TYPE OF REPORT – (X)	
Initial Completion	
Special	
General Survey	X

NEW MEXICO OIL CONSERVATION COMMISSION

Form C-122 Revised

RESERVOIR PRESSURE REPORT

Operator	Pool	County	Date
Cities Service Company	Empire Abo	Eddy	10-29-80

Address	Producing Formation	Oil Gradient	Water Gradient	Gas Gravity	Datum Level
Box 1919, Midland, Texas 79702	Abo	.035 psi/ft.	.475 p.s./ft.	.770	-2400

LEASE	WELL NO.	LOCATION U	S	T	R	ELEV.	OIL (O) OR GAS (G)	DATE TESTED	SHUT-IN HOURS	SHUT-IN TBG. PRESS.	BOMB TEST DATA: TEST DEPTH	B.H. TEMP. °F	BOMB TEST DATA: OBSERVED PRESS.	SONIC INSTRUMENT TEST DATA*: PROD. TEST (BBLS./DAY) OIL	WATER	LIQUID LEVEL	LIQUID GRADIENT PSI/FT.	WT. OF LIQUID COL. PSI	WT. OF GAS COL. PS.	CSG. PRESS.	PRES. AT DATU
Citgo Empire Abo Unit	109	H	35	17	27	3610	O	10-22-80	52	831	5600		1150								1191
	110	O	35	17	27	3600	O	10-22-80	50	926	5621		1095								1110
	213	P	35	17	27	3641	O	10-22-80	50	799	5701		963								967
	214	M	35	17	27	3615	O	10-22-80	51	7	5658		1163								1184
	305	C	2	18	27	3585	O	10-22-80	54	891	5601		1054								1065
	404	B	2	18	27	3591	O	10-22-80	49	0	5700		1075								1129

BEFORE EXAMINER MORROW
OIL CONSERVATION DIVISION
EXHIBIT NO. A
CASE NO. 10356 & 10357

All depths plus or minus sea level; all pressures psi; Bomb shall be calibrated frequently enough against a dead weight tester to ensure an accuracy of one per cent; gas gravity shall be determined by analysis; liquid level shall be feet above datum plane. SEE RULE 302.

* Well shall be produced at least 24 hours prior to shutting in for sonic test.

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

J. K. Brazer (Signature)

Engineering Technician (Title)

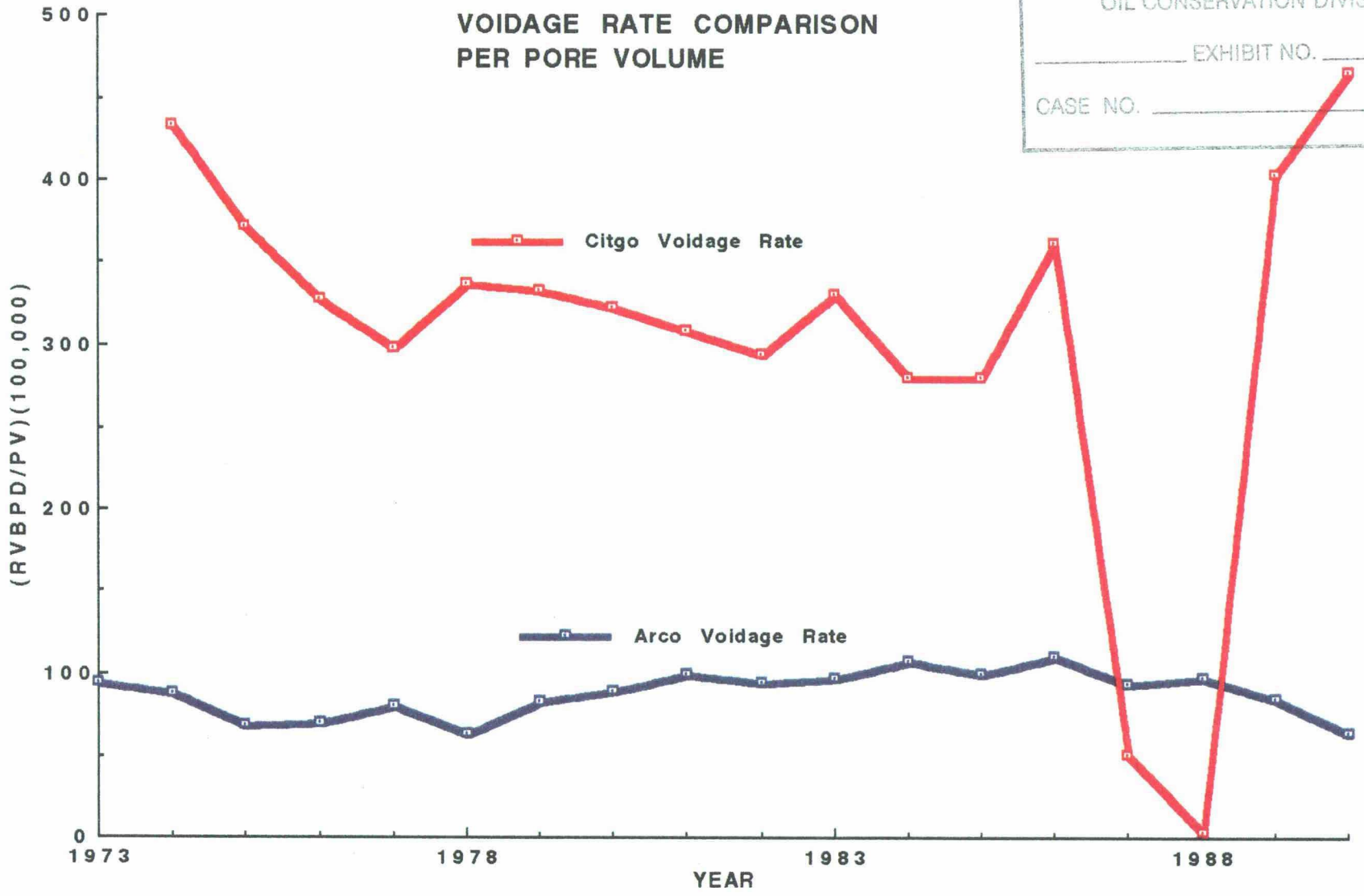
November 11, 1980

BEFORE EXAMINER MORROW

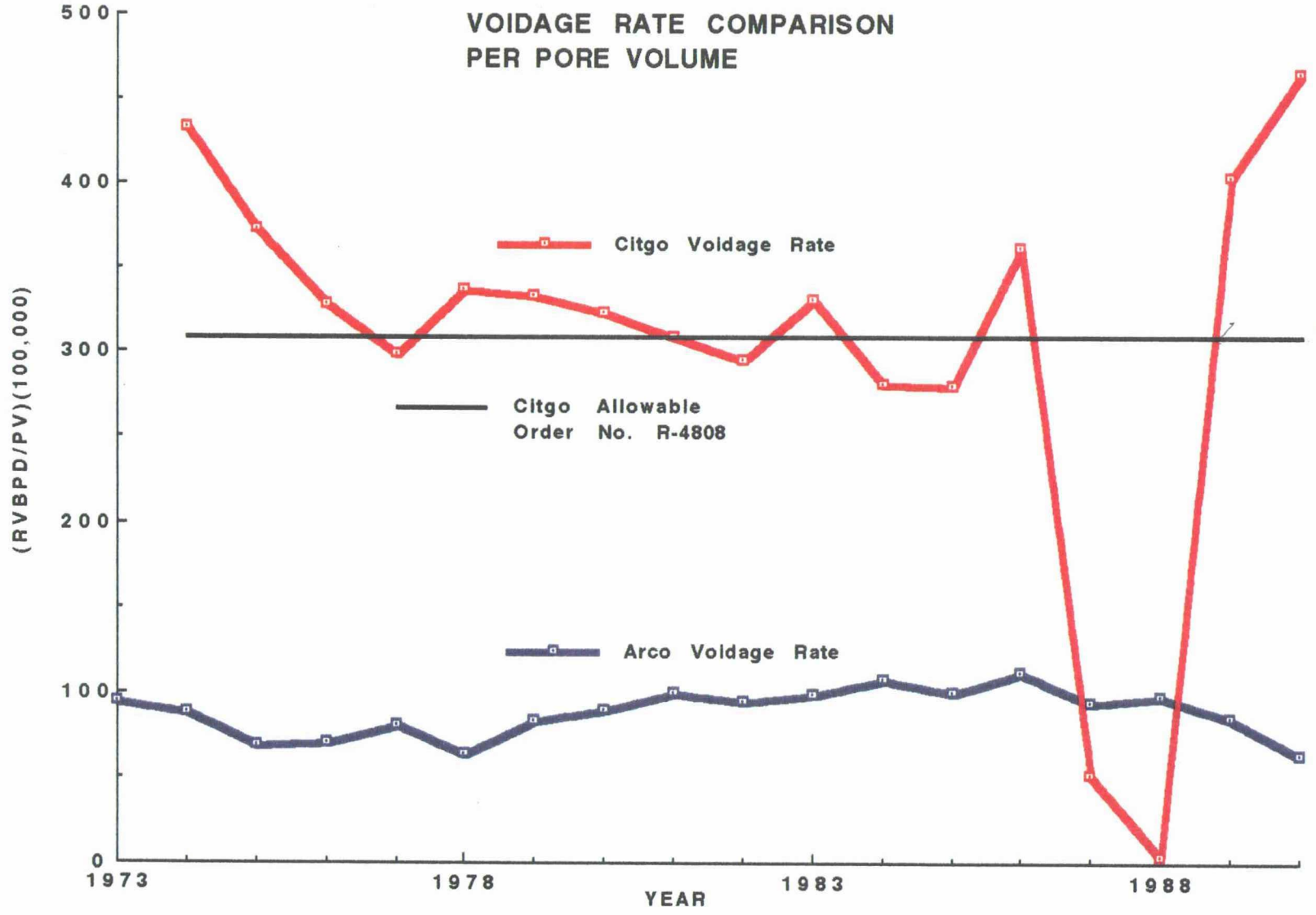
OIL CONSERVATION DIVISION

EXHIBIT NO. 1

CASE NO. _____

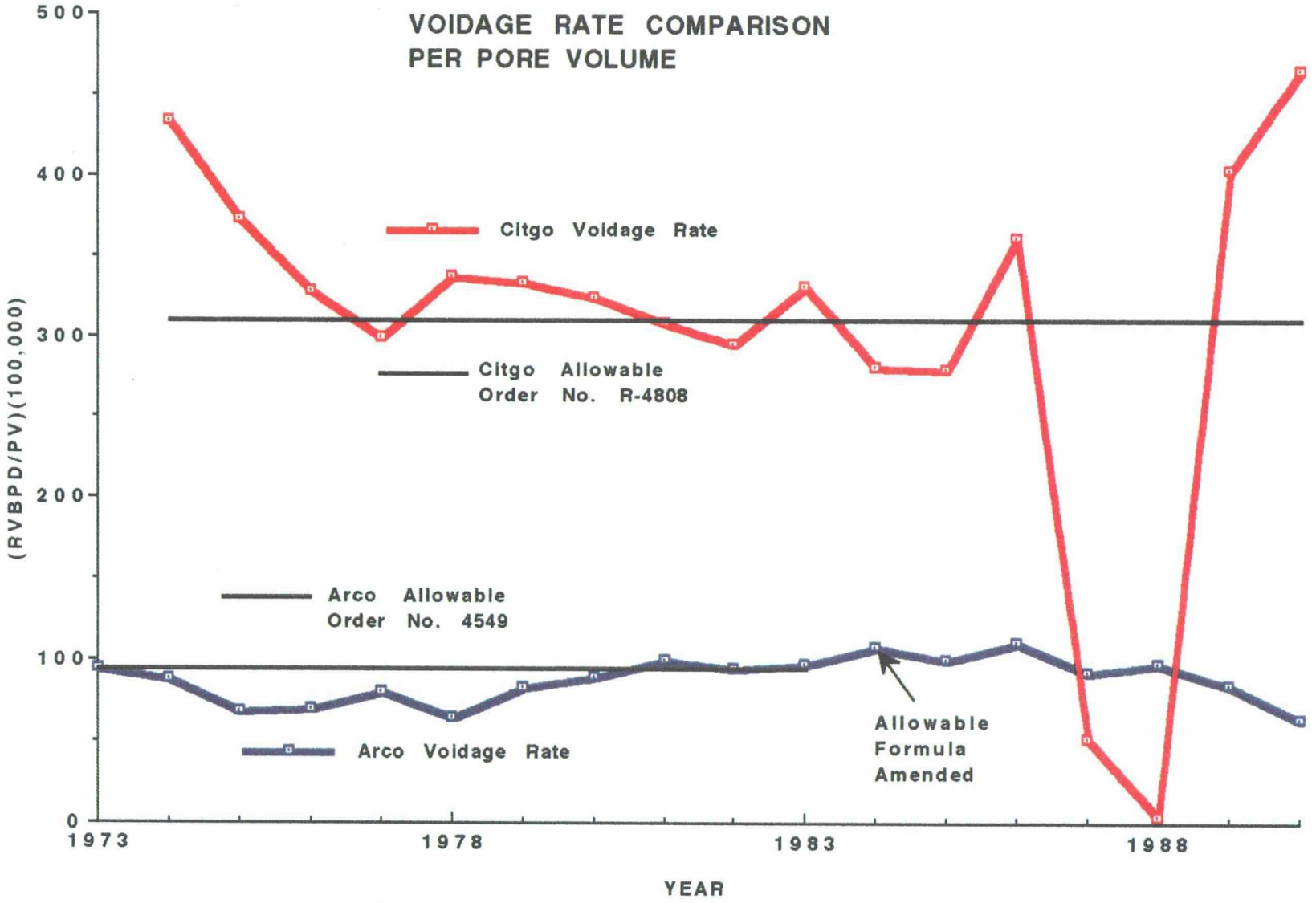


The CITGO UNIT has been voided 3.3 times faster than the ARCO UNIT


VOIDAGE RATE COMPARISON
PER PORE VOLUME
500
400
300
200
100
0
(RVBPD/PV)(100,000)
Citgo Voidage Rate
Citgo Allowable
Order No. R-4808
Arco Voidage Rate
1973
1978
1983
1988
YEAR
2213 rate.

The Citgo Unit has consistently overproduced its allowable except when it had no gas market.

The ARCO UNIT has produced within its allowable limit for the life of the unit.


VOIDAGE RATE COMPARISON
PER PORE VOLUME
500
400
300
200
100
0
(RVBPD/PV)(100,000)
Citgo Voidage Rate
Citgo Allowable
Order No. R-4808
Arco Allowable
Order No. 4549
Arco Voidage Rate
Allowable
Formula
Amended
1973
1978
1983
1988
YEAR

In 1984 the ARCO allowable was changed from a **subsurface voidage rate** to a **surface allowable**.

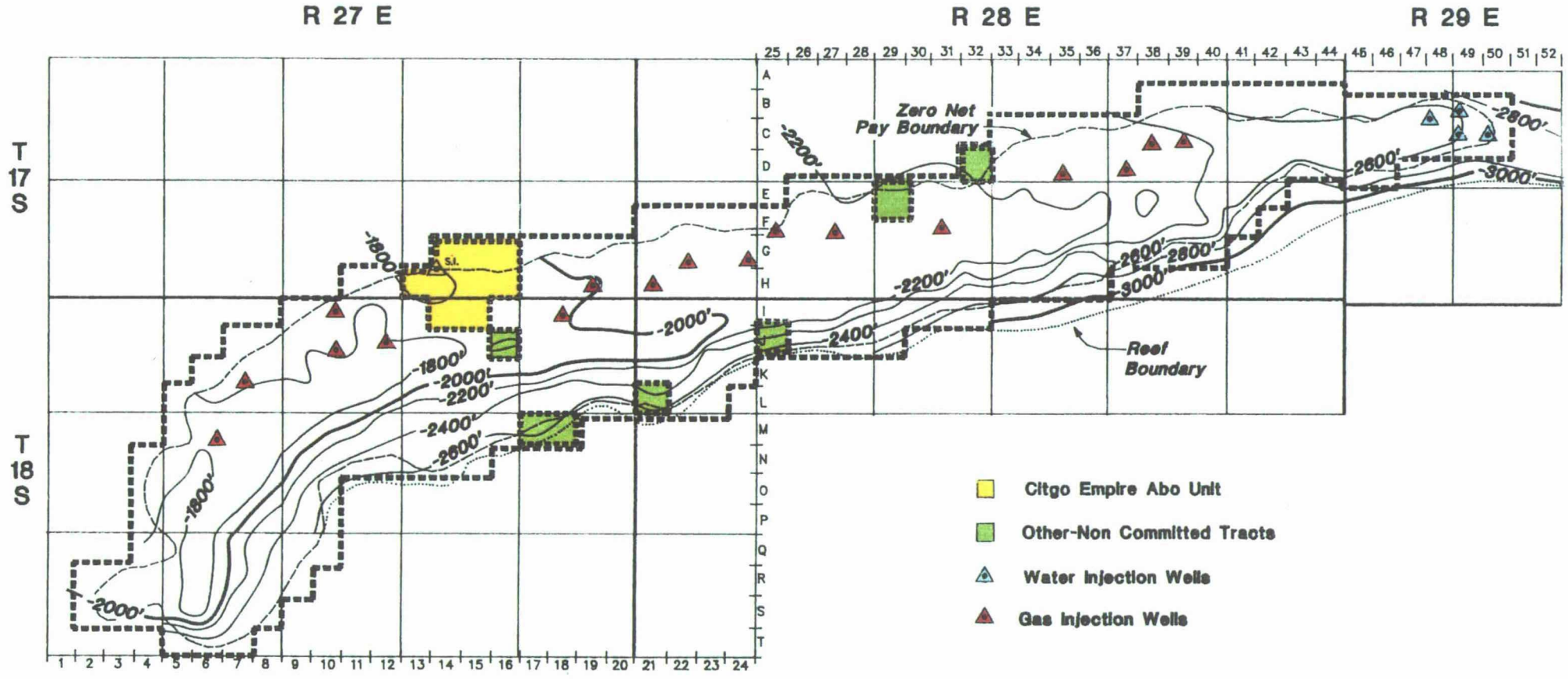
The allowable was changed because it was demonstrated with a reservoir simulation model that the units **total voidage would change only slightly** and that recovery of NGL's would be **increased by 3,300,000 barrels**.

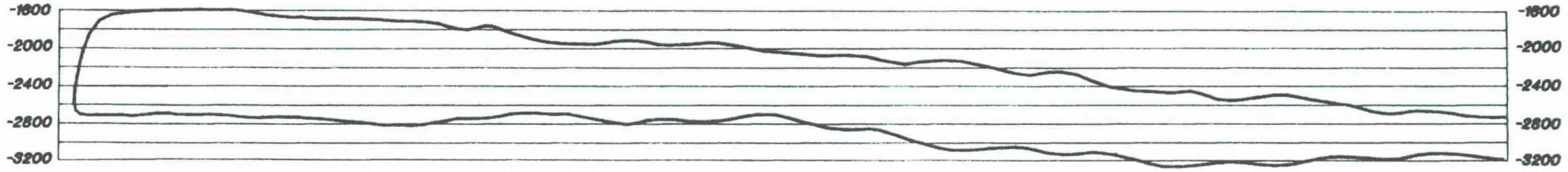
"Reinjection of all available residue gas" is **required** to receive a surface allowable of 65 MMCFPD by Order No. R-4549-F.

EMPIRE ABO POOL

Eddy County, New Mexico

Top Of Reef





West-East Front Elevation

From Order No. R-4808
Case No. 5213
June 11, 1974
Application of Cities Service for a pressure maintenance project

Rule 3. The maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage for the project area for the calendar year 1972 (2213 reservoir barrels) or 852 barrels of oil per day, whichever is less.

Rule 8. That all calculations of reservoir voidage shall be in accordance with the formula set out in Attachment "A" to this order utilizing the Table of Fluid Properties set out in Attachment "B" to this order.

To calculate reservoir voidage using Attachment A & B the following must be known:

1. Oil production
2. Gas production
3. Gas injection
4. Average reservoir pressure @ -2264' subsea

From the operators monthly Allowable Request Letters, Pressure Project Maintenance Report, Reservoir Pressure Report Form C-124 and the NMOCD Statistical Reports we have prepared on the following pages a detailed pressure history to be used for calculating voidage.

Row 1 is the year in which pressures were recorded in the NMOCD Statistical Report.

Row 2 is the subsea depth at which the pressures were reported.

Rows 3-8 are the reported pressures of the six wells in the Citgo Unit.

Row 9 is the arithmetic average pressure for the unit.

Row 10 is the porosity-feet weighted average pressure for the unit.

Row 11 is the porosity-feet weighted average reservoir pressure at the correct datum of -2264'.

Row 12 are the pressures reported by the operator in monthly allowable request letters to the NMOCD.

12

CITGO EMPIRE ABO BHP II REV

1	**YEAR**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**
2	**DATUM**	-2400	-2400	2100	-2400	-2400	-2400	-2400	-2100
3	Tract 2 Magruder A #13	1375		1160	1246	1025	1120	967	923
4	Tract 2 Magruder A #14	1213		1160	1075	1320	1328	1184	1133
5	Tract 1 Russell C #9	1079		1302	1487	1368	1272	1191	1072
6	Tract 1 Russell C #10	1198	1158	1296	1371	1034	1176	1110	1007
7	Tract 3 STate CE #5			1214	1190	1142	1171	1065	1017
8	Tract 4 Wright State #4B	1384		1173	1149	1123	1227	1129	1088
9	Arithmetic Avg.	1250	1158	1218	1253	1169	1216	1108	1040
10	Porosity-ft. Wt. Avg.	1278	1158	1204	1223	1160	1221	1111	1049
11	**Press@Res. MP -2264 SS**	**1273**	**1153**	**1219**	**1218**	**1155**	**1216**	**1099**	**1087**
12	**Press Reported by the Operator in Allowable Letters to the NMOCD**	* *	* *	**1380**	**1321**	**1321**	**1192**	**1192**	**1191**

13

CITGO EMPIRE ABO BHP II REV

1	**YEAR**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**
2	**DATUM**	-2100	-2400	-2400	-2400	-2100	-2100	-2100
3	Tract 2 Magruder A #13	895	860	841	795	739	786	
4	Tract 2 Magruder A #14	1131	1082	1047	1006	956	931	
5	Tract 1 Russell C #9	1108	1087	1036	959	941	868	
6	Tract 1 Russell C #10	1012	968	932	896	859	811	857
7	Tract 3 STate CE #5	994	942	909	865	808	800	761
8	Tract 4 Wright State #4B	1074	1026	991	953	846	892	
9	Arithmetic Avg.	1036	994.2	959.3	912.3	858.2	848	809
10	Porosity-ft Wt. Avg.	1042	999.3	965.3	921.1	858.6	858.7	787.9
11	**Press@Res. MP -2264 SS**	**1047**	**993**	**961**	**906**	**898**	**900**	**821**
12	**Press Reported by the Operator in Allowable Letters to the NMOCD**	**1191**	**1035**	**1035**	**1035**	**1035**	**1035**	**1030**

CITGO EMPIRE ABO BHP II REV

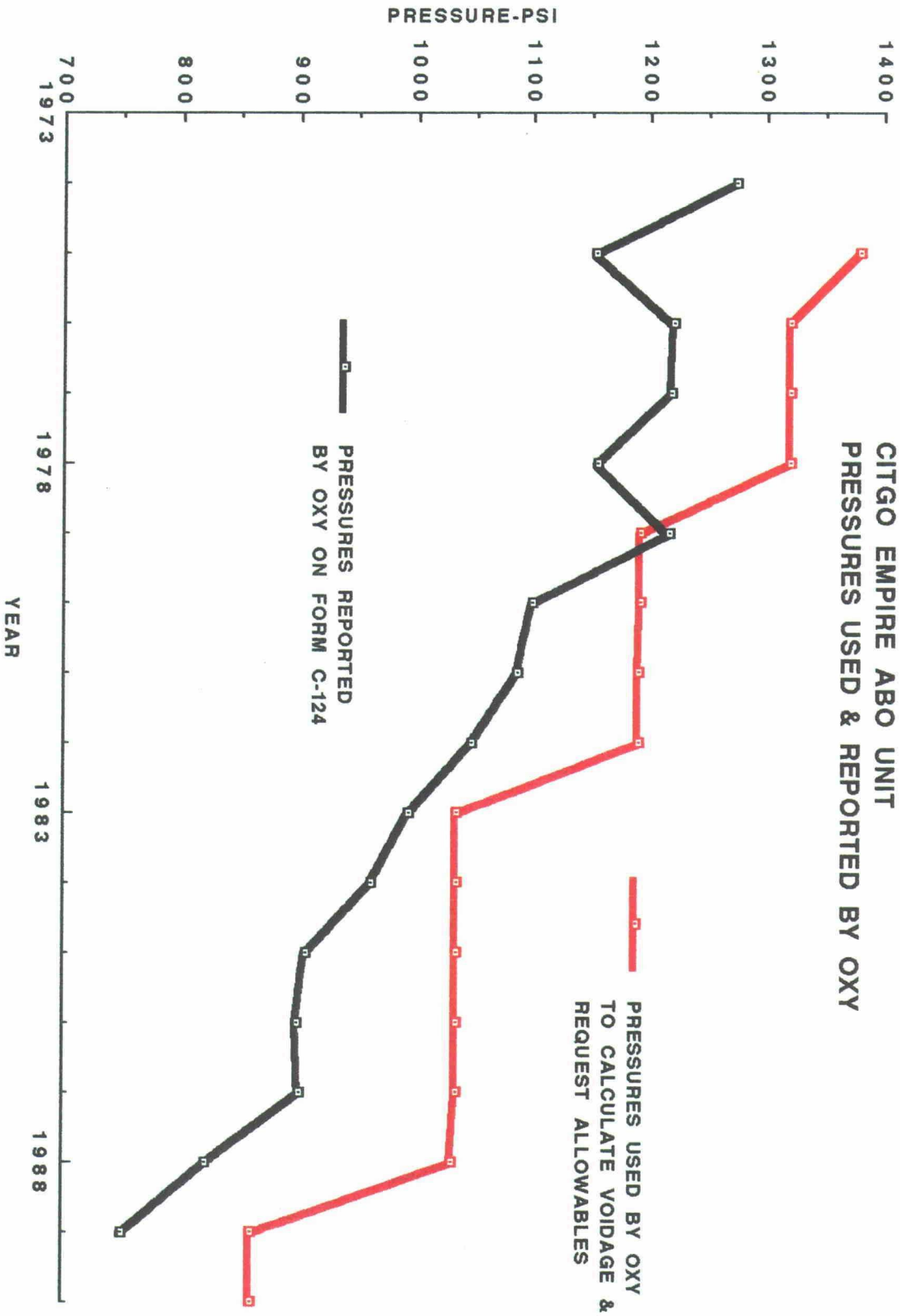
1	**YEAR**	**1989**	**1990**
2	**DATUM**	-2400	* *
3	Tract 2 Magruder A #13	762	* *
4	Tract 2 Magruder A #14	* *	* *
5	Tract 1 Russell C #9	* *	* *
6	Tract 1 Russell C #10	* *	* *
7	Tract 3 STate CE #5	739	* *
8	Tract 4 Wright State #4B	* *	* *
9	Arithmetic Avg.	751	* *
10	Porosity-ft. Wt. Avg.	756	* *
11	**Press@Res. MP -2264 SS**	**751**	* *
12	**Press Reported by the Operator in Allowable Letters to the NMOCD**	**860**	**860**

Citgo Unit Average Reservoir Pressure Summary

YEAR	PRESS. USED BY OPERATOR IN ALLOWABLE REQ.	PRESSURE FROM C-124's & STATISICAL RPTS.
1974	****	1273
1975	1380	1153
1976	1321	1219
1977	1321	1218
1978	1321	1155
1979	1192	1216
1980	1192	1099
1981	1191	1087
1982	1191	1047
1983	1035	993
1984	1035	961
1985	1035	906
1986	1035	898
1987	1035	900
1988	1030	821
1989	860	751
1990	860	****

The operator has used a higher pressure to calculate voidage in **14** of the **15** years that we can compare from the table above than what is supported by the statistical data.

Using a higher than actual pressure to calculate voidage yields voidage amounts that are lower than actual. **This enables the operator to produce more than they are entitled to by Order No. R-4808.**


CITGO EMPIRE ABO UNIT
PRESSURES USED & REPORTED BY OXY
PRESSURE-PSI
1400
1300
1200
1100
1000
900
800
700
1973
1978
1983
1988
YEAR
PRESSURES REPORTED BY OXY ON FORM C-124
PRESSURES USED BY OXY TO CALCULATE VOIDAGE & REQUEST ALLOWABLES

CITGO EMPIRE ABO UNIT AREA

Reservoir Voidage Formula - Gas Injection Credit

Equation 1: $Vrvb = Qo \quad [Bo + (Rpn - Rs)\ Bg]$

Where:

Vrvb = Reservoir voidage, bbls. per day
Qo = Oil Production rate, Stock tank bbls. per day
Bo = Oil formation volume factor (1), reservoir volumetric bbls/stock tank bbl.
Rpn = Net producing gas-oil ratio, NCF/S.T.B.O.

$$Rpn = Rp\ (1.0 - \frac{Gi}{Gp})$$

Where:

Rp = producing gas-oil ratio, MCF/BO
Gi = daily volume of gas injected MCF/Day
Gp = daily volume of gas produced, MCF/Day

Rs = Solution gas-oil ratio (2), MCF/STBO
Bg = Gas formation volume factor (3), RVB/MCF

(1), (2), (3): These values calculated from Table of Fluid Properties, Attachment "B".

CITGO EMPIRE ABO UNIT AREA

Table of Fluid Properties

P_{base} = 15.025 psia P_{bp} = 2231 psia T_{res} = 109°F (569° R)

P_r	B_o	R_s	B_g	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 absolut

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

Attachment "B"
Order No. R-4808

YV w/o RVBG w/Rev Pres

CITGO EMPIRE ABO UNIT
YEARLY VOIDAGE CALCULATIONS

		A	B	C	D	E	F
	YEAR	GAS PROD. (MCF)	GAS INJ. (MCF)	OIL PROD. (STB)	**ACTUAL YEARLY VOIDAGE (RVB)**	**YEARLY ALLOWABLE (RVB)**	** YRLY. VOID. MINUS YRLY ALL. (RVB)
1	*1974	343882	0	72865	631530	451452	180078
2	1975	1016087	486807	117151	971456	807745	163711
3	1976	1441799	1007840	94879	859737	809958	49779
4	1977	1310454	905104	66327	780269	807745	-27476
5	1978	1301134	852494	51582	879926	807745	72181
6	1979	1191601	760916	37793	870544	807745	62799
7	1980	1241728	818955	27132	846103	809958	36145
8	1981	1313541	944714	19706	805322	807745	-2423
9	1982	1279490	936239	19370	768845	807745	-38900
10	1983	1299282	930701	16857	861067	807745	53322
11	1984	1270003	973741	13801	733159	809958	-76799
12	1985	1148885	868164	9909	728584	807745	-79161
13	1986	1058923	712448	8489	943205	807745	135460
14	1987	461636	412548	5842	133481	807745	-674264
15	1988	23680	19478	838	11414	809958	-798544
16	1989	339764	0	4919	1051978	807745	244233
17	1990	360629	0	3226	1214095	807745	406350

*Production data starts at the unitization date of 6/74
**Positive values are overproduction

CITGO EMPIRE ABO UNIT
YEARLY VOIDAGE CALCULATIONS

Columns A,B & C are production data as supported by the operators letters reporting voidage to the NMOCD and by the NMOCD statistical reports.

Column D is the yearly voidage as calculated by the voidage equation of Attachment A of Order No. R-4808.

Column E is the voidage allowable from Order No. R-4808 times the number of days in the year. (2213 RVBPD)(365)=807745

Column F is the yearly voidage (Col. D) minus the yearly voidage allowable (Col. E). Overproduction is therefore positive.

Order No. R-4808 provides for a method to accumulate a gas bank during times of gas injection. The gas bank was intended to allow the unit to "maintain allowable production during times of injection compressor shut downs and similar problems". The status of the gas bank must be considered before any theoretical overage/underage calculation can be completed.

From Order No. R-4808
Case No. 5213
June 11, 1974
Application of Cities Service for a pressure maintenance project

Rule 3. The maximum daily project allowable shall be an amount of oil which will result in reservoir voidage no greater than the average daily reservoir voidage for the project area for the calendar year 1972 (2213 reservoir barrels) or 852 barrels of oil per day, whichever is less.

Rule 7. That the volume of gas required to be injected in any month to maintain average daily reservoir voidage in the project area at 2213 reservoir barrels shall be known as "Reservoir Voidage Balance Gas."

Rule 8. That all calculations of reservoir voidage shall be in accordance with the formula set out in Attachment "A" to this order utilizing the Table of Fluid Properties set out in Attachment "B" to this order.

Rule 9. A gas "bank" shall be established for the project against which injection credit may be drawn in order to maintain allowable production during such times as injection compressor shutdowns and similar problems. The gas bank shall operate under and be subject to the following provisions:

(a) That volume of gas injected in the project in any month in excess of Reservoir Voidage Balance Gas shall be credited to the gas bank and be carried cumulatively forward.

(b) The gas bank balance shall not exceed a maximum of the average monthly total Reservoir Voidage Balance Gas volumes for the previous three (3) month, not including the month being reported.

(c) The operator shall report monthly to the Commission the status of the gas bank in a form acceptable to the Commission. The report shall be designed to show the status of the gas bank over a twelve (12) month period and shall be revised monthly to a current basis.

(d) The accumulated gas bank may be applied to the injection volume during any future month in which the gas injection volume is less than the Reservoir Voidage Balance Gas volume.

(e) **In the event there are insufficient credits accrued to the gas bank to bring actual injection plus applied credits up to the Reservoir Voidage Balance Gas requirement during any given production month, production for that month shall be reduced to an amount commensurate with the average daily reservoir voidage set forth in Rule 3 above. Production beyond this amount shall be considered overproduction and shall be compensated for by underproduction during the following month.**

Rule 7 & Rule 9(a) indicate that the gas bank increases when the amount of gas injected in a month is enough to make calculated reservoir voidage less than 2213 RVBPD.

Therefore, the amount of gas that would have to be injected to maintain voidage at 2213 RVBPD must be calculated. This is called Reservoir Voidage Balance Gas by the Order. When actual gas injection is greater than Reservoir Voidage Balance Gas then the gas bank is credited and becomes larger.

When actual gas injection is less than the Reservoir Voidage Balance Gas the gas bank is debited and becomes smaller. **A negative bank status indicates the unit is overproduced and should be shut in the following month to make up overproduction as per Rule 9 (e).**

The following pages are calculations of the gas bank status and the Citgo Units theoretical overage/underage position.

24

YV w/o RVBG w/Rev Pres

CITGO EMPIRE ABO UNIT
YEARLY VOIDAGE CALCULATIONS

		A	B	C	D	E	F	G
							**	**
	YEAR	GAS PROD. (MCF)	GAS INJ. (MCF)	OIL PROD. (STB)	**ACTUAL YEARLY VOIDAGE (RVB)**	**YEARLY ALLOWABLE (RVB)**	YRLY. VOID. MINUS YRLY ALL. (RVB)	CUM O/U (RVB)
1	*1974	343882	0	72865	631530	451452	180078	180078
2	1975	1016087	486807	117151	971456	807745	163711	343789
3	1976	1441799	1007840	94879	859737	809958	49779	393568
4	1977	1310454	905104	66327	780269	807745	-27476	366092
5	1978	1301134	852494	51582	879926	807745	72181	438273
6	1979	1191601	760916	37793	870544	807745	62799	501072
7	1980	1241728	818955	27132	846103	809958	36145	537217
8	1981	1313541	944714	19706	805322	807745	-2423	534794
9	1982	1279490	936239	19370	768845	807745	-38900	495894
10	1983	1299282	930701	16857	861067	807745	53322	549216
11	1984	1270003	973741	13801	733159	809958	-76799	472417
12	1985	1148885	868164	9909	728584	807745	-79161	393256
13	1986	1058923	712448	8489	943205	807745	135460	528716
14	1987	461636	412548	5842	133481	807745	-674264	0
15	1988	23680	19478	838	11414	809958	-798544	0
16	1989	339764	0	4919	1051978	807745	244233	244233
17	1990	360629	0	3226	1214095	807745	406350	**650583**

*Production data starts at the unitization date of 6/74

**Positive values are overproduction

CITGO EMPIRE ABO UNIT
YEARLY VOIDAGE CALCULATIONS

Columns A,B & C are production data as supported by the operators letters reporting voidage to the NMOCD and by the NMOCD statistical reports.

Column D is the actual yearly voidage as calculated by the voidage equation of Attachment A of Order No. R-4808.

Column E is the voidage allowable from Order No. R-4808 times the number of days in the year. (2213 RVBPD)(365)=807745

Column F is the yearly voidage (Col. D) minus the yearly voidage allowable (Col. E). Overproduction is therefore positive.

Column G is a cumulation of column F. **Positive numbers represent overproduction. Under production does not accumulate after overage is made up in 1987 because the gas bank balance is still not positive. The gas bank would have become positive in 1988 had the unit been injecting gas.**

SUMMARY
CITGO EMPIRE ABO UNIT
VOIDAGE CALCULATIONS

There has never been a positive gas bank in the Citgo Empire Abo Unit from which overproduction could occur. Therefore, any amount produced in excess of 2213 RVBPD is overproduction.

Column F indicates that the unit has been **overproduced in 10 of the 17 years** since it was unitized.

Column G indicates that **overproduction from as far back as 1974 was not made up until 1987.** Order No. R-4808 requires that overproduction be compensated for with underproduction in the following month. Col G also shows that **as recently as 1986 the unit was overproduced by 528,716 reservoir volumetric barrels and, is overproduced by 650,583 RVB at the end of 1990.**

Citgo Prod. History/Yrly

CITGO EMPIRE ABO UNIT
PRODUCTION HISTORY

	A	B	C	D	E	F
YEAR	NP/YR BO	CUM NP BO	GP/YR MCF	CUM GP MCF	GI/YR MCF	CUM GI MCF
1959		0		0	0	0
1962	327278	327278	561233	561233	0	0
1963	148166	475444	197881	759114	0	0
1964	147946	623390	196429	955543	0	0
1965	159828	783218	210072	1165615	0	0
1966	180344	963562	266591	1432206	0	0
1967	198311	1161873	295305	1727511	0	0
1968	191125	1352998	332122	2059633	0	0
1969	245095	1598093	379936	2439569	0	0
1970	268000	1866093	467976	2907545	0	0
1971	278239	2144332	494085	3401630	0	0
1972	225764	2370096	488012	3889642	0	0
1973	210634	2580730	627091	4516733	0	0
1974	142525	2723255	628420	5145153	0	0
1975	117151	2840406	1016087	6161240	486807	486807
1976	94879	2935285	1441799	7603039	1007840	1494647
1977	66327	3001612	1310454	8913493	905104	2399751
1978	51582	3053194	1301134	10214627	852494	3252245
1979	37793	3090987	1191601	11406228	760916	4013161
1980	27132	3118119	1241728	12647956	818955	4832116
1981	19706	3137825	1313541	13961497	944714	5776830
1982	19370	3157195	1279490	15240987	936239	6713069
1983	16857	3174052	1299282	16540269	930701	7643770
1984	13801	3187853	1270003	17810272	973741	8617511
1985	9909	3197762	1148885	18959157	868164	9485675
1986	8489	3206251	1058923	20018080	712448	10198123
1987	5842	3212093	461636	20479716	412548	10610671
1988	838	3212931	23680	20503396	19478	10630149
1989	4919	3217850	339764	20843160	0	10630149
1990	3226	**3221076**	360629	**21203789**	0	**10630149**

Gas Recovery = 21.2 BCF - 10.6 BCF = 10.6 BCF

ORIGINAL GAS IN PLACE
CITGO EMPIRE ABO UNIT

1. Original Reservoir Pressure = 2359 psi.

2. Boi = 1.606 RVB/STB

3. Bgi = 0.933 RVB/MCF

4. Rsi = 1250 SCF/STB

5. OOIP = <u>4,449,530 STB</u> — This came from Oct 70 study — Citgo used it in their testimony!

6. OGIP = FREE GAS + SOLUTION GAS

7. FREE GAS =
   (38 Ac-Ft)(7758 Bbl/Ac.Ft) / (0.933 RVB/MCF)
   =316 MMCF

8. SOLUTION GAS = OOIP(Rsi) = (4449530 STB)(1250 SCF/STB)=
   5.562 BCF

9. **OGIP = 5.562 + .316 = 5.878 BCF** —

<u>% GAS RECOVERY</u>

1. Produced gas = 10.6 BCF

2. OGIP = 5.878 BCF

3. **% Recovery** = (10.6/5.878)(100)= **180 %**

CITGO EMPIRE ABO UNIT

CALCULATED GAS INFLUX

A	B	C	D	E	F
YEAR	AVERAGE RES. PRESS. PSI	CUM OIL PRODUCTION STB	CUM GAS PRODUCTION MCF	CUM GAS INJECTION MCF	CALCULATED CUM GAS INFLUX MCF
1959	2359	0	0	0	0
1962	1952	327,278	561,233	0	228,576
1963	1937	475,444	759,114	0	437,865
1964	1875	623,390	955,543	0	537,964
1965	1771	783,218	1,165,615	0	555,546
1966	1688	963,562	1,432,206	0	659,695
1967	1605	1,161,873	1,727,511	0	773,222
1968	1528	1,352,998	2,059,633	0	921,724
1969	1376	1,598,093	2,439,569	0	896,484
1970	1222	1,866,093	2,907,545	0	935,183
1971	1194	2,144,332	3,401,630	0	1,342,861
1972	1147	2,370,096	3,889,642	0	1,673,529
1973	1066	2,580,730	4,516,733	0	2,034,192
1974	1273	2,723,255	5,145,153	0	3,320,007
1975	1153	2,840,406	6,161,240	486,807	3,460,582
1976	1219	2,935,285	7,603,039	1,494,647	4,111,375
1977	1218	3,001,612	8,913,493	2,399,751	4,512,638
1978	1155	3,053,194	10,214,627	3,252,245	4,747,743
1979	1216	3,090,987	11,406,228	4,013,161	5,384,392
1980	1099	3,118,119	12,647,956	4,832,116	5,416,900
1981	1087	3,137,825	13,961,497	5,776,830	5,741,904
1982	1047	3,157,195	15,240,987	6,713,069	5,947,848
1983	993	3,174,052	16,540,269	7,643,770	6,143,510
1984	961	3,187,853	17,810,272	8,617,511	6,335,238
1985	906	3,197,762	18,959,157	9,485,675	6,451,887
1986	898	3,206,251	20,018,080	10,198,123	6,774,228
1987	900	3,212,093	20,479,716	10,610,671	6,829,193
1988	821	3,212,931	20,503,396	10,630,149	6,596,890
1989	751	3,217,850	20,843,160	10,630,149	6,709,195
1990	751	3,221,076	21,203,789	10,630,149	**7,069,392**

CITGO EMPIRE ABO UNIT
MATERIAL BALANCE SOLUTION

Columns A, B, C & D are a tabulation of the average reservoir pressure and cumulative production by year.

Column E is a listing of the Cumulative Gas Injection by year.

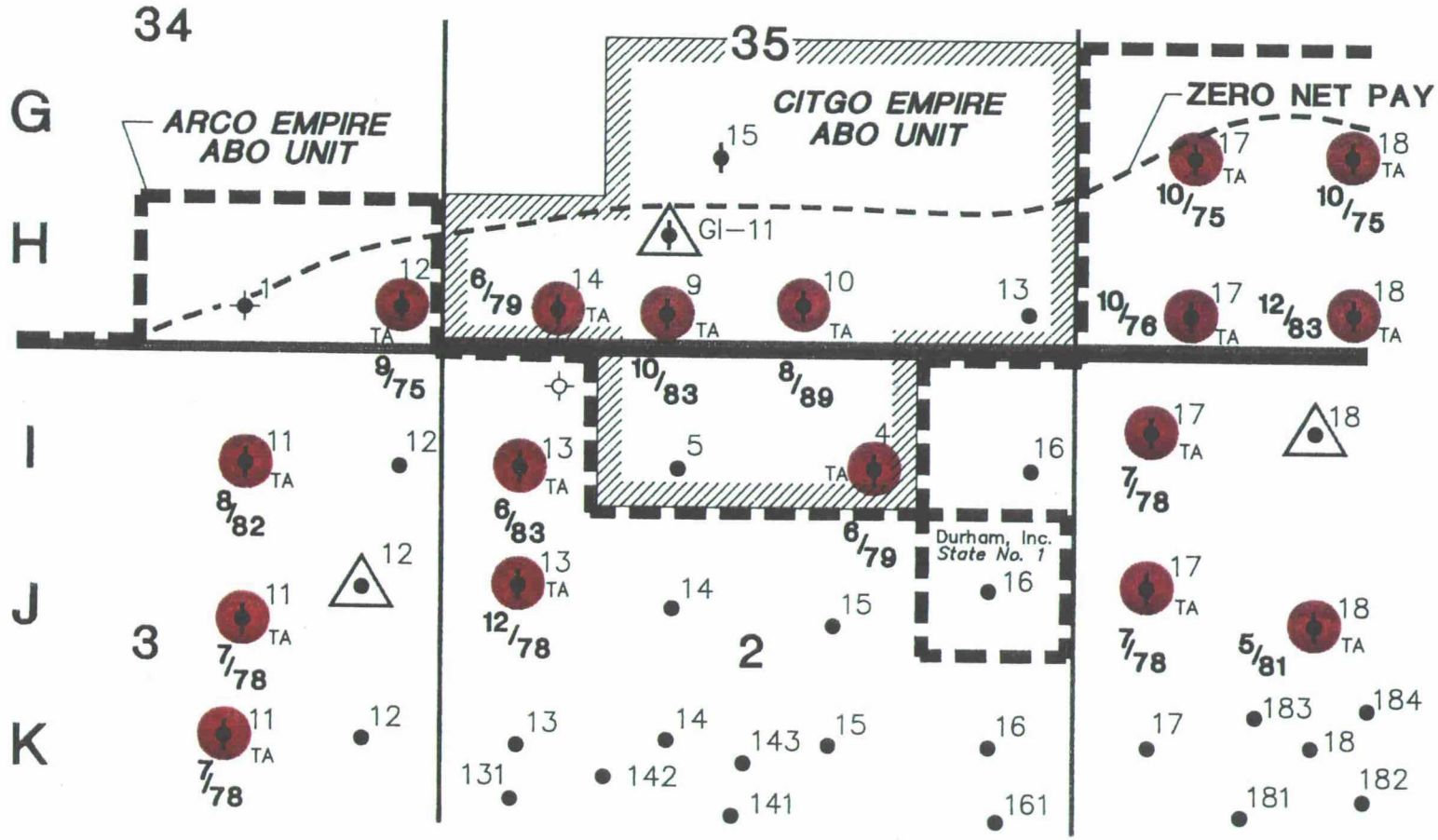
Column F is a solution to the material balance equation indicating a **total gas influx into the Citgo Unit** of **7.1 BCF** at the end of **1990**.

Notice that the near shut in condition of the Unit for 1988 caused the calculated influx to be reduced from 6.8 BCF to 6.6 BCF. Had the Unit been shut in earlier in the life of the reservoir, when reservoir energies were higher, the calculated influx would have been much less.

R 27 E

T 17 S

T 18 S



L E G E N D

- PLUGGED ABANDONED
- INACTIVE GAS INJECTOR
- GAS INJECTOR
- PRODUCER
- TA TEMPORARY ABONDONED

ARCO Oil and Gas Company
Division of AtlanticRichfieldCompany
Central District Midland, Texas

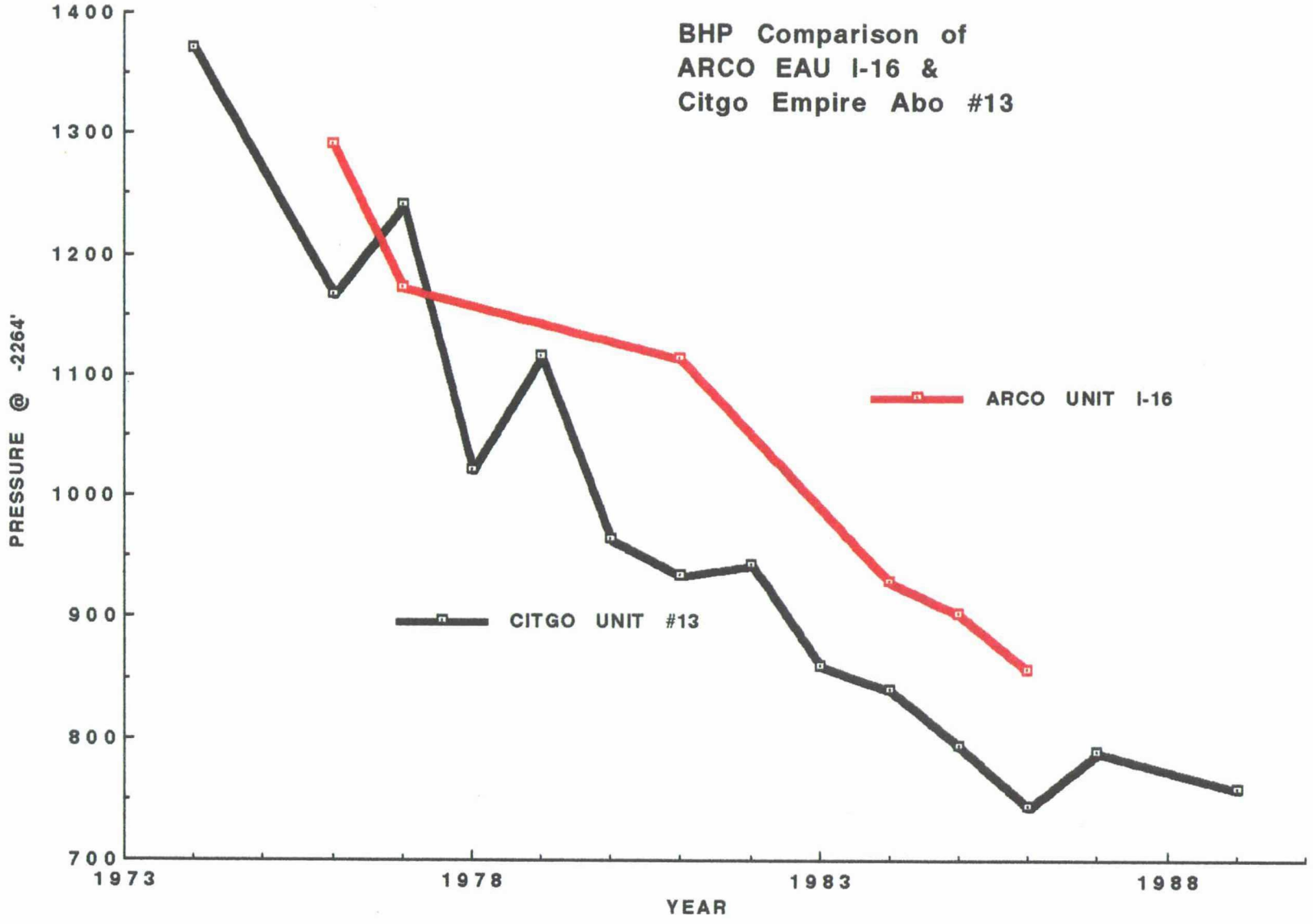
EMPIRE ABO FIELD

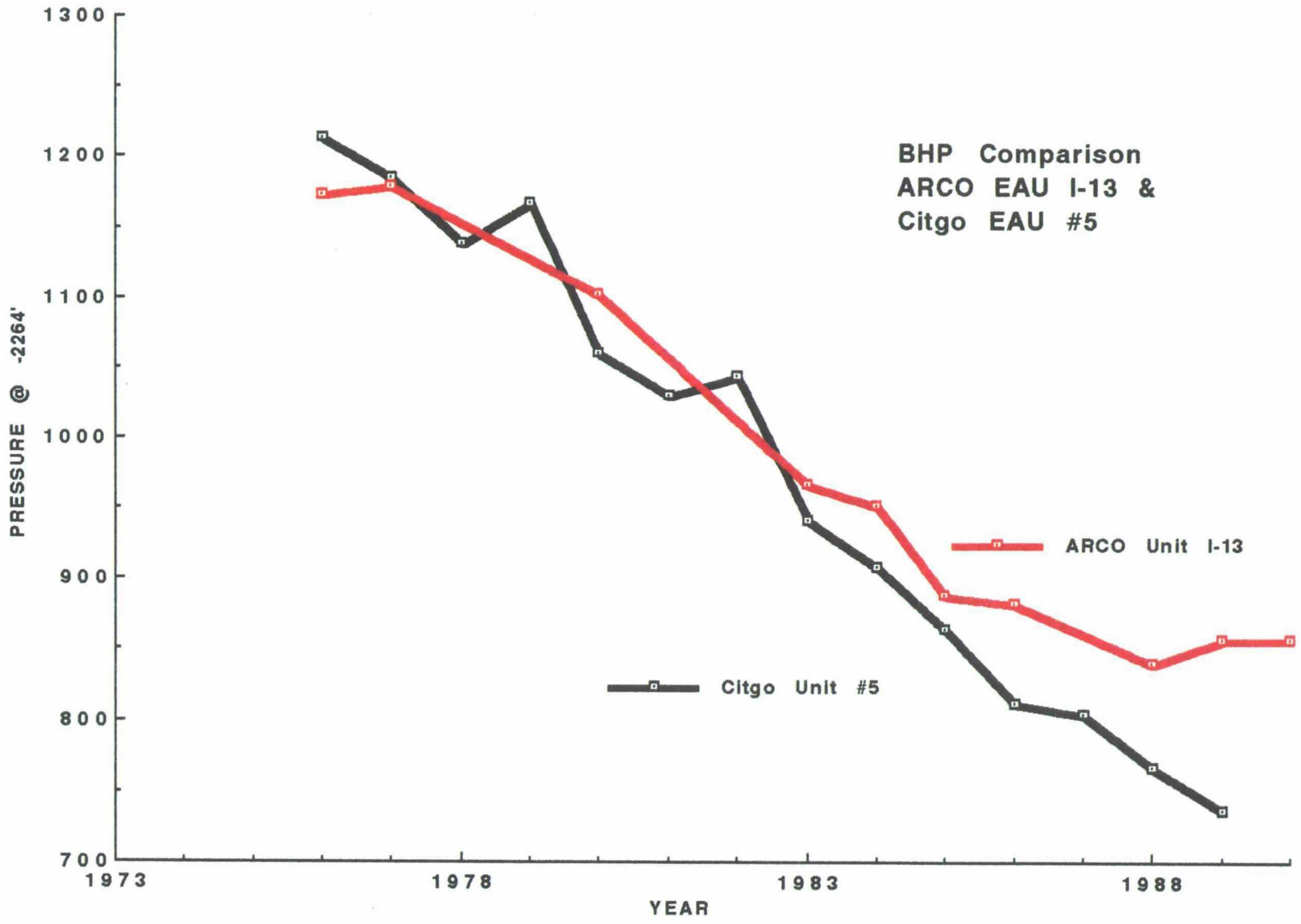
Eddy Co., New Mexico

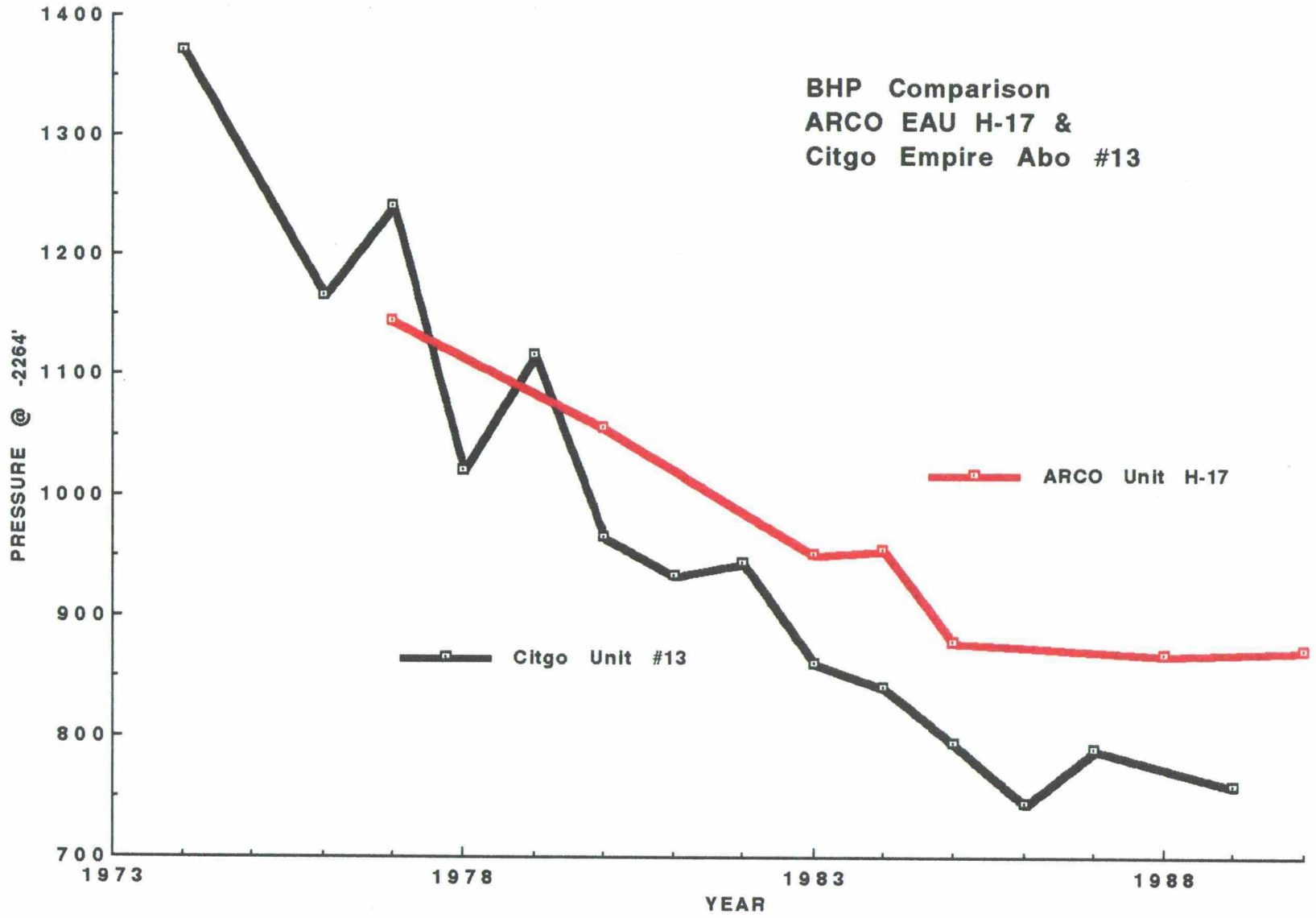
SHUT IN DATES

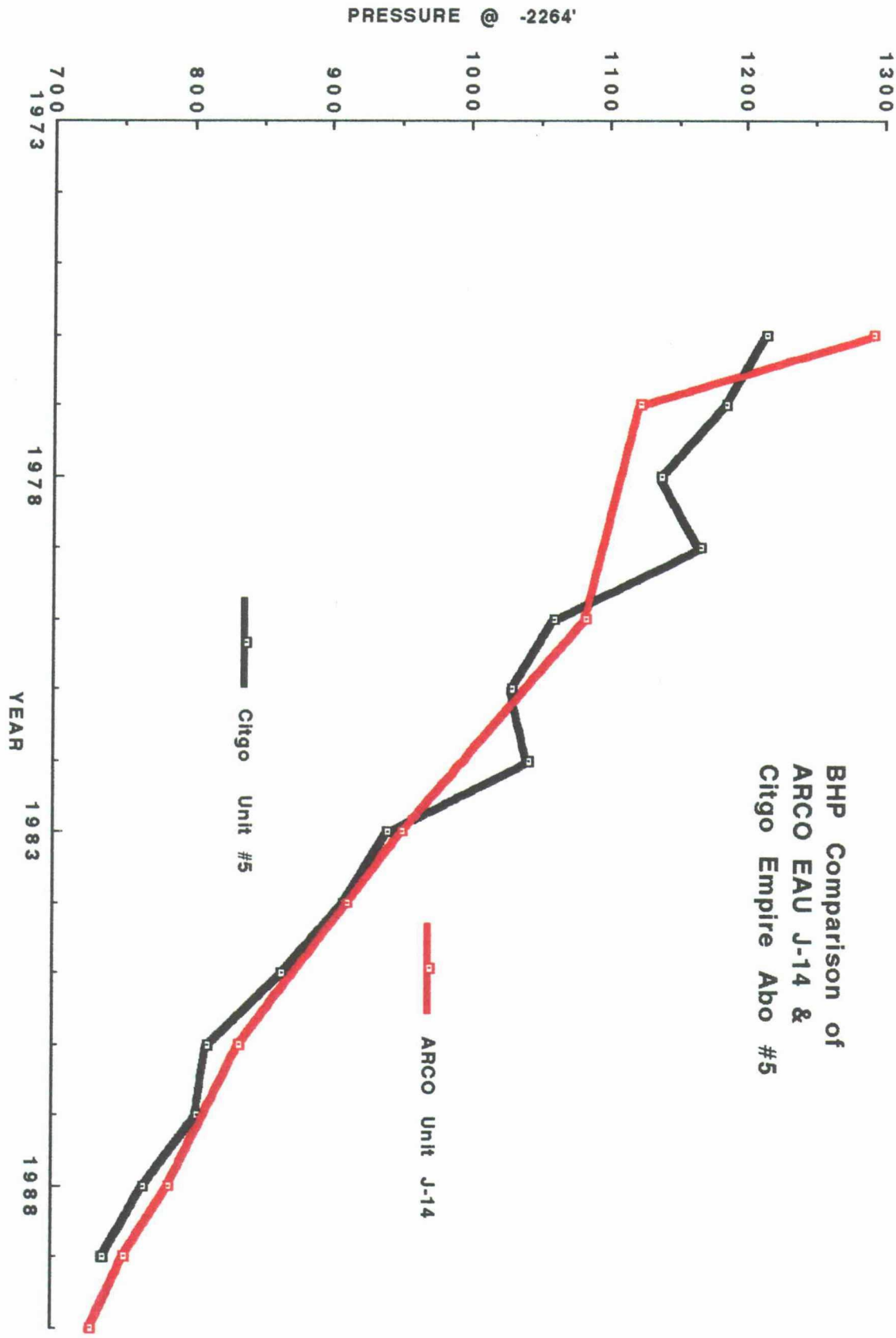
Scale 1"=1500'

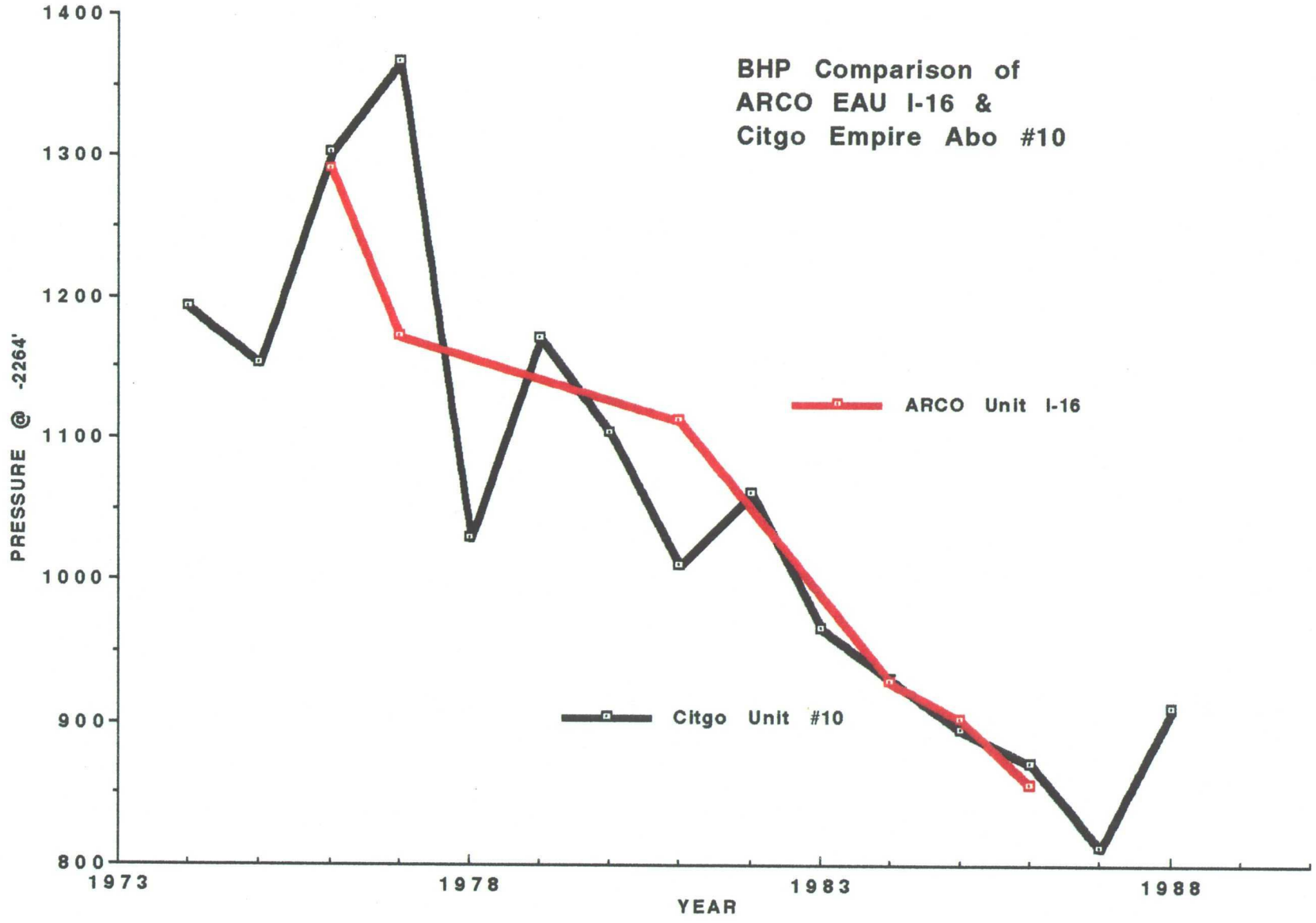
By: G. SMALLWOOD	Drawn By:	Date: 4/90
Date: 4/90	Revised By:	Date: 5/91
Dept: ROCKY MT./N.MEX. AREA	Dwg No. CITGOUT NMPLT01	


BHP Comparison of
ARCO EAU I-16 &
Citgo Empire Abo #13
ARCO UNIT I-16
CITGO UNIT #13
PRESSURE @ -2264'
1400
1300
1200
1100
1000
900
800
700
1973
1978
1983
1988
YEAR

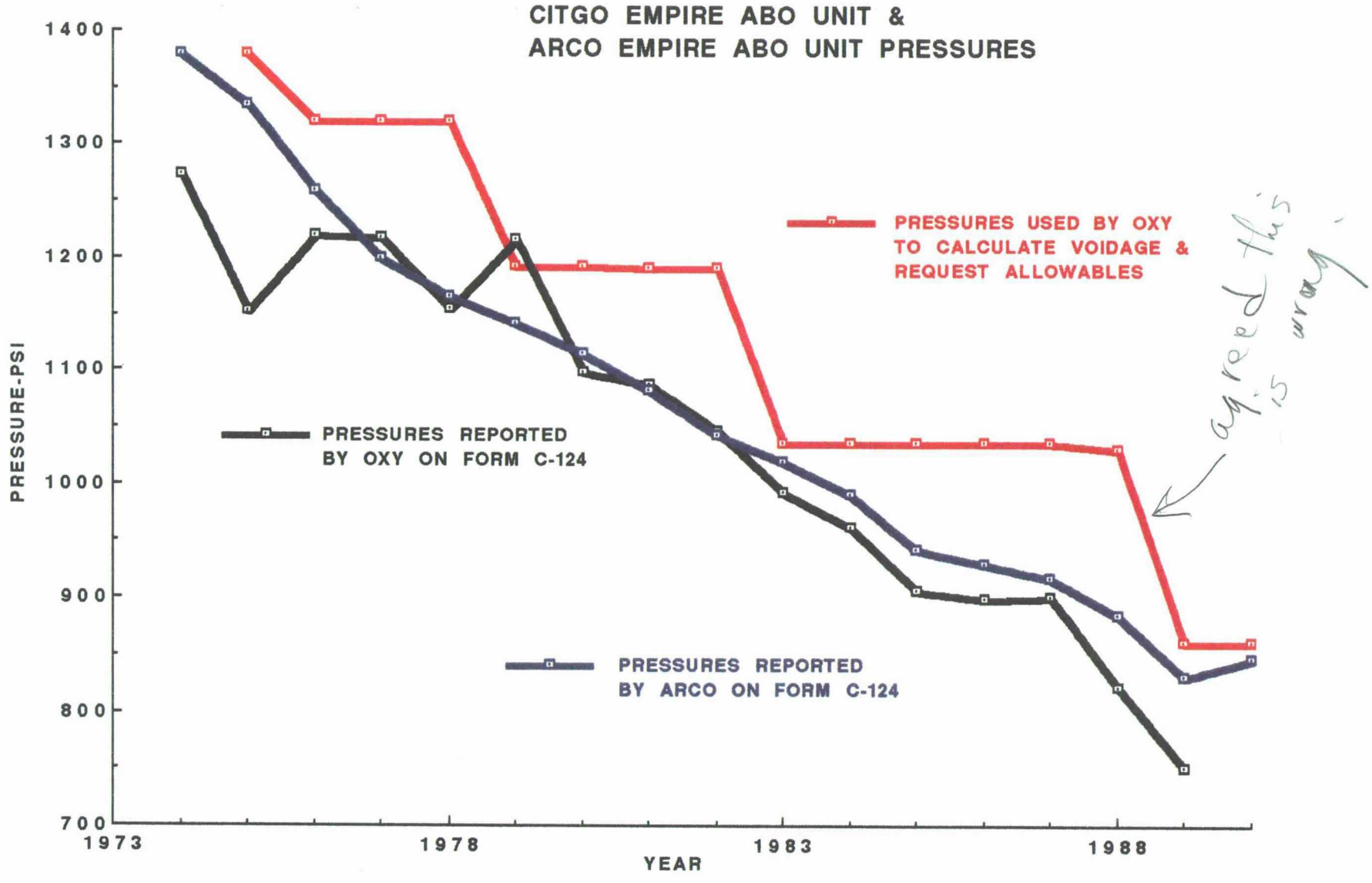

BHP Comparison
ARCO EAU I-13 &
Citgo EAU #5
ARCO Unit I-13
Citgo Unit #5
PRESSURE @ -2264'
1300
1200
1100
1000
900
800
700
1973
1978
1983
1988
YEAR

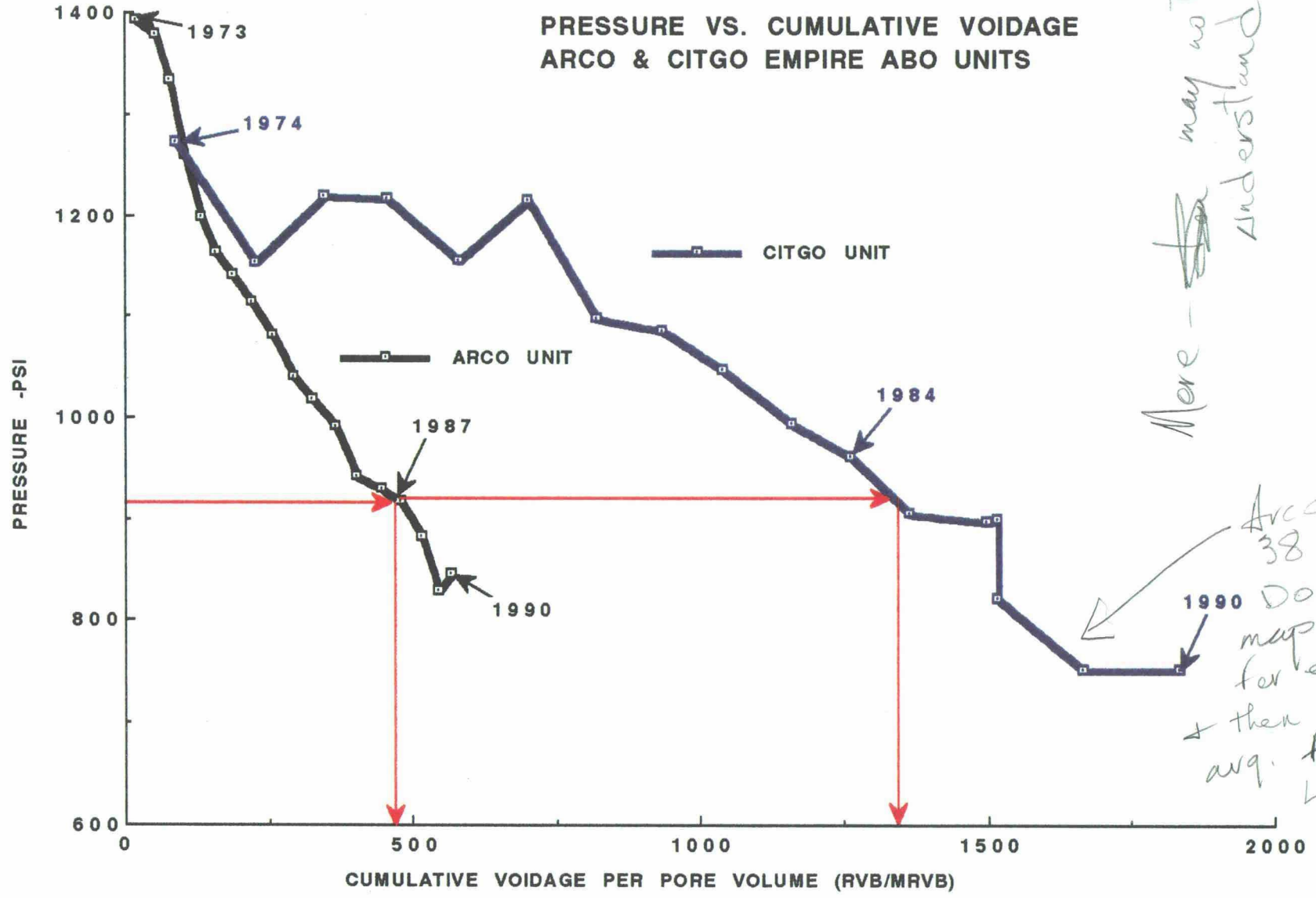

BHP Comparison
ARCO EAU H-17 &
Citgo Empire Abo #13
ARCO Unit H-17
Citgo Unit #13
PRESSURE @ -2264'
1400
1300
1200
1100
1000
900
800
700
1973
1978
1983
1988
YEAR


BHP Comparison of
ARCO EAU J-14 &
Citgo Empire Abo #5
PRESSURE @ -2264'
1300
1200
1100
1000
900
800
700
1973
1978
1983
1988
YEAR
Citgo Unit #5
ARCO Unit J-14


BHP Comparison of
ARCO EAU I-16 &
Citgo Empire Abo #10
ARCO Unit I-16
Citgo Unit #10
PRESSURE @ -2264'
YEAR
1400
1300
1200
1100
1000
900
800
1973
1978
1983
1988

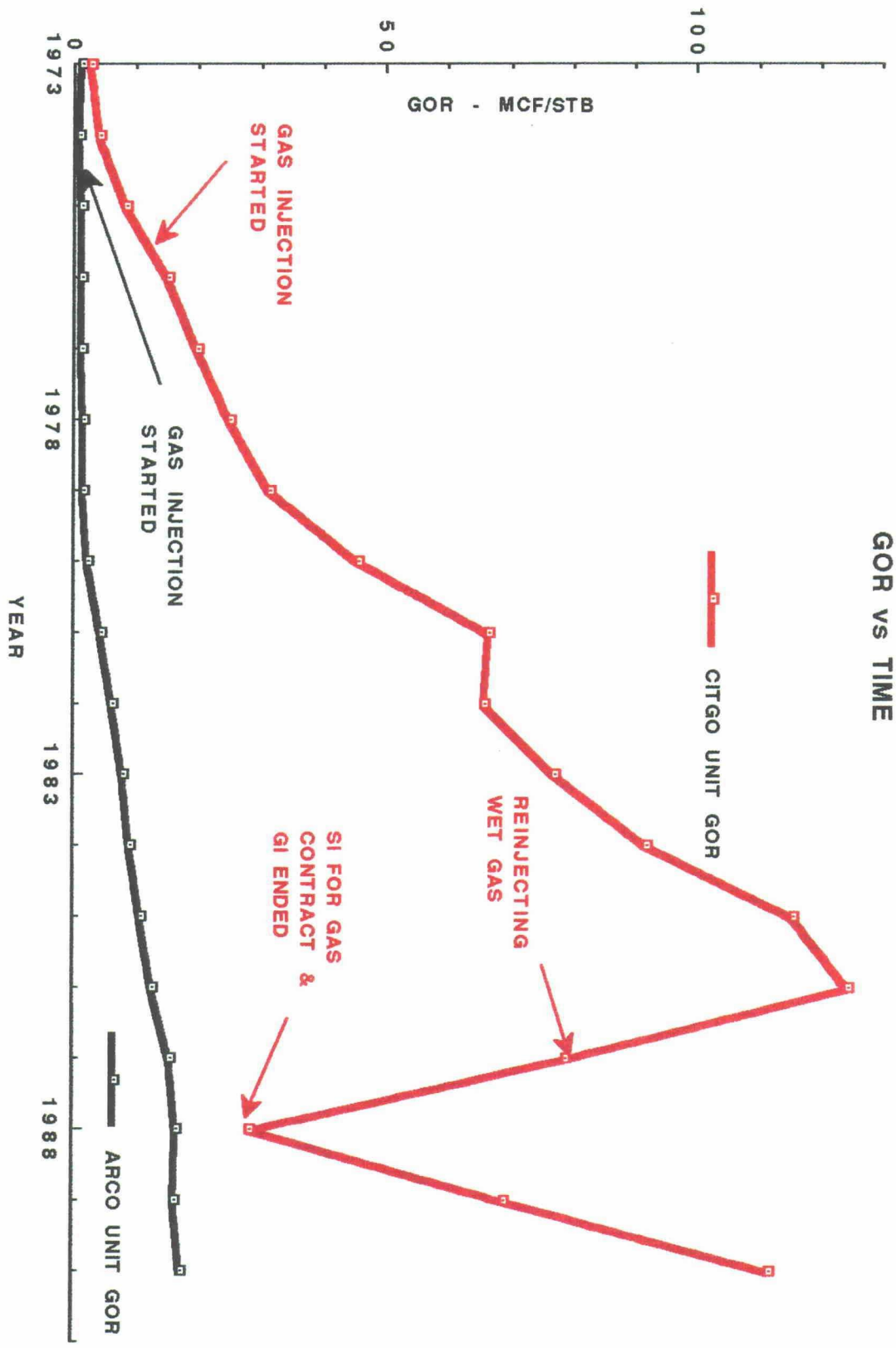
37

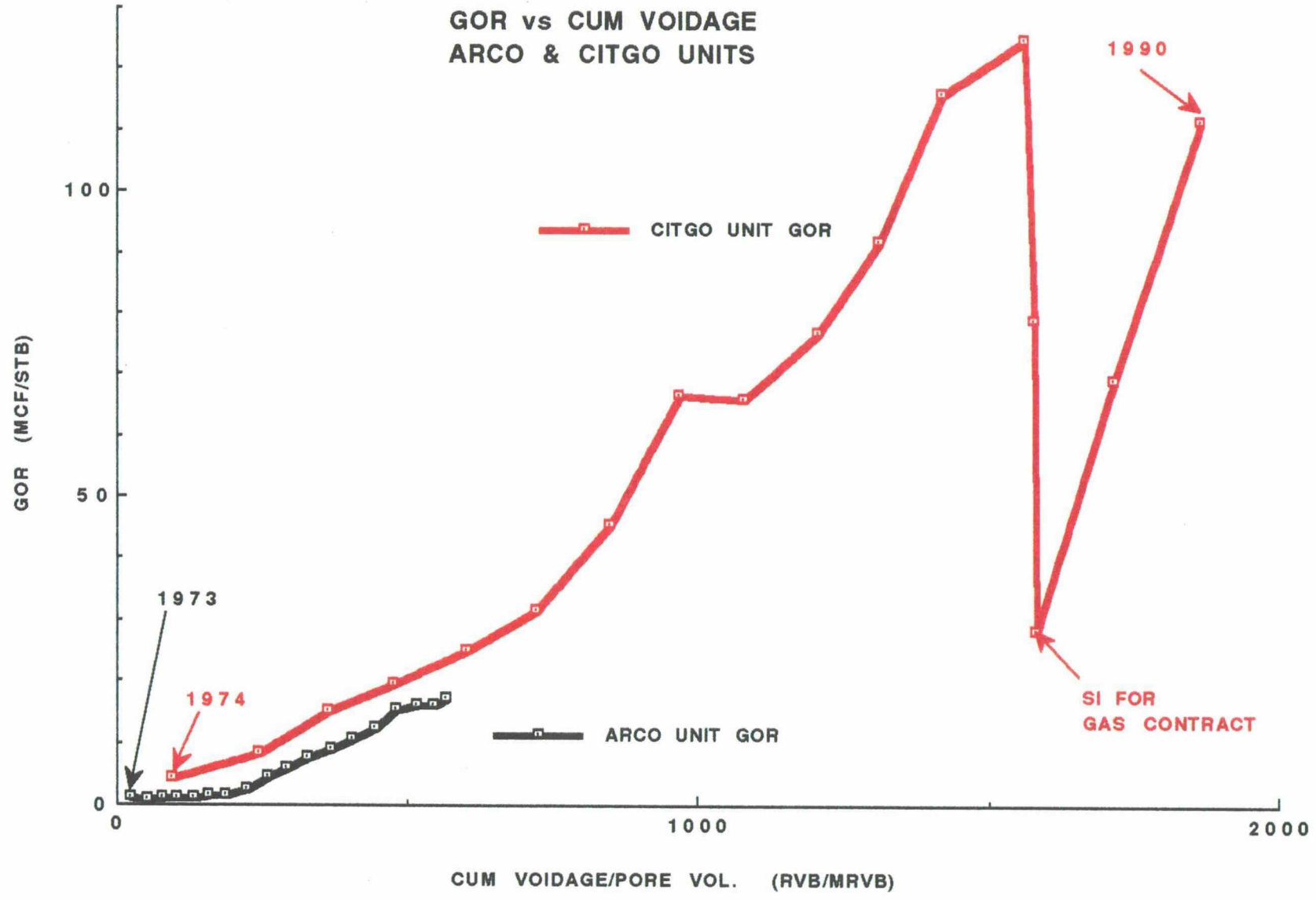

CITGO EMPIRE ABO UNIT &
ARCO EMPIRE ABO UNIT PRESSURES
PRESSURE-PSI
1400
1300
1200
1100
1000
900
800
700
1973
1978
1983
1988
YEAR
PRESSURES USED BY OXY
TO CALCULATE VOIDAGE &
REQUEST ALLOWABLES
PRESSURES REPORTED
BY OXY ON FORM C-124
PRESSURES REPORTED
BY ARCO ON FORM C-124
agreed this
is wrong



Here - I may not understand:

Arco uses 38 Key wells. Do an isobaric map. Pick pres for each well & then a weighted avg. for Arco Unit.


GOR vs TIME
CITGO UNIT GOR
ARCO UNIT GOR
GOR - MCF/STB
0
50
100
1973
1978
1983
1988
YEAR
GAS INJECTION STARTED
GAS INJECTION STARTED
REINJECTING WET GAS
SI FOR GAS CONTRACT & GI ENDED

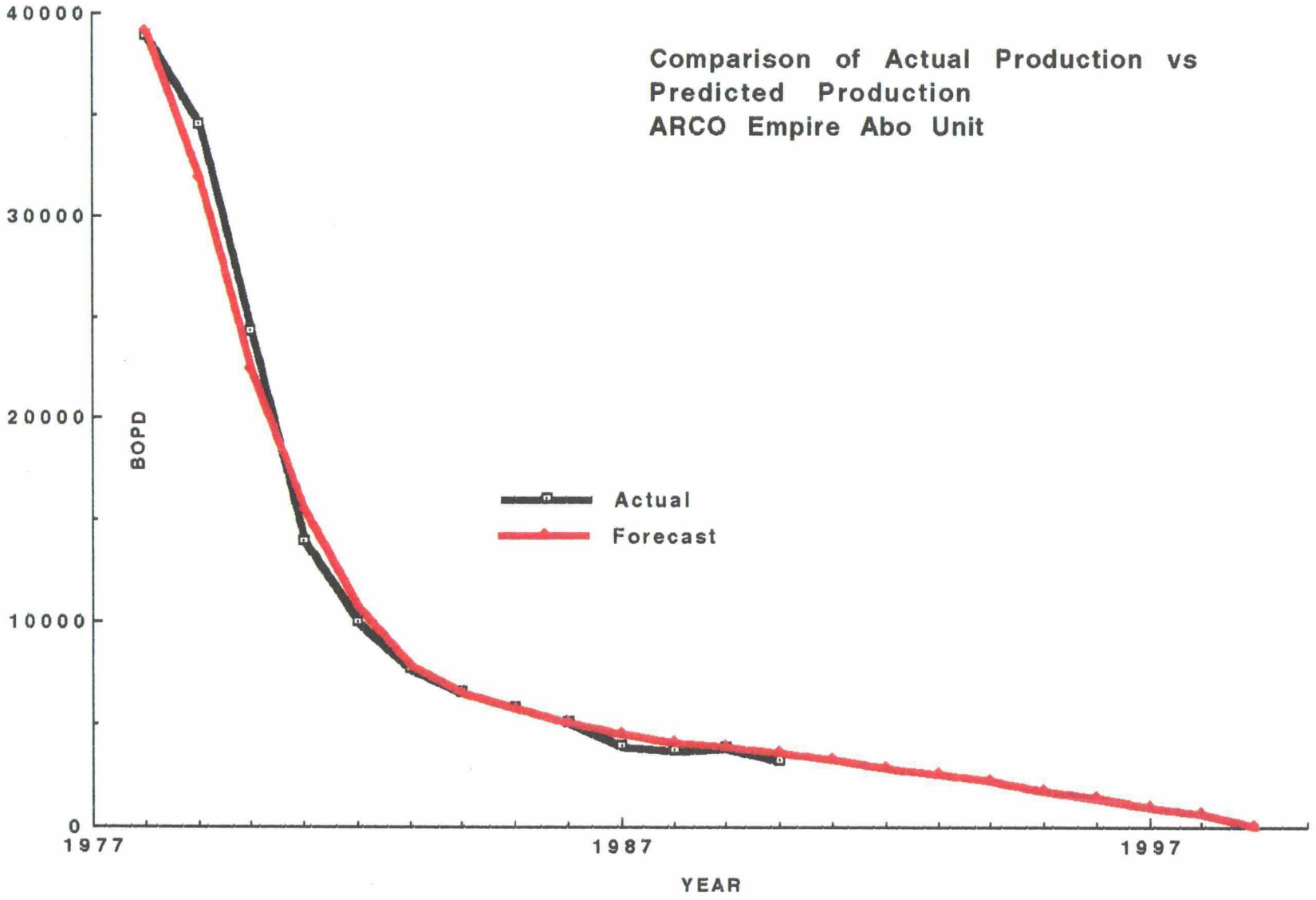

GOR vs CUM VOIDAGE
ARCO & CITGO UNITS
1990
CITGO UNIT GOR
100
50
0
GOR (MCF/STB)
1973
1974
ARCO UNIT GOR
SI FOR
GAS CONTRACT
0
1000
2000
CUM VOIDAGE/PORE VOL. (RVB/MRVB)

EMPIRE ABO POOL
Eddy County, New Mexico
Comparison of CITGO and ARCO Operated Units

		CITGO	ARCO
1.	OPERATOR	CITGO	ARCO
2.	Original Oil in Place, MMSTB	4.45	374
3.	Oil Filled Pore Volume, MMRVB	7.15	600.7
4. *	Hydrocarbon Pore Volume, MMRVB	7.15	600.7
5.	**Gas Recovery % OGIP**	**180 %**	**36 %**
6.	**Oil Recovery % OOIP**	**72 %**	**56 %**
7.	1990 Voidage MMRVB	1.044	13.77

In 1990 the Citgo Unit was drained 6.37 times faster than the Arco Unit. The cumulative average is 3.3 times as fast.

* The initial pore volume occupied by free gas is so small that it takes more significant figures for the hydrocarbon pore volumes (line 4) to appear different than the oil filled pore volume (line 3)


Comparison of Actual Production vs
Predicted Production
ARCO Empire Abo Unit
40000
30000
20000
10000
0
BOPD
Actual
Forecast
1977
1987
1997
YEAR

RECOMMENDATION

We recommend shutting in the Citgo Unit until all overproduction is made up.

With the current surface voidage allowable of the ARCO Unit of 65 MMCFPD, which is contingent upon reinjection of all available residue gas, the estimated subsurface voidage of the ARCO Unit is 18,800,000 RVB per year.

The ARCO Unit is 84 times larger than the Citgo Unit.

We recommend an allowable for the Citgo Unit of 1/84th of the estimated ARCO voidage of 18,800,000 RVB per year or, 613 reservoir volumetric barrels per day.

Current = 2213

We recommend that Rule 3 of Order R-4808 be amended to read as follows: **"The maximum daily project allowable be an amount of oil which will result in reservoir voidage no greater than 613 reservoir volumetric barrels per day."**

No other changes are recommended for Order No. R-4808.