.45 0.044 0.20	<.05 0.29 <.001 0.40 0.050 0.26 <.0002 0.026 338+-10	<.05 0.21 4.201 0.36 0.045 0.21 <.0002 0.014 376+-10
The state of the s			Sale America	2.8+-1.2

Sample Description:

B086-9	368
3089-7	MT-1
3089-8	M1-6
3089-9	117-10

P. O. Box 3632 - Casper, WY 82602

ANALYSIS REPORT

()MPANY: Teton Exploration Drilling DATE: May 28, 1982

Sample type Water

Samola No-

W. O. No. 3165

Analysis in Milligrams per Liter except where Noted Limits of Detection are Noted Following Less Than Mark (<)

Sample No.	* * * * * * * * * * * * * * * * * * * *		3	4	ס
Ammonia (NH3 as N)	<.05	<.05	<.05	0.24	<.05
Nitrate (NO3 as N)	<.05	<.05	<.05	<.05	<.25
Nitrite (NO2 as N)	<.001	<.001	0.005	<.001	<.001
Fluoride (F)	0.36	0.65	0.65	0.40	0.30
Boron (B)	0.30	0.12	0.10	0.12	0.12
Arsenic (As)	0.284	0.036	0.014	0.034	0.030
Mercury (Hg)	<.0002	<.0002	<.0002	<.0002	<.0002
Selenium (Se)	<.001	<.001	<.001	0.004	0.026
Uranium (as U) PPB	127	1230	63	142	41

Analysis in Picocuries per Liter except where Noted

Radium 226 +- Prec				453+-11	
Thorium 230 +- Prec	16.2+-2.5	14.4+-2.4	17.1+-2.6	24.3+-3.0	21.6+-2.8

Sample Description:

3165-1	301	3-29-82
3165-2	306	3-29-82
3165-3	308	3-29-82
3165-4	MR-1	3-29-82
3165-5	MR-3	3-29-82

P. O. Box 3632 - Casper, WY 82602

ANALYSIS REPORT

JMPANY:

Teton Exploration Drilling

DATE: May 28, 1982

Sample type Water

W. O. No. 3165

Analysis in Milligrams per Liter except where Noted Limits of Detection are Noted Following Less Than Mark (<)

Sample No.

6

Ammonia (NH3 as N) Nitrate (NO3 as N) Nitrite (NO2 as N) Fluoride (F) Boron (B) Arsenic (As) Mercury (Hg) Selenium (Se)

<.05 <.05 <.05 <.001 0.27 0.11 0.150

<.05 0.14 <.001 0.30 0.10

<.001 0.36 0.18 0.056 0.046 0.054 <.0002 <.0002

<.05

<.001 0.33 0.18

<.05

< . 05

Uranium (U308) PPB 106

0.150 <.0002

0.013 0.006 106 288 288

0.014 254

<.0002 0.006 263

Analysis in Picocuries per Liter except where Noted

adium 226 +- Prec 169+-6.9 117+-6 238+-8 419+-11

horium 230 +- Prec 16.9+-2.6 20.7+-2.8 21.8+-2.8 12.6+-2.2

Sample Description:

3165-6 MR-5 3-29-82

3165-7 MI-1 3-29-82

3165-8 MI-6 3-29-82

3165-9 MI-10 3-29-82

04008728110 EAMCO LAB

P. O. Box 2953 - Casper: WY 82602

ANALYSIS REPORT

: YMPANY:

Teton Exploration Drilling

DATE: May 28, 1982

Sample type Water

W. O. No. 3214

Analysis in Milligrams per Liter except where Noted Limits of Detection are Noted Following Less Than Mark (<)

Sample No.	1	2	3	4	5
Ammonia (NH3 as N) Nitrate (NO3 as N) Nitrite (NO2 as N) Floride (F)	<.05 <.05 <.001 0.30	<.05 <.05 <.001 Ø.45	<.05 <.05 <.001 0.45	<.05 <.05 <.001 0.30	<.05 <.05 <.001 0.27
Boron (B) Arsenic (As) Mercury (Hg) Uranium (U308) PPB	0.23 0.095 <.0002 240	Ø.10 Ø.012 <.0002 1200	Ø. 25 Ø. ØØ3 <. ØØØ2 46	0.42 0.008 <.0002 1550	0.24 0.012 <.0002 105

Analysis in Picocuries per Liter except where Noted

Radium 226 +- Prec 631+-14 1164+-19 11.7+-1.9 491+-12 15.3+-2.2 Thorium 230 +- Prec 16.7+-2.6 16.2+-2.6 14.3+-2.4 20.4+-2.8 17.2+-2.6

Sample Description:

3214-1 301, 4/26/82 3214-2 306, 4/26/82 3214-3 308, 4/26/82 3214-4 MR-1, 4/26/82 3214-5 MR-3, 4/26/82 04008728110E

WAMCO LAB

P. O. Box 2953 - Casper, WY 82602

ANALYSIS REPORT

.. YVASMC

Teton Exploration Drilling

DATE: May 28, 1982

Sample type Water

W. O. No. 3214

Analysis in Milligrams per Liter except where Noted Limits of Detection are Noted Following Less Than Mark (<)

Sample No.	6		8	9
Ammonia (NH3 as N)	<.05	<.05	4.03	<.05
Nitrate (NO3 as N)	<.05	<.05	. 05	<.25
Nitrite (NO2 as N)	<.001	<.001	<.001	<.001
Floride (F)	0.27	0.24	0.24	Ø.33
Boron (B)	0.18	0.23	0.28	0.22
Arsenic (As)	0.059	0.021	0.063	0.034
Mercury (Hg)	<.0002	<.0002	<.0002	<.0002
Selenium (Se)	<.001	<.001	<.001	<.001
Uranium (U308) PPB	185	360	780	340

Analysis in Picocuries per Liter except where Noted

Radium 226 +- Prec 171+-7 112+-6 278+-9 394+-11 Thorium 230 +- Prec 12.4+-2.2 13.3+-2.3 24.1+-2.9 10.8+-1.9

Sample Descriptions:

3214-6 MR-5, 4/26/82 3214-7 MI-1, 4/26/82 3214-8 MI-6, 4/26/82 3214-9 MI-10, 4/26/82



WAMCO LAB



P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY: TETON EPL & AILING DATE: 5-25-82

WAMCO NO.	SAMPLE DESCRIPTION	1 1	2	3	14	15	16
3259		1	1	1	1	1	1
			James A	with the last		-	-
leaf Shirtage	19100 11 115	98	196	90	35	130	63
	NHS	0.22	0.22	0.32	0.36	0.32	6.37
	ITS SEE SEE SEE	0.000	0.174	0.108	0,174	0.025	0.108
	B	0.13	0.11	0-14	0.16	0.17	50.0
	F	0.22	0.21	027	0.30	10.24	0.27
	Ha	2.0002	6.0002	1.0002	2,0002	4.000Z	2.0002
	NOZ GEN	20,001	10,001	20.001	40.001	40.001	40 U.
	Nos as in	20.05	20,05	40.05	10.05	40.05	2005
	Sc.	12001	0.002	1.001	0.003	0.011	0,005
	1200-216	1/7±5.3	362±9.4	3=1 + 8.8	1641 ± 12.5	19.512,3	190= 7
	Thur- 230						
						1000	
		1					
		1					
		1				-	

REMARKS:

Well " mi-1

6.

mr-6

m I-10

MR-1

m R-3

m R-5

5-24-82

20628

O4008728110E WAMCO LAB



P.O. BOX 3632 . CASPER, WYOMING 82602

ANALYSIS REPORT

COMPANY:

DATE:

AMCO NO.	SAMPLE DESCRIPTION		18	191		
		1				
	Floor 4 gpB	50	140	20	T	
	(1) It 3	0.20	0.20	40,05		
	AS	0.150	0.021	0.007		
	ß	0.07	0.08	0.13		
	F	0.30	0.51	0.45		
	Hg .	1.00+2	<.00 m	4.0002		
	Noz DS N	10,001	40.001	20001		
	(NO3 (AS (N)	40.05	20.05	0.30		
•	Se	2.001	<.001	2.001		
	1290-286		921, 1 14.2	Commence of the last of the la		
	Thor 230			2000		
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EMARKS: 7 Well # 301

8 1 306 5·24-82 9 1 308