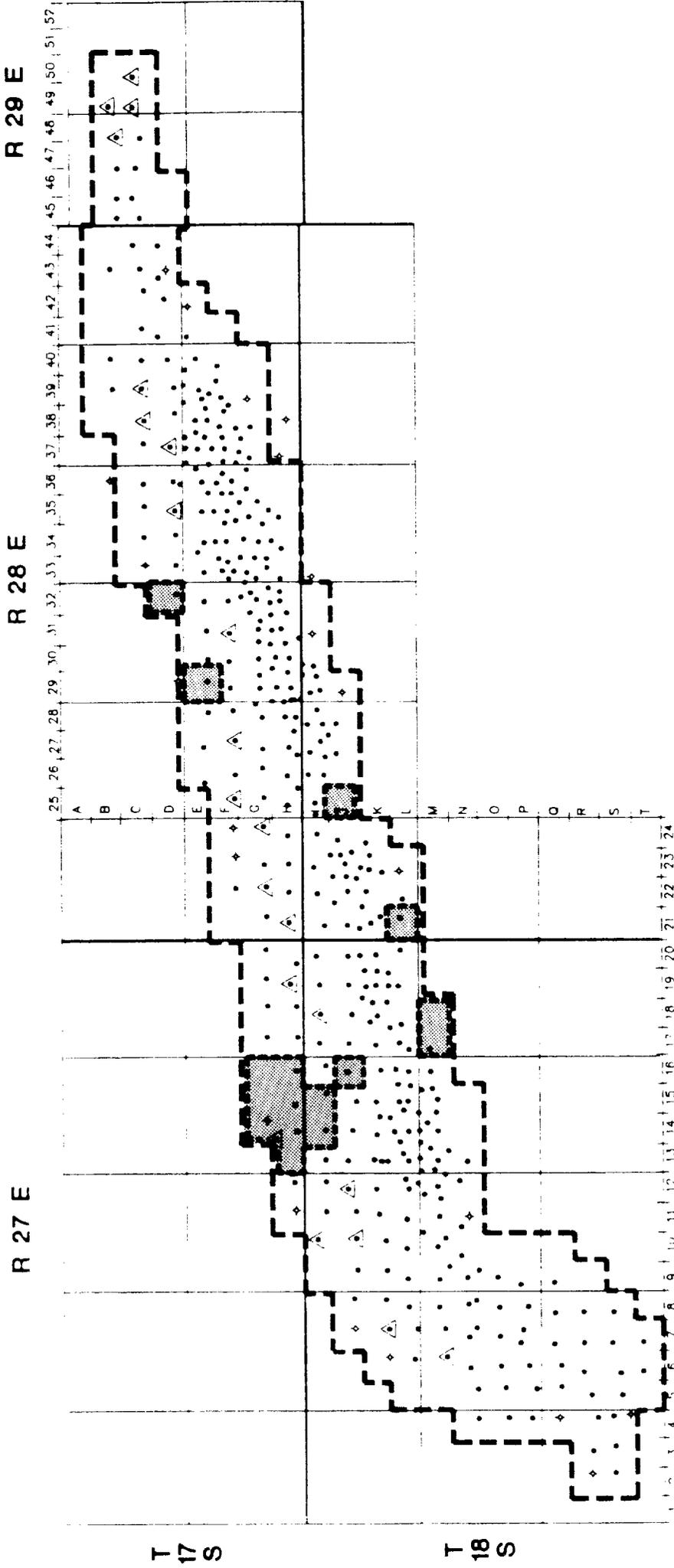


Exhibits 1 through 9  
Complete Set

# EMPIRE ABO UNIT

## Eddy County, New Mexico



BEFORE EXAMINER STUCKER  
OIL CONSERVATION DIVISION

ARCO EXHIBIT NO. 1

CASE NO. 10138

Empire Abo Unit  
Regulatory History

BEFORE EXAMINER STOGNER  
OIL CONSERVATION DIVISION

ARCO EXHIBIT NO. 2

CASE NO. 10138

<u>Order No.</u>	<u>Approval Date</u>	<u>Subject</u>
R-4548	June 15, 1973	Approval of Unit Agreement
R-4549	June 15, 1973	Established a pressure maintenance project w/ allowable of 30,000 BOPD prior to the start of gas injection and 40,192 BOPD after the reinjection of 70% of the produced gas has been achieved
R-4549-A	January 15, 1974	Committed an additional 200+ acres to the unit and increased the allowable to 33,000 BOPD for the period of time before the start of gas injection
R-4549-B	April 30, 1974	Based on addition of uncommitted lands to the unit and the reinjection of "all available residue gas" rather than 70% of the produced gas the allowable was increased to 40,555 BOPD
R-4549-C	July 1, 1975	Expanded the unit by 120+ acres and increased the allowable to 41,041 BOPD
R-4549-D	November 17, 1975	Provided for the injection of up to 35 MMCFPD of extraneous gas into the Abo formation. Allowed for the "withdrawals of extraneous gas, but pending reservoir blowdown, during not more than 30 days in any 180 day period"
R-4549-E	January 28, 1980	Allowed for the approval and drilling of horizontal drainholes
R-4549-F	April 20, 1984	Based on increased recovery of liquid hydrocarbons and the reinjection of all available residue gas the allowable was set at an amount of oil which will result in monthly average associated gas production of no more than 65 MMCFPD.
Verbal	February 7, 1989	Emergency verbal approval for Gas Company of New Mexico to take up to 10 MMCFPD of the extraneous stored gas to meet emergency needs due to the severe cold weather of Feb 7-10
Verbal	December 26, 1989	Emergency verbal approval for Gas Company of New Mexico to take up to 10 MMCFPD of the extraneous stored gas to meet emergency needs due to the severe cold weather of Dec. 22-24

ARCO Oil and Gas Company  
Central District - Hobbs Area  
P.O. Box 1710  
Hobbs, New Mexico 88240  
Telephone 505 392 3551



February 7, 1989

RECEIVED

FEB 7 1989

GAS COORDINATION  
Central District

Mr. William J. LeMay  
State of New Mexico  
Energy, Minerals and Natural Resources Department  
New Mexico Oil Conservation Division  
P.O. Box 2088  
Santa Fe, New Mexico 87504

Dear Mr. LeMay:

As per our telephone conversation on February 7, 1989, this letter is to confirm your grant of exception to Order #R4549-F, Rule 4 preventing the sale of gas from the Empire Abo Unit as discussed in said conversation.

Gas Company of New Mexico has contacted ARCO Oil and Gas Company due to the emergency demand for natural gas resulting from inclimate weather conditions currently prevailing in southeastern New Mexico. ARCO is in agreement to allow Gas Company of New Mexico to take approximately 10 MMCFGPD from the unit during this emergency situation.

Gas Company of New Mexico has a bank of gas stored in the Empire Abo Unit however, they have not injected any extraneous gas into the Abo resevoir during the last several years.

Rule 4 states that no gas may be withdrawn pending resevoir blow down except for a thirty (30) day period not exceeding the average daily rate of injection of extraneous gas during the preceeding 180 day period. Since this stipulation was not met, your approval for this exception was therefore required.

Also as per your request, Gas Company of New Mexico should be forwarding a letter to you explaining the nature of the emergency and the reason for their request.

If you should require additional information, please feel free to contact me.

Respectfully,

  
Steven D. Smith  
Sr. Area Prod. Supt.

SDS:kdw

cc: D. McGee - MIO 309  
G. Brinker - MIO  
Tommy Sanders - GCNM



February 8, 1989

Mr. Tommy H. Sanders  
Gas Company of New Mexico  
P. O. Box 26400  
Albuquerque, New Mexico 87125

Dear Mr. Sanders:

As a result of Gas Company of New Mexico's critical shortage of natural gas supplies during the week of February 7 through February 10, because of severe cold weather, ARCO Oil and Gas Company is agreeable to providing Gas Company of New Mexico a volume of gas up to a maximum of 10 MMCFD to be produced from the Empire Abo Unit recycling project. Mr. William J. LeMay, Director, with the NMOCD, gave us verbal approval for this emergency situation the morning of Tuesday, February 7.

Gas Company of New Mexico is agreeable to replace with pipeline quality gas the BTU's of gas that is delivered to Gas Company plus an additional 12% to cover all fuel, metering, pipeline and reservoir losses. Gas Company will begin reinjecting these volumes by April 1 with all gas to be replaced by June 1. Gas Company will provide this replacement volume at the inlet of the Empire Abo Unit gas injection compressors. The volume to be supplied by Gas Company on a daily basis will not exceed the volume that ARCO Oil and Gas Company feels is an acceptable volume based upon the capacity of the Unit's injection compressors.

This agreement is for a one time only situation to alleviate Gas Company of New Mexico's critical shortage of gas supply during the severe cold weather the week of February 7 through February 10.

Yours very truly,

D. E. Griffiths  
Manager - Gas Coordination

DEB/so

(2/8/89/GCNM)

c: Willima J. LeMay, Director  
New Mexico Oil Conservation Division

**ARCO Oil and Gas Company** 

Central District  
Post Office Box 1610  
Midland, Texas 79701  
Telephone 315 685 5200

December 26, 1989

Mr. Tommy H. Sanders  
Gas Company of New Mexico  
P. O. Box 26400  
Albuquerque, New Mexico 87125

Dear Mr. Sanders:

As a result of Gas Company of New Mexico's critical shortage of natural gas supplies from December 22 to 24, 1989, because of severe cold weather, ARCO Oil and Gas Company agreed to provide Gas Company of New Mexico a volume of gas up to a maximum of 10 MCFD to be produced from the Empire Abo Unit recycling project. Mr. Mike Stogner, Engineer, with the NMOCD (in Mr. LeMay's absence), gave us verbal approval for this emergency situation the morning of December 26, 1989.

Gas Company of New Mexico is agreeable to replace with pipeline quality gas the BTU's of gas that is delivered to Gas Company plus an additional 12% to cover all fuel, metering, pipeline and reservoir losses. Gas Company will begin reinjecting these volumes by April 1 with all gas to be replaced by June 1. Gas Company will provide this replacement volume at the inlet of the Empire Abo Unit gas injection compressors. The volume to be supplied by Gas Company on a daily basis will not exceed the volume that ARCO Oil and Gas Company feels is an acceptable volume based upon the capacity of the Unit's injection compressors.

This agreement is for a one time only situation to alleviate Gas Company of New Mexico's critical shortage of gas supply during the severe cold weather of December 22 to 24.

Yours very truly,



*for* D. M. Thomas  
Manager  
Central Supply and Coordination

DLS/drh

ARCO Oil and Gas Company

Central District  
Post Office Box 141  
Midland, Texas 79701  
Telephone 315-6141

JTL

- For your files

December 26, 1989

Mr. William J. LeMay  
State of New Mexico  
Energy, Minerals and Natural Resources Department  
New Mexico Oil Conservation Division  
P. O. Box 2088  
Santa Fe, New Mexico 87504

Dear Mr. LeMay:

As per my telephone conversation with Mike Stogner on December 26, 1989, this letter is to confirm your grant of exception to Order #R4549-F, Rule 4 preventing the sale of gas from the Empire Abo Unit as discussed in said conversation.

Gas Company of New Mexico contacted ARCO Oil and Gas Company due to the emergency demand for natural gas resulting from inclement weather conditions prevailing in southeastern New Mexico December 22 to 24, 1989. ARCO agreed to allow Gas Company of New Mexico to take up to 10 MMCFD of gas from the unit during this emergency situation.

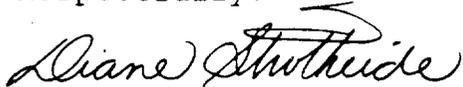
Gas Company of New Mexico has a bank of gas stored in the Empire Abo Unit. However, they have not injected any extraneous gas into the Abo reservoir during the last several years.

Rule 4 states that no gas may be withdrawn pending reservoir blow-down except for a thirty (30) day period not exceeding the average daily rate of injection of extraneous gas during the preceding 180 day period. Since this stipulation was not met, your approval for this exception was therefore required.

Gas Company of New Mexico should have contacted you explaining the nature of the emergency and the reason for their request.

If you should require additional information, please feel free to contact me.

Respectfully,



D. L. Strotheide  
Gas Engineer

DLS/dh

EXTRANEOUS GAS EMERGENCY USAGE

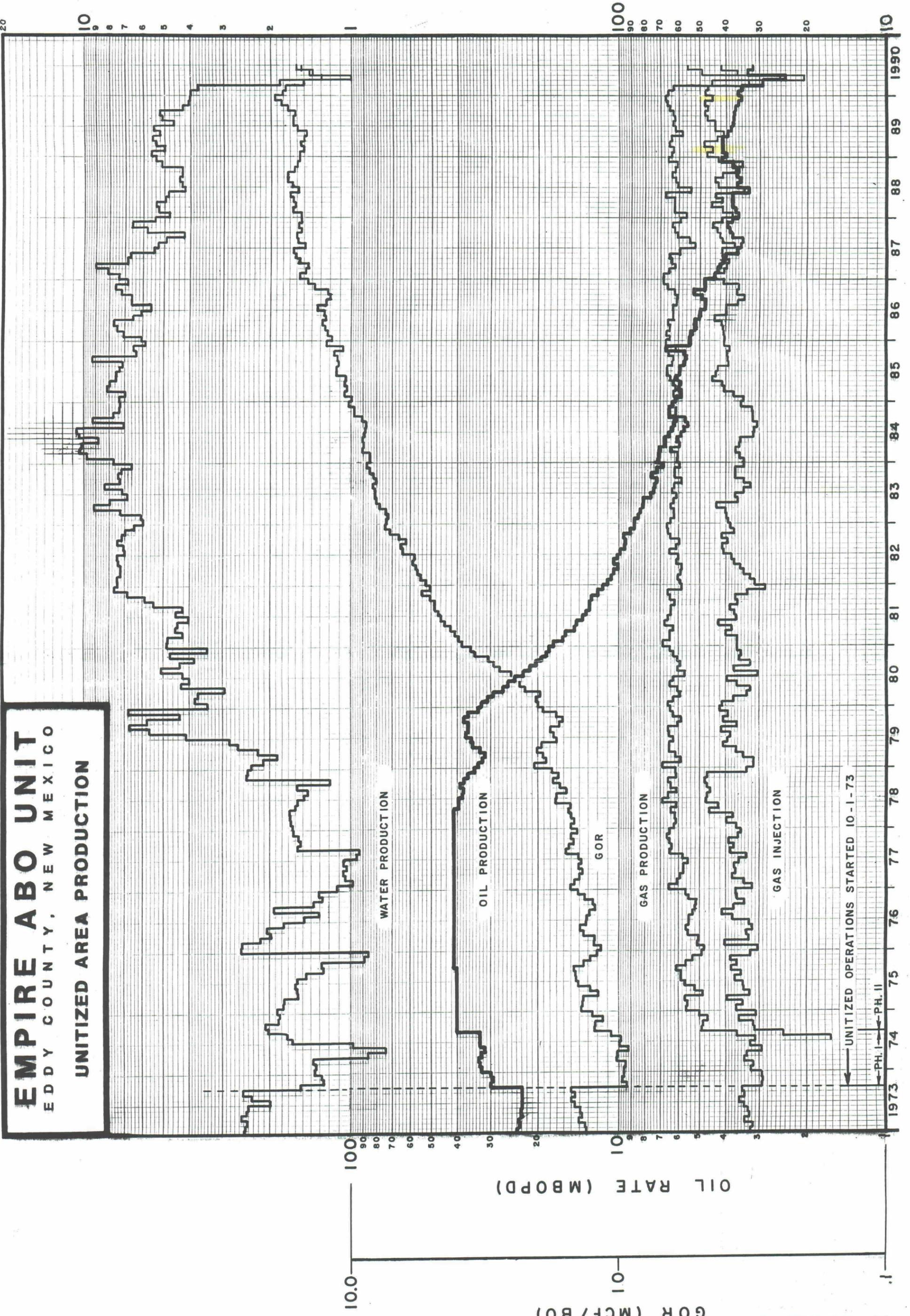
Month/Year	2 / 8 9	6 / 8 9	7 / 8 9	1 2 / 8 9	3 / 9 0	6 / 9 0	7 / 9 0
MMCF Withdrawn	1 7			2 2 . 6			
MMCF Replaced		9 . 2	6 . 3		1 5 . 5	. 2	1 3 . 3
Cum. Net Change	- 1 7	- 7 . 8	- 1 . 5	- 2 4 . 1	- 8 . 6	- 8 . 4	4 . 9

BEFORE EXAMINER STOGNER  
OIL CONSERVATION DIVISION

APCD EXHIBIT NO. 3

CASE NO. 10138

**EMPIRE ABO UNIT**  
 EDDY COUNTY, NEW MEXICO  
 UNITIZED AREA PRODUCTION



BEFORE EXAMINER STOGNER  
OIL CONSERVATION DIVISION

Azco EXHIBIT NO. 4

CASE NO. 10138

EMPIRE ABO UNIT

CURRENT RESERVOIR PRESSURE: 830 PSIG

CURRENT  $B_g$ : 333 SCF/bbl

300 MMSCF OF W/D'S =  $(300MM/333)$  = 900 M bbl of  
Res Pore Vol.

1989 VOIDAGE = 19 MMRB

1989 PRESSURE DECLINE = 54 PSIG

EXP. PRES. DEC. =  $(54/19000)900$  = 2.6 PSIG

$(2.6/830)100$  = 0.3%

TOTAL RESERVOIR PORE VOL = 800 MM bbls.

WITHDRAWALS = 1/1000 OF RES. PORE VOL.

BEFORE EXAMINER STOCHER	
OIL CONSERVATION DIVISION	
ARCO	EXHIBIT NO. 4-A
CASE NO. 10138	

**RULE 4:** That all Available Residue Gas from the unit shall be reinjected. No raw gas nor plant residue gas attributable to the project shall be sold or otherwise disposed of by any other means.

That in addition to the injection of Available Residue Gas, the project operator may inject up to and including 35 million cubic feet of extraneous gas per day into the Abo formation underlying the project area.

That withdrawals of said extraneous gas may be made, pending reservoir blow down, as follows:

(A) During each of the winter seasons (November 1 through March 31) of 1990 through 1996, a volume of gas not to exceed 300,000 MCF may be withdrawn, provided that the volume of extraneous gas withdrawn shall be replaced during the next succeeding summer season (April 1 through October 31) at a rate not to exceed 2,300 MCFD.

(B) During each of the winter seasons (November 1 through March 31) of 1996 through 1998, a volume of gas not to exceed 800,000 MCF may be withdrawn, provided that the volume of extraneous gas withdrawn shall be replaced during the next succeeding summer season (April 1 through October 31) at a rate not to exceed 5,500 MCFD.

(C) In addition to complete replacement of the volumes of extraneous gas withdrawn during the immediately preceding winter season, an additional volume of gas shall be injected during each summer season equal to 12% of the volume withdrawn during the immediately preceding winter season to compensate the Empire Abo Unit for any fuel used, shrinkage or metering errors.

(D) No extraneous gas may be withdrawn during a winter season until all gas withdrawn during preceding winter seasons is replaced plus the additional 12% volume

required by paragraph C of this rule.

(E) The provisions of paragraph 4 (A) through 4 (D) shall be of no further effect on the date the Pressure Maintenance Project ceases or November 1, 1998, whichever occurs first.

The project operator shall establish and maintain an "Extraneous Gas Bank Statement" which shall be filed with the Division each month concurrently with the project operators "Empire-Abo Pressure Maintenance Project Monthly Report", and which shall show thereon each month the volume of extraneous gas injected, the cumulative volume of such gas injected, the volume of gas withdrawn and delivered back to the supplier of extraneous gas and the net cumulative extraneous gas bank.

BEFORE EXAMINER STOGNER  
OIL CONSERVATION DIVISION

EMPIRE ABO UNIT  
1990 Plan of Operation

Azco EXHIBIT NO. 6

CASE NO. 10138

SUBMITTED SEPTEMBER 4, 1990

1. Summary of the Amended Plan of Operation for 1990

ARCO Oil and Gas Company proposes to continue operation of the Empire Abo Unit, Eddy County, New Mexico, substantially the same as in recent years. We will continue to reinject all available residue gas from the Phillips extraction plant and the Amoco extraction plant. Oil will be produced from the most efficient wells in order to maximize recovery. Gas Company of New Mexico will be allowed to make emergency withdrawals of extraneous gas during the winter. The withdrawal will be replaced by Gas Company of New Mexico in the summer.

2. Project Area - Description and History

The Empire Abo Unit 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, Eddy County, New Mexico.

The Unit, as originally proposed, would have covered 11,399.15 acres. Certain tracts within the Unit Area did not qualify for participation as of October 1, 1973, the effective date of the Unit. These tracts are: 2, 6, 28, 41, 42, 46, 55, 56, 69, 79, 84, and 91. Total area of these tracts is 644.74 acres. The remaining 10,694.41 acres comprised the Project Area for pressure maintenance until September 1, 1975. On this date Tracts 41, 79, and 84 joined the Unit. The addition of these three tracts, which cover 120.03 acres, increased the total area of the Unit to 10,814.44 acres. Tracts 2, 6, 42, and 46 comprise the CITGO Empire Abo Unit, which received NMOCD approval in June, 1974. The Unit Area is now disposed as follows:

	<u>Acres</u>
ARCO Empire Abo Unit	10,814.44
CITGO Empire Abo Unit	241.05
Non-Participating Tracts	<u>283.66</u>
Total Area	11,339.15

ARCO Oil and Gas Company operates a pressure maintenance project at the Empire Abo Unit. This project involves injection of plant residue gas from Abo production back into the Abo formation.

3. Current Performance

In June, 1990, the Unitized Project Area averaged 3,225 BOPD with a 64 percent water cut and a gas-oil ratio of 16,907 cubic feet of gas per barrel of oil. Gas injection averaged 41,261 MCFPD (see attached Production History Plot).

Cumulative oil production from the Project Area through June, 1990 was 210.8 MMBO. This is about 56.8 percent of the 371 MMBO originally in place. Cumulative net gas production from the Project Area through June, 1990 was 277 MCF. This is about 59 percent of the 468 BCF originally in place. As of June, 1990, the Unit has 205 active producing wells.

4. Basic Concepts Governing Future Unit Operations

- Field production history and reservoir numeric model studies have demonstrated that oil recovery is governed by gravity drainage and secondary gas cap expansion. We will be able to maximize the beneficial effects of these recovery mechanisms by observation of well performance and producing from the most efficient wells, those with the lowest GOR's. Natural gas liquid production from individual wells will also be considered when determining the most efficient wells in the future.
- Gas injection will help maintain reservoir pressure and control expansion of the secondary gas cap.

5. Discussion of Past, Current, and Future Operations

a) *Gas Injection*

Fifteen gas injection wells along the north edge of the field handle all of the Empire Abo Unit injected gas. Table I lists these wells. Beginning in July, 1974, and continuing through the latest month for which data is available (June, 1990), all available plant residue gas has been injected into the Abo gas cap. The Unit receives plant residue gas at about 700 psi and compresses it to 2000 psi for injection. Superhydration facilities at the extraction plants reduce hydrogen sulfide content to minimize possible corrosion. A rigorous corrosion treatment program is maintained. Permits for the Gas Injection Facilities have been granted by the State of New Mexico Environmental Improvements Agency. We believe the injection facilities meet the requirements of the United States Geological Survey and the State of New Mexico.

b) *Workovers*

An intensive workover program in previous years has been successful in maximizing low GOR production. The majority of the workovers consisted of recompleting wells lower in the reef. As a result of this program, almost all possible lower recompletions have been performed. On the eastern portion of the field where water influx is occurring, workovers consisting of recompleting wells higher in the reef have been successful. We will continue to seek out wells with recompletion potential. In 1990, we converted the Empire Abo Unit No. J-10 and plan to convert the No. J-13 to gas injection. These conversions will increase recovery by balancing the Unit's gas injection and providing pressure support to low pressure areas of the Unit.

c) *Continuing Field Study*

In order to maximize future reserves, we will continue to maintain an intensive field surveillance program. We will also continue to evaluate alternate and enhanced recovery techniques.

d) *Injection of Non-Abo Gas*

Gas from non-Abo sources was delivered from the Gas Company of New Mexico (formerly Southern Union Gas Company) to the Empire Abo Unit. This began on June 18, 1976. Cumulative outside gas injected through July, 1990 was 4,106.33 MMCF. Cumulative gas delivered back to the supplier through July, 1990 was 451.1 MMCF and the net cumulative non-Abo gas bank was 3,655.3 MMCF.

e) *Withdrawals of Non-Abo Gas*

Gas Company of New Mexico will be permitted to withdraw up to 300 MMCF of the extraneous stored gas for emergency use during the winter period, November 1 - March 31. The withdrawn gas will be replaced by Gas Company of New Mexico during the next summer season, April 1 - October 31.

f) *Voidage Limit Removal*

The voidage limit was replaced with a gas production limit of 65 MMCFPD in 1984. This will allow more efficient operation of the Unit. Also, the wet gas compressors were removed and the practice of injecting unprocessed gas was discontinued.

6. Modifications to Plan

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 of the U.S.G.S., the Commissioner of Public Lands of the State of New Mexico, and the Department of Energy and Minerals, Oil Conservation Division, State of New Mexico.

ARCO Oil and Gas Company, as Unit Operator, will act prudently to preserve the rights of the mineral owners, and to effectively and efficiently recover the Unit Area Reserves. This Company will meet all economical offset obligations, act to prevent waste, conserve natural resources, and protect correlative rights.

7. Effective Date and Duration of Plan

This Amended Plan of Operation shall be effective September 1, 1990 and extend through the calendar year unless otherwise amended.

If this Plan of Operation meets with your approval, please sign on the next page and return one copy for our files.

Very truly yours,

ARCO Oil and Gas Company

OPERATOR



Gary B. Smallwood  
Senior Engineer

GBS:eeg

APPROVED BY: Joe J. Lara DATE: 4/13/90  
*Asst.* District Manager - Minerals  
United States Department of the Interior  
Bureau of Land Management - Roswell District

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
Commissioner of Public Lands  
State of New Mexico

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
Division Director  
Department of Energy and Minerals  
Oil Conservation Division  
State of New Mexico

**EMPIRE ABO UNIT  
1989 AND 1990 PRODUCTION HISTORY**

<u>Month</u>	<u>BO</u>	<u>BW</u>	<u>Gross MCFG</u>	<u>Injected MCFG</u>	<u>Net MCFG</u>
January	127,553	174,883	1,998,160	1,449,096	549,064
February	116,620	142,094	1,782,261	1,266,858	515,403
March	128,827	168,504	2,019,490	1,483,893	535,597
April	124,539	167,780	1,932,008	1,317,495	614,513
May	121,138	162,709	1,801,256	1,285,547	515,709
June	116,402	166,224	1,875,606	1,349,515	526,091
July	116,771	143,037	1,961,348	1,375,908	585,440
August	115,150	159,399	1,929,303	1,459,950	469,353
September	112,295	157,023	1,871,241	1,455,967	415,274
October	114,934	134,100	2,017,084	1,442,749	574,335
November	108,525	125,801	1,976,391	1,454,917	521,474
December	105,920	137,114	1,980,927	1,398,743	582,184
January	113,005	124,600	2,050,366	1,494,951	555,415
February	99,257	105,788	1,777,839	1,319,546	458,293
March	91,535	58,042	1,409,616	1,037,207	372,409
April	73,833	111,064	762,048	612,893	149,155
May	103,666	145,908	1,529,593	1,126,608	402,985
June	<u>96,748</u>	<u>169,020</u>	<u>1,635,865</u>	<u>1,237,824</u>	<u>398,041</u>
Totals	1,986,718	2,553,090	32,310,402	23,569,667	8,740,735

GBS:eeg  
08/20/90

# TABLE I

## EMPIRE ABO UNIT Gas Injection Wells

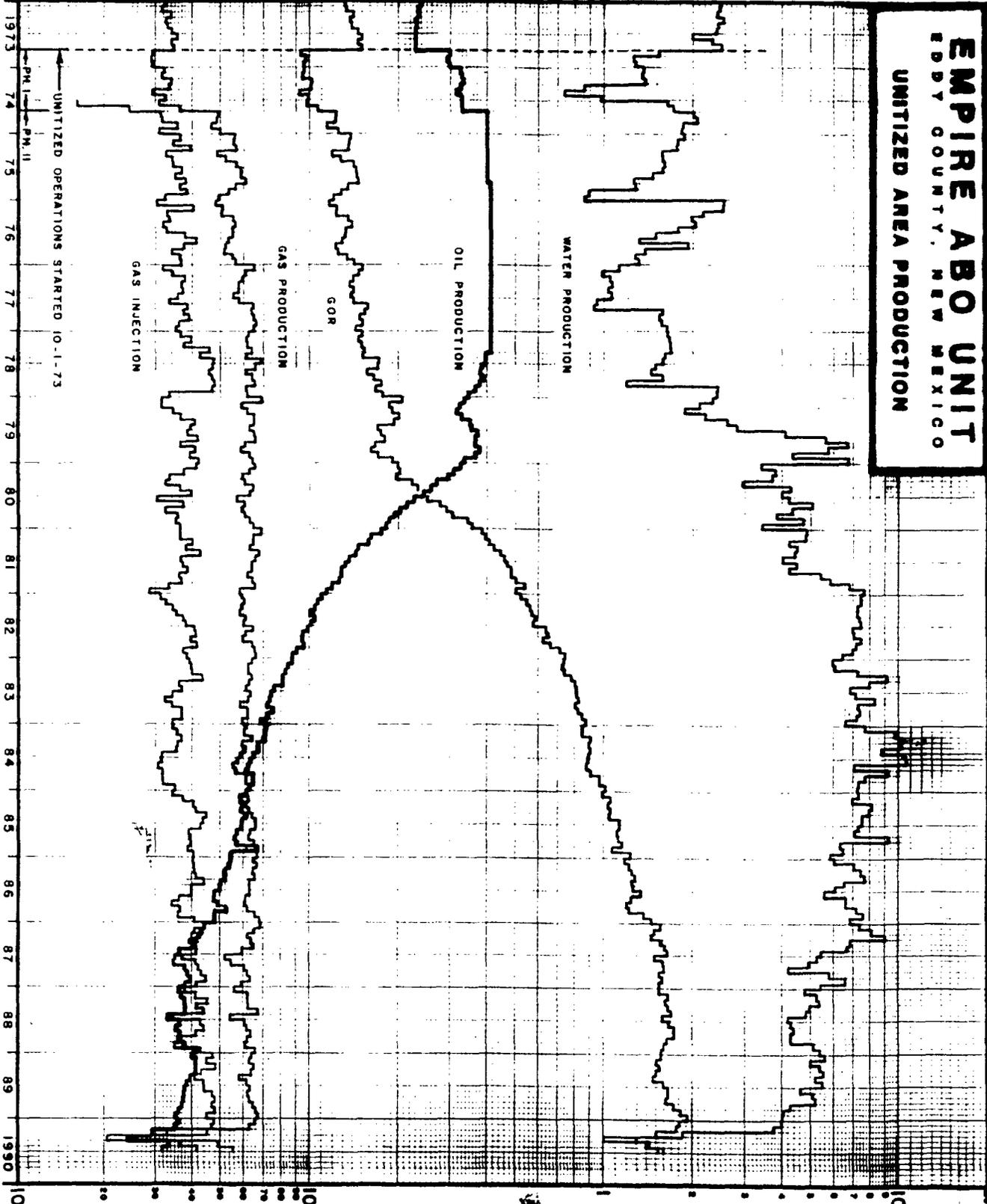
<u>Previous Operator/ Lease and Well</u>	<u>Unit Well Designation</u>	<u>Location (Sec.-Twp-Rng)</u>			
Hondo/State "A" No. 24	C-39	NW/4 SE/4	26	17	28
Hondo/State "A" No. 16	D-37	SW/4 SW/4	26	17	28
Amoco/State "BV" No. 1	F-25	SW/4 NW/4	32	17	28
Hondo/State "A" No. 35	F-27	SW/4 NE/4	32	17	28
ARCO/M. Yates B (ARC) No. 8	F-31	SW/4 NE/4	33	17	28
Amoco/State "BM" No. 1	G-22	NE/4 SW/4	31	17	28
Hondo/State "A" No. 9	G-24	NE/4 SE/4	31	17	28
Gulf/NCT "C" No. 1	H-19	SW/4 SE/4	36	17	27
Amoco/State "BE" No. 1	H-21	SW/4 SW/4	31	17	28
Amoco/Malco "H" Fed. No. 9	I-10	NE/4 NW/4	3	18	27
Amoco/State "F" No. 8	I-18	NE/4 NW/4	1	18	27
Amoco/Malco "H" Fed. No. 2	J-12	SE/4 NE/4	3	18	27
Amoco/Windfohr Fed. No. 4	K-7	NW/4 SE/4	4	18	27
Exxon/CBDU "A" No. 8	M-6	SE/4 NW/4	9	18	27
Cities Service/Hudson A #1	J-10	SE/4 NW/4	3	18	27

GBS:eeg  
09/04/90

GOR (MCF/BO)

OIL RATE (MBOPD)

**EMPIRE ABO UNIT**  
EDDY COUNTY, NEW MEXICO  
UNITIZED AREA PRODUCTION



GAS RATE (MMCF/D)

WATER RATE (MBWPD)

State of New Mexico



W.R. HUMPHRIES  
COMMISSIONER

Commissioner of Public Lands

P.O. BOX 1148  
SANTA FE, NEW MEXICO 87504-1148

September 24, 1990

ARCO Oil and Gas Company  
Central District  
P.O. Box 1610  
Midland, TX 79702

Attn: Mr. Gary Smallwood

Re: Empire Abo Unit  
1990 Plan of Development Amendment  
Extraneous Stored Gas Withdrawal, Paragraph 5 (e)

Dear Mr. Smallwood,

The Commissioner of Public Lands has this date approved the amended 1990 Plan of Development for the Empire Abo Unit. Our approval is subject to like approval by all other appropriate agencies.

The amended 1990 Plan of Development changes paragraph 5 (e), Withdrawals of Non-Abo Gas, to incorporate Rule 4 of NMOCD Order No. R-4549-f (attached). The amendment allowed the Gas Company of New Mexico (supplier of the Non-Abo injection gas to the Empire Abo Unit) to withdraw extraneous stored gas during times of emergency during the winter period of November 1 thru March 31. The Gas Company of New Mexico will replace the gas during the next summer season of April 1 thru October 31.

Enclosed is an approved copy of the amended 1990 Plan of Development and a copy of the NMOCD Order No. R-4549-F. If we may be of further help, please call Clyde Langdale at (505) 827-5791.

Sincerely,

W. R. HUMPHRIES  
COMMISSIONER OF PUBLIC LANDS

BY: *Floyd O. Prando*  
Floyd O. Prando, Director  
Oil, Gas & Minerals Division

cc: OCD - Santa Fe  
BLM

WRH/FOP/CL/dm

BEFORE EXAMINER'S SIGNATURE	
OIL CONSERVATION DIVISION	
ARCO	EXHIBIT NO. 7
CASE NO.	10138

**EMPIRE ABO UNIT**  
1990 Plan of Operation

SUBMITTED SEPTEMBER 4, 1990

1. Summary of the Amended Plan of Operation for 1990

ARCO Oil and Gas Company proposes to continue operation of the Empire Abo Unit, Eddy County, New Mexico, substantially the same as in recent years. We will continue to reinject all available residue gas from the Phillips extraction plant and the Amoco extraction plant. Oil will be produced from the most efficient wells in order to maximize recovery. Gas Company of New Mexico will be allowed to make emergency withdrawals of extraneous gas during the winter. The withdrawal will be replaced by Gas Company of New Mexico in the summer.

2. Project Area - Description and History

The Empire Abo Unit 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, Eddy County, New Mexico.

The Unit, as originally proposed, would have covered 11,399.15 acres. Certain tracts within the Unit Area did not qualify for participation as of October 1, 1973, the effective date of the Unit. These tracts are: 2, 6, 28, 41, 42, 46, 55, 56, 69, 79, 84, and 91. Total area of these tracts is 644.74 acres. The remaining 10,694.41 acres comprised the Project Area for pressure maintenance until September 1, 1975. On this date Tracts 41, 79, and 84 joined the Unit. The addition of these three tracts, which cover 120.03 acres, increased the total area of the Unit to 10,814.44 acres. Tracts 2, 6, 42, and 46 comprise the CITGO Empire Abo Unit, which received NMOCD approval in June, 1974. The Unit Area is now disposed as follows:

	<u>Acres</u>
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CITGO Empire Abo Unit	241.05
Non-Participating Tracts	<u>283.66</u>
Total Area	11,339.15

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4. Basic Concepts Governing Future Unit Operations

- Field production history and reservoir numeric model studies have demonstrated that oil recovery is governed by gravity drainage and secondary gas cap expansion. We will be able to maximize the beneficial effects of these recovery mechanisms by observation of well performance and producing from the most efficient wells, those with the lowest GOR's. Natural gas liquid production from individual wells will also be considered when determining the most efficient wells in the future.
- Gas injection will help maintain reservoir pressure and control expansion of the secondary gas cap.

5. Discussion of Past, Current, and Future Operations

a) *Gas Injection*

Fifteen gas injection wells along the north edge of the field handle all of the Empire Abo Unit injected gas. Table I lists these wells. Beginning in July, 1974, and continuing through the latest month for which data is available (June, 1990), all available plant residue gas has been injected into the Abo gas cap. The Unit receives plant residue gas at about 700 psi and compresses it to 2000 psi for injection. Superhydration facilities at the extraction plants reduce hydrogen sulfide content to minimize possible corrosion. A rigorous corrosion treatment program is maintained. Permits for the Gas Injection Facilities have been granted by the State of New Mexico Environmental Improvements Agency. We believe the injection facilities meet the requirements of the United States Geological Survey and the State of New Mexico.

b) *Workovers*

An intensive workover program in previous years has been successful in maximizing low GOR production. The majority of the workovers consisted of recompleting wells lower in the reef. As a result of this program, almost all possible lower recompletions have been performed. On the eastern portion of the field where water influx is occurring, workovers consisting of recompleting wells higher in the reef have been successful. We will continue to seek out wells with recompletion potential. In 1990, we converted the Empire Abo Unit No. J-10 and plan to convert the No. J-13 to gas injection. These conversions will increase recovery by balancing the Unit's gas injection and providing pressure support to low pressure areas of the Unit.

c) *Continuing Field Study*

In order to maximize future reserves, we will continue to maintain an intensive field surveillance program. We will also continue to evaluate alternate and enhanced recovery techniques.

d) *Injection of Non-Abo Gas*

Gas from non-Abo sources was delivered from the Gas Company of New Mexico (formerly Southern Union Gas Company) to the Empire Abo Unit. This began on June 18, 1976. Cumulative outside gas injected through July, 1990 was 4,106.33 MMCF. Cumulative gas delivered back to the supplier through July, 1990 was 451.1 MMCF and the net cumulative non-Abo gas bank was 3,655.3 MMCF.

e) *Withdrawals of Non-Abo Gas*

Gas Company of New Mexico will be permitted to withdraw up to 300 MMCF of the extraneous stored gas for emergency use during the winter period, November 1 - March 31. The withdrawn gas will be replaced by Gas Company of New Mexico during the next summer season, April 1 - October 31.

f) *Voidage Limit Removal*

The voidage limit was replaced with a gas production limit of 65 MMCFPD in 1984. This will allow more efficient operation of the Unit. Also, the wet gas compressors were removed and the practice of injecting unprocessed gas was discontinued.

6. Modifications to Plan

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 of the U.S.G.S., the Commissioner of Public Lands of the State of New Mexico, and the Department of Energy and Minerals, Oil Conservation Division, State of New Mexico.

ARCO Oil and Gas Company, as Unit Operator, will act prudently to preserve the rights of the mineral owners, and to effectively and efficiently recover the Unit Area Reserves. This Company will meet all economical offset obligations, act to prevent waste, conserve natural resources, and protect correlative rights.

7. Effective Date and Duration of Plan

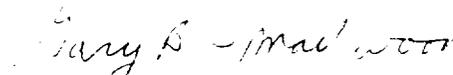
This Amended Plan of Operation shall be effective September 1, 1990 and extend through the calendar year unless otherwise amended.

If this Plan of Operation meets with your approval, please sign on the next page and return one copy for our files.

Very truly yours,

ARCO Oil and Gas Company

OPERATOR

  
Gary B. Smallwood  
Senior Engineer

GBS:eeg

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
District Manager  
United States Department of the Interior  
Bureau of Land Management - Roswell District

APPROVED BY: W R Humphreys DATE: 9-24-80  
Commissioner of Public Lands  
State of New Mexico

APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
Division Director  
Department of Energy and Minerals  
Oil Conservation Division  
State of New Mexico

**EMPIRE ABO UNIT  
1989 AND 1990 PRODUCTION HISTORY**

<u>Month</u>	<u>BO</u>	<u>BW</u>	<u>Gross MCFG</u>	<u>Injected MCFG</u>	<u>Net MCFG</u>
January	127,553	174,883	1,998,160	1,449,096	549,064
February	116,620	142,094	1,782,261	1,266,858	515,403
March	128,827	168,504	2,019,490	1,483,893	535,597
April	124,539	167,780	1,932,008	1,317,495	614,513
May	121,138	162,709	1,801,256	1,285,547	515,709
June	116,402	166,224	1,875,606	1,349,515	526,091
July	116,771	143,037	1,961,348	1,375,908	585,440
August	115,150	159,399	1,929,303	1,459,950	469,353
September	112,295	157,023	1,871,241	1,455,967	415,274
October	114,934	134,100	2,017,084	1,442,749	574,335
November	108,525	125,801	1,976,391	1,454,917	521,474
December	105,920	137,114	1,980,927	1,398,743	582,184
January	113,005	124,600	2,050,366	1,494,951	555,415
February	99,257	105,788	1,777,839	1,319,546	458,293
March	91,535	58,042	1,409,616	1,037,207	372,409
April	73,833	111,064	762,048	612,893	149,155
May	103,666	145,908	1,529,593	1,126,608	402,985
June	<u>96,748</u>	<u>169,020</u>	<u>1,635,865</u>	<u>1,237,824</u>	<u>398,041</u>
Totals	1,986,718	2,553,090	32,310,402	23,569,667	8,740,735

GBS:eeg  
08/20/90

## TABLE I

### EMPIRE ABO UNIT Gas Injection Wells

Previous Operator/ Lease and Well	Unit Well Designation	Location (Sec.-Twp-Rng)			
Hondo/State "A" No. 24	C-39	NW/4 SE/4	26	17	28
Hondo/State "A" No. 16	D-37	SW/4 SW/4	26	17	28
Amoco/State "BV" No. 1	F-25	SW/4 NW/4	32	17	28
Hondo/State "A" No. 35	F-27	SW/4 NE/4	32	17	28
ARCO/M. Yates B (ARC) No. 8	F-31	SW/4 NE/4	33	17	28
Amoco/State "BM" No. 1	G-22	NE/4 SW/4	31	17	28
Hondo/State "A" No. 9	G-24	NE/4 SE/4	31	17	28
Gulf/NCT "C" No. 1	H-19	SW/4 SE/4	36	17	27
Amoco/State "BE" No. 1	H-21	SW/4 SW/4	31	17	28
Amoco/Malco "H" Fed. No. 9	I-10	NE/4 NW/4	3	18	27
Amoco/State "F" No. 8	I-18	NE/4 NW/4	1	18	27
Amoco/Malco "H" Fed. No. 2	J-12	SE/4 NE/4	3	18	27
Amoco/Windfohr Fed. No. 4	K-7	NW/4 SE/4	4	18	27
Exxon/CBDU "A" No. 8	M-6	SE/4 NW/4	9	18	27
Cities Service/Hudson A #1	J-10	SE/4 NW/4	3	18	27

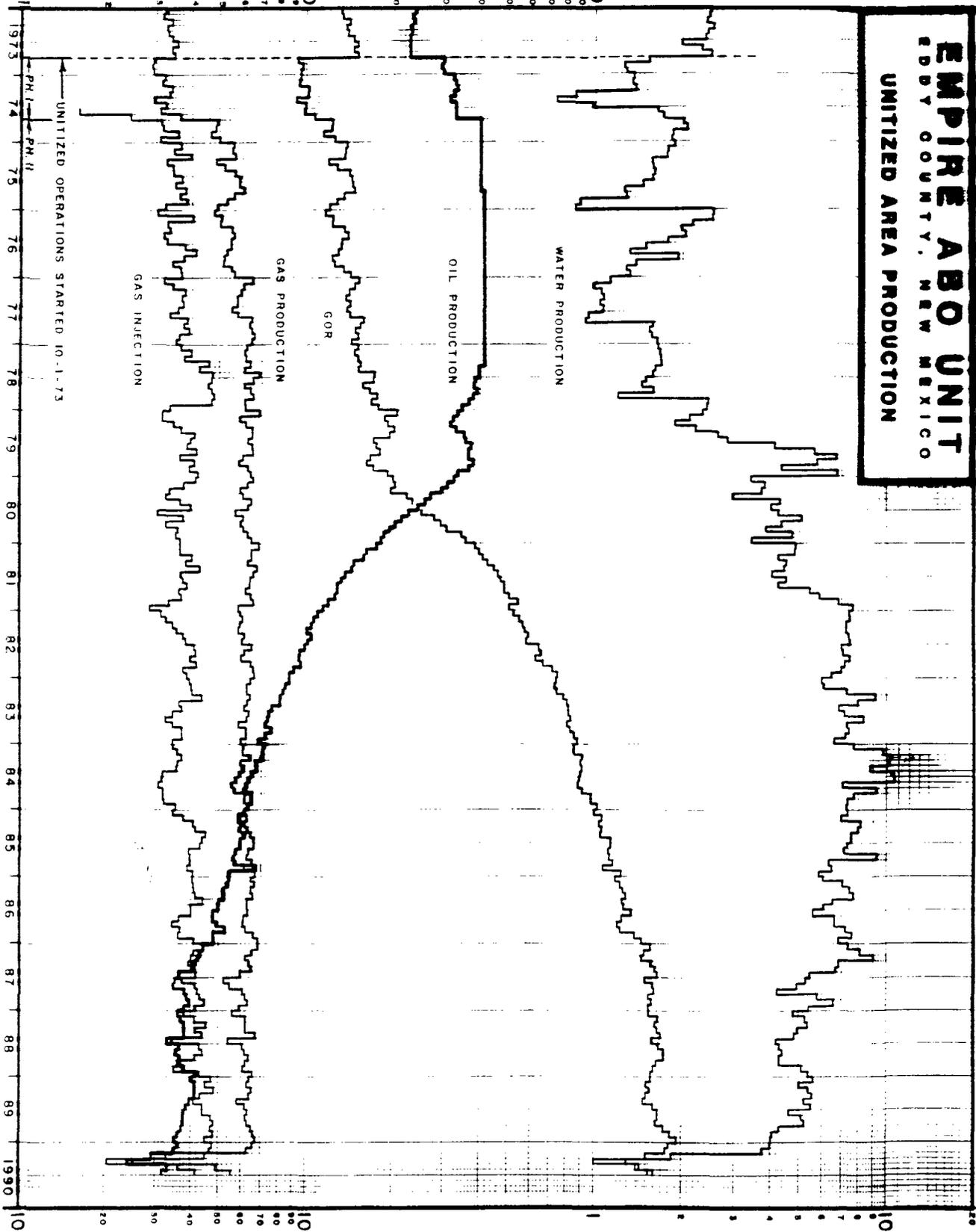
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09/04/90

EMPIRE ABO UNIT  
EDDY COUNTY, NEW MEXICO

GOR (MCF/BO)

OIL RATE (MBOPD)

**EMPIRE ABO UNIT**  
EDDY COUNTY, NEW MEXICO  
UNITIZED AREA PRODUCTION



GAS RATE (MMCF/D)

WATER RATE (MBWPD)

STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING  
CALLED BY THE OIL CONSERVATION  
DIVISION FOR THE PURPOSE OF  
CONSIDERING:

APPLICANT	ARCO
ORDER NO.	8
DATE	10/31/90

Case No. 10138  
Order No. R-4549-G

APPLICATION OF ARCO OIL & GAS COMPANY  
FOR AMENDMENT OF THE SPECIAL RULES AND  
REGULATIONS FOR THE EMPIRE-ABO PRESSURE  
MAINTENANCE PROJECT, EDDY COUNTY, NEW MEXICO.

**ORDER OF THE DIVISION**

**BY THE DIVISION:**

This cause came on for hearing at 8:15 a.m. on October 31, 1990, at Santa Fe, New Mexico, before Examiner Michael E. Stogner.

NOW, on this \_\_\_\_ day of November, 1990, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

**FINDS:**

(1) Due public notice having been given as required by law, the Division has jurisdiction over this cause and the subject matter thereof.

(2) The applicant, ARCO Oil & Gas Company, is the operator of the Empire-Abo Pressure Maintenance Project, Empire-Abo Pool, Eddy County, New Mexico, which project was authorized by Division Order No. R-4549 and is governed by operating rules contained in the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project, included in said Order as amended by Orders Nos. R-4549-A through R-4549-F.

(3) That said rules provide for the injection of extraneous gas into the Abo formation and for the withdrawal of this extraneous gas at certain specified times and rates.

(4) The applicant seeks the amendment of the rules governing withdrawal of the extraneous gas to permit the withdrawal of certain volumes during winter months and the make-up of the amounts withdrawn by reinjection of gas during the succeeding summer months, plus an additional volume of gas to compensate the Empire-Abo Unit for any fuel use, shrinkage or metering errors.

(5) That during recent winters, the Division has authorized emergency withdrawals of volumes of extraneous gas from this unit to meet consumer demands for this gas and that the withdrawal volumes have been subsequently replaced by the reinjection into the unit of additional extraneous gas.

(6) The evidence presented in this case established that the withdrawal and reinjection of gas into the unit has not had an adverse impact on the recovery of hydrocarbons from the unit and has not resulted in waste.

(7) That approval of the application will establish a procedure for the withdrawal of extraneous gas from the unit during periods of high demand for natural gas.

(8) That reinjection of the withdrawn gas during the succeeding summer season plus the injection of an additional 12% to cover fuel usage, shrinkage, and metering errors, will assure that the ultimate recovery of hydrocarbons from the project will not be reduced.

(9) That the proposed amendment of said special rules will not result in a violation of correlative rights.

(10) That the application for amendment of said rules should be approved.

**IT IS THEREFORE ORDERED:**

(1) That Rule 4 of the Special Rules and Regulations for the Empire-Abo Pressure Maintenance Project contained in Division Order No. R-4549, as Amended, is hereby rescinded.

(2) That said special rules are amended by the adoption of a new Rule 4 which reads in its entirety as follows:

**RULE 4:** That all Available Residue Gas from the unit shall be reinjected. No raw gas nor plant residue gas attributable to the project shall be sold or otherwise disposed of by any other means.

That in addition to the injection of Available Residue Gas, the project operator may inject up to and including 35 million cubic feet of extraneous gas per day into the Abo formation underlying the project area.

That withdrawals of said extraneous gas may be made, pending reservoir blow down, as follows:

(A) During each of the winter seasons (November 1 through March 31) of 1990 through 1996, a volume of gas not to exceed 300,000 MCF may be withdrawn, provided that the volume of extraneous gas withdrawn shall be replaced during the next succeeding summer season (April 1 through October 31) at a rate not to exceed 2,300 MCFD.

(B) During each of the winter seasons (November 1 through March 31) of 1996 through 1998, a volume of gas not to exceed 800,000 MCF may be withdrawn, provided that the volume of extraneous gas withdrawn shall be replaced during the next succeeding summer season (April 1 through October 31) at a rate not to exceed 5,500 MCFD.

(C) In addition to complete replacement of the volumes of extraneous gas withdrawn during the immediately preceding winter season, an additional volume of gas shall be injected during each summer season equal to 12% of the volume withdrawn during the immediately preceding winter season to compensate the Empire Abo Unit for any fuel used, shrinkage or metering errors.

(D) No extraneous gas may be withdrawn during a winter season until all gas withdrawn during preceding winter seasons is replaced plus the additional 12% volume required by paragraph C of this rule.

(E) The provisions of paragraph 4 (A) through 4 (D) shall be of no further effect on the date the Pressure Maintenance Project ceases or November 1, 1998, whichever occurs first.

**CASE NO. 10138**  
**ORDER NO. R-4549-G**  
**Page -4-**

The project operator shall establish and maintain an "Extraneous Gas Bank Statement" which shall be filed with the Division each month concurrently with the project operators "Empire-Abo Pressure Maintenance Project Monthly Report", and which shall show thereon each month the volume of extraneous gas injected, the cumulative volume of such gas injected, the volume of gas withdrawn and delivered back to the supplier of extraneous gas and the net cumulative extraneous gas bank.

(3) Jurisdiction of this cause is retained for the entry of such further orders as the Division may deem necessary.

**DONE** at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO  
OIL CONSERVATION DIVISION

WILLIAM J. LeMAY  
Director

S E A L

BEFORE THE

OIL CONSERVATION DIVISION

NEW MEXICO DEPARTMENT OF ENERGY, MINERALS AND NATURAL RESOURCES

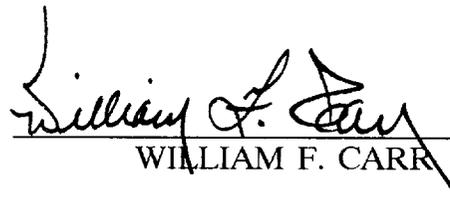
IN THE MATTER OF THE APPLICATION  
OF ARCO OIL & GAS COMPANY FOR  
AMENDMENT OF THE SPECIAL RULES  
AND REGULATIONS FOR THE EMPIRE-ABO  
PRESSURE MAINTENANCE PROJECT,  
EDDY COUNTY, NEW MEXICO.

CASE NO. 10138

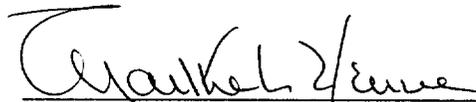
AFFIDAVIT

STATE OF NEW MEXICO     )  
  )ss.  
COUNTY OF SANTA FE     )

WILLIAM F. CARR, attorney in fact and authorized representative of ARCO Oil & Gas Company, the Applicant herein, being first duly sworn, upon oath, states that the notice provisions of Rule 1207 of the New Mexico Oil Conservation Division have been complied with, that Applicant has caused to be conducted a good faith diligent effort to find the correct addresses of all interested persons entitled to receive notice as shown by Exhibit "A" attached hereto, and that pursuant to Rule 1207, notice has been given at the correct addresses provided by such rule.

  
WILLIAM F. CARR

SUBSCRIBED AND SWORN to before me this 30th day of October, 1990.

  
Notary Public

My Commission Expires:

August 19, 1991

BEFORE EXAMINER STOGNER  
OIL CONSERVATION DIVISION  
ARCO EXHIBIT NO. 9  
CASE NO. 10138

## EXHIBIT A

Sidney Lanier  
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Hobbs, New Mexico 88241

Tracy P. Clark  
5609 E. Country Rd. 120  
Midland, TX 79701

Frederick L. Dunn, III  
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Tulsa, OK 74107

Marbob  
Dr. 217  
Artesia, New Mexico 88210

Cibola Energy Corporation  
P. O. Box 1426  
Albuquerque, NM 87103

Union Texas Petroleum Corp.  
Attn: Supervisor Jt. Int. 26th  
P. O. Box 2120  
Houston, TX 77252

Rhonda Operating Company  
500 N. Loraine, #1000  
Midland, Texas 79701

Dixon & Yates Oil Company  
207 South Fourth Street  
Artesia, NM 88210

Rogers Aston  
P. O. Box 1090  
Roswell, NM 88201

Bridge Oil Company  
Merit Drive, Suite 1600  
Dallas, Texas 75251

Evans H. Dunn  
310 Expressway Tower  
2431 E. 51st Street  
Tulsa, Oklahoma 74105

T. J. Brown  
P. O. Box 1251  
Midland, TX 79702

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Midland, Texas 79702

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100 Expressway Tower  
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OXY U.S.A., Inc.  
Attn: Joint Interest  
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Midland, Texas 79710

Lincoln Aston  
P. O. Box 3048  
La Jolla, CA 92038

Ben A. Copass, Jr.  
P. O. Box 1377  
Alpine, TX 79831

Phillips Petroleum Company  
Attn: P/S Operations Controls  
P. O. Box 1967  
Houston, Texas 77001

Robert E. Boling  
305 South 5th Street  
Artesia, NM 88210

DeKalb Energy Company  
1625 Broadway  
Denver, CO 80202

Abo Petroleum Company  
207 South Fourth Street  
Artesia, NM 88210

Chevron U.S.A.  
Attn: John Prindle  
P. O. Box 670  
Hobbs, NM 88240

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2431 E. 51st Street, Suite 100  
Tulsa, OK 74105

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Conoco Inc.  
Attn: D. W. Johnson  
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Hobbs, NM 88240

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Dallas, Texas 75206

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Dallas, TX 75225

Exxon Company, USA #A08271  
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P. O. Box 1600  
Midland, TX 79702

Burnett Oil Company, Inc.  
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Fort Worth, TX 76102

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Arkansas Pass, TX 78336

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Roswell, NM 88201

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1645 Candeb Way  
Oklahoma City, OK 73116

Delton Marcum  
3115 Stanolind  
Midland, TX 79701

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Republic Bank Dallas  
Trust Oil & Gas  
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Dallas, TX 75221

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Dallas, TX 75205

Phillips Petroleum Co.  
Attn: P/S Operations Controls  
P. O. Box 1967  
Houston, TX 77001

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Lubbock, TX 79423

Estate of W.D. Flynn  
c/o First of Fort Worth  
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Fort Worth, TX 76113

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Taylor, TX 76574

A. H. Hedden  
P. O. Box 2165  
Santa Fe, New Mexico 87501

Beth Joanne Johnson  
c/o Rutter & Wilbanks  
P. O. Box 3186  
Midland, TX 79702

Marathon Oil Company  
Attn: Financial Acctg. Supr.  
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Midland, TX 79702

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Midland, TX 79701

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Midland, TX 79701

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Laguna Niguel, CA 92677

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Lake Forest, IL 60045

Rutter & Wilbanks Corp.  
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Midland, TX 79701

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Lubbock, TX 79411

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Alamogordo, NM 88310

Harold Kersey  
c/o Kersey & Company  
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Fort Worth, TX 76116

Thelma Kersey Methvin Trust  
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Hugh Munn  
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Midland, TX 79705

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3811 Turtle Creek Blvd.  
Dallas, TX 75219

L.J. Reischman  
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Roswell, NM 88202

Samedan Oil Corporation  
Attn: Mgr. of Secondary Rec.  
P. O. Box 909  
Ardmore, OK 73402

Estate of Nellie G. Scheurich  
Carlsbad National Bank  
Trust Dept.  
P. O. Box 1359  
Carlsbad, NM 88220

Henry Shaw  
P. O. Box 2723  
Midland, TX 79702

Meridian/Southland Royalty Co.  
Attn: Laura Anderson  
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Midland, TX 79701

Mary Ann Tredwell  
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Oklahoma City, OK 73116

Harvey E. Yates Company  
P. O. Box 1933  
Roswell, New Mexico 88201

Amoco Production Company  
Attn: Joint Interest  
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Houston, TX 77253

SunWest Bank of Roswell  
Per.Rep. Estate of Charles Aston  
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Roswell, NM 88201

Cheedle and Elizabeth Caviness  
7505 Derickson Ave., NE  
Albuquerque, NM 87109

Maria Jo Schmid  
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Austin, TX 78759

Margaret Sheldon  
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Kingsland, TX 78639

Sun Exploration & Production  
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Midland, TX 79702

Mr. Bud F. Walker  
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Albuquerque, NM 87104

Yates Petroleum Corporation  
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Yates Building  
Artesia, NM 88210

Yates Energy Corporation  
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Roswell, NM 88202

Seven Oil Ltd.  
500 West Texas, Suite 1160  
Midland, TX 79701

SOLT, Inc.  
c/o First National Bank of Artesia  
P. O. Drawer AA  
Artesia, NM 88210

Devon Energy Corporation  
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Dallas, Texas 75206

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Houston, TX 77002

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Albuquerque, NM 87131