AtlanticRichfieldCompany
North American Producing Division
Permian District
Post Office Box 1610
Midland, Texas 79701
Telephone 915 682 8631

Ex. 6

April 25, 1973

United States Department
of the Interior
Geological Survey
P. O. Drawer 1857
Roswell, New Mexico 88201

Attention: Mr. N. O. Frederick (6)
Oil and Gas Supervisor

State of New Mexico
Mr. Alex J. Armijo
Commissioner of Public Lands
P. O. Box 1148
Santa Fe, New Mexico

Attention: Mr. Ray D. Graham, Director (3)
Oil and Gas Department

State of New Mexico
Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Jr. (3)
Secretary Director

Working Interest Owners
Empire Abo Unit
(see attached address list)

Re: Initial Plan of Operation
Empire Abo Unit
Eddy County, New Mexico

Gentlemen:

In compliance with Section 11 of the Unit Agreement, Empire Abo Unit, Eddy County, New Mexico, Atlantic Richfield Company, as

Unit Operator on behalf of itself and the other participating working interest owners, hereby submits for your approval a Plan of Operation to cover the period beginning with the effective date of the Unit Agreement and extending through the remainder of calendar year 1973.

Yours very truly,

ATLANTIC RICHFIELD COMPANY
OPERATOR

P. E. Fletcher
Operations Manager

PEF/SHC/jrb

INITIAL PLAN OF OPERATION
EMPIRE ABO UNIT

1. Project Area

History and Background

The Empire Abo Unit area consists of some 11,339.15 acres in Eddy County, New Mexico (see attached plat, Exhibit 1). The area is located in portions of sections 34, 35, 36 Township 17 South, Range 27 East; sections 1, 2, 3, 4, 8, 9, 10, 11, 12, 15, 16, 17 Township 18 South, Range 27 East; sections 25, 26, 27, 28, 31, 32, 33, 34, 35, 36 Township 17 South, Range 28 East; sections 4, 5, 6 Township 18 South, Range 28 East; sections 29, 30 Township 17 South, Range 29 East. Within the Unit Area, owners of the following tracts have chosen not to participate in the unit: 2,6,42,46,49,55,56,69,73C,77,79,84,91. These non-participating tracts total ~~684.84~~ 840 acres. 10,499 The remaining ~~10,654.31~~ acres is to be developed as a project area for pressure maintenance by injection of plant residue gas from Abo production back into the Abo formation.

The Abo producing zone is found at an average depth of about 5800 feet (see attached type log, Exhibit 2). The Abo is a lower Leonard (Permian) carbonate reef which has undergone complete dolomitization. Vugs, fractures and fissures have been observed in cores throughout the main reef, with local anhydrite infilling sometimes restricting flow. Reef development is long (12 1/2 miles) and narrow (1 1/2 miles). The reef crest dips about 1° from southwest to northeast. Average gross reef thickness is about 300 feet, ranging to the maximum of 732 feet on the Amoco State AT No. 1 (L2-18S-27E).

On the up-dip west and southwest end of the reservoir productive limits are the result of anhydrite deposition, while on the back-reef north side there is a facies change to an impermeable carbonate "mud" interspersed with green shale. Limits to the south, east and northeast result as the top of the reef dips below the oil-water contact.

2. Current Production, Future Recovery

The original discovery well was the Amoco Malco Federal A No. 1, located in the NE NW Section 11, T-18-S - R-27-E, completed in November 1957.

At the present time the Pool has 235 producing wells. Of these, 153 are capable of producing more than the current top allowable of 142 BOPD/well. There are 183 flowing wells. Field performance and detailed study of cores indicate excellent vertical permeability. The principal producing mechanism is gravity drainage with an expanding secondary gas cap. There are 22 operators in the field and 112 separate working interest owners.

In January 1973, Abo Pool total oil production averaged 25,625 BOPD with 9% water production and gas oil ratio 1,366 cu. ft./BO. Cumulative oil production from the pool is 90 MMBO to February 1, 1973. Remaining primary after February 1, 1973, based on ARCO numeric model studies, is estimated to be 83 MMBO. Unitized residue gas injection for pressure maintenance is calculated to increase future recovery by about 30 MMBO compared to continued primary operations.

3. Basic Concepts Governing Future Unit Operations

a) Field production history and reservoir numeric model studies have demonstrated that reservoir recovery is governed by a gravity drainage mechanism. With unitization, the operator will be able to maximize beneficial effects of this most efficient recovery mechanism by careful observation of well performance and shutting in or curtailing production from inefficient wells.

b) Injection of plant residue gas will act toward pressure maintenance and orderly control of expansion of the secondary gas cap.

4. Special Rules

a) Unit Allowable

1st Step - Starting on the effective date of the unit, the unit will receive a unit allowable, calculated so that Unit Area reservoir voidage will not exceed average daily reservoir voidage rate for 1972. This will result in an increase from current 23,600 BOPD to about 30,000 BOPD for the Unit Area.

2nd Step - to be effective with the start of gas injection. Unit Area allowable to be 40,192 BOPD. Reservoir numeric model studies demonstrate added recovery and no reservoir waste at this rate.

b) Provision to produce the unit allowable from the most efficient wells without restriction. The only exception will be where a Unit producing well offsets a non-unit well.

c) Provision that if any unit well is located within 660' of a non-participating tract on which is located an Empire Abo producing well, such unit well will be allowed to produce no more than two times normal unit allowable for the Empire Abo Pool.

d) Provision for administrative approval of additional injection wells, or changes in injection well locations.

5. Operating Plans for 1973

Initially gas injection will be into the Abo gas cap in the following eight wells (see plat Exhibit 1):

Current Operator	Lease & Well	Location
Exxon	Chalk Bluff Draw Unit "A" No. 4	NE/4 NW/4 Sec.9-T18S-R27E
Amoco	Windfohr Federal No. 4	NW/4 SE/4 Sec.4-T18S-R27E
Amoco	Malco "H" Federal No. 2	SE/4 NE/4 Sec.3-T18S-R27E
M.YatesIII	Dooley Abo State No. 2	NW/4 SE/4 Sec.36-T17S-R27E
Amoco	State "BM" No. 1	NE/4 SW/4 Sec.31-T17S-R28E
Amoco	State "BV" No. 1	SW/4 NW/4 Sec.32-T17S-R28E
Arco	M. Yates B (ARC) No. 8	SW/4 NE/4 Sec.33-T17S-R28E
Hondo	State "A" No. 21	NE/4 SW/4 Sec.26-T17S-R28E

Attached Exhibit 3 is an example of an injection well log, while Exhibit 4 is a schematic diagram of a typical mechanical setup for an injection well.

Maximum gas injection volume into all wells is ~~estimated at~~ 37,000 MCF/Day. In terms of reservoir space fill-up, this is equivalent to over 60,000 barrels of water injection per day. Plans are to pick up residue gas at about 700 psi and compress it to 2000 psi for injection. The gas will contain hydrogen sulfide. Superdehydration facilities are planned in order to minimize possible corrosion.

67,000 BWPD Equivalent

A rigorous corrosion checking procedure will be maintained.

A regular and comprehensive well-testing program will be followed to maintain reservoir control and aid in determining optimum operating conditions.

Workovers: Wherever well production data and reservoir conditions so indicate, workovers will be performed to lower gas-oil or water-oil ratios and maximize producing well efficiencies.

Facilities for produced water gathering and reinjection will be constructed.

Atlantic Richfield Company, as unit operator, will act prudently to preserve all rights of the mineral owners and to effectively and efficiently recover the unit area reserves. This Company will meet all economical offset obligations and act to prevent undue waste.

Modifications - It is understood that to meet changing conditions, this Plan of Operation may be modified from time to time, with the approval of the Supervisor, the Commissioner of Public Lands of the State of New Mexico and the New Mexico Oil Conservation Commission.

Effective Date:

This Plan of Operation shall be effective July 1, 1973.

If this Plan of Operation meets with your approval, please indicate in the space below and return one copy for our files.

Yours very truly,

ATLANTIC RICHFIELD COMPANY
OPERATOR

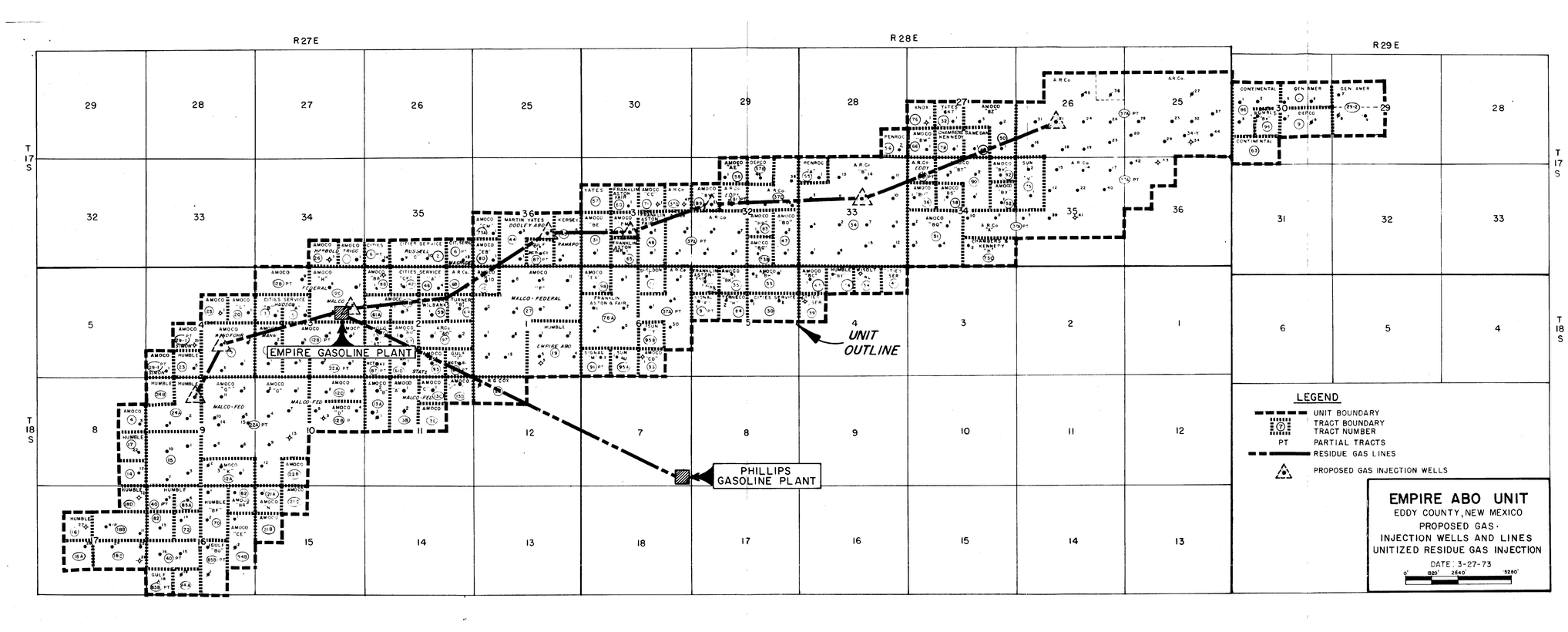
P. E. Fletcher
Operations Manager

PEF/SHC/jrb

APPROVED BY: _____ Date: _____
Supervisor of United
States Geological Survey

APPROVED BY: _____ Date: _____
Commissioner of Public
Lands, State of New Mexico

APPROVED BY: _____ Date: _____
Secretary-Director
New Mexico Oil Conservation
Commission


R27E
R28E
R29E
T 17 S
T 18 S
EMPIRE GASOLINE PLANT
PHILLIPS GASOLINE PLANT
UNIT OUTLINE
LEGEND
UNIT BOUNDARY
TRACT BOUNDARY
TRACT NUMBER
PT PARTIAL TRACTS
RESIDUE GAS LINES
PROPOSED GAS INJECTION WELLS
EMPIRE ABO UNIT
EDDY COUNTY, NEW MEXICO
PROPOSED GAS INJECTION WELLS AND LINES
UNITIZED RESIDUE GAS INJECTION
DATE: 3-27-73
0' 1320' 2640' 5280'

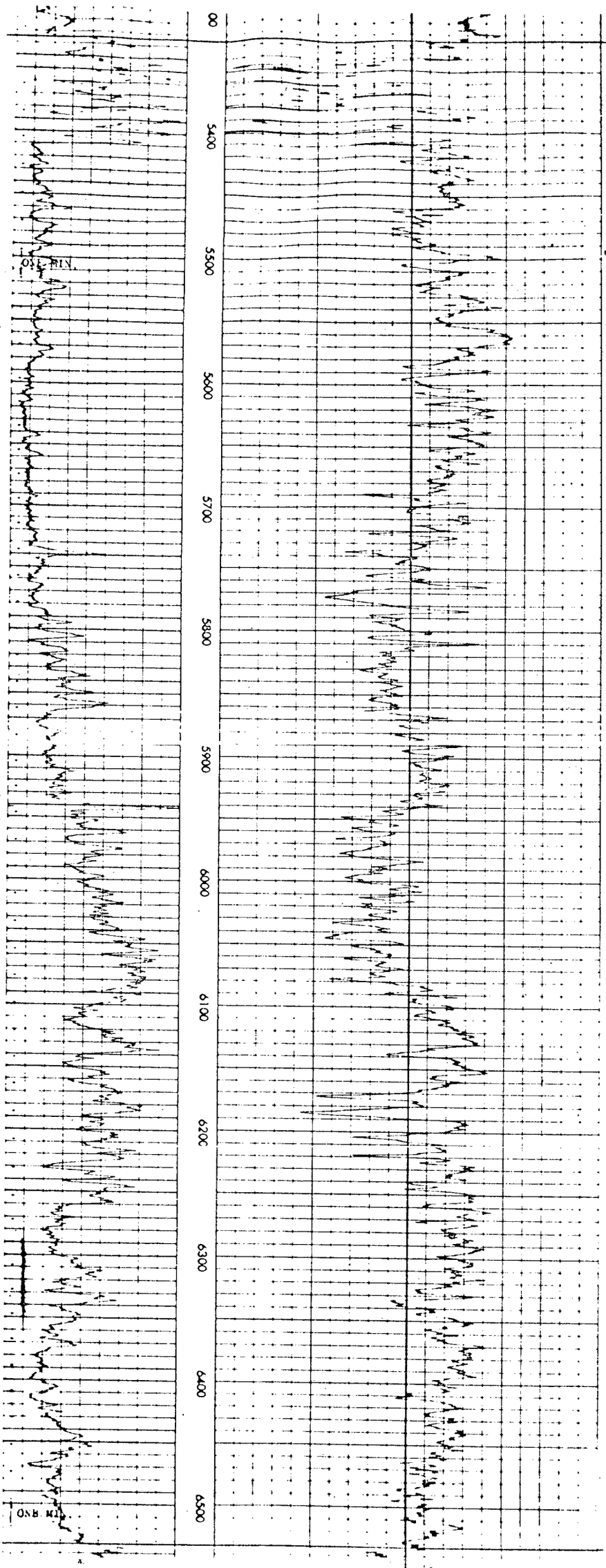
AMOCO PRODUCTION COMPANY

State AU No. 1

1980' FSL & 1830' FWL SEC. 2, T-18-S, R-27-E

EDDY COUNTY, NEW MEXICO

RADIOACTIVITY LOG



BASE OF THE DRINKARD — 5325 (-1784)

TOP OF THE WOLFCAMP (LIMESTONE) — 6533 (-2992)

ATLANTIC RICHFIELD COMPANY

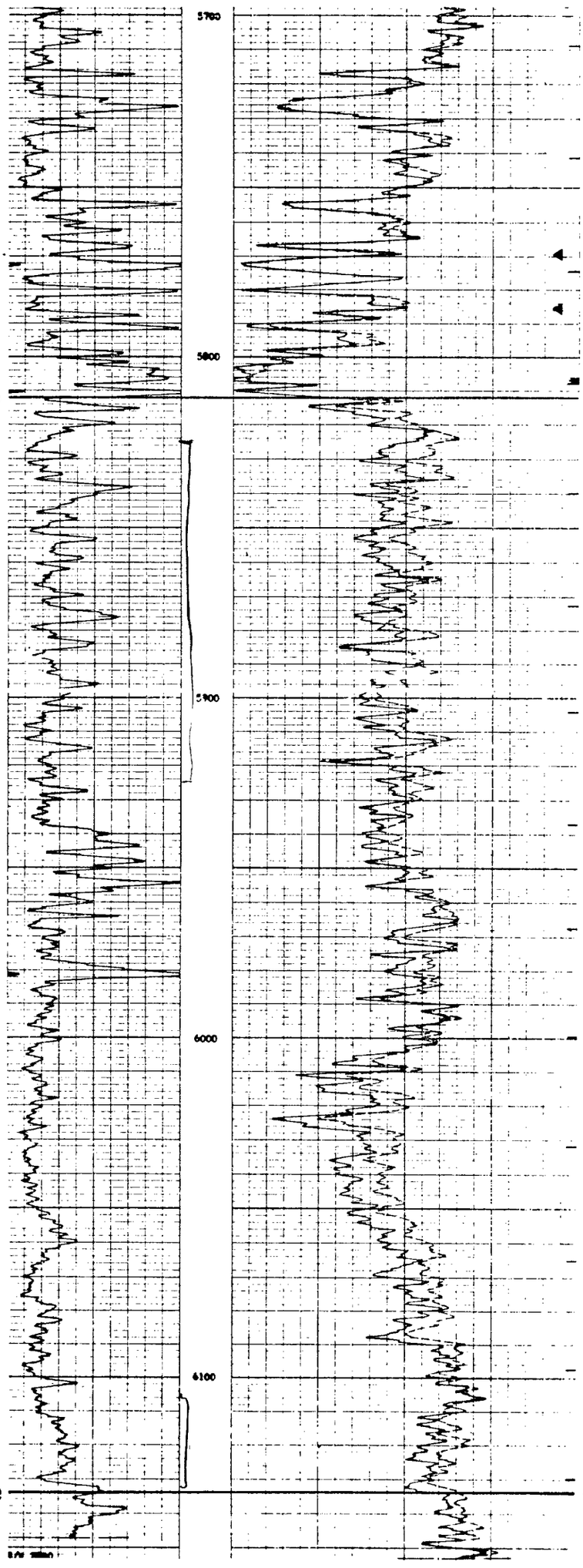
M. Yates "B" (ARC) Well No.8

1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E

EDDY COUNTY, NEW MEXICO

GAMMA RAY – ISOTRON

EMPIRE ABO UNIT
PLAN OF OPERATION
EXHIBIT 3



Reef Top -2144

Reef Base -2466

ATLANTIC RICHFIELD COMPANY

M. Yates "B" (ARC) Well No. 8

1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E

EDDY COUNTY, NEW MEXICO

INJECTION WELL DIAGRAM

EMPIRE ABO UNIT
PLAN OF OPERATION
EXHIBIT 4

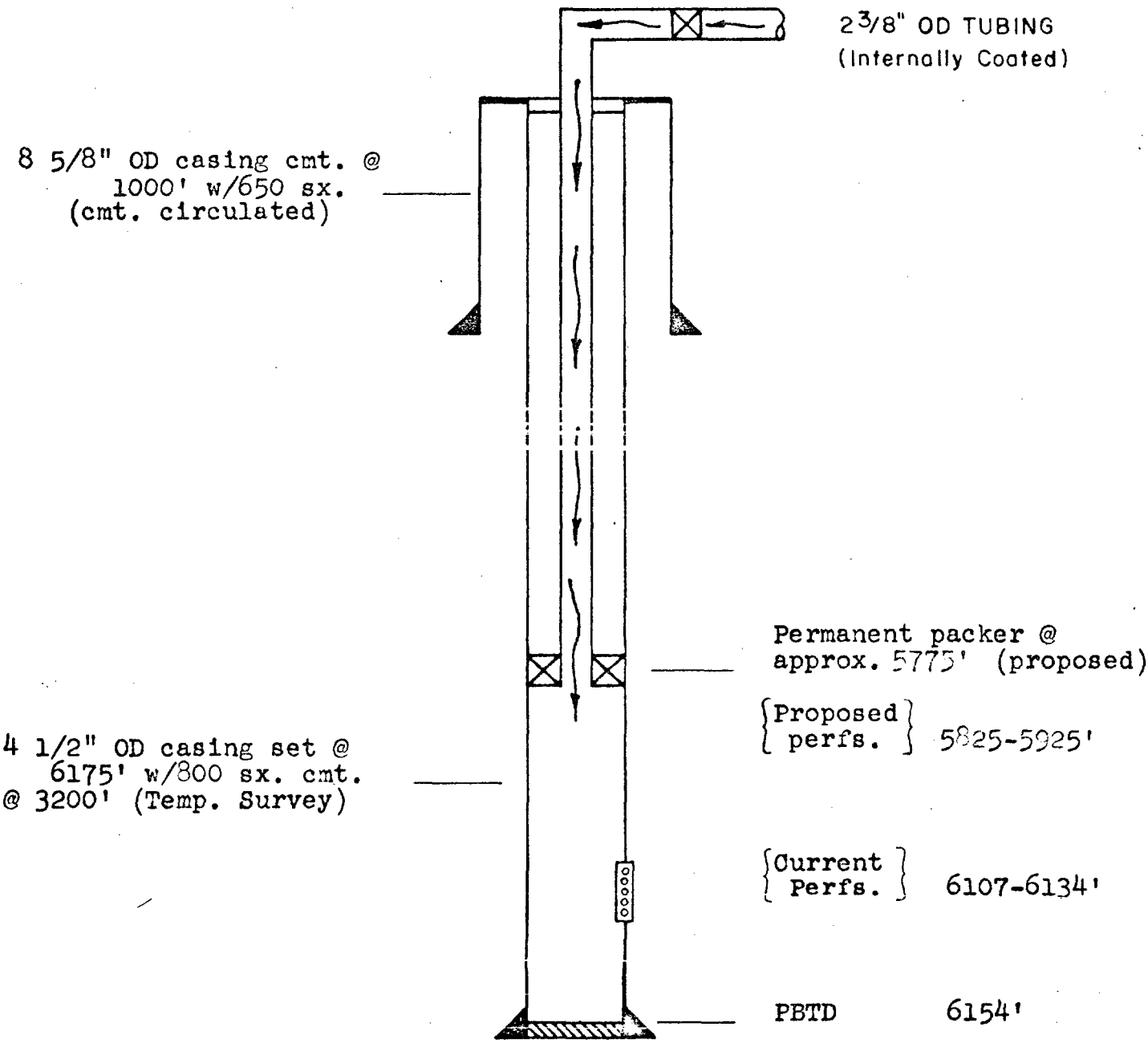
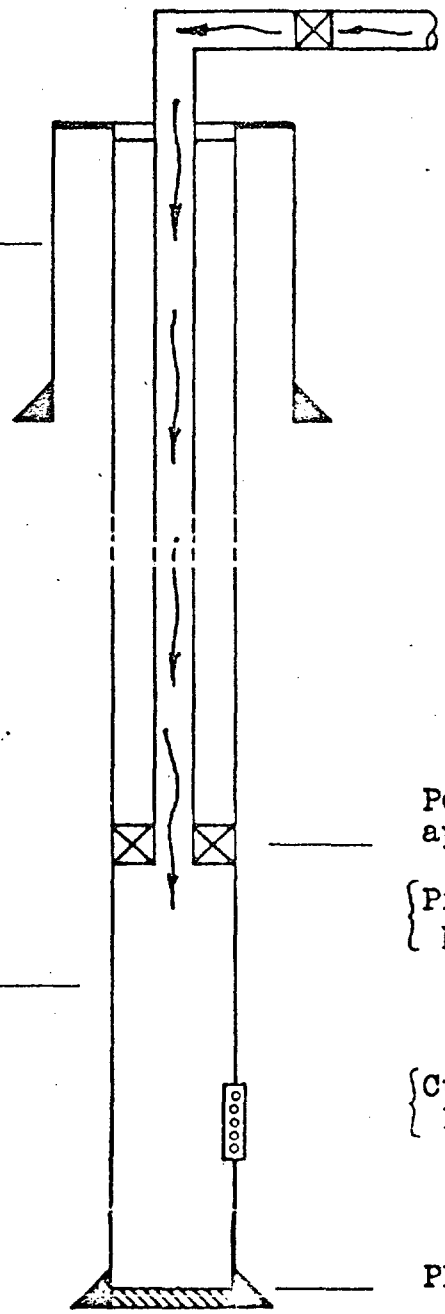


EXHIBIT NO. _____

ATLANTIC RICHFIELD COMPANY
M. Yates "B" (ARC) Well No. 8
1980' FNL & 2130' FEL SEC. 33, T-17-S, R-28-E
EDDY COUNTY, NEW MEXICO
INJECTION WELL DIAGRAM

EMPIRE ABO UNIT
PLAN OF OPERATION
EXHIBIT 4



2 3/8" OD TUBING
(Internally Coated)

8 5/8" OD casing cmt. @
1000' w/650 sx.
(cmt. circulated)

Permanent packer @
approx. 5775' (proposed)

{Proposed perfs.} 5825-5925'

4 1/2" OD casing set @
6175' w/800 sx. cmt.
@ 3200' (Temp. Survey)

{Current Perfs.} 6107-6134'

PBTD 6154'

EXHIBIT NO. _____

To: N.M.O.C.C. Dist. II (3)
P. O. Drawer DD
Artesia, New Mexico 88210
Attn: Mr. W. A. Gressett

EMPIRE ABO PRESSURE MAINTENANCE PROJECT

(N.M.O.C.C. ORDERS , .)

ATLANTIC RICHFIELD COMPANY - OPERATOR

MONTHLY REPORT FOR March, 19 74

BEFORE EXAMINER STAMETS
OIL CONSERVATION COMMISSION
EXHIBIT NO. 7
CASE NO. 4952 & 4953
Submitted by ARCO
Hearing Date 25 April 1973

Ex. 7

PROJECT AREA: EMPIRE ABO UNIT

Total Requested Allowable for June 1974 is 3700 BOPD.

Sheet A

(1)	(2)	(3)	(4)						(5)				(6)			(7)	(8)	(9)	(10)	(11)
Empire Abo Unit			Well Test Data - Latest 24-hr.						Production-Average March 1974 Top Well Allow. BO				Injection-Average March 1974			Voidage Avail. for Trnsfr.[1]	Requested Voidage Transfer	Net Void. @ Normal Unit Allow.[2]	Requested Net Void. ((8)+(9))	Requested Oil Allowable for 6, 19
R. Well No.	Location Un. Sec. T R	Well Sta.	Date M	Date Y	Oil Bbls.	Wtr Bbls.	Gas MCF	GOR CF/B	Oil BOPD	Wtr. BWPD	Gas MCF/D	GOR CF/B	Gas MCF/D	WHInj Press. PSI	Cum. Inj. MMCF	ResvB/D	ResvB/D	ResvB/Day	See I (9) ResvB/Day	BOPD
1	J 36 17 27	Inj.	3	74	---	---	---	---	---	---	---	---	2773	1800	250	484.6	---	---	---	---
2		F	3	74	350	0	245	700	300	0	210	700					56.5	58.9	115.4	300
3		F	3	74	400	0	320	800	300	0	240	800					64.7	66.2	130.9	300
4		F	3	74	365	0	329	900	300	0	270	900					72.7	73.4	146.1	300
5		F	3	74	382	0	382	1000	300	0	300	1000					80.9	80.8	161.7	300
6		F	3	74	424	0	466	1100	348	0	383	1100					118.7	88.0	206.7	348
7		F	3	74	372	0	446	1200	284x	0	341	1200					86.3	95.3	181.6	284
8		F	3	74	325	0	228	700	284x	0	199	700					49.9	58.9	108.8	284
9		F	3	74	310	0	248	800	284x	0	227	800					57.2	66.2	123.4	284
10		F	3	74	360	0	324	900	250	0	225	900					46.8	73.4	120.2	250
11		F	3	74	250	0	250	1000	250	0	250	1000					52.5	80.8	133.3	250
12		F	3	74	250	0	275	1100	210	0	231	1100					33.1	88.0	121.1	210
13		F	3	74	150	0	180	1200	150	0	180	1200					-3.6	95.3	91.7	150

([1]See Attachment I(b) Col. (9)).
([2]See Attachment I(a) Col. (10)).
([x] = Production limited to twice N.U.A.)
([y] = Limited capacity, see Attachment I(c) Col.'s (9) & (9c).).

To: N.M.O.C.C. Dist. II (3)
P. O. Drawer DD
Artesia, New Mexico 88210
Attn: Mr. W. A. Gressett

EMPIRE ABO PRESSURE MAINTENANCE PROJECT

(N.M.O.C.C. ORDERS , .)

ATLANTIC RICHFIELD COMPANY - OPERATOR

MONTHLY REPORT FOR March , 19 74

PROJECT AREA: EMPIRE ABO UNIT

Total Requested Allowable for June 1974 is 3700 BOPD.

Sheet A

(1)	(2)	(3)	(4)						(5)				(6)			(7)	(8)	(9)	(10)	(11)
Empire Abo Unit			Well Test Data - Latest 24-hr.						Production-Average March 1974 Top Well Allow. BO				Injection-Average March 1974			Voidage Avail. for Trnsfr.[1]	Requested Voidage Transfer	Net Void. @ Normal Unit Allow.[2]	Requested Net Void. ((8)+(9)) See I (9)	Requested Oil Allowable for 6 ,19 74
Well No.	Location Un. Sec. T R	Well Sta.	Date M	Date Y	Oil Bbls.	Wtr Bbls.	Gas MCF	GOR CF/B	Oil BOPD	Wtr. BWPD	Gas MCF/D	GOR CF/B	Gas MCF/D	WHInj Press. PSI	Cum. Inj. MMCF	ResvB/D	ResvB/D	ResvB/Day	ResvB/Day	BOPD
14		P	3	74	150	100	180	1200	150	100	180	1200					96.4	95.3	191.7	150
15		P	3	74	150	75	105	700	150	75	105	700					69.3	58.9	128.2	150
16		F	3	74	100	35	500	5000	100	35	500	5000					0	288.1y	288.1	100
17		F	3	74	40	0	120	3000	40	0	120	3000					0	54.8y	54.8	40
18		SI	3	74	14	2	42	3000	---	---	---	---				479.4				---
19		SI	3	74	5	1	70	14000	---	---	---	---				477.9				---
20		SI	3	74	158	0	553	3500	---	---	---	---				480.3				---
TOTALS:									3700	210	3961	1071	2773		250	1922.2	881.4	1422.3	2303.7	3700

([1]See Attachment I(b) Col. (9)).
([2]See Attachment I(a) Col. (10)).
([x] = Production limited to twice N.U.A.)
([y] = Limited capacity, see Attachment I(c) Col.'s (9) & (9c).)

EMPIRE ABO PRESSURE MAINTENANCE PROJECT

Monthly Report for March, 1974

Attachment I: Allowable Calculations Based on Net Reservoir Voidage.

mpire Abo Unit	Tract No. (1)	Well No. (1)	Q_o = per well Allowbl. Prodctn. STBOPD (2)	Gi=A-6 / Gp A-5 (Fraction) (3)	(1.000-Gi)= Gp / (1.000-β)) (Fraction) (4)	Rp, from Col. A-5 (GOR) 19 MCF/BO (5)	Rpn = Equation 1a (5)x(4) MCF/BO (6)	Vr(hc) (Equation 1) (ResBbls/Day) (7)	Vr(w) (Equation 2) ((A-4)-180/20) x 1.0 (ResBbls/Day) (8)	Vrt=(7)+(8) (Equation 3) Total Res. Voidage (ResBbls/Day) (9)	Vr(hc) for ea. well @ N.U.A. of 142 BOPD (Equation 1) (ResBbls/Day) (10)
) Wells accepting transferred allowables:	1	2	300	0.700	0.300	0.700	0.210	124.4	-9	115.4	58.9
		3	300			0.800	0.240	139.9	-9	130.9	66.2
		4	300			0.900	0.270	155.1	-9	146.1	73.4
		5	300			1.000	0.300	170.7	-9	161.7	80.8
		6	348			1.100	0.330	215.7	-9	206.7	88.0
		7	284			1.200	0.360	190.6	-9	181.6	95.3
		8	284			0.700	0.210	117.8	-9	108.8	58.9
		9	284			0.800	0.240	132.4	-9	123.4	66.2
		10	250			0.900	0.270	129.2	-9	120.2	73.4
		11	250			1.000	0.300	142.3	-9	133.3	80.8
		12	210			1.100	0.330	130.1	-9	121.1	88.0
		13	150			1.200	0.360	100.7	-9	91.7	95.3
		14	150			1.200	0.360	100.7	91	191.7	95.3
		15	150			0.700	0.210	62.2	66	128.2	58.9
a)Totals:			3560	0.700	0.300			1911.8	49	1960.8	1079.4
) Wells Transfering allowables:		1	142	0	1.000	2.000*	2.000	493.6	-9	484.6	
		18	14	0	1.000	20.286*	20.286	486.4	-7	479.4	
		19	5	0	1.000	56.800*	56.800	485.9	-8	477.9	
		20	81	0	1.000	3.500*	3.500	489.3	-9	480.3	
b) Totals			242					1955.2	-33	1922.2	

c) Capacity wells, allowable calculations:											Vrt for top all. Max GOR well Ib(9), (ResB/D) (9a)	Ratio: Vrt(9a)/ Vrt(9) (Frac)z (9b)	Req.Cap.All. Col(2),or(2) (9b) BOPD (9c)
	1	16	100	0.700	0.300	5.000	1.500	262.1	26	288.1	484.6	1.682	100
		17	40	0.700	0.300	3.000	0.900	63.8	-9	54.8	484.6	8.843	40

(z Note: Capacity well allowed to produce at any rate as long as Vrt(9a)/Vrt(9) ≥ 1.0. When Vrt(9a)/Vrt(9) < 1.0, Daily Oil allowable of capacity well must be no greater than (2) x Vrt(9a)/Vrt(9) or (2) x (9b)).

Fluid Factors: (based on Previous Reservoir Pressure Survey, 1343 psi, July, 1973):
Bo, Oil Formation Volume Factor, Reservoir bbls./stock tank bbl=1.415
Bg, Gas Formation Volume Factor, Resv. bbls/thousand std cu ft =1.71
Rs, Solution gas-oil ratio, MCF/Stock tank bbl oil =0.795
Bw, Water formation volume Factor, Resv bbls/stock tank bbl =1.0

Established Constants: Qwe, Natural water encroachment stock tank bbls/day, based on Numeric model studies: = 180
Qo, Top per-well N.U.A., STBOPD = 142

Basic Voidage Equations: 1) Vr(hc) = Qo (Bo+(Rpn-Rs)Bg), Net hydrocarbon resv voidage, RvB/D; 1a.) Rpn = Rp (1.0-Gi/Gp); 2) Vrw = (Qwp-Qwe)Bw, Net resv space voided by wtr, RvB/D; 3) Vrt = Vrhc + Vrw, Total net reservoir space voided on daily basis.

* Rp = 284MCFPD/QoI(2), where 284 MCFPD is the daily gas limit, and QoI(2) is from Attach. I, Column (2).

Empire Abo Unit

Reservoir Voidage Formula:

Equation 1: $V_{rvb} = Q_o\ (B_o + (R_{pn} - R_s)\ B_g) + (Q_{wp} - Q_{we})B_w$

Where:

V_{rvb} = Reservoir voidage, bbls. per day
Q_o = Oil production rate, Stock tank bbls. per day
B_o = Oil formation volume factor(1), reservoir volumetric bbls/stock tank bbl.
R_{pn} = Net producing gas-oil ratio, MCF/S.T.B.O.

$$R_{pn} = R_p(1.0 - \frac{G_i}{G_p})$$

Where: R_p = producing gas-oil ratio, MCF/BO
G_i = daily volume of gas injected, MCF/Day
G_p = daily volume of gas produced, MCF/Day

R_s = Solution gas-oil ratio(2), MCF/STBO
B_g = Gas formation volume factor (3), RVB/MCF
Q_{wp} = Water production rate, S.T.B.W./Day
Q_{we} = Aquifer water influx rate, S.T.B.W./Day, determined from reservoir numeric model runs to be 1950 BWPD
B_w = Water formation volume factor, RVBW/STBW, use 1.0

Solving Equation 1 for daily oil rate, Q_o,

Equation 2: $$Q_o = \frac{V_{rvb} - (Q_{wp} - Q_{we})\ B_w}{(B_o + (R_{pn} - R_s)\ B_g)}$$

(1), (2), (3): These values calculated from fluid analysis data.

EMPIRE ABO UNIT AREA

Table of Fluid Properties (P Base = 15.025 P_{bp} = 2231)

Tres. = 109°F (569° R)

P_r (PSIA)	BO (RVBO/STBO)	Bg RVB/MCF	Rs (MCF/BBL)	Z
15.025	1.000	194.696	0	1.0
100	1.125	28.229	.180	.965
200	1.163	13.749	.235	.940
300	1.193	8.970	.290	.920
400	1.218	6.692	.345	.915
500	1.244	5.236	.395	.895
600	1.263	4.276	.445	.877
700	1.285	3.644	.495	.872
800	1.304	3.108	.540	.850
900	1.325	2.746	.585	.845
1000	1.344	2.437	.625	.833
1100	1.364	2.178	.675	.819
1200	1.384	1.962	.725	.805
1300	1.404	1.790	.775	.795
1400	1.425	1.649	.825	.789
1500	1.445	1.516	.875	.777
1600	1.465	1.404	.925	.768
1700	1.485	1.304	.975	.758
1800	1.505	1.220	1.025	.751
1900	1.525	1.147	1.075	.745
2000	1.548	1.053	1.125	.720
2100	1.573	1.000	1.175	.718
2200	1.597	.953	1.225	.717
2231	1.606	.939	1.250	.716

P_r = Reservoir average pressure at datum -2264' subsea, lbs/in^2 absolute.

B_o = Oil formation volume factor, reservoir volumetric bbls/stock tank bbl.

B_g = Gas formation volume factor, reservoir volumetric bbls/thousand std. cu. ft.

R_s = Solution Gas/Oil Ratio, Thousand std. cu. ft./stock tank bbls. oil.

Z = Gas Compressibility Factor.

EXHIBIT _____

4-25-73