Case No.

977

Application, Transcript,
Small Exhibits, Etc.

FORM F-9

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 1 of 2

Well [illegible] Cores [illegible] File [illegible]

Field [illegible] Formation [illegible] Analysts [illegible]

County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]

Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION			PROBABLE PRODUCTION	REMARKS
				OIL		TOTAL WATER		
				% VOLUME	% PORE	% PORE		
1	3[illegible]5	0.0	3.1	0.0	[illegible]			
2	[illegible]5	0.0	6.3	0.0	[illegible]			
3	66.5	[illegible]	[illegible]	0.0	[illegible]			
4	67.5	0.0	[illegible]	0.0	[illegible]			
5	[illegible]8.5	0.00	7.2	0.0	79.9			
6	69.5	0.0	7.1	0.0	78.0			
7	70.5	0.0	[illegible]	0.0	20.0			
8	71.5	0.0	[illegible]	0.0	[illegible]			
9	72.5	0.0	[illegible]	0.0	[illegible]			
10	73.5	0.0	[illegible]	0.0	[illegible]			
11	74.5	0.0	7.1	0.0	[illegible]			
12	75.5	0.0	[illegible]	0.0	[illegible]			
13	76.5	0.0	7.0	0.0	[illegible]			
14	77.5	0.0	[illegible]	0.0	[illegible]			
15	78.5	0.0	7.1	0.0	71.8			
16	79.5	0.0	7.7	0.0	75.6			
17	80.5	0.0	7.0	0.0	[illegible]			
18	[illegible]	0.0	[illegible]	0.0	[illegible]			
19	82.5	0.0	7.1	0.0	83.1			
20	83.5	0.0	[illegible]	0.0	[illegible]			
21	84.5	0.0	7.1	0.0	[illegible]			
22	[illegible]	0.0	[illegible]	0.0	[illegible]			
23	86.5	0.0	7.1	0.0	73.3			
24	87.5	0.0	7.8	0.0	73.8			
25	[illegible]	0.0	[illegible]	0.0	[illegible]			
26	89.5	0.0	[illegible]	0.0	[illegible]			
27	90.5	0.0	[illegible]	0.0	76.0			
28	91.5	0.0	7.5	0.0	77.5			
29	92.5	0.0	9.5	0.0	[illegible]			
30	93.5	0.0	[illegible]	0.0	76.2			
31	[illegible]	0.0	[illegible]	0.0	[illegible]			
32	[illegible]	0.0	[illegible]	0.0	[illegible]			

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
EXHIBIT No. [illegible]
CASE [illegible]

NOTE:
(*) REFER TO ATTACHED LETTER.
(I) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.
(2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representation, as to the productivity, proper operation or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

FORM F-4

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 1 of 2
Well [illegible] Cores [illegible] File [illegible]
Field [illegible] Formation [illegible] Analysts [illegible]
County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]
Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION		PROBABLE PRODUCTION	REMARKS
				OIL	TOTAL WATER		
				% VOLUME % PORE	% PORE		
1	3[illegible]5	0.0	3.1	0.0	[illegible]		
2	65.5	0.0	6.3	0.0	[illegible]		
3	66.5	0.0	[illegible]	0.0	[illegible]		
4	67.5	0.0	7.2	0.0	[illegible]		
5	68.5	0.00	7.1	0.0	[illegible]		
6	69.5	0.0	[illegible]	0.0	[illegible]		
7	70.5	0.0	[illegible]	0.0	[illegible]		
8	71.5	0.0	[illegible]	0.0	[illegible]		
9	72.5	0.0	[illegible]	0.0	[illegible]		
10	73.5	0.0	7.1	0.0	[illegible]		
11	74.5	0.0	[illegible]	0.0	[illegible]		
12	75.5	0.0	7.0	0.0	[illegible]		
13	76.5	0.0	[illegible]	0.0	[illegible]		
14	77.5	0.0	7.1	0.0	[illegible]		
15	78.5	0.0	7.7	0.0	[illegible]		
16	79.5	0.0	7.0	0.0	[illegible]		
17	80.5	0.0	[illegible]	0.0	[illegible]		
18	[illegible]	0.0	7.2	0.0	[illegible]		
19	82.5	0.0	[illegible]	0.0	[illegible]		
20	83.5	0.0	7.1	0.0	[illegible]		
21	84.5	0.0	[illegible]	0.0	[illegible]		
22	[illegible]	0.0	7.1	0.0	[illegible]		
23	86.5	0.0	7.8	0.0	[illegible]		
24	87.5	0.0	7.1	0.0	[illegible]		
25	88.5	0.0	[illegible]	0.0	[illegible]		
26	89.5	0.0	[illegible]	0.0	[illegible]		
27	90.5	0.0	7.5	0.0	[illegible]		
28	91.5	0.0	9.5	0.0	[illegible]		
29	92.5	0.0	[illegible]	0.0	[illegible]		
30	93.5	0.0	[illegible]	0.0	[illegible]		
31	[illegible]	0.0	[illegible]	0.0	[illegible]		
32	3[illegible]5	0.0	[illegible]	0.0	[illegible]		

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
So. Union EXHIBIT No. 2
CASE 1774

NOTE:
(*) REFER TO ATTACHED LETTER.
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.
(2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representation, as to the productivity, proper operation or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

ILLEGIBLE

FORM R-8

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report JULY 17, 19[illegible] Page 2 of 2
Well JICARILLA B. 1-C Cores File
Field Formation Analysts
County State Elevation Coregraph
Location Remarks

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION		PROBABLE PRODUCTION	REMARKS
				OIL	TOTAL WATER		
				% VOLUME % PORE	% PORE		
33	3496.5	0.0	10.8	0.0	87.1		
34	97.5	0.0	9.8	0.0	81.6		
35	98.5	0.0	9.3	0.0	86.0		
36	99.5	0.0	9.1	0.0	85.8		
37	3500.5	0.0	10.5	0.0	83.9		
38	01.5	0.0	11.3	0.0	77.9		
39	02.5	0.0	10.5	0.0	95.6		
40	3503.5	0.0	20.3	0.0	21.2		

This section is essentially non-productive.

NOTE:
(*) REFER TO ATTACHED LETTER.
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED. (2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.

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ILLEGIBLE

FORM F-6

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 1 of 2

Well [illegible] Cores [illegible] File [illegible]

Field [illegible] Formation [illegible] Analysts [illegible]

County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]

Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION		PROBABLE PRODUCTION	REMARKS
				OIL			
				% VOLUME	% PORE	TOTAL WATER % PORE	
41	3504.5	0.0	9.7	0.0	75.2		
42	05.5	0.0	9.4	0.0	82.0		
43	06.5	0.0	9.2	0.0	69.5		
44	07.5	0.0	9.0	0.0	78.5		
45	08.5	0.0	10.7	0.0	68.3		
46	09.5	0.0	8.2	0.0	78.0		
47	10.5	0.0	9.7	0.0	73.2		
48	11.5	0.0	9.6	0.0	78.0		
49	12.5	0.0	8.1	0.0	71.7		
50	13.5	0.0	10.5	0.0	74.2		
51	14.5	0.0	8.8	0.0	82.9		
52	15.5	0.0	7.9	0.0	81.0		
53	16.5	0.0	8.9	0.0	85.6		
54	17.5	0.0	10.5	0.0	78.1		
55	18.5	0.0	9.8	0.0	79.3		
56	19.5	0.0	10.2	0.0	74.5		
57	20.5	0.0	9.9	0.0	75.8		
58	21.5	0.0	12.5	0.0	67.3		
59	22.5	0.0	11.3	0.0	76.1		
60	23.5	0.0	11.1	0.0	79.3		
61	24.5	0.0	9.1	0.0	72.4		
62	25.5	0.0	8.2	0.0	70.2		
63	26.5	0.0	9.4	0.0	75.5		
64	27.5	0.0	9.1	0.0	73.5		
65	28.5	0.0	11.3	0.0	79.5		
66	29.5	0.0	8.9	0.0	74.0		
67	30.5	0.0	10.1	0.0	77.2		
68	31.5	0.0	9.0	0.0	74.5		
69	32.5	0.0	10.2	0.0	78.4		
70	33.5	0.0	7.9	10.7	64.6		
71	34.5	0.0	9.3	0.0	72.0		
72	3535.5	0.0	9.7	0.0	85.6		

NOTE:

(*) REFER TO ATTACHED LETTER.

(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.

(2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.

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ILLEGIBLE

FORM F-B

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 2 of 2
Well [illegible] Cores [illegible] File [illegible]
Field [illegible] Formation [illegible] Analysts [illegible]
County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]
Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION			PROBABLE PRODUCTION	REMARKS
				OIL		TOTAL WATER		
				% VOLUME	% PORE	% PORE		
73	3536.5	0.0	7.5	[illegible]	[illegible]	[illegible]		
74	37.5	0.0	11.0	[illegible]	[illegible]	[illegible]		
75	38.5	0.0	10.3	[illegible]	[illegible]	[illegible]		
76	39.5	0.0	[illegible]	12.6	[illegible]	[illegible]		
77	40.5	0.0	[illegible]	[illegible]	[illegible]	[illegible]		
78	3541.5	0.0	[illegible]	[illegible]	[illegible]	[illegible]		

The oil saturations noted are from a study sample.

This section is essentially non-productive.

NOTE:
(*) REFER TO ATTACHED LETTER. **(2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.**
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.

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ILLEGIBLE

DERIVATION OF FORMULA
TO CALCULATE THE RELATIVE UNRECOVERABLE RESERVES
AT DEPLETION FOR 160 AND 320 ACRE SPACING

The pressure distribution in a radial flow system will be given by the following for isothermal conditions

$$P^2 = \frac{(Pe^2 - Pw^2)\log r/rw}{\log re/rw} + Pw^2$$

or

$$P = \left[\frac{(Pe^2 - Pw^2).\log r/rw}{\log re/rw} + Pw^2\right]^{1/2}$$

Since the system is considered to be radial flow to the well, the pressure at any point on a concentric circle to the well bore would be described by inserting the radius of that circle in the above equation.

To evaluate the reserves under the area drained by the well, the reserves at each point in the reservoir can be described by the equation

$$\Delta R = Ph\phi\,\Delta A$$

$$\Delta A = 2\pi r \Delta r$$

Therefore by reducing this equation to its differential form and intergrating over the limits of the radius of drainage, the reserves in the area drained by the well can be described as a function of the pressure at the edge of drainage (Pe) and at the well (Pw). The integral is as follows

$$\int_0^R dR = \int_{rw}^{re} 2\pi h\phi r p\, dr$$

Since p is a function of r as stated in the equation from Muskat for steady state pressure distribution, the complete equation is as follows

$$\int_0^R dR = 2\pi h\phi \int_{rw}^{re} r\left[\frac{(Pe^2 - Pw^2)}{\log re/rw}\log r/rw + Pw^2\right]^{1/2} dr$$

The problem proposed was the two methods of draining the reservoir, the first by drilling wells on 160 acre spacing and the second by drilling wells on 320 acre spacing. The answer to this problem is what is the increase in recoverable reserves by use of the 160 acre spacing as opposed to the 320 acre spacing. Disregarding the assumption that the closer spacing might decrease the total time required to deplete the reservoir, we have made this study to show that at some time in the future, the reservoir pressures will be reduced by depletion to the point where the remaining reserves will be uneconomical to produce. This reservoir pressure will be approximately the same for both types of spacing as would be proved by the equation of deliverability given by Muskat as Equation (3), Section 11.3.

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
EXHIBIT No. 19
CASE 477

$$Q = \frac{\pi h k}{\mu} \frac{(P_e^2 - P_w^2)}{\log r_e/r_w}$$

$$\frac{Q160}{Q320} = 1 + \frac{\log \sqrt{2}}{\log r_e/r_w} = 1.0434 \qquad \left(\frac{r_e}{r_w}\right)_{160} = 2980$$

Therefore, the ratio of reserves remaining in the reservoir under each type of spacing could be calculated by the following equation

$$\frac{R_{160}}{R_{320}} = \frac{\int_{r_w}^{r_e} r \left[\frac{(P_e^2 - P_w^2)}{\log r_e/r_w} \log r/r_w + P_w^2\right]^{1/2} dr}{\int_{r_w}^{r_e\sqrt{2}} r \left[\frac{(P_e^2 - P_w^2)}{\log r_e\sqrt{2}/r_w} \log r/r_w + P_w^2\right]^{1/2} dr}$$

Solving this equation the solution is as follows

$$\frac{R_{160}}{R_{320}} = \left[\frac{\log \sqrt{2}\, r_e/r_w}{\log r_e/r_w}\right]^{1/2} e^{\frac{2P_w^2 \log\sqrt{2}}{P_e^2 - P_w^2}} \frac{\sum_0^\infty \frac{2^n \left[1 - \left(\frac{P_w}{P_e}\right)^{2n+3}\right]}{n!(2n+3)} \left[\frac{\log r_e/r_w}{1 - P_w^2/P_e^2}\right]^{n+3/2}}{\sum_0^\infty \frac{2^M \left[1 - \left(\frac{P_w}{P_e}\right)^{2n+3}\right]}{n!(2n+3)} \left[\frac{\log \sqrt{2}\, r_e/r_w}{1 - P_w^2/P_e^2}\right]^{n+3/2}}$$

NOMENCLATURE

P - pressure at a distance or from the well

Pe - pressure at the edge of drainage

Pw - pressure at the well bore

r - distance from the center of the well bore

re - radius of the area of drainage

rw - radius of the well bore

h - thickness of the producing zone

f - porosity of the producing zone

k - permeability

μ - viscosity

Subscript

160 - with reference to 160 acre spacing

320 - with reference to 320 acre spacing

Gunsite Butte Uranium Corporation

Calculation of Return on Investment
Undrilled 160 Acre Locations

February, 1958

Average sand thickness	30.75	
Recoverable gas per acre-foot	326	MCF
Recoverable gas per acre	10,024	MCF
Average price of gas*	12.7	¢ per MCF
Royalty interest	12.5	%
Production and ad valorem taxes	6	%
Well spacing	160	acres
Well cost	$35,000	

10,024 x 160 x $.127 = $203,688 total value of recoverable gas from 160 acres

$203,688 x .94 x .875 = $167,533 net value of gas from 160 acres

Return on well investment 4.79 to 1.00

* The average price of the gas recoverable during a 20 year production period from a 160 acre well site is estimated using the graph entitled "Production Decline Curve - Tapacito Pictured Cliffs Field."

Gunsite Butte Exhibit No. 7
Docket No. 977

TABULATION OF RESERVES ON PRODUCING WELLS CONNECTED TO SOUTHERN UNION GAS COMPANY'S SYSTEM
TAPACITO PICTURED CLIFFS FIELD, RIO ARRIBA COUNTY, NEW MEXICO

Operator & Well	Reserve/320 Acre*	Cumm. Prod. 2-28-58	% Reserve Produced	Days Produced	% Reserve Produced/365 Days
Honolulu Oil Corporation					
Jicarilla 1	2,033,920	387,632	19.06	451	15.42
Jicarilla 2	1,016,960	270,204	26.57	390	24.87
Jicarilla 3	1,307,520	741,432	56.71	267	77.52
Jicarilla 4	1,162,240	67,973	5.85	245	8.41
Jicarilla 6	---	37,011	---	230	---
Southern Union Gas Company					
Jicarilla 1-A	3,050,880	536,845	17.60	444	14.47
Jicarilla 2-A	4,503,680	361,271	8.02	354	8.27
Jicarilla 4-A	1,162,240	81,391	7.00	279	9.16
Jicarilla 5-A	3,632,000	264,029	7.27	312	8.51
Jicarilla 2-C	1,162,240	109,753	9.44	193	17.85
Jicarilla 1-D	1,743,360	89,475	5.13	402	4.66
Jicarilla 2-D	2,324,480	151,672	6.53	476	5.01
Jicarilla 3-D	2,615,040	260,762	9.97	184	19.76
Jicarilla 5-D	3,196,160	601,514	18.82	435	15.79
Jicarilla 1-E	2,033,920	883,488	43.44	546	29.04
Jicarilla 2-E	3,341,440	212,308	6.35	250	9.27
Jicarilla 3-E	3,050,880	353,715	11.59	448	9.44
Jicarilla 4-E	2,905,600	827,174	28.47	559	18.59
Jicarilla 5-E	2,469,760	568,902	23.03	229	36.71
Jicarilla 2-H	290,560	40,867	1.41	165	3.12
McCroden 1	3,777,280	119,338	3.16	143	8.06
McCroden 1-A	2,324,480	113,367	4.88	165	10.79
McCroden 1-B	2,615,040	88,676	3.39	89	13.90

*Based on 454 MCF/AF

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
EXHIBIT No. ____
CASE ____

TABULATION OF RESERVES ON PRODUCING WELLS
CONNECTED TO SOUTHERN UNION GAS COMPANY'S SYSTEM
TAPACITO PICTURED CLIFFS FIELD
RIO ARRIBA COUNTY, NEW MEXICO

Operator & Wells	Location	Connection Date	Sand Thickness	Micro Log Sand Thickness	Reserve/ 320 Acre Gross	Reserve/ 320 Acre Net M.L.	Cumm. Prod. 2-28-58	% Reserve Produced Gross	% Reserve Produced M.L.	Days Produced	% Gross 320 Acre Reserve Produced/ 365 Days	% M.L. 320 Acre Reserve Produced/ 365 Days
Honolulu Oil Corporation												
Jicarilla 1	SW/4 10-26-4	1-23-56	30	14	3,129,600	1,460,480	387,632	12.39	26.54	451	10.03	21.48
Jicarilla 2	NE/4 9-26-4	3-5-56	31	7	3,233,920	730,240	270,204	8.36	37.00	390	7.82	34.62
Jicarilla 3	SW/4 9-26-4	11-6-56	26	9	2,712,320	938,880	741,432	27.34	78.97	267	37.37	107.96
Jicarilla 4	SW/4 4-26-4	1-22-57	30	8	3,129,600	834,560	67,973	2.17	8.14	254	3.12	11.70
Jicarilla 6	SW/4 3-26-4	1-23-57	27	0	2,816,640	0	37,011	1.31	---	230	2.08	---
Southern Union Gas Company												
Jicarilla 1-A	SW/4 23-26-4	1-25-56	32	21	3,338,240	2,190,720	536,845	16.08	24.51	444	13.22	20.15
Jicarilla 2-A	SW/4 14-26-4	2-16-56	33	31	3,442,560	3,233,920	361,271	10.49	11.17	354	10.82	11.52
Jicarilla 4-A	SW/4 13-26-4	3-10-56	26	8	2,712,320	834,560	81,391	3.00	9.75	279	3.92	12.76
Jicarilla 5-A	NE/4 23-26-4	3-30-56	33	25	3,442,560	2,608,000	264,029	7.67	10.12	312	8.97	11.84
Jicarilla 2-C	SW/4 11-26-4	5-21-57	30	8	3,129,600	834,560	109,753	3.51	13.15	193	6.64	24.87
Jicarilla 1-D	NW/4 32-26-3	1-12-56	24	12	2,503,680	1,251,840	89,475	3.57	35.53	402	3.24	32.26
Jicarilla 2-D	SW/4 29-26-3	3-30-56	22	16	2,295,040	1,669,120	151,672	6.61	9.09	476	5.07	6.97
Jicarilla 3-D	SE/4 32-26-3	2-5-57	28	18	2,920,960	1,877,760	260,762	8.93	13.89	184	17.71	27.55
Jicarilla 5-D	SW/4 30-26-3	12-11-56	32	22	3,338,240	2,295,040	601,514	18.02	26.21	435	15.12	21.99
Jicarilla 1-E	SE/4 16-26-4	2-16-56	20	14	2,086,400	1,460,480	883,488	42.34	60.49	546	28.30	40.44
Jicarilla 2-E	SW/4 15-26-4	12-11-56	26	23	2,712,320	2,399,360	212,308	7.83	8.85	250	11.43	12.92
Jicarilla 3-E	NE/4 15-26-4	3-29-56	32	21	3,338,240	2,190,720	353,715	10.60	16.15	448	8.64	13.16
Jicarilla 4-E	NE/4 22-26-4	2-16-56	26	20	2,712,320	2,086,400	827,174	30.50	39.65	559	19.91	25.89
Jicarilla 5-E	NW/4 16-26-4	2-15-57	29	17	3,025,280	1,773,440	568,902	18.80	32.08	229	29.97	51.13
Jicarilla 2-H	NE/4 17-26-4	4-30-57	17	2	1,773,440	208,640	40,867	2.3	19.59	165	5.09	43.34
McCrodem 1	SW/4 3-25-3	2-6-57	29	26	3,025,280	2,712,320	119,338	3.94	4.40	143	10.06	11.23
McCrodem 1-A	NE/4 9-25-3	2-5-57	27	16	2,816,640	1,669,120	113,367	4.02	6.80	165	8.89	15.04
McCrodem 1-B	SW/4 4-25-3	11-21-57	33	18	3,442,560	1,877,760	88,676	2.58	4.72	89	10.58	19.36

Reserve figures are based on MCF/AF supplied by Gunsite Butte, Witness Val R. Reese.

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
EXHIBIT NO. P-2
CASE 777

Weighted Average 12.6775¢ / MCF
Used 12.7¢ / MCF thereby taking into consideration probability of slight additional drop in production in early years and production continuing after the 20th year.

Gunsite Butte No. 1
Daniel No. 1

Price 10.9¢ / MCF until Jan 1959 when it increases 1¢ / MCF and 1¢ each 5 yrs. thereafter.
Used Gunsite av. percent decline based on drainage of less than 320 Ac. and slightly in excess of 160 Ac.

Percent Reserves Produced

Years

PRODUCTION DECLINE CURVE

Tapacito Pictured Cliffs Field

Val R Reese and Associates, Inc. February 1958

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 13, 1958

IN THE MATTER OF: Case No. 977

TRANSCRIPT OF PROCEEDINGS

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

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BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 13, 1958

IN THE MATTER OF: The hearing order to be held by Paragraph 7 of Order No. R-794-B to permit Southern Union Gas Company and all other interested parties to appear and show cause why the Special Pool Rules for the Tapacito-Pictured Cliffs Gas Pool, as set forth in Order No. R-794, should be continued in effect beyond April 1, 1958.	Case 977

BEFORE:

Mr. A. L. Porter, Jr.
Mr. Murray Morgan
Governor Edwin L. Mechem

AFTERNOON SESSION

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: The meeting will come to order. The Commission will take up next Case 977.

MR. COOLEY: Case 977: In the matter of the hearing order to be held by Paragraph 7 of Order No. R-794-B to permit Southern Union Gas Company and all other interested parties to appear and show cause why the Special Pool Rules for the Tapacito-Pictured Cliffs Gas Pool, as set forth in Order No. R-794, should be continued in effect beyond April 1, 1958.

MR. GRENIER: If the Commission please, this is the fourth hearing which has been held in this matter. It involves generally the question of the propriety of 320-acre spacing in the Tapacito-

Pictured Cliffs Pool in Northwestern New Mexico.

At the time the first hearing was held, it was upon an application for a temporary order establishing 320-acre spacing, and that was granted by the Commission in its Order No. R-794 under date of April 18, 1957. At that time the Commission requested that an interference test be conducted by Southern Union Gas Company and that was done. Subsequently another test was also informally suggested by the Commission's staff, and when the matter came on for hearing in March of last year, it was continued further until August, so that the results of those two tests might be presented. At that time only the first test had developed any significant results, and it was further continued until this hearing, so that possibly the second test results could be presented at this time.

We are now ready to proceed, picking up the case from the point indicated. We will have one witness, Mr. Wiederkehr.

MR. PORTER: Mr. Wiederkehr, stand and be sworn.

(Witness sworn.)

A. M. WIEDERKEHR,

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. GRENIER:

Q Will you please state your name for the record?

A A. M. Wiederkehr.

Q By whom are you employed, and in what capacity, Mr. Wiederkehr?

A Southern Union Gas Company, Manager of Exploration Department.

Q You have previously testified in this same case at the prior hearings thereon?

A I have.

MR. GRENIER: Are the witness's qualifications still acceptable to the Commission?

MR. PORTER: Yes.

Q Now as was mentioned in the opening statement, Mr. Wiederkehr, there were two interference tests made in the Tapacito Field area by Southern Union Gas Company, is that correct?

A Yes, that's right.

Q Is there a map on the board which indicates generally the location and outlines of the Tapacito Field and the relationship of the two interference test areas to the pool outlines?

A Yes. In general, the area outlined in our Exhibit No. 5 in red is the pool boundary. Now, one order came in after I had left town on the extensions of this field, and actually there are a few extensions along the northeastern edge that have been approved by the Commission that are not on this map. The area of test number one centered in the center of 26 North, 4 West. The second interference test was in the southwest part of Township 26 North, 3 West. Both of these test areas lying along the southern extremities of the productive pay in the Tapacito Field. I think it's worthwhile to point out that the Southern Union Jicarilla 1-E Well in the

interference in the southeast quarter of Section 16, 26, 4, is a direct offset to the 6-E Well located in Section 20, Northeast quarter, which was non-productive in the Pictured Cliff formation.

These interference test areas are not limited to the fairway of the field, but actually in the instance mentioned and also in the second interference test area, both wells,or two of the wells are very definitely on the edge and are offset with dry holes.

Q Now in addition to this Exhibit 5, at the prior hearings in this matter there were also introduced as Southern Union Exhibits No. 1 and 2 smaller plats showing the detailed locations of the wells involved in the respective interference tests. Those exhibits, I believe, have now been placed on the board again, is that correct?

A Yes. Interference test number one, Exhibit No. 1, had three producing wells with one shut in well in the center. Number two interference test, we had two producing wells with one shut in well.

Q Now, at the first -- now as to the first test, the results of that were given at the prior hearing, but in order that we may compare the results of that test intelligently with the results of the second, can you briefly state to us now again what that test indicated?

A Interference test number one, with three producing wells, these three wells during the time of the test produced a cumulative total of 1,340,450,000 cubic feet of gas, with the shut in well

losing 22 pounds casing pressure, 21½ pounds tubing pressure during the time of this interference test. That amounts to about two percent of the original gas in place being withdrawn during the time this well was shut in.

Q Now then, the data as to that was presented in Exhibit No. 3, I believe, at the last hearing in this matter, and in Exhibit 4, the data up to the date of that hearing was presented as to the second interference test. Have you now prepared additional exhibit bringing down to date the data as to the second interference test?

A Yes, I have, showing the same general type of information as shown in one, with the monthly production, the cumulative production, and the monthly shut in casing and tubing pressures on the shut in well, and on the bottom of that, as per the Commission's order, we have two sets of bottomhole pressures run on both the two flowing wells and the one shut in well. Those pressures were run on October 8 and January 30, respectively.

Q Now, may we have this exhibit marked as Southern Union Exhibit 6?

(Southern Union Gas Company's Exhibit No. 6 marked for identification.)

Q Can you summarize the results, then, as to cumulative production which was obtained from the two wells offsetting the Southern Union well, and what if any pressure drop was noted?

A Yes. The cumulative production for the two wells through

the month of January, 1958, amounted to 700,654,000 cubic feet of gas. During that time the pressures were recorded, the maximum pressure was 1,066 pounds on the casing and the minimum pressure was 1,056 pounds, or a ten pound pressure drop. On the tubing, the maximum pressure was 1,064½ pounds, and the minimum pressure was 1,054 pounds, or 9½ pounds. It's interesting to note that approximately fifty percent as much gas was withdrawn during this interference test, and we had a pressure drop of approximately fifty percent as much; in other words, we had twenty-two versus ten and a billion three versus seven hundred million.

Q You are speaking in comparison to the first interference test, is that correct?

A Right, that is correct. On the bottomhole pressures, on October 8, 1957, the shut in well bottomhole pressure amounted to 1199 pounds. The tophole pressure at that same time was 1,061 pounds. On January 30, 1958, the shut in pressure on the 4-D Well was 1193 pounds, that's the bottomhole, and the tophole shut in was 1,055 pounds. We had there a six pound pressure drop between October 8 and January 30 on the bottomhole from bomb, and at the same time we had a six pound pressure drop tophole, deadweight measurement, which indicates there was no fluid in the hole and we are actually getting then true tophole pressures.

Q Now what do those two tests indicate as to the area which a well in these portions of the field, at least, is capable of draining?

A The area, assuming a drainage pattern of a circle, circular drainage pattern, the minimum area drained under interference test number one would have to have been 785 acres; in other words, we were getting interference out of an area of 785 acres. The second test indicated interference over 783 acres.

Q What was the basis on which those figures were derived? How did you arrive at your respective acreages?

A Actually taking the diameter of a circle between the locations of the various wells and drawing a circle with it.

Q A radius?

A A radius, rather. Drawing a circle, using as the radius the distance between the producing well and the shut in well.

Q That is to the closest of the producing wells, is that correct?

A That's correct.

Q Would you say, then, that that is the minimum area which is indicated to be drained?

A Yes. I think we have conclusively proved that you can move gas over an area of 780 acres.

Q Do you feel that these two tests, considering their relationship geographically to the remainder of the field, are fairly representative of the conditions which may be expected to be found in the field as a whole, or are they of somewhat more local significance only?

A As pointed out a while ago, the fact that the test areas

are on the extreme boundary and they are offset with dry holes, and I might point out that Jicarilla 5-D Well, located in the southwest quarter of Section 30, 26, 3, which was the closest well to the 4-D shut in well and which is the extreme well next to the edge of the field, produces 546 billion of the 700 million feet that was produced from the field. In other words, what we're saying is that you have good sand development right up to a breaking point, and then immediately you go in a period of one location, you go from good sand development to practically nothing. That can be pointed out again by looking at Section 1, 26, 5, in which Southern Union completed its 2-G Jicarilla well for 20 million I.P., and the southwest quarter was a dry hole in the Pictured Cliff and cored, and we had pretty good information. Yet across that section we went from a sand body that would give an I.P. of 20 million to nothing.

So then we have in reality a very definite breaking point that could be carried on further through, one of Pacific Northwest's wells offsetting a 20 million foot well that made a million, just about a million feet, I believe. I have pointed out another example here, I might point out between Southern Union 2-HJ and 5-EH, the 5-E I.P. for 6 million, and that was through a three-quarter inch choke, and the 2-H direct offset I.P. for 920 thousand, so there is a very definite edge point along which the sand just goes completely to pot.

Q So that the entire length of the field rather closely

resembles itself in that regard, is that correct?

A That is correct. We can trace it all the way from the northernmost edge right on down to the south end of it.

Q To reiterate the question, then, do you feel that these two tests areas then are representative of conditions to be found in the field as a whole?

A Yes, I do.

Q Have you made any estimate of the reserves in this Tapacito-Pictured Cliffs Pool, Mr. Wiederkehr?

A Yes, actually we keep our reservoir calculations based on what our operating line pressures are. At the present time we are operating, or we have a system that will operate at about 500 pounds in this area, and the recoverable reserves to 500 pounds have been calculated to be 835 million feet of gas on 160 acres, or 1,670,000,000 cubic feet of gas on 320 acre unit.

Q What was the basis upon which you arrived at those reserve estimates?

A Using the porosity, water saturation, and sand thickness, it was a volumetric calculation based on all the information we had available.

Q Now, what does it cost, on the average, to drill a well in this area?

A We have drilled some nineteen or twenty wells with an average cost running between thirty-nine and forty-one thousand dollars.

Q What would --

A (Interrupting) I would say forty thousand is a good round number.

Q Now, would an investment of that kind be economically justifiable in the event 160-acre spacing were established for this pool, considering the reserve computations which you have made and the other known facts about the pool?

A Yes, a well drilled on 160 acres would pay for itself.

Q Then why is it that 320-acre spacing is being recommended by Southern Union in this case, since as you state, 160-acre spacing, rather, drilling on 160 acre basis would be economically justifiable?

A Simply because it appears that we can recover approximately as much gas from wells on 320 as we could on wells on 160. Right now there are approximately forty-six wells in the field developed on 320. If we have to go back in there and develop on 160, we are talking about an additional forty-six wells, or an expenditure of about two million dollars. That two million dollars can be used very well other places.

Q Well, now, if 160-acre spacing were established by the Commission's order in this case, or it were just left under the area 160-acre spacing order, what effect would that have upon this two million dollar investment? Would it necessarily have to be made?

A Well, of course, each operator would have the prerogative

of drilling either on the 160 or 320, but in the event of proration, which we suspect might come about, if one operator drilled on 160, drilled two wells then to the 320, and the other operator only had one well on the 320, there might be drainage across lease lines. So we should have a uniform pattern, and we feel like the 320 is the most logical pattern to set.

Q Do I infer from that, then, that if an operator who had developed his lands on 320 were being offset by another operator on 160, that 160-acre spacing pattern might in sort of a chain reaction force the 320 developed operator to go to 160?

A It certainly could and probably would in certain areas of the field where there are varied ownerships, both operators and royalty owners, and to protect correlative rights of the royalty owners, I wouldn't be a bit surprised if we weren't forced to offset additional wells.

Q Now, you stated, I believe, that prorationing has not yet been instituted in this pool, is that correct?

A That is correct.

Q Has it been instituted in other Northwestern New Mexico Pictured Cliff pools?

A In all but one, I believe, of the major pools.

Q Would you think it likely that this pool would go on for much longer time in an unprorated condition?

A Of course, I can't second-guess the Commission, but with three pipe line companies taking gas out of the area at varied

rates, it wouldn't surprise me any if it were prorated.

Q Well, I gather from that then that you feel that there might be some reasonable likelihood of prorationing hearings being held in the fairly near future?

A I suspect there will be.

Q Now, if that is the case, would it be your recommendation that the Commission proceed in this case without regard to the problems which they might encounter in establishing prorationing?

A I think certainly that we have to look at this case in line with the Commission's policy to prorate gas in the Northwestern New Mexico area.

Q In Section 65-3-14 of the New Mexico Conservation Commission Act, it provides in sub-paragraph (b) as follows: "The Commission may establish a proration unit for each pool, such being the area that can be efficiently and economically drained and developed by one well, and in so doing the Commission shall consider the economic loss caused by the drilling of unnecessary wells, the protection of correlative rights, including those of royalty owners, the prevention of waste, the avoidance of the augmentation of risks arising from the drilling of an excessive number of wells, and the prevention of reduced recovery which might result from the drilling of too few wells." Now, considering the standards set up in the section of the law just quoted, do you feel that 160 acres or 320 acre spacing is best adapted to meeting the standards which the Commission is going to have to consider when and as it gets to the point of

prorationing orders?

A I think definitely that the 320-acre unit is the most logical at this stage of the field development.

Q Would 320-acre spacing be sufficient to, and I quote: "...efficiently and economically drain"...Will one well in this area efficiently and economically drain a 320-acre tract?

A From all the information we have presently available, it certainly appears that it would.

Q Would 320-acre spacing or 160-acre spacing be best calculated to prevent economic loss caused by the drilling of unnecessary wells?

A Certainly drilling on 160 would be an economic loss due to the fact that you would be drilling unnecessary wells.

Q Would that be so at the 320-acre spacing?

A It might be, but we don't have enough information to prove that we can drain any larger area at this time, effectively.

Q Your interference tests have indicated that possibly they could?

A Yes, but these interference tests don't run into effectiveness. They just show you can drain an area, and I would be skeptical that you would drain that far an area effectively.

Q Now, would you feel that institution of 320-acre spacing would adequately protect correlative rights, including those of royalty owners?

A If the field was developed on that spacing, it certainly

would.

Q Would you feel that there was anything to choose between the 320 and the 160 acre spacing patterns as to the prevention of waste?

A That is a question that in all probability there may be a very small amount of additional gas recovered on 160 drilling versus 320 drilling, but as I pointed out earlier today, the area where you go from good sand to poor sand is extremely narrow, you just run out of sand in one location offsets, and as a consequence I doubt that there is much additional gas that could be recovered even by drilling on 160-acre spacing.

Q In contrast to the other Pictured Cliffs Pools in this area, would it be your opinion that there is better than average or poorer than average communication in this pool as between wells?

A This seems to be in all probability the best Pictured Cliff field in the northwest or in the San Juan Basin.

Q As contrasted to the presently prorated pools, just slightly so or substantially so?

A Appreciably so.

Q Which as between 320 and 160 acre spacing would better avoid augmentation of risks arising from the drilling of an excessive number of wells?

A As pointed out on the map, if we will look on the southwest side of the map, we know three or four wells that Southern Union drilled in there, that 320-acre spacing even with dry holes being

less than a mile from production, so certainly drilling on 160, you are taking a greater risk of drilling additional dry holes.

Q Now, as the pool has been developed to date, have all of the wells within it been drilled on 320-acre spacing pattern, in accordance with this temporary order that we have now had in effect for, well, since April of 1957?

A I think there's one well that was drilled on 160-acre spacing. A special hearing was held on a Pacific Northwest well.

Q To your knowledge, there's only that one exception of a well less than 320?

A That's the only one that I know of.

Q In which corners of the sections does the Commission order contemplate that these wells are to be drilled?

A Southwest and northeast.

Q Are there some wells in the pool which have not been drilled in accordance with that?

A Yes, there are.

Q Now, do I understand then that each of those wells, even though irregularly located within the section, is still so located as to permit the assignment of 320 acre unit to it, is that correct?

A That is correct. There are no more than two Pictured Cliffs in any other section,or any section.

Q This may be a little premature, Mr. Wiederkehr, but still looking down the road just a little bit to this prorationing problem which you have indicated may well be upon us in the near future,

wouldn't further continuance of 320-acre spacing as the standard spacing pattern for this pool necessarily have to preclude anybody from drilling up his acreage on 160-acre basis, if he so desired in a particular situation?

A I think that if the Commission so desires, that an order of 160-acre spacing could be allowed with the thought in mind that wells drilled on 320 acre would be given a 320-acre unit rather than a 160 as has been done in the other areas of the State of New Mexico.

Q In other words, you would give a double allowable to a well drilled on 320, as contrasted to a single allowable to the well on the 160?

A Assuming the deliverability is the same, the formula would work out that way, yes.

Q Would it be your thought, if a man wanted or company wanted to put in two wells on 320 acre tract and produce the unit allowable from the two of them, that he should be in effect permitted to do so in this fashion?

A I would think they would be permitted to do so as individual wells, each one getting 160 acres allocated to it.

Q If it can be accommodated to either 160 acres or 320, then, in the prorationing process, assuming that there is a double allowable to 320 acre well, why is it that you are now suggesting a 320 acre spacing pattern?

A Because I think it more nearly conforms to what the law says

should be done. I believe I feel like the 320 is. I think it is a waste of money to drill wells on any closer pattern.

Q Do you have any further comment?

A Yes, I would like to make one comment further with respect to production. The question was brought up at a previous hearing as to whether these wells in Tapacito, if they were allowed to be drilled and produced on 320-acre spacing, could or would produce twice as much as wells on 160-acre spacing in other Pictured Cliffs fields, and just for my own information, I ran through the month of December production figures for all the Pictured Cliff fields, and here is the results on Pictured Cliffs-Tapacito wells, average 16.15 million feet per month per well. The next closest field is Otero at 6.1 million feet per month per well. 5.9 for South Blanco, Aztec-Pictured Cliffs, 4.4; West Kutz, 3.8; Ballard, 3.1; Fulcher Kutz, 2.6; Canyon Largo, 1.5. In other words, the average production from these Tapacito field wells drilled on 320-acre spacing produced approximately two and a half times as much as any other field average. I think that that is something else that could influence the Commission, because this does indicate that the Tapacito wells are well above average as far as deliverable capacity is concerned, and consequently well above average as far as being able to recover in the same number of years the gas that is in the field.

We are not talking about deferring income for twice as long as other Pictured Cliffs fields, but we are talking about wells

that can probably recover the gas from under the tracts in lesser time than the other wells in Pictured Cliffs fields, even on 320-acre spacing.

Q Would that last comment that you made be true as respects both working interest owners and also the royalty owners?

A That is correct. In other words, we'll just get, the field is of such characteristics that it can be drained much more rapidly than any of the Pictured Cliffs fields we know of in the area.

Q That would be to the benefit of not only the working interest but the Indians, the Government?

A Anybody else.

Q Equally as the working interest owners themselves?

A That is correct. One other thing, speaking strictly for Southern Union, we have already laid a gathering line into the area, about 20 or 30 miles of it across there with the wells that we have developed and the wells committed to our company. That line is so packed right now that the average wellhead working pressure is running about 600 pounds. If we drilled additional wells, we couldn't cram any more gas through the line anyhow. We as a company could not take additional gas, or appreciable quantities of additional gas without expending additional sums of money for additional pipe lines, which we don't feel like the reserves would justify, so even if we went to drilling of additional wells in there, in all probability all we would do would be cut back the production from the ones we have, and the net production from

the field would probably be about the same. At the present time, Southern Union has, either owns or under gas purchase contract, about half the wells in the field. I believe that's all I have.

MR. GRENIER: I have a concluding statement, but I think it might be appropriate to reserve that until after we see if anybody else has testimony in this case.

MR. PORTER: Does anyone have a question of this witness? Mr. Kellahin.

MR. KELLAHIN: Jason Kellahin, representing the Gunsite Butte Uranium Corporation.

CROSS EXAMINATION

By MR. KELLAHIN:

Q Mr. Wiederkehr, in connection with your interference test and in reference to Exhibit No. 5, I believe you stated that the wells on which the tests were run were located along the southern extremity of the pay zone?

A Actually southwestern extremity. It depends on how you look at the field, being southwest-northeast, it has to be on the southwest side of the field.

Q They are not located, then, in the fairway of the field, is that your testimony?

A What I was saying was that one well in each of the interference tests was located adjacent to dry holes, so they are located pretty close to the edge of the field.

Q Is that based solely on the fact that they are located

closely or adjacent to a dry hole, is that the basis of your testimony that they are at the edge of the field?

A Yes. They're also at the edge of the field as determined by the state under the field boundary.

Q That I will agree to. Now, in connection with that, have you made any study of the micro-logs as to porosity through the field?

A Yes, as a matter of fact, I have core information on quite a number of wells in the field.

Q On the basis of that study, do you still say they are not located in the fairway?

A Well, it depends on how you define "fairway". I define fairway as the middle, in the middle of the field. If you do that, they are not in the middle, they are on the edge.

Q Actually it is a relative question as to porosity and sand thickness?

A That is correct.

Q In general, the areas which were subject to the interference tests are in a good micro-porosity area, are they not?

A The wells in general are pretty good, but we took them as close to the edge of the field as we had available.

Q I'm referring to characteristics of the wells as compared to the pool as a whole. They are relatively good?

A The wells that we used on the interference test, not necessarily, they were about average.

Q You had good sand characteristics there, did you not?

A Yes, pretty good sand.

Q Now, in connection with these interference tests, I would like to go over those again with you; as to interference test number one, I believe you said you had a shut in pressure drop on the casing of 22 pounds, is that correct?

A That is correct.

Q What was your total production?

A 1,340,450,000 cubic feet of gas.

Q How far was the shut in well from the producing wells?

A Let's see, about 3300 feet, that was the nearest one.

Q Over what period of time did you achieve that pressure drop?

A There was no production in January, '56, so the first production was in February of '56, and the conclusion of the test was in December of '56, we are talking about eleven months.

Q You are talking about eleven months, with a 22 pound pressure drop?

A Right, over a 3300 foot interval.

Q Now, as to your interference test number two, give us the same information on that.

A Yes, the distance between wells is 3295 feet, the pressure drop was 10 pounds, the production was 700,654,000 cubic feet of gas, and actually the majority of that production was in a 13-month period prior to the time of the test; 60,000,000 feet of gas had been produced from the Jicarilla 2-D well.

Q Would that have any effect on your interference test?

A I seriously doubt it, that small amount of gas, because we didn't find a definite break in pressure until about six months had elapsed. It took about that length of time before we actually started moving gas from the well that was shut in. Then after it started, it started moving pretty rapidly.

Q In connection with your interference test, I believe your test does not show the effectiveness of the drainage, is that correct?

A I would say that it doesn't prove that you could effectively drain 785 acres.

Q It does not effectively prove it?

A That's right. It does prove, as far as I am concerned, that you can dril 320 acres.

Q Effectively?

A Yes, sir, effectively.

Q And economically?

A And economically.

Q In connection with those dry holes which you said the pressure tests offset, does completion method have anything to do with that, in your opinion?

A It would not in this case, because we drilled the wells in this case, and I happened to have the supervision of the drilling in the wells.

Q So you know they were completed properly?

A I know they were completed properly.

Q There are some producing wells to the south and west of the Tapacito not shown on your map?

A Producers south and west?

Q Between the Tapacito and the South Blanco?

A There may be, because I was only interested in the Tapacito property.

Q You don't have your well data up to date on that map?

A Yes, inside the Tapacito.

Q Outside the Tapacito?

A No. Actually it was only brought up to date for the Tapacito Field, only.

Q Give us the method you used in calculating reserves.

A I said that I used the volumetric method.

Q You used an abandonment pressure, in effect, of 500 pounds?

A I pointed out that we carry our reserves on the basis of what we can get at our presently anticipated operating line pressure. Certainly I do not doubt before this thing is over with, we will be down to a lesser pressure. I said recoverable to 500 pounds, I wanted that pointed out very definitely.

Q Other pipe lines operate at considerably lower pressures in that area?

A I don't know about El Paso's, I believe Pacific Northwest is appreciably higher.

Q You wouldn't know if El Paso's was 250?

A I don't know. I didn't ask them.

Q As a general proposition in calculating reserves other than in the operation of your pipe line, you calculate them in 100 pounds?

A Depending on the characteristics, and I suspect that one of these days we will be down to that point on this field. I'm not arguing that there is not plenty of gas to support 160 acre.

Q In connection with your calculation of reserves, could you give us what porosity you used?

A I used a 19 percent porosity figure, taking only the area that I considered to be, to have the permeability that would be productive. Actually you can take from core analysis, you can go throughout the entire section, which is 100 feet or so, if you want to, and because of the variations in porosity up and down, you can get a much lower average porosity, and then you just increase your sand thickness.

Q You just took the effective permeability?

A What I figured was the effective area that could be drained because of the fact of the no permeability in much of the section.

Q What range of permeabilities did you find that you considered effective?

A Oh, I would say from about two-tenths of a millidarcy. We have fracted wells with as little as that, and made wells out, and the permeability runs up; we had some as high as two or three hundred millidarcies.

Q What water saturation?

A Thirty percent water saturation, which may or may not be exact. I have seen certain core analyses that showed a water saturation of twenty percent, and I have seen some showed as high as fifty and sixty, yet they made producers; for my calculation I used thirty percent. If it is higher than that, it will reduce your reserves a little bit.

Q You referred to a Pacific Northwest well drilled off pattern subsequent to the last order. Tell us which well that is, please.

A Northwest quarter of Section 7, 26, 4; that well has not been spotted, that is where it is, northwest quarter of Section 7, 26, 4.

Q Mr. Wiederkehr, I don't know if you touched on this directly in your direct examination, but in referring to your line pressure operating at 500, does that indicate that you are loaded in that line, there is a limited market in this pool?

A As far as Southern Union is concerned, there is a limited market.

MR. KELLAHIN: Thank you very much.

MR. PORTER: Anyone else have a question of the witness? Mr. Cooley.

By MR. COOLEY:

Q Mr. Wiederkehr, in relation to the information that the information tests give us, I believe you reiterated at least twice that it does not show that it will effectively drain, or how long it will take to drain a particular area. Do you have any estimates

as to how much longer it will take to drain the Tapicito-Pictured Cliffs Pool on 320-acre spacing, as compared to 160-acre spacing?

A Well, as I said, as far as Southern Union, it would be about the same because we can only take so much gas. Assuming all wells were produced at the same proportionate part of their capacity, then you would drain the wells in approximately twice as fast if you drilled it on 160 as on 320.

Q You think it would be just a direct relationship?

A Relatively close, I don't think there is going to be much gas on the edge drained in anyway, because of the relatively thin area where you go from productive to non-productive.

Q In your arguments in favor of 320-acre spacing, I believe you stated that you felt that it would be undesirable to have 160-acre spacing in there or that 160-acre spacing would cause, necessitate offsets?

A Yes. That would be, of course, in the event of prorationing and in the event, regardless of your acreage, you were prorated on the same basis.

Q Assuming those facts to be the case, you feel that correlative rights of at least the royalty owners would be violated or impaired if the offset was not drilled?

A Yes.

Q Would this not also be true if, as you proposed, the Commission permits or goes to 320 proration units, but permits 160-acre wells, two wells on 320-acre unit?

A If the acreage, well, assuming that deliverability of the two wells on the 320 was the same as the deliverability on the one well on the offset 320, there would be no violation because their allowables would be the same.

Q Why does this hold true in one instance and not the other? I don't understand your reasoning.

A What I said originally was that if you did not drill, if somebody drills on 160 and the offset operator did not drill on 160, and you prorated on the basis of 160, the two 160 wells get twice as much allowable as the one on the 320, so then you have drainage. If you double the allowable, the 320 will get twice as much as either of the two 160, but the same as both combined.

MR. COOLEY: Thank you very much.

MR. PORTER: Mr. Mankin, do you have a question?

MR. MANKIN: Warren Makin with Aztec. I have some questions, Mr. Wiederkehr.

By MR. MANKIN:

Q A while ago, Mr. Kellahin mentioned about some development extending out of the south part of the Tapacito in the South Blanco. Is it not true that the trends of the Pictured Cliff normally line up and that this trend would go into the Gavilan rather than the South Blanco?

A If it doesn't die behind it, it probably will some day end up down there, but as far as we know, all Pictured Cliffs trends found in the Basin, quite a number of them have followed the north-

west - southeast trend.

Q Also it was mentioned that there were certain exceptions given, I believe when this order was originally written there was at least two Southern Union wells and one Gunsite well recognized as exceptions to the wells by wells previously drilled?

A That is correct, that was asked for at the outset.

Q Some time later, Southern Union had a hearing and asked for an exception for the No. 5-E well occasioned by prior drilling of one of the excepted wells?

A That is correct, we overlooked it the first time.

Q Some time later, Gunsite Butte had a hearing and made a point of asking that the well be drilled in the northwest section of 3, and later drilled the well in the northeast quarter?

A Yes, as I understand, that was a true fact. I was not present but had a report.

Q Do you have any reason to doubt that some of the testimony that was given previously might not have been somewhat changed by conditions on development?

A Well, since I wasn't at that hearing, I had better not make any statement on that. I do know that Pacific Northwest, when they got their exception, didn't do any better than they would have the first thing.

Q But the exception was granted for the Gunsite in the northwest quarter of Section 3, 25, 3, but the well was drilled in the proper place in the northeast quarter?

A That is my understanding.

Q So apparently some condition must have changed. Also I wanted to ask you here if you now would recommend that this test on the 4-D well be discontinued due to proving that there has been interference?

A Yes, sir, I would like to ask that this test be discontinued because we have had over this period of time at least two wells shut in now for two years.

Q So there has been, in your estimation, sufficient proof of interference, and therefore it would be to the benefit of both Southern Union and Aztec that this well could revert to production?

A Yes, that is correct.

MR. MANKIN: That's all.

MR. PORTER: Mr. Kellahin.

By MR. KELLAHIN:

Q I would like to ask a question to clarify a matter brought out by Mr. Mankin. My question, Mr. Wiederkehr, originally was directed to wells outside the Tapacito Pool lying to the south and west of the Pool, between it and the South Blanco. Now did you understand it that way?

A Yes, I understood you to ask me if there were not additional wells.

Q And your answer was there are?

A Yes, there are some wells and some dry holes.

Q In connection with your exhibits showing the circle of

influence of those wells, they assume a uniform porosity and permeability, do they not?

A Yes, since we don't have enough information to go beyond that, we had to make that assumption.

MR. KELLAHIN: That's all. Thank you.

MR. PORTER: Mr. Utz, did you have a question?

MR. UTZ: Yes, sir.

By MR. UTZ:

Q I wonder if you would give me your 160 - 320 reserves figures again.

A Based on 500 pounds abandonment pressure --

Q Is that bottomhole or reservoir?

A Reservoir. On 160 acres, 835 million cubic feet of gas. On 320 acre unit, 1,670,000,000 cubic feet of gas.

Q Do you consider those recoverable reserves?

A To that pressure, that is correct.

Q Then that would mean that you consider your 320-acre drainage as efficient as the 160-acre drainage?

A Yes, as I mentioned earlier, I think there will be very little difference in this particular field.

Q Your statement --

A (Interrupting) May I go ahead on that last question first?

Q Go ahead.

A Particularly at this point, certainly at 500 pounds, we wouldn't have made any difference with respect to the reserves.

Now there may be a variation in recoverable reserves by the time you get on down to the final abandonment, but that would be very minor.

Q Well, you made a statement that you would recover approximately as much gas on 320 as 160. You have just qualified that, is that right?

A No, I haven't qualified it. I said that on my first statement of reserves, on 835 million on 160 and 1,670,000,000 on 320, that since they were based on 500 pounds pressure, that you wouldn't have left anything in the reservoir at that time. Now I say as you take it below 500, there will be a slight amount of gas, a little more gas left in the reservoir on 320 than on 160, but that is not nearly enough to offset the additional expenditure that would be required to get it.

Q How many wells did you say were in the Tapacito Pool?

A I believe there were 46 at the last count, I added up to 46.

Q Do you know that all those wells are connected?

A As far as I know, there are two or three that are not connected. The majority are, though.

Q Do I understand your testimony to the effect that you had no objection to either 160 or 320 acre spacing in the Pool?

A I said that, I don't think I said I wouldn't object to it. I said if the Commission should desire to do that, we felt like some provision should be made in the proration order. I think

320 is justified and think that is the proper order. I think it would be a waste of money to drill them on any other spacing.

Q If an operator saw fit to drill on 160, would you object to that?

A Well, I would object to it, because of the effect it might have on the field as a whole. I just think you ought to try to develop a field, if possible, on a common ground, particularly where you are starting out with a new field, but I wouldn't object near as strenuously if we knew the proration order was going to read two to one allowable on 160.

Q Let's assume for the moment that the proration order did read two to one allowable, what would be your recommendation?

A Then I would say that would be up to the individual company. My company policy would certainly be not to drill them on 160, but some other company might think they could do so.

MR. UTZ: I believe that's all I have.

MR. PORTER: Anyone else have a question of the witness? Did you offer your exhibits?

MR. GRENIER: I have one or two questions on redirect, Mr. Porter.

MR. PORTER: All right.

REDIRECT EXAMINATION

By MR. GRENIER:

Q Now we don't have a proration order yet, do we?

A No, sir.

Q We don't have any guarantee that one is going to come along on 160 or 320 acre basis?

A That is correct.

Q I gather, then, that we don't have any idea whether there will be a two to one protection in the proration order or not?

A That is the problem we are facing right now.

Q Now then, pending the arrival of prorationing and without any certainties as to what the prorationing order might do as to providing a two to one ratio, do you have any firm recommendation as between 160 and 320 during this interim period?

A I certainly do. I think we should continue our 320 acre spacing that the Commission has granted us up to date.

Q In other words, going back to Mr. Utz's line of cross examination, if anything were to be done along the lines that he is thinking about, do you think it would be better to do it after we had a proration order rather than before, is that correct?

A That is correct.

MR. GRENIER: I don't believe we have introduced, asked to have Exhibits 5 and 6 introduced in evidence, but we do so request now.

MR. PORTER: Without objection, Exhibits 5 and 6 will be admitted. Are there any further questions of this witness? The witness may be excused.

(Witness excused.)

I believe you stated that you just had the one witness?

MR. GRENIER: Yes, sir. That completes our direct presentation.

MR. PORTER: Does anyone else have testimony to present?

MR. KELLAHIN: Jason Kellahin of Kellahin and Fox, representing Gunsite Butte Corporation. We will have one witness, Mr. Val Reese.

(Witness sworn.)

If the Commission please, we will have some exhibits. It might be helpful to put them on the board.

(Recess.)

MR. PORTER: The hearing will come to order, please. Mr. Reese, would you stand and be sworn?

MR. COOLEY: This man has been sworn already.

MR. PORTER: Let the record show that the witness has been sworn.

VAL R. REESE

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. KELLAHIN:

Q Would you state your name, please?

A My name is Val R. Reese, and I make my home in Albuquerque, New Mexico.

Q By whom are you employed and what is the nature of your employment?

A I am employed by Val R. Reese and Associates, Inc., consulting geological and engineering firm located at 2929 Monte Vista Boulevard, Northeast, Albuquerque, New Mexico.

Q In connection with your employment, would you describe your duties?

A The nature of my duties is in a consulting capacity as a geologist in recommending wellsites, pre-determining of well depths, refixing casing points, determination of production zones for purposes of perforation, calculation of oil and gas reserves, recommending the development of leasehold of oil and gas acreage, and recommending the acquirement of gas and oil acreage for clients. These are dictated by geological studies and surveys and surface information.

Q Do you have a staff available to you?

A My staff consists of Thomas A. Dugan of Farmington, New Mexico, who is a petroleum engineer specializing in the drilling and completion of wells. He is assisted by Mr. Jim Jacobs, a geologist. The other member of my staff is Mr. Louis C. Jamison, a geological engineer. Mr. Jamison is an expert on the calculation of oil and gas reserves. He has worked under my supervision in the preparation of oil and gas reserves which we are submitting for your considerating in this hearing.

Q Have you ever testified before this Commission before, Mr. Reese?

A No, I haven't.

Q Would you describe your formal education and experience prior to your association with Val R. Reese and Associates?

A I attended San Jose State College in California for a period of three years prior to my entering the Army in 1941. While in San Jose State College, I majored in Geology, also was actively engaged in Mining Geology in the States of California and Arizona before and during my attendance at San Jose College. Following my discharge from the Army in 1946, I enrolled in Stanford University, and in 1947 graduated from Stanford with a Bachelor of Science Degree in Geology. I was thereafter employed by Associated Engineers, Palo Alto, California, for approximately a year until April, 1948, as a pipe line superintendent. In April of 1948 I was employed with Phillips Petroleum Company as an exploration geologist.

Q In connection with your work with Phillips Petroleum Company, have you had any experience in the San Juan Basin?

A My exploration activities for Phillips first took me into the San Juan Basin during the latter part of 1948. I have been actively engaged in geological studies relating to the San Juan Basin since that time, a period of approximately nine years. In April of 1951, I became District Geologist for Phillips in the San Juan Basin. My chief duty with Phillips Petroleum Corporation was to find and develop gas reserves in approximately 5,000 acres in the San Juan Basin. These gas reserves it later dedicated to the Pacific Northwest Pipe Line Corporation. In September of 1954,

I became Chief Geologist for Pacific Northwest Pipe Line Corporation, and later I also became Chief Geologist and in charge of the Land Department for Northwest Production Corporation, a subsidiary to Pacific Northwest Pipe Line Corporation. In June of 1957, I organized Val R. Reese and Associates, Inc.

Q Now, in connection with the Tapacito Pool, have you made any special study of that pool in connection with this case, Mr. Reese?

A Yes, we have.

(Gunsite's Exhibit No. 1 marked for identification.)

Q Referring to what has been marked as Exhibit No. 1, would you state what that is?

A Exhibit No. 1 is an isopacous map of the net pay sands of the Tapacito-Pictured Cliffs Field. The yellow outline shown on the map is the present outline of the Tapacito Field, and the yellow outline in the southwest part of the map is the northeast edge of the South Blanco-Pictured Cliffs Field.

Q What do the contours on that exhibit indicate?

A The contours represent an isopacous map or a thickness map of the net pay gas sands in the Tapacito Field. The thickness of these sands has been determined by studying the core information available in the Pictured Cliffs. Pay gas sandstones from the core information were determined as pay when they had more than five percent porosity and less than sixty percent water saturation. The electrical Schlumberger logs on wells that were not cored were

then correlated with the cored wells and the net sand thickness which corresponded to the cored information was determined as the net sandstone gas pay for each well.

Q On that map there are some triangles. What are those triangles?

A Those triangles are the cored wells on which we had core information.

Q Now how many wells did you have core information on?

A There were seven wells altogether, four cored wells within the area of the Tapacito Field, and three cored wells outside of the area of the Tapacito Field. In addition to the cored wells, we had forty-seven wells on which we had Schlumberger information within the Tapacito Field, and thirteen wells outside of the Tapacito Field.

Q Now, on the basis of that information, do the gas-bearing sands in the Pictured Cliff extend beyond the Tapacito Field?

A Yes, they do. We have shown these contours on the southwest side of the Tapacito Field extending over and into the South Blanco-Pictured Cliffs Field.

Q Is that also illustrated by cross-sections to be offered later?

A Yes, that is.

Q Is the area on which you have prepared cross-sections shown on Exhibit No. 1?

A Yes. The line of cross-sections are shown by lines drawn between wells. The first cross-section extends from the northern

end or northwestern end of the Tapacito Field down through its center to the southeast end.

Q Now how is that designated?

A That is designated as Cross-Section A-A'. The second cross-section extends from the northwest part of the Tapacito Field southwestward into the Blanco-Pictured Cliff Field. It is designated as B-B'. Likewise, Cross-Section C-C' extends from the middle of the Tapacito Field into the South Blanco-Pictured Cliff Field and Cross-Section D-D' extends from the southeastern end of the Tapacito Field into the South Blanco-Pictured Cliffs Field.

Q In connection with that, Mr. Reese, is there any producing wells lying south and west of the Tapacito Pool between it and the South Blanco?

A Yes. Skelly Oil Company has completed Pictured Cliffs wells in Section 18 of 25 North, 3 West; and Humble has completed a Pictured Cliff well, Humble has completed three Pictured Cliff wells in 25 North, Range 4 West. In Township 26 North, Range 5 West, there are Pictured Cliff dual completions by both Humble and Northwest Production Corporation.

Q Have you made any study, based on the information you have given, of the gas reserves in the Tapacito Pool?

A Yes. The area within the Tapacito Field was found to comprise 21,600 acres.

Q In that connection, you are referring to the Tapacito as it is presently defined by the Commission?

A Yes, that's right.

Q Proceed.

Q In our reserve study, we took the area between the contour lines and perimitered it and gave it weighted average thickness, which was determined between each contour interval of five feet.

(Gunsite's Exhibit No. 2 marked for identification.)

Q Is this information you have compiled shown on Exhibit No. 2?

A Yes, it is.

Q Would you please continue, then?

A The contour lines as shown on this map, the interval is five foot between contours. It was found that the entire average net sand thickness for the Tapacito Field was 28.4 feet. The porosity and oil saturations of the sandstones was determined from core analysis, the cored wells which lay in the most permeable areas, and which showed the best porosities on electrical logs were averaged together. These wells were the No. 3 Honolulu in Section 9 of Township 26 North, Range 4 West, and the No. 1-E well in Section 28 of Township 26 North, Range 4 West. The other five cored wells were averaged on their porosity and connate water and oil saturations; the averages of the first two wells were then weighted twice and counted two-thirds to one-third against the second group of cored wells. The average porosity of the sands was found to be 15.3 percent, water saturation was found to be

38.3 percent, oil saturation of the sant, .4 percent. The calculated bottomhole pressure for the field was then determined to be 1190 pounds. Reservoir temperature is 109 degrees Fahrenheit. The compressibility factor is .865, the gas per acre foot originally in place is 352 MCF. The gas per acre foot remaining at 100 pounds psi, abandonment pressure is 26 MCF, the recoverable gas per acre foot is 326 MCF. The average recoverable gas per acre for the Tapacito Field is 9,258 MCF. The total recoverable gas is 199,972,800 MCF.

Q Now in connection with that, you testified that two wells in the high permeability zone were weighted twice. Why did you do that?

A These are the two wells that were weighted twice, and the reason why we did that is because part of the cored wells are outside of the Tapacito Field, and after studying the Schlumbergers or electrical logs, it was found that these two cored wells represented approximately two-thirds of the porosity development or the better porosity development in the Tapacito Field.

Q Now is that information then reflected in Exhibit No. 2 designed to show the reserves for the entire pool?

A Yes, it is.

Q Have you made a study of the reserves of the producing wells within the pool?

A Yes, we have.

(Gunsite's Exhibit No. 3 marked for identification.)

This is reflected in Exhibit No. 3, and we made a study of each well within the pool, and on Exhibit No. 3, we have the number of the well, its location, and its completion date, total depth, its initial potential, deliverability when available, sand thickness, cumulative production, reserves per acre, reserves per 320 acres and percent of reserves produced.

(Gunsite's Exhibit No. 4 marked for identification.)

Q Referring to what has been marked as Exhibit No. 4, would you state what that is?

A Exhibit No. 4 is an isopacous map of the microlog porosity of the Tapacito Field. The porosity is again represented in contours, the contour interval is five feet. The contours on the map show the microlog feet of porous and permeable sandstones that produce the larger volumes of gas into the well bore. The number of feet of microlog porosity and permeability are plotted beside each well. The use of the microlog has been correlated with core analysis which show the most permeable sandstones to be in the areas of the best porosity. Where no measurable microlog porosity was found, a zero footage was plotted beside the well. The microlog porosity was then contoured, beginning with zero and going up to thirty feet. We used twenty-eight logs which were available for microlog porosity study within the Tapacito Field, and nine logs outside of the Tapacito Field.

Q Where you assigned a zero microlog porosity, does that

indicate there is no production in those areas?

A No. A zero microlog porosity merely indicates that the porosity and permeability is so low that we are not able to measure it. The zero areas to the southwest of the Tapacito Field have producing Pictured Cliff gas wells in them.

Q Would an example of zero microlog porosity be found in Section 19 in 26, 3, on Magnolia's 2-B Well?

A Yes, that would be an example.

Q That is a producing well, is it not?

A That is a producing well within the Tapacito Field.

Q What is the calculated absolute open flow on that well?

A 2,610,000 cubic feet of gas.

Q Then where you have assigned a zero microlog porosity, that indicates a conservative approach to your reserve figures, is that correct?

A Yes. The area in which we are able to measure the microlog porosity indicates that the sandstones are porous and permeable.

Q What do the contour results on this map indicate, Mr. Reese?

A The microlog contours as shown on the map fairly clearly illustrate that the porous sandstone in the Pictured Cliffs are trending in a northwest to southeast belt. Actual gas production extends to the northeast and southwest. I do not know the contour lines in the zero microlog area. However, the area of the best gas production is shown by the microlog contours to be a belt of highly permeable and porous sand.

Q Is there any connection between the microlog contour map and the gas production in the Tapacito Pool?

A The effect of the porous and permeable belt of sandstones trending northwest to southeast is such that the drainage of gas from the reservoir is accomplished in a northwest to southeast pattern parallel to the porous and permeable belt.

Q In other words, then, you are saying an irregular pattern of drainage has been established in the Tapacito Pool, is that what you mean?

A Yes. The drilling blocks of 320 acres are being irregularly drained due to the northwest-southeast trend of the drainage. For example, on the 4-E drilling block located in Section 22 of 26 North, 4 West.

Q Is that the block colored in green that you are referring to?

A Well, the 4-E drilling block would be running north-south comprising 320 acres. The block colored in green is our estimate of the area that is being drained by the 4-E Well. That block has been drawn on the map parallel to the trend of the porous belt of sandstones and a little closer toward the higher or the greater thickness of permeable sandstones. It can be seen from looking at this green block that the area of drainage of the 4-E Well would not only be in the northeast corner of the Section, but also in the Section to the north of it in the southeast corner.

Q That is assuming that it will drain 320 acres?

A That is correct. It will also have a drainage effect in the Section to the southeast of the regular drilling block.

Q That would leave part of the gas in the southern portion of the unit committed to that well undrained, is that right?

A That is correct. The micro-porosity in that Section goes from fifteen feet down to zero feet in the southeast portion of the standard drilling block, and that area would be relatively undrained.

Q I take it from your testimony there you do not agree with Mr. Wiederkehr's assumption that you have a radial drainage in the Tapacito Pool, is that correct?

A Yes, that is correct. We have definite information from the microlog porosities and by plotting that information on the map, we find that there is a definite permeable trend northwest to southeast.

Q Do you have other examples of unequal drainage due to the trend in this porosity belt?

A Yes, a second example is the Honolulu No. 4 Well, located in Section 4 of 26 North, 4 West. The cross-hatched area colored green on the map shows the area in which the greatest drainage will take place. Drainage will take place in the southeast of Section 5, and in the northwest of Section 9, as well as in the southwest portion of Section 4. This is because the zone of the most porous and permeable sands lie to the southwest of the No. 4 Honolulu Well, that's the zone in this area. The eastern part of the normal 320

acre drilling block on which the No. 4 Honolulu is located will be relatively undrained by the No. 4 Well, due to a decrease of the permeable sands in that direction. The permeability in the western part of the No. 4 320 acre drilling block totals ten feet, and in the center part of the 320 acre drilling block it drops to five, and on the eastern edge it drops to zero.

Q Is this irregular drainage that you are talking about compensated by offset drainage under the present development of the Pool?

A Under the present development of 320 acres, it is not compensated. In this example, in order to protect the drainage, or effectively equalize the drainage, a well should be drilled in the southeast of Section 5, and a well should be drilled in the northwest of Section 9.

Q In your testimony there, you are referring to this No. 4 Honolulu Well, are you not?

A Yes. There's a diagonal well, the No. 7-8 in Section 8.

Q Wells drilled at the locations that you have mentioned would then be on 160 acre pattern, is that correct?

A That is correct.

Q Now, you made a study of the effect of this drainage trend upon the acreage held by Gunsite Butte Uranium Corporation?

A Referring to the green-colored 320 acre drilling block located in Township 25 North, Range 3 West, it can be seen that the drainage is again northwest to southeast across the trend of the

regular 320 acre drilling blocks. The Southern Union well located in the southwest of Section 3 will drain parts of Section 4 and 9 of Gunsite Uranium acreage. The Gunsite acreage in Section 3 and 4 will be drained by Southern Union before the normal 320 acre block on which the Southern Union well lies is drained in its eastern portions. Again the permeability in the eastern part of the Southern Union 320 acre block has decreased from twenty-five feet to twenty feet and less. Close examinations of the wells drilled by Southern Union and Gunsite show that Gunsite acreage has been offset by Southern Union wells on 160 acre spacing. The Gunsite acreage in Section 5 has been offset by the No. 3-D Well in Section 31 of Southern Union.

Q Section 32, is it not?

A That is correct, Section 32. Northwest Production has drilled a well in the southwest of Section 33; the two Gunsite wells, the No. 1 Florence is located in the northwest of Section 4 and the No. 2 Florence is located in the northeast of Section 5.

Q Southern Union and Northwest Production have protected their acreage from drainage, have they?

A Yes, this is a case of where we have 160 acre spacing around a common corner, and the drainage would be equalized. The Gunsite Florence No. 1 and 2 Wells were drilled in 1955, and the 3-D well in Section 33 in October of 1956. The No. 1-33 well was drilled in the southwest quarter of Section 33 by Northwest Production in October of 1956, Southern Union 1-B was drilled in the

southwest of Section 4 of Township 25 North, Range 3 West, in April of 1957.

Q Now, is the acreage owned by Gunsite in the western part of Section 3 and the eastern part of Section 4 protected from drainage by Southern Union and Northwest Production?

A At the present time it is not, with the permeability trend of the sandstones northwest to southeast, this acreage will be drained by the Northwest Production Corporation Well No. 3-34, and the Southern Union No. 1-33.

Q How could that acreage be protected against drainage?

A That acreage could be protected by the drilling of 160 acre well locations in the northwest of Section 3 and the northeast of Section 4 on Gunsite Uranium acreage.

Q In connection with your testimony, I believe you said Southern Union Well 1-33. You mean Northwest Production Well 1-33?

A Yes.

Q You heard Mr. Wiederkehr's testimony in regard to the interference tests made by Southern Union. Have you examined the reports filed with the Commission on these tests?

A Yes, I have.

Q Do you have any comment to make on those tests?

A The comment that I would have on those tests is that the interference wells are located in the most porous and permeable part of the Tapacito Field, and that the drainage effect would be in a northwest to southeast direction. There is question as to

whether one of those wells would drain 320 acres, even along the most permeable trend. The is the only significance I can attach to interference tests.

Q On the basis of that, in your opinion will one well, considering the Pool as a whole, effectively and economically drain 320 acres?

A In my opinion it won't, because of the variations of permeability within the sandstones. It will leave gas undrained in a normal 320 acre drilling block, and it will also drain offset owners.

Q Now, is it a fact that those test wells are located in the most permeable zones indicated on your Exhibit No. 2?

A Yes, it is. The first set of test wells are indicated by circles --

Q (Interrupting) I said Exhibit No. 2. I mean Exhibit No. 4.

A Three of the interference wells are located within the twenty foot contour line of permeability. The No. 1-E is located on the fifteen foot contour line of permeability. The second set of wells on the second interference test are located between the fifteen and twenty-two foot contours of permeability. This is relatively a very high permeability measurement.

Q Now, referring to what has been marked as Exhibit No. 5, would you explain cross section A-A'?

(Gunsite's Exhibit No. 5 marked for identification.)

A Exhibit No. 5 is the line of cross-sections showing the development of the Pictured Cliff sandstones. Cross-Section A-A' has been drawn in a northwest to southeast direction in the Tapacito Field. It's this top cross-section. The cross-section shows a highly developed and very porous sand as indicated by the potential on the Schlumberger. This section bears out the porosity and the permeability as indicated by the microlog porosity map. The depth to the Pictured Cliffs formation as shown by the cross-sections varies between 3500 and 3850 feet. The thickness of the Pictured Cliff sands on this cross-section varies between thirty and fifty feet.

Q Would you explain the Cross-Sections B-B', C-C', and D-D' in the same fashion?

A The three cross-sections, B-B', C-C', and D-D', have been constructed to show that the Pictured Cliff sandstones can be correlated and traced with accuracy into the South Blanco-Pictured Cliffs gas field. Cross-Section B-B' extends from the No. 18-36 Well at the northwest end of the Tapacito Field and southwestward toward the Jicarilla 12-J Well in the south end of the field. The sandstones are easily traced, and variations in porosity can be observed. We have indicated the variations in porosity by the lack of coloring on the cross-section. The C-C' cross-section extends from the Jicarilla 2-A Well in the Tapacito Field southwestward to the Jicarilla 2-K Well in the South Blanco Field. Marked variations in porosities can be observed on these cross-sections. D-D' starts

with the Florence No. 2 Well at the south end of the Tapacito Field, and extends southwestward to the Phillips Government No. 1 Well in Section 32 of 25, 3. All three of these sections show variations in the amount of total Pictured Cliff sands present and indicate loss of porosity on the southwest side of the Tapacito Field. The thinning of the Pictured Cliff sandstones again bears out the microlog, in the Tapacito Field in the northwest to southeast direction.

It should be added that the lesser amounts of Pictured Cliff sandstone lying to the southwest of the Tapacito and on the northwest side of the South Blanco-Pictured Cliffs gas field have much less gas reserves present in comparison to the Tapacito Field area. Likewise, the measureable permeability is zero.

Q Do you know what the spacing in the South Blanco-Pictured Cliffs is?

A The spacing is 160 acres.

Q Has the Pool been developed on that basis?

A It has been partially developed on that basis. At the present time, El Paso Natural Gas is developing this part of the field --

Q (Interrupting) What part of the field are you referring to?

A The part of the South Blanco Field lying in 26 North, Range 3 West. That area has been drilled on 160 acres.

Q Is that 6 or 5 West?

A That's 5 West, excuse me.

Q Do you mean then that the Pictured Cliff sandstones in the South Blanco in the interval between the South Blanco and the Tapacito have less reserves than the Tapacito and are being drilled on 160 acre spacing?

A Yes, that is true. Northwest Production has drilled an Indian, Jicarilla Indian block in the southwest of Township 26 North, Range 4 West, in Sections 29, 30, 31, and 32, on 160 acre spacing, and in the Tapacito Field, Northwest has again drilled Sections 5, 6, 7, and 8 of 26 North, 4 West on 320 acre spacing. The comparatives reserves being about twice as great in the Tapacito Field. Additional 160 acre spacing has been drilled within one to two miles of the Tapacito Field in Township 25 North, Range 3 West. This drilling has been accomplished by Skelly, Sun, and MacMillan, and I guess that's all in that area.

Q Now, about the gas reserves in that area you just referred to --

A The gas reserves are again less than the reserves in the Tapacito Field.

Q Have you plotted a production decline curve on the Tapacito-Pictured Cliffs Pool?

A Yes. We have constructed this curve marked Exhibit No. 6 to determine the average price for gas over a period of twenty years on which Gunsite Butte Uranium would receive income.

(Gunsite's Exhibit No. 6 marked for identification.)

This curve shows approximately fifteen percent of the reserves produced in the first year and then declines on out to twenty years.

Q How was this curve plotted, Mr. Reese? Does that information appear on the exhibit?

A This curve was plotted from the basis of actual production on Gunsite Uranium wells.

Q How did you determine the price of gas on this exhibit?

A We determined the price of the gas by using a weighted average of 12.7 cents per MCF, taking into consideration the probability of slight additional drop in production in early years, and production continuing after the twenty years.

Q Do you have anything to add in connection with that exhibit?

A Well, the price of the gas takes into account the increase in each five years of the price on production paid to Gunsite.

Q That is based upon the contract?

A Yes.

Q Have you calculated return on the investment to Gunsite drilled on 160 acre locations, which they have?

A Yes, we have.

Q Referring to Exhibit No. 7, would you state what that shows?

(Gunsite's Exhibit No. 7 marked for identification.)

A Exhibit No. 7 shows the average sand thickness on the undrilled 160 acre locations to be 30.75 feet, recoverable gas per acre foot is 326 MCF. The recoverable gas per acre is 10,024 MCF.

The average price of the gas is 12.7 cents per MCF, royalty interest is 12.5, production and ad valorem tax is 6 percent, well spacing 160 acres, well cost is $35,000, and the total recoverable revenue from 160 acres is $203,688. The net value of the gas from 160 acres is $167,533. This shows a return on the well investment of 4.79 to 1.

Q Do you consider that an economic operation, Mr. Reese?

A Yes, I would.

Q If you have a well cost of $35,000, you heard Mr. Wiederkehr testify on well cost ranging, an average cost of $40,000, I believe it was. What is the basis of your figure here?

A The basis of our figure is a well cost estimate furnished by Gunsite Butte Uranium Corporation on their No. 1 Florence and No. 2 Florence.

Q Is the average price of gas recoverable based upon your production decline curves as shown in Exhibit No. 6?

A Yes, it is.

Q You made a calculation of the payout on these 160 acre locations?

A Yes, we have. We have calculated, based on the present pipe line production, an estimated payout of 1.12 years on the undrilled 160 acre well locations. In this payout calculation we used an average price of 11.9 cents per MCF, and a well cost of $35,000 with an operating cost of $50.00 per month. We also included the production and ad valorem taxes.

Q Your estimated production to the time of payout, what is that based on, Mr. Reese? Is that based on the average production from the two wells that you presently have?

A Yes, that is based on the actual production and the average production at the present time is 890 MCF per day. That 890 MCF per day was taken from eight months of production.

Q Have you taken into account operating expense?

A Yes, cost of $50.00 per month.

Q Mr. Reese, on the basis of your study of this reservoir and the information that you have obtained from it, in your opinion if this pool is developed on the basis of 320 acre spacing as the present order requires, would that leave any gas unrecovered in the reservoir at the time of abandonment?

A Yes, in my opinion it would. It would leave gas within the reservoir due to the unequal drainage.

Q Is this gas that is economically recoverable on the basis of 160 acre spacing?

A Yes, it is.

Q Mr. Reese, you heard Mr. Wiederkehr testify that they had no need for any further gas from this pool at the present time. Do you have any information that will indicate there will be an increased demand in this area?

A The history of the demand for natural gas has been one of continual increase. At the present time Pacific Northwest Pipe Line Corporation has been interested in a hearing before the

Federal Power Commission in Washington, at which hearing the granting of a certificate will take an additional hundred cubic feet of gas per day out of the Basin, and this gas will go eastward into Chicago. El Paso at the same time has applied for additional gas to California. The market appears, from the fact that it is steadily increasing, that all the gas available will be used in supplying the market to California and the market to the Pacific Northwest, and an additional new market to the East.

MR. KELLAHIN: That's all the questions we have, if the Commission please.

MR. PORTER: Anyone have a question of Mr. Reese?

MR. HOY: My name is George Hoy, representing Honolulu Oil Corporation.

CROSS EXAMINATION

By MR. HOY:

Q Mr. Reese, on your various exhibits you had information concerning Honolulu wells. Was that information derived from core analysis and logs which have been released by Honolulu to the industry?

A Yes, as far as I know it has been.

Q They are then subject to interpretation and analysis by anyone interested?

A That's right.

MR. HOY: Thank you.

MR. PORTER: Any further questions? Mr. Johnson.

By MR. JOHNSON:

Q What rate of decline did you assume in your curve, starting from your 890,000 MCF per day the first eight months?

A During the first year we assumed a fifteen percent rate of decline. During the second year, an eleven percent, third year eight percent, fourth year six percent, and then it was graduated on down. The sixteenth year was 3.25 percent. This is on our reserves.

Q It is on reserves, not on deliverability?

A No, this is on the reserves produced.

Q You made no assumption as to deliverability, then?

A No, we did not.

MR. PORTER: Anyone else have a question?

MR. WIEDERKEHR: Yes, please. I would like to look at the exhibits, if I may, along with some of the questions.

By MR. WIEDERKEHR:

Q Going back to your Exhibit No. 1, I believe in the northeast quarter of Section 25, 26, 4, you have shown Southern Union Gas Company Jicarilla 2-B Well with a net isopac net pay sand of 26 feet?

A Yes.

Q Are you familiar with the fact that is a dry hole in the Pictured Cliff?

A I have a gauge of 150 MCF on it.

Q Yes, sir, and you calculated reserves and showed production

on it on your Exhibit 3, but that is all from the Mesaverde.

A That would still not influence the net sand pay in the Pictured Cliff, even if it is a Mesaverde well, because the log goes through the Pictured Cliff, and we obtained that net sand footage of that log.

Q You have a net sand and consequently, what I'm trying to do is question net pay sand. In other words, if it is pay sand, I believe it would have produced, I don't believe it would have been a dry hole.

A Has there been a completion attempt in the Pictured Cliffs?

A Not on that particular well, but on other wells with the same type log.

A Based on our information, that well should have been produced, or would produce if it was completed in the Pictured Cliffs. The fact that it was completed in the Mesaverde does not alter the information in the Pictured Cliffs.

Q You said you were a consultant geologist and one of your jobs was to recommend well locations?

A Yes.

Q Would you recommend that some company farm that out and drill that location?

A Well, I would recommend, I would recommend that the small gauge in the Pictured Cliff would justify, the small gauge in Mesaverde would justify recompletion in the Pictured Cliffs, because of the amount of net sand pay in that well. Now there's one point

on this well,we were not able to determine the micro-porosity on it, due to the lack of the log, so there is no indication of the micro-porosity.

Q There was no microlog porosity. I believe you have zero microlog porosity on your map?

A That is correct.

Q So you did have a microlog, I guess, you put zero in there?

A Yes.

Q You mentioned several wells, you mentioned a Humble well over here in 26, 4, that's outside of the Pictured Cliffs-Tapacito Field?

A 26,5.

Q 26, 5, in about Section 4?

A Yes.

Q And as being completed in the Pictured Cliff sand. What initial potential do you show?

A We showed a Pictured Cliff I.P. of 102 MCF, and a Mesaverde I.P. of 2,424 MCF.

Q Well, then, as a practical geologist, wouldn't you consider that to be a dry hole in the Pictured Cliff sand? You wouldn't drill a well for 104 or 102 MCF I.P., would you?

A Not if I knew it. However, in Section 5 we drilled a Pictured Cliff well which was a triple completion and we obtained a gauge of two million one hundred twenty-four MCF in the Pictured Cliff.

Q What I am getting at, though, this could very well be a trend of non-permeability, since that well is for all practical purposes a dry hole. That is a dry hole in the southwest quarter of Section 1, that is a dry hole in the Tapacito; 1-H is a dry hole. The 1-F is a dry hole in the Pictured Cliffs; the 1-B is a dry hole in the Pictured Cliffs; here is another well down here in Section, looks like 15, 25, 3, Jackson Well, that is a dry hole. Isn't there a line of dry holes that we could draw between those which would, for all practical purposes, make it appear there is a zone of non-permeability between South Blanco and Tapacito?

A At one time we thought that was true, and we did draw a zone of non-production between the two fields which was much larger than the present boundaries of the field. However, additional drilling to the Mesaverde in this area shows that there are sufficient Pictured Cliff sands for a gas production, and in Section 29, Northwest Production has completed the No. 7-29 in the Pictured Cliffs in eight feet of sandstone, so that it's a question of how little sand can you complete in. This contour interval that we have in this thin area which we illustrated on the cross-sections goes down to ten feet, and there is actually, or there has been actually wells completed down into that area.

Q With this low sand thickness in here, you wouldn't think there would be drainage between Blanco and Tapacito?

A No, not in that low sand thickness area; however, to effect any drainage you would have to drill at least 160 acre spacing.

Q Up here where you had twenty-five feet of pay, would you think there would be effective drainage in there across from one field to the other?

A Well, what we are looking at is the present distance between the fields;as far as effective drainage between the two fields, I don't believe there would be. However, the drilling is continually decreasing the distance between these two fields and all of these Mesaverde wells show that the Pictured Cliff is present in the shallow horizon and it is my belief that they will be,eventually be produced in the Pictured Cliffs.

Q Except for quite a number of locations drilled as dry holes?

A Some of these dry holes were drilled in the earlier days of drilling. The 1-F was drilled by Southern Union, I believe, right after its discovery well in the Tapacito Field, and the sand was ten foot or less and no completion attempt was made in it. The same way with the No. 1-H, Southern Union, and I assume from the way those early wells were drilled that they were exploration wells. They at that time outlined generally the most porous belt in the Tapacito Field, however, that -- the lean area or the thin area's continually being narrowed by wells coming from the southeast.

Q All right. Let me go to your Exhibit No. 4, I believe it is, on your drainage area around Southern Union Jicarilla 4-E Well. I believe you stated that the drainage there would be northwest-southeast, and the gas lying to the southwest of the 4-E well would be left, that we hadn't drained any of that gas at the present time?

A Yes, it would be relatively undrained.

Q What causes drainage?

A Well, it's the ability of the sands to transmit the fluid or gas.

Q Because of a differential in pressure?

A Differential in pressure.

Q If we began to drain the area around the 4-E well, consequently we reduce that pressure; as gas comes out, the pressure is dropped?

A Yes.

Q Then the gas remaining on the edge having higher pressure, wouldn't it migrate toward that then?

A Very slowly.

Q Well, then let me -- following that line of reasoning --

A (Interrupting) There's a good chance that the drainage would take place over a period of forty to fifty years.

Q You pointed out that Southern Union 1-E Well located here in Section 16 was on a poorer part of the sand than the 5-E or the 4-E or the 3-E?

A Yes, it's on the twenty foot microlog porosity line, while the others are between the twenty and thirty foot.

Q Would that, refer to your Exhibit 3, the 1, 5, and 4 E Wells in the interference test area, That is 1, 5, and 4 were the three wells in the interference test turned on within a month of each other and produced correspondingly against the same line pressure.

Now, would you please note that you show that thirty-eight percent of the reserves out of the No. 1 well have been produced, while only ten percent of the reserves under the No. 3 well and thirteen percent of the reserves under the No. 5 well have been produced to date, and yet according to you, your theory of better wells being in the middle of the sand looks to me like that that well should have produced the least of all, and yet it has produced in excess of twice of the amount of the others. How do you account for that, please?

A The only way I can account for that production is that there may be some higher permeability streaks within the 1-E well. In other words, there might be two or three hundred millidarcies of permeability present in the 1-E well.

Q Doesn't it look like, then, that there could be just as good a wells on your thinner section of sand as there are over in the center? In other words, the producing capacity of this well would so indicate, would it not?

A Well, now, we're using a net footage of permeability of between twenty and thirty feet, which is relatively a very high permeability for Pictured Cliff sandstones in any of the fields, and whether one well in that twenty or thirty feet may produce more than the other two wells or the other three wells would be open to question, because within that twenty or thirty feet of permeability, we made no measure as to how many millidarcies were in there. There could be an average of two or three hundred millidarcies in several

feet of that sand.

Q You pointed out, I believe, that your drainage area runs northwest-southeast in this field?

A Yes.

Q And using 320-acre spacing unit, that you would have cross-drainage in the field, draining out from one unit into another unit and vice versa?

A Using 320-acre --

Q You would be draining back and forth?

A Yes.

Q Have you ever in your life known of a field where that was not the fact, that actually all production was cross-drainage where you locate a well in 330 feet out of a 40, actually it is not in the center, actually it is, all fields that we know of are produced in that same manner where you have drainage and cross-drainage on leases? Isn't that one of the things we can't control?

A It is one of the things that is very common and it is controlled by offset wells. It is controlled as much as possible by offset wells.

Q But this is not an uncommon situation to occur?

A Well, this is an uncommon situation in that your most porous belt runs northwest-southeast, and the drainage from a well is not circular in fashion.

Q You mentioned, I believe, an area where there were four wells sort of developed on 160-acre spacing?

A Yes.

Q Two of the wells being Southern Union wells, or one well being Southern Union and one Pacific Northwest?

A Northwest Production.

Q Northwest Production. Actually Northwest Production Well 1-33 is drilled on the spacing pattern as set up by the Commission?

A That is correct.

Q Do you know that the Southern Union Jicarilla 3-D well was drilled in that position because the 1-D well had been drilled prior to any spacing order, and then the exception was granted the 3-D well on that basis?

A No, I wasn't aware of that.

Q Are you aware that Gunsite Butte's, I don't know what the name of that is --

A No. 1 Florence.

Q -- No. 1 Florence had a special hearing and was granted an exception to the spacing pattern as set out, and that if the well had been drilled where the normal spacing is in the northeast quarter of Section 4, 25, 3, that situation you are talking about would not have occurred to the great extent that it has?

A Yes, I am aware of that.

Q Then it is not entirely Southern Union's fault that situation exists?

A That is correct. I don't know the past history on it, but I was merely concerned with it, there are four wells already in

this common corner.

Q Two of them would normally have been there, one of them was forced because a well had already been drilled in the same section prior to the time spacing was set, and then the last one was just because Gunsite Butte wanted to move over into that location. Now, you pointed out some Skelly wells down in 25, 3, the west side of it, that are drilled on apparently 160-acre spacing?

A Yes.

Q Would you not consider that those wells were in the -- or would be included in the South Blanco Field, since they are within a mile of the boundary of that field?

A I don't know how to, what to consider. They are within a mile, about a mile and a half of the Tapacito and a mile of the South Blanco.

Q How far from Tapacito? I believe you will find that is two miles, at least.

A About two miles.

Q Diagonally?

A Diagonally.

Q You quoted your cost of Gunsite Butte being $35,000, I believe?

A Yes.

Q Those wells, were they not drilled sometime ago?

A Yes, that is correct.

Q Are you familiar with the terrain in the area of the Gunsite

Butte wells?

A Not right on the well site.

Q Well, I am. If I might say so, that is a generally flat area, while the area in which Southern Union has been drilling, it is not uncommon for the location costs alone, road and location, to run five to ten thousand dollars. That would increase it, and on top of that, any new drilling, isn't it true that drilling costs have gone up and are going up all the time?

A Yes, they are.

Q So any future development, don't you think it would be appreciably higher than the cost of the wells you drilled several years ago?

A Well, we were taking into accountthe new locations for the undrilled 160 locations on Gunsite acreage, and I believe that if the terrain is as you described it, that the cost would be about what Gunsite has incurred for their other wells.

Q But isn't it just a known fact that the cost of drilling is going up?

A Yes, it is.

Q All right. Now, you mentioned, I believe, that there would be additional gas left in place if the wells were drilled on 320 versus 160. Do you think there would be enough gas in there to pay for the additional development that would be required to develop on 160?

A In this Tapacito Field, reserves are adequate to justify

the drilling on 160, and on the amount of gas left on 320 could only be estimated, I don't believe it should be approached that way.

Q That is not what I asked you. That is what the lawyers say, I believe. I asked you if in your opinion there would be enough gas left abandoned because of drilling on 320, enough gas there to pay for the drilling of an additional well?

A Yes, I believe there would be.

Q Throughout the field?

A Yes.

MR. WIEDERKEHR: I believe that's all the questions I have.

MR. PORTER: Mr. Mankin.

MR. MANKIN: Warren Mankin with Aztec.

By MR. MANKIN:

Q Mr. Reese, on your Exhibit No. 5, you didn't intend to infer that with electric log you could determine permeability from that log, did you?

A No, I didn't. Our Exhibit No. 5 does not show the microlog there which is on the lower part of the electrical log. We do intend to infer that the microlog part will indicate permeability, I mean by this cross-section where we show the electrical log showing the porosities of the sand, does not indicate the permeability that we have shown on this map. However, the lower part of the electrical log does indicate permeability from the microlog.

Q Isn't all, actually, that would show would be the porosity?

A No, the microlog is an indication of porosity and permeability.

Q Is it a very interpretative sort of thing?

A It is a very interpretative sort of thing when you are using the microlog in zero areas of permeability, because the lower permeable sands do produce gas, but in an area like this where we have marked microlog permeability, it is a very useful method of determining permeability.

Q You have developed that there is possibly some communication across from the portion in the South Blanco in 26, 5, into the Tapacito. Do you have any indication as to pressures in those areas, comparative pressures? Is there pressure communication?

A The distance between the two fields is such that I don't know if there is any pressure communication. The main correlation that we have established between these two fields is our ability to trace the sands between the two fields and variations in permeability and local variations in sand may in places form a pressure barrier.

Q Just take one particular point. Since you indicate there is considerable distance, let's take a point here in the southwestern portion of 26, 4, where Northwest Production has drilled several wells, as compared to going directly northeast in Tapacito where it is less than a mile across that area, would you expect there would be similar pressure across that area?

A I would expect they would be fairly, at least the information that we have, that they would be similar.

Q Have you seen such pressure?

A I have some of the pressure here. I could look them up to see what they are. I have never looked at them, I might say.

Q Is your knowledge, do you remember whether they were the same as in the Tapacito?

A I think they were similar. I don't know whether they are exactly the same per pound. You get some variation between these pressures within the same field, depending on the time that you read the pressure at the top of the well.

Q Then you don't believe that there is considerable difference in pressures across that area?

A I don't believe there is. I just don't recall just right at this moment.

Q You inferred a while ago, also, that Skelly had started their 160-acre development down in 25, 3. Didn't they likewise change that development to revert to 320, even though it was in the South Blanco?

A If they did, I am not familiar with it.

Q Also, are you aware that on a hearing today there is that area that you suggested might be in Tapacito, or you didn't know, is being considered to be taken into the South Blanco?

A I am aware of that, it will be in the order of hearing today.

Q Are you also aware that there has been considerable development in South Blanco on 320-acre development by Ohio and others in the area nearby the Tapacito?

A Yes, I am. Also there's considerable development on 160

in the South Blanco, in fact, all this north part that is not shown on this map is 160, Northwest Production has drilled their edge wells on twelve section blocks in this area and 160 pattern, and their center wells on 320 on the inside of their Indian leases.

Q Are you familiar with the pressures of those wells drilled on 320 in the South Blanco, as compared to the wells drilled offsetting on 160-acre development? I am mentioning the El Paso development versus the Ohio development.

A I am not familiar, I made no detailed study of that pressure.

Q As a geologist, isn't it known that there is considerable development previously known to be in sand bars, therefore the permeability and porosity development has been considerably less in some areas?

A Yes, that is very true, that is what we are looking at here. We are finding the best development in the northwest and southeast.

Q Not only --

A (Interrupting) The trend in the sand bars, however, you get the sand extending between the two fields, and there is actual connection between the two fields.

Q To what do you attribute some of these very tight and practically impermeable zones coming into the edge of the Tapacito Field? I will take a particular example, what was brought out a while ago about Southern Union Jicarilla 2-B Well, to what would you attribute such a zero permeability?

A I would attribute that to variations in the deposition of the sand in this zero permeability area. There is probably a higher content of ventilated clays in that one area, and that's why you get your variations.

Q Then is it your recommendation that this entire area, whether called the Tapacito or South Blanco, would best be developed on 160 acre development?

A Yes, that would be my recommendation, in order to get as much gas as possible from the sands.

Q Let's return again to the amount of gas that would be left on 320 acre development. Can you calculate the amount of gas that would be, would remain in formation and not be recovered by wells drilled on 320, as compared to wells on 160; and if so, would a well be paid for by the additional drilling in that area?

A I can't calculate the amount of gas that would be left. I can only estimate, depending on where the well is located and the type of the sands developed in that area that a well might leave as high as fifty percent of the gas, depending on its location. In an area of real good permeability, the 320 acre block might drain the entire 320 acres on one well.

Q Let's get down to Gunsite Butte leases here. That's in a very nice developed area as far as your microlog porosities, is that not true?

A Yes, that's true.

Q To run again to a question Mr. Wiederkehr mentioned, I

believe he mentioned that there were two Gunsite wells drilled there previously, one, of course, drilled prior to rules, and one drilled sometime later. I believe the record will indicate that the two wells were drilled previously by Gunsite, and one of them was given exception in the original order, is that correct?

A I'm not familiar with the original order.

Q Then sometime later, Gunsite had a hearing and asked that a well be drilled in the northwest quarter of Section 3, this position right here?

A Yes.

Q Sometime later, after the well was never drilled in that location but drilled in the northeast quarter, is that correct, which is the Riddel No. 1?

A Yes. I'm not familiar with that hearing, but I assume that is correct.

Q I take it that you do not agree with the testimony put on by Gunsite Butte at that hearing, that that would be an area that would be a dry hole if drilled in the southeast quarter of Section 3?

A I am not familiar with that testimony. This Gunsite well in the northeast of 3, I believe, was drilled to the Mesaverde. I would have to check that.

Q But it is presently completed as a Pictured Cliff well?

A As far as I know, that is correct.

Q Then you indicated that, as I say, you did not agree with

the previous testimony. I believe Caswell, Silva, and others indicated there was considerable string development, and this would be a dry hole which did not prove to be a fact?

A In the northwest of Section 3?

Q In other words, it was shown that it was tested to that, that would be a dry hole, but apparently conditions changed that?

A Well, yes, I don't agree that that would be a dry hole. That would be a very nice producer there.

Q To get back to leaving fifty percent if you drill on 320 acres with good sand development and permeability and porosity as you found on the Gunsite lease, particularly in Sections 3 and 4, is it known reservoir conditions that cause you to assume that that would be the fact? Do you have knowledge of other reservoirs where it would leave fifty percent?

A I only used the fifty percent as an estimate. It might be even a greater percentage of lesser percentage than fifty percent.

Q You don't have reservoir knowledge that would indicate that might be considerably less than fifty percent, then, by infill drilling that was later determined?

A In this condition where we have high permeability and good porosity and well developed sands, our average gas per acre is ten million cubic feet recoverable; if the two Gunsite locations are left undrilled there is a good chance that gas will be drained from them and that percentage could go up to maybe fifty percent over a period of time, or more.

Q I don't follow your testimony when you say there would be gas drained from these particular wells, particularly when all the other development has been on 320 acre development. It looks like it would go the other way.

A This would be a case of a reverse in the direction that it would go, because the trend of the permeability is northwest to southeast, and the No. 1-33 Well in Section 33 would have a tendency to drain into the Gunsite acreage there in that undrilled 160 acre location.

Q In other words, you would recover Northwest Production gas in that case, or Southern Union, is that correct?

A No, Southern Union would recover Gunsite's gas.

Q I don't follow your line, but I'll leave it at that. My next question is this, you put some 320 acre units trending in a northwest-southeast direction, and I assumed if there was 320 acre put in that, you would suggest that possibly maybe the northeast half of a section be one unit, and southwest half be another, if that was put in?

A Well, you mean that the unit would run east-west?

Q That you would have a diagonal line running from the northwest to the southeast which you would have 320 acres which would be the northeast half, if there was such a designation, to be a unit in the southeast half if there was such a designation?

A Well, that would, my only assumption in showing this is to show that at present there is unequal drainage across a section on

which ownership has been based, the only way that I would change that would be by putting spacing on 160 acres.

Q All right. Let's revert to your assumption of 160 acres. On your assumption that there would be unequal drainage and compensating drainage might not be proper, I assume from that that you would not suggest a proper legal quarter-section as a proration unit, if and when it was prorated. In other words, it would have some peculiar shape outside of a quarter-section, which is fantastic, of course.

A These 320 acre blocks are not what we would assume would be the regular spacing pattern or a northeast or southwest half of the section. These are merely put on here to illustrate the present trend of the drainage. I would only assume that the proration would be developed on a regular 160 acre tract in a section or a 320 acre tract, if this is left at 320.

Q Going back again to your statement previously, did I understand that you did not believe that these interference tests proved anything?

A If anything, they proved that this is a very excellent field due to the fact there has been so little pressure drop over the period of time. Most Rocky Mountain fields show a rather rapid pressure drop throughout the whole field in a very short period of time. The interference test proved that there is some effect on a well as they are set up, and the pressure drop; there is some question as to whether, prove whether there has been gas produced

from that well site yet.

Q You don't believe because there was some pressure differential from one period of time to another that that proved there was any gas traveling from a shut-in well to the other wells, then?

A There may have been some gas traveling; however, it would be normal for the well to show some pressure drop because of the pressure throughout the reservoir at least showing a drop.

Q Do you know whether that pressure drop was the same as the pressure throughout the reservoir?

A Well, the pressure drop indicates that the reservoir pressure was dropped.

Q In the same proportion?

A I don't know what the proportion would be. It would have something to do with the distance. It should be somewhat similar, though.

Q To get to another something that you weren't sure about, the pressures between the South Blanco and the Tapacito, if there was some two to three hundred pounds difference across the field, would you feel that was good pressure communication?

A No, I wouldn't feel that was good pressure -- in that short distance.

Q There might be some permeability or other barriers in between?

A Yes. Now that gets back to your interference test again somewhat, in that before this pressure would affect this area, you

would have a certain amount of time involved in production from this area or the other way around, due to the permeability barriers.

Q The development is going on in the Tapacito the same as South Blanco is at the same time, is it not?

A Yes, but your rate of production is not the same; in more impermeable sands, the rate of production is very slow, and it would take maybe two or three times the amount of time to produce the same amount of gas from the Tapacito Field as compared to this area right in here.

MR. MANKIN. That's all.

MR. PORTER: Does anyone else have a question of the witness? Mr. Utz.

By MR. UTZ:

Q Mr. Reese, turning to your Exhibit No. 2, I note that your recoverable gas per acre is 9258, and referring -- that figure is an average for the field?

A Yes, sir, that is correct.

Q On your Exhibit No. 7, you give a figure of 10,024 MCF per acre. Is that for your Gunsite Butte properties?

A Yes, that's on the undrilled well locations.

Q Would that indicate, then, that your Gunsite properties are a little above average?

A Yes, it would.

Q What reserve per acre would you consider a minimum economic risk for this area?

A I haven't calculated what would be a minimum economic risk. I would say that the reserve should show at least the payout of the well with some excess above it.

Q You have no idea how to convert that to cubic feet per acre, is it five million, four million, three million?

A I know that the reserves in some of the other Pictured Cliffs fields are as low as four and five million cubic feet of gas per acre. However, generally those lower reserve areas you have a shallower drilling depth and less well cost. There may be some reserves drilled as low as three million per acre.

Q I was attempting to pin it down to this area with the well cost of 35,000, if you can do it.

A I would say a well should have at least five million cubic feet of gas per acre, just as an estimate on it.

Q The point which I think might well be cleared up, we have had two reserve figures given to us at this hearing. One was 1.6 million for 320 acres, yours I believe calculates on the basis of 9258 per acre, 2.9 for 320 acre tract.

MR. WIEDERKEHR: That is at different recoverable pressures. That makes a lot of difference.

MR. UTZ: That's the point I want to clear up.

Q Your pressure was 100 pounds, is that correct?

A Yes, that is correct.

Q Theirs was 500?

A Yes.

Q Would that account for approximately twenty-five percent of the difference between Southern Union reserves and yours?

A I believe that it would.

Q Also, they have used the porosity of nineteen percent as to your fifteen percent, is that correct?

A That is correct.

Q Then actually their calculation would give you approximately twenty percent more reserves, would it not?

A On the basis of porosity.

Q On the basis of porosity alone?

A I haven't calculated, but I assume that it would.

Q It is a ratio of fifteen to nineteen. You have used thirty-eight percent water, where they have used thirty percent water, so on the basis of connate water alone, that would be about eight percent more than the Southern Union calculation?

A That is correct.

Q On the basis of pressure alone, you could account for about twenty-five percent, but when you come back to porosity and connate water, why you do away with twenty-five percent, don't you?

A Yes.

Q Well, then, what is left in your reserve calculation that would make such a difference in reserves?

A Well, I just don't know what would make the difference.

Q Just about have to be net pay, wouldn't it?

A I assume that it would be, yes.

Q You used twenty-eight feet, twenty-eight point four, is that right?

A Yes, that's right.

Q So just looking at it in a glance, Southern Union must have used something like fourteen feet, is that about right?

A I assume that that's correct.

Q So there is quite a difference in the two reserves, and particularly the two methods of net pay picked for the field?

A I believe that I saw one figure, going through the previous notes on this hearing, where there was an indicated twenty-three feet of net pay on the Indian E Well from core analysis. However, I'm not sure about that figure, I think it was twenty-three feet as made by Southern Union.

MR. UTZ: I think that's all I have.

MR. PORTER: Mr. Mankin.

By MR. MANKIN:

Q I believe, Mr. Reese, there was some difference here in the net pay, probably some eight to ten feet difference between what Southern Union used and you used, and also considerable difference in abandonment pressures. Wouldn't those two factors be reflected in the probable differences in the reserve calculations?

A Yes, they would.

Q Possibly the addition of those two factors together. Also I wanted to ask you this one question, you indicated to get some fifty percent more gas or some other figure, if you would drill on

160 versus drilling on 320. If you took the thing even further, on 80 acre drilling would you gain anything in drilling on 80 acre development, necessarily?

A I don't know. I hadn't considered 80 acre drilling. I don't see where you would gain anything on it, but I haven't considered it.

Q It would seem to tie together, if you convert down from one wider spacing to another, and then you certainly don't get it all in one spacing, do you?

A Well, there still may be a percent of gas left, a certain percentage of your gas left on 160 acre, but I don't see where there would be any point in considering an 80 acre spacing.

Q I meant on the same analogy that you have used, that you won't get it all on 320. Probably there is some assumption you might get more if you went on 80, though it might be uneconomic?

A You would get more gas on 80, however, when the recoverable gas is exhausted, there would still be a small quantity of gas left in the sands.

Q In other words, you finally run out of time and money on this sort of thing?

A Somewhere along the line you do, yes, sir.

MR. PORTER: Does anyone else have any questions?

MR. KELLAHIN: I have a couple on redirect.

REDIRECT EXAMINATION

By MR. KELLAHIN:

Q Mr. Reese, in connection with your exhibits, you showed certain production figures on Pictured Cliff wells. Where did you obtain that information?

A We obtained that information from the figures furnished to the Commission.

Q Did you check the figures furnished to the United States Geographical Survey?

A No, we did not. We took the annual report through 1956 and used those figures, and then we went to the State office at Aztec and copied off the figures reported there to the State and used those figures.

Q Now, in connection with your Exhibit No. 2, Mr. Wiederkehr questioned you about the Jicarilla 2-B well. I believe your Exhibit No. 2 shows production from that well. Do you know where you obtained that figure?

A Well, the production was obtained from the figures reported to the State.

Q In connection with the payout on wells, Mr. Wiederkehr used the figure of $40,000 per well, would that appreciably affect the payout time if your figure of 35,000 were increased to 40?

A No, it would not.

Q Would payout time of 1.29, as compared to 1.2 years sound reasonable to you?

A Yes, any payout time in that order would be very reasonable.

Q Now, Mr. Utz questioned you as to what you thought would be

an economic reserve to produce. I believe in connection with your testimony, you testified that the return on the well investment at the present time on 160 acres would be 4.79 to 1. Would you consider the ratio of 2 to 1 economical, if it were not a wildcat well?

A Yes, under the circumstances I would, because of the fact that that gas will be available for markets.

Q Then if you took that as an economic well, you would then reduce your recoverable gas per acre in proportion and say that that would be an economical well, would you not?

A Yes, I would.

MR. KELLAHIN: That's all the questions I have. Thank you.

MR. PORTER: Mr. Grenier.

RECROSS EXAMINATION

By MR. GRENIER:

Q Mr. Reese, at one point you were speaking about the South Blanco Field as having been drilled on 160 acre basis with somewhat less reserves there than we have in the Tapacito Field. Do you recall that portion of your testimony? I believe it was on cross examination by Mr. Mankin.

A I think it was in reference to this Northwest Production block in the South Blanco Field.

Q Generally speaking, do you know enough about the South Blanco reservoir to be able to express an opinion as to whether or not the general permeability of the sands in that field are as

good or better or poorer than they are in Tapacito?

A I haven't made a detailed study of the South Blanco-Pictured Cliffs Field. However, I suspect that such a detailed study would show a permeable belt through the center of it and as you go outward from the center toward the edges you will get a decrease.

Q You are not prepared, on the basis of your study of this problem, to date, then, to indicate whether South Blanco permeabilities are comparable, taking the field as a whole, to Tapacito, or better or poorer?

A I am not prepared, however, I think if they were compared over all, there would be some similarities in the better part of the field.

MR. GRENIER: Thank you.

MR. PORTER: Does anyone else have a question of the witness? The witness may be excused.

(Witness excused.)

MR. PORTER: Did you offer your exhibits?

MR. KELLAHIN: At this time, I would like to offer Gunsite's Exhibits 1 through 7 inclusive.

MR. PORTER: Any objection to the admission of the exhibits? They will be admitted.

MR. PORTER: Mr. Johnston.

MR. JOHNSTON: I would like to introduce one short exhibit and testimony in this case.

MR. PORTER: We'll take a ten minute break.

(Recess.)

MR. PORTER: The meeting will come to order. Mr. Johnston.

(Witness sworn.)

W. R. JOHNSTON,

a witness, having been first duly sworn on oath, testified as follows:

MR. JOHNSTON: I am W. R. Johnston, manager of production operations, Northwest Production Corporation. Our company has been mentioned in this case on several occasions today. I have testified on this particular case previously as an expert witness, and at least one additional case in the Tapacito. I would like to be admitted as an expert witness.

MR. PORTER: Your qualifications are acceptable.

A I have one exhibit I would like to introduce.

(Northwest Production's Exhibit No. 1 marked for identification.)

A This is a hypothetical set of curves plotting daily average deliverability of any gas well against cumulative production, both plotted against years. I took an assumption of an initial year's settled production, then declined that production yearly in ten percent increments. I do not know nor do I think anyone else knows the exact decline percentage-wise of deliverability in the Tapacito Gas Pool. We have eleven producing wells in the Tapacito Field and one unconnected, a total of twelve at this time. They have been

on the line an average of eight months per well, and have delivered right at a million cubic feet of gas per day per well, against a line pressure in excess of 600 pounds continuously. At that rate you produce reserves reasonably fast. If you will refer to the top curve and the dashed line which is the cumulative reserves of a well producing a million cubic feet per day, in the first year you will have the reserves that we think our wells might follow.

I would like to state that I do not know this curve is exact, but I do know the wells will decline to some extent. If this curve is right, and using the highest reserve figure I have heard today, which is in the range of a billion and a half cubic feet of recoverable gas per 160 acres, if you refer to a billion and a half on the right hand side, that's 1500, and draw a line across the chart, it will intersect the dashed line at five years; in other words, all of the gas under that 160 at 100 pounds abandonment pressure will be depleted in five years.

At the present line pressures on our wells of 600 pounds, the reserves will amount to something like 835 million, using Southern Union testimony, and our wells will cease producing, if my curve is right, due to line pressure in two years. Well, now, I know that is not true, but I do think that something occurs there and it has to be one of three things, either there are much larger reserves under the area than we think; secondly, the wells are going to decline exceedingly rapidly; or else we're draining a much larger area, and from my standpoint we are draining much

larger than 160 acre area. It was brought up today in testimony that Northwest Production is drilling wells on 160 acres in the South Blanco Field. This curve clearly illustrates why we do so. Those wells will average in the first year only 400,000 per day or less. If you will refer down the fourth curve, down to 400, and the fourth dotted curve down to 400, you will find that that same a billion and a half under the 160 is reached in 23 years, so consequently, to drain the gas in anything like a reasonable well life, we have to develop on 160 acres on a low deliverability well.

Using this as a basis, I would like to put Northwest Production on record as supporting 320 acre spacing in the Tapacito Pool. That's all.

MR. PORTER: Does anyone have a question of Mr. Johnston? Mr. Grenier.

CROSS EXAMINATION

By MR. GRENIER:

Q Are you familiar, sufficiently familiar with the South Blanco Pool and with the Tapacito Pool to be able to express an opinion as to which of the pools has the greater permeability?

A Well, I am familiar with our wells, and due to their producing characteristics, which I just stated that the average South Blanco well we have will have an initial first year daily deliverability of 400,000 against the million in the Tapacito, there is bound to be a better producing mechanism in the Tapacito, whether it is permeability or fracturing, I could not answer.

Q In any event there seems to be communication of some kind?

A There definitely is.

Q Are most of your wells drilled in the portion of the South Blanco Pool that has been drilled on 160 acre spacing? Do I understand you correctly there?

A Yes.

Q So you are speaking about that portion of the pool?

A That is entirely right.

Q With this differentiation that we have seen between the two pools as to deliverability characteristics, in which pool would you think that 320 acre spacing would leave the most gas behind it that could have been recovered by 160 acre spacing?

A Well, I would think it would leave more behind it in the South Blanco, where there are tighter sands.

Q Substantially more?

A To some extent. I couldn't say how much more.

Q So that on that basis, to some extent, then there would be a justification on that basis, too, for drilling --

A (Interrupting) That is correct.

Q -- to 160 acre density in South Blanco, as contrasted with the 320 acre density in Tapacito?

A Right. I might for another comment compare this curve with one that Mr. Reese submitted, showing his initial first year deliverability of 890,000 a day. If you pair a curve in on my curve, using 890,000 a day, they will have produced their gas

against 500 pounds line pressure in three and a half years, and they will have depleted the reservoir in 5.2 years under 160 acres. Now Mr. Reese's curve assumes one of the exceptions I mentioned that could be possible, that the deliverability was going to decline over or approximately 100 percent of the second year, and I question that. Southern Union has one well that has produced over 800 million and its present deliverability is still roughly eighty to eighty-five percent of its initial deliverability, so we have some indication that the wells are not going to decline at that rate. That is the basis we must be draining larger than 160 acres.

Q Are you sufficiently familiar with the Tapacito Pool, Mr. Johnston, to be able to express an opinion as to whether the additional volume of gas which could be expected to be recovered through 160 acre spacing as contrasted to 320 would be sufficient to justify the drilling of an additional well to recover that gas alone?

A I feel very firmly it would not be, that you would not have enough gas remaining to afford to drill that other well.

Q Now then, if you waited until the tenth year or twentieth or fiftieth or whatever it is that we get down to the point where nothing more can economically be gotten out by 320, you are stating to us then that you would not think an additional well would be justified to be spotted in there to pick up, in each of these 320's to pick up the remaining gas?

A I'll clarify that slightly. If the Tapacito Field extends into areas where the initial deliverabilities are so low that it

would require, which it could do, as the field extends eastward to a well that is only capable of delivering 300,000 per day, it would probably have to be drilled on 160 to drain it, but the return from that well would be so small that you would question wanting to drill it.

Q Is the pool developed sufficiently far to the northeast to reach these areas to which you are referring?

A Not to my knowledge. Our average--and we have wells on both ends of the pool--our average is a million a day. The range we have is 400,000 a day and the highest, 2100 a day after a month's production.

Q So the pool has been more accurately defined to the southwestern border as to the northeastern border?

A There are some good wells going northeast. There is eventually going to be a development to where you have small wells.

Q I am talking about development to date.

A It is developed both ways, it is better defined, you might say, to the southeast.

Q I said the southwest, I meant the border closest to South Blanco.

A It is definitely defined there.

Q The one up to the northeast has been sketchily defined, if at all?

A That's right.

Q Now suppose we move this well that you said would be

unjustified to drill, at the tail end --

A Yes.

Q -- of the field's history, moved it forward in time to right now, all the additional gas that that one well is going to recover in any event is going to be just what it would have recovered if it had been drilled on at the tail end?

A That's right. It wouldn't matter when you did it.

Q Actually it would be erroneous to attribute any more gas to that well and its investment now than if drilled twenty years from now?

A That is my opinion.

MR. PORTER: Anyone else have a question of the witness? Mr. Cooley.

By MR. COOLEY:

Q Do you have any method of estimating what quantity of gas would be left in the reservoir on 320 acre spacing as compared to 160 acre spacing?

A No, sir, I do not.

MR. COOLEY: That's all.

MR. PORTER: Mr. Kellahin.

By MR. KELLAHIN:

Q Mr. Johnston, I would like to hand you one of the exhibits offered in this case by Gunsite Butte and as I understand the exhibit which you have offered, Exhibit No. 1 is based entirely upon your own wells, is that correct?

A Well, the exhibit is based on nothing but figures.

Q Nothing but figures?

A And assumes decline curve. I put our wells on it because our wells happened to be in the million class.

Q If you refer to Southern Union Jicarilla No. 2-A, No. 2 well on page 2 of the exhibit --

A Yes.

Q -- that shows that well has been producing since 1954, would it not?

A It shows the completion on the 5th of May, 1954. It does not show when it started producing.

Q Then it shows that it produced 8.84 percent of its reserves?

A That is correct.

Q That would agree then with your curve here, would it?

A No, it would not, but the Gunsite well that has produced fifteen percent would fall right in.

Q That would only agree on the first year?

A Well, but we don't know anything about the second year.

Q Do you know of wells producing from the Pictured Cliffs formation for a period of more than twenty years?

A I understand that there are several wells in the San Juan Basin that have produced for over twenty years.

Q There are such wells in the Fulcher-Kutz?

A Yes. They start delivering 100,000 a day, don't they?

Q Do you know of wells that according to the production records

of the Commission show production of over two billion feet per 160 acres over a period of twenty years?

A I don't know of any particular wells. I suppose there are some. I don't think they got it under 160.

Q Sir?

A I don't think they got it under 160.

Q Then they are draining gas from somewhere else?

A That's right.

Q If you continue development of this pool on 320 acre basis then you are going to drain gas from acreage other than the acreage dedicated to the well, in your opinion, is that correct?

A It's possible. I think these fields are going to produce a long time, and it may be that the spacing,actually draining pattern, might be 500 acres. I know it is more than 160 by the way the wells are producing.

Q Do you think that the South Blanco and Tapacito Pools will eventually --

A (Interrupting) Not anywhere near our acreage, because we have the stringers outlined between the two of them now.

Q Did you make a reserve calculation?

A I did not in this case. I heard enough of them I didn't have to make one.

Q Is this exhibit based on the reserve calculations made by Gunsite Butte?

A No, it is not based on anyone's. I took yours and used it

on the right hand side. That is the highest one I have heard mentioned for the Tapacito area. I have seen some reserve estimates made by other companies and they were lower, although I couldn't tell you exactly how much.

Q Do you know what companies and what the reserves were?

A One of them was a reserve made by Mr. Reese for Northwest Pacific Pipe Line.

Q That included acreage outside the Tapacito?

A It included all our wells, too.

Q It included all the good and bad acreage?

A Yes. The other one was made by MacNaughton for our company.

Q Was that confined to the Tapacito alone?

A No, to our wells.

Q That included acreage outside the Tapacito?

A No, just individual wells.

MR. KELLAHIN: Thank you.

MR. PORTER: Anyone else? Mr. Grenier.

By MR. GRENIER:

Q You just stated in answer to Mr. Cooley that you had no basis for estimating how much gas would be left in this pool. Did you mean by that no specific basis, or that based on your general knowledge and experience in other pools?

A No, you couldn't calculate it without a pressure from the depleted reservoir. You could calculate it nicely if you would

drill the other well and get the bottomhole pressure to find out how much gas was left there. In a good gas field you can drain a lot of acreage, in a good gas field you are going to leave very little gas. I think this is a good gas field. It is so far better than the average Tapacito gas field that it deserves different treatment.

Q Your opinion is that there would be little gas left in the Tapacito?

A In my opinion, there would be very little left in the Tapacito.

By MR. KELLAHIN:

Q Did you take into consideration the variations in the permeability and porosity in this field in connection with your testimony?

A No, I did not. I have a fairly good indication that the wells are quite similar because most of them seem to produce very well. Your two wells that you speak of making 890,000 a day for eight months, our eleven that have averaged out a million, Southern Union's average well is pretty high, so I assume there are pretty good characteristics throughout the field.

Q That's down the center of the field?

A No, that is all over the field. We have 1-33 just north of the Gunsite wells are good. Our wells up in 5, 6, 7, 8, of 26, 4, that is six miles away. Southern Union has wells located in between, El Paso and Pacific have a well in 36, 27, 35 that is a

beautiful well. It will produce three to four million a day.

Q All those wells are right in the heart of the field?

A That is a big heart.

Q Is it your testimony --

A (Interrupting) It's twelve miles apart.

Q Is it your testimony that the pool pinches out suddenly at the edge?

A I know it pinches out suddenly.

Q Very suddenly?

A Yes, sir, because I drilled a well to find out and got permission from this Commission to do so, because I thought it would be a much better well, but it was not.

MR. PORTER: Are there further questions of the witness?

MR. WIEDERKEHR: I would like to make a statement with respect to Mr. Kellahin. This Southern Union which was supposedly on production in '54, we didn't have a line in there until 1956, so that would make it fall pretty well in line with your work, wouldn't it, Mr. Johnston?

A Yes, it sure would.

MR. PORTER: Any further questions? The witness may be excused.

(Witness excused.)

MR. PORTER: Anyone else have testimony to present in the case? Any statements? Mr. Buell.

MR. BUELL: Guy Buell for Pan American Petroleum Corporation.

In our opinion the data are conclusive that a well in this pool will effectively drain any tract of 320 acres. We therefore urge that the Commission adopt a permanent 320 acre order.

MR. PORTER: Mr. Anderson.

MR. ANDERSON: John Anderson, United States Geological Survey, Roswell. We have a particular interest in this case, inasmuch as about sixty or seventy percent is Jicarilla Indian Tribal land. I don't think these Indians want any special consideration;at the same time, in addition to having some assurance that all of the recoverable gas in the lands will be produced and they will get their royalties, they want some assurance that this gas will be produced in a reasonable time. I would take reasonable time to mean that the withdrawals from the Tapacito area should be comparable to other Pictured Cliff fields, and I think in the testimony that has been given today by Mr. Wiederkehr, he mentioned the withdrawals from Tapacito and Otero and South Blanco and other fields during December, which if we bring them down to the common denominator of 160 acre tracts would make the withdrawals from the Tapacito area about one-third more than Otero and South Blanco, which will have the highest withdrawal per well during that month.

Our own figures on withdrawals from Tapacito and other Pictured Cliff Pools bear this out. From Tapacito the withdrawals per acre have been slightly in excess of the other fields. Of course, going into the future, the only thing that we have had introduced today is Mr. Johnston's deliverability curve we might

look at to see whether Tapacito on 320 acre spacing is going to be able to continue this rate of withdrawals. If his curve is correct and which I think he testified that it was an arbitrary curve, why certainly this would occur.

We in the Survey have nothing to confirm this or to refute it, and other than urging that the Commission consider the time element in production from the Tapacito area, we have no other matters to discuss.

MR. PORTER: Mr. Woodruff.

MR. WOODRUFF: Norman Woodruff, representing El Paso Natural Gas Company. El Paso is the operator in the 27-4 unit and 27-5 unit. The wells in both units are included in the northwest extremity of the Tapacito Pool. El Paso considers that the communication tests which have been testified to here today by Southern Union show that a well can effectively and economically drain a 320 acre tract. For this reason we would concur with Southern Union in the recommendation for a permanent 320 acre spacing order in the Tapacito Pool.

MR. PORTER: Mr. Hinkle.

MR. HINKLE: Clarence Hinkle, representing Humble Oil and Refining Company. We concur in the position of Southern Union that these special field rules should be continued and made permanent as far as 320 acre spacing is concerned. We believe that the evidence clearly shows that one well will effectively and efficiently drain more than 320 acres.

MR. HOY: George Hoy, Honolulu Oil. We concur in the position of Southern Union Gas Company. Southern Union's 320 acre spacing will adequately drain this reservoir. We concur in that.

MR. PORTER: Mr. Mankin.

MR. MANKIN: Warren Mankin, representing Aztec Oil and Gas. Aztec's name hasn't been particularly mentioned here today, but at this particular time I want to state that Aztec has an undivided fifty percent interest in ten of the nineteen wells of Southern Union, so we have a sizeable stake in this particular pool.

We have analyzed the data that has been presented by Southern Union as to the interference tests and we feel that it conclusively shows that there is interference and that one well will drain at least 320 acres both economically and efficiently. Also, in addition to this, we would like to urge the Commission to put in a permanent 320 acre order, and likewise to authorize the discontinuance of the interference test that is now being carried in Order R-794-B, that the test be discontinued and the well returned to production.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: At the outset of this case there was a brief review made of the history of the orders in the Tapacito, and I will not, on account of the time involved, review that, but I do want to point out that for the first time in the history of this case, an attempt has been made to offer to this Commission some reservoir information on which they can base an order. The proponents have never seen fit to offer the type of testimony given

by Gunsite Butte, and it is normally the type of testimony presented to the Commission and the type of testimony that the Commission has a right to expect in connection with any spacing case.

We feel that the interference tests which were made upon the order of the Commission failed to show any significant drainage, particularly when you consider the small pressure drop involved in these wells over the period of time and as against the amount of the production of gas from the producing wells.

It is also significant that there was no pressure information given upon the producing wells which would show whether there was any appreciable drop in the pressures in those wells, which in fact would be significant if we are considering the effective radial drainage. Certainly those tests leave a great deal to be desired and can hardly support a contention that one well will effectively and economically drain 320 acres.

I think the testimony offered by Gunsite Butte also clearly shows that in order to protect correlative rights, as this Commission must do under the statutes, the area would have to be developed upon 160 acre basis; otherwise many of the operators within the pool will suffer drainage which is not compensated by offset drainage, a factor which this Commission should consider very carefully.

Of course, every company in here has its own economic problem and, as was testified by the Southern Union witness, they would like to use their two million dollars somewhere else. We also have our own peculiar economic problem, in that we have taken a small amount

of acreage upon the basis of 160-acre spacing. A few months after acquiring it, the 320-acre order was entered. We are sitting there without a way for developing that acreage, and it creates a problem to the Gunsite Corporation, just as they have testified the expenditure for the wells would create one for them. We submit, on the basis of the testimony that has been offered, the rule on 320-acre spacing in the Tapacito should be terminated and the pool allowed to revert to the normal 160-acre units, which is in effect in all of the other Pictured Cliffs gas pools in the San Juan Basin.

I am also authorized to state that Elliot and Hall, who have acreage which I understand is within the two-mile radius governed by the present pool rules, are opposed to the continuation of the 320-acre spacing order.

MR. PORTER: Mr. Grenier.

MR. GRENIER: To touch briefly first on one point of Mr. Kellahin, data has been regularly furnished to the Commission with respect to the pressures of the producing wells involved in these interference tests. We had not thought that those pressures were particularly significant. The significant thing, of course, being the pressure drop realized in these shut-in wells. There has been several, there has been considerable amount of suggestion in the preceding statements that this order should be made permanent. I don't know that there is such a thing as a permanent order, it was just an order that stands until the next time we have occasion to take a look at the thing. That is the way all these Commission

orders have been, and that is what we would suggest should be done now, that the normal pattern of standing order be instituted, subject to being reopened at any time when anyone feels there is new evidence or testimony that should come in, and that very possibly might be necessary on a number of accounts after we get prorationing in this area. When that thing comes along, we will then have the full picture before us in a way that we have not got it in front of us now.

The Commission may remember my having made the comment in some previous cases here that you can always drill them up, but you can never undrill them once they have been drilled. The same principle is patently applicable to this situation here.

We therefore do urge that the Commission grant us an order subject to further revision upon its own motion and after hearing, or upon the motion of any interested party after hearing 320-acre spacing be established in this pool. We feel it has been clearly established that one well will effectively drain more than 320 acres. We feel on that basis it is clearly justified and proper under the circumstances. Thank you.

MR. PORTER: Anyone else have a statement? Mr. Johnston, I believe we overlooked your exhibit. Do you wish to offer it as an exhibit?

MR. JOHNSTON: Yes.

MR. PORTER: Have you identified the exhibit?

MR. JOHNSTON: It is Northwest Production's Exhibit No. 1.

MR. PORTER: Is there objection? If not, the exhibit will be admitted.

Is there anything further in this case? We will take the case under advisement.

* * * * * * * * * * * *

C E R T I F I C A T E

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in stenotype and reduced to typewritten transcript under my personal supervision, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this 24th day of February, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My commission expires:

June 19, 1959.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
August 15, 1957

MAIN OFFICE OCC
1957 JUL 9 AM 8:36

TRANSCRIPT OF HEARING

Case 977

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
August 15, 1957

IN THE MATTER: The hearing ordered to be held by Paragraph 3 of Order R-794-A, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.	Case 977

BEFORE:

Mr. A. L. Porter
Mr. Murray Morgan
Honorable Edwin L. Mechem

TRANSCRIPT OF HEARING

MR. PORTER: The case to be considered next is Case 977.

MR. COOLEY: In the matter of the hearing ordered to be held by Paragraph 3 of Order R-794-A, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

MR. GRENIER: We will have one witness in this case. I am A. S. Grenier, Counsel for Southern Union Gas Company. Mr. Wiedikehr, if he may be sworn.

(Witness sworn.)

MR. GRENIER: If it please the Commission, this case originally came on for hearing in November 16, 1955 and was called

upon the application of Southern Union Gas Company for an order establishing 320-acre drilling units within the Tapacito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico. At that time the Commission, in its Order No. R-794, ordered that an interference test be conducted involving the Southern Union Gas Company Jicarilla Well No. 2-E, located in the Northeast Quarter of the Southwest Quarter of Section 14, Township 36 North, Range

The case, at that time, was continued until April 1, 1957, at which time it was anticipated that the results of that test might be indicative as to whether or not the relief requested was appropriate. Subsequently, by order dated April 15 of 1957, which followed a hearing in March of that year, the Commission decided that an additional test was appropriate involving the Southern Union Jicarilla No. 4-D Well, and that test has been in progress since that time. It was further ordered in that case, that a hearing should be had on August 15, 1957 to show cause why the rules promulgated by this original order R-794 should be continued in February.

A. M. WIEDIKHR

called as a witness, having first been duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. GRENIER:

Q Will you please state your name?

A. A. M. Wiedikehr.

Q What is your employment, Mr. Wiedikehr?

A Manager of Exploration, Southern Union Gas Company.

Q Have you testified previously in this and other cases before the Commission? A Yes, I have.

MR. GRENIER: Are the witness's qualifications acceptable to the Commission?

MR. PORTER: They are.

Q Now, Mr. Wiedikehr, is it your thought that this is an appropriate time to give final consideration to this matter so as to determine definitely 320-acre spacing is appropriate?

A No, it isn't.

Q Why do you say that, Mr. Wiedikehr?

A If the Commission please, the first interference test run on the run on the 2-E Well, we had three additional wells offsetting this well producing.

Q You are pointing now to an exhibit?

(Marked Southern Union's Exhibit No. 1, for identification.)

A To an exhibit marked Exhibit 1, showing the location of the four wells which were involved in this particular test. The drainage area of these four wells, assuming a radial drainage pattern, would have been a minimum of 785 acres to a maximum of 960 acres to show interference on the shutin well.

From a tabulation of the pressures versus production, we find that no definite break in pressure in the shutin well was observed until such time as approximately 625,000,000 feet of gas had been produced from the three offset wells. The initial pressure was in the order of 187½ pounds, in June of '56 after production of 625,000,000 feet of gas the pressure was 185½ pounds. Then in July, the pressure took an abrupt drop down to 183 pounds and continued dropping at the rate of about three pounds per month until the test was discontinued in December, 1956. This test showed that the tubing pressure dropped 21½ pounds on the shutin well during the time the test was run, and during that time, 1,340,000 feet of gas was produced from the three offset wells.

I feel that this conclusively proves that the area in which we are talking, that a well cannot only drain 320 acres, but as is indicated on Exhibit 1, a minimum of 785 acres, because that is the minimum drainage that would have had to occur for a pressure drop to have occurred in our test well.

Q Just a minute, Mr. Wiedikehr, you were speaking there of 185 pounds, was that not 1,085? A 1,085.

Q In each instance it was intended to be a thousand plus pounds? A Yes.

Q Thank you.

A Now, the second interference test shown by Exhibit 2, was actually begun back in November, 1956. Pressures were taken in

Jicarilla

December '56 on the shutin well, the [redacted] 4-D, showing casing pressure of 1,065, a tubing pressure of 1,064. Production through June of '57 was 393,000,000 feet of gas, and the pressure had dropped one-half pound.

I would like to point out that the pressure did rise from 1,064 to 1,064½ and then dropped to 1,063½, or one pound pressure drop, which we do not feel is conclusive, but if you will look at figures on Exhibit 2, you will notice that there are only two wells which affect the drainage of the shutin well, and the minimum acreage to be drained before interference would be determined is 783 acres, the maximum 858 acres. The producing capacity of the two wells involved in this interference test is approximately forty-five to fifty million feet per month. The capacity of the three wells in Test No. 1, ran one hundred forty to one hundred fifty million a month. Consequently, we do not feel that this second test has had a fair chance.

I'm sorry that we were not able to present pressures during the month of July. We have had a man in the field the last week trying to get down there, but because of the rain and the bad roads, he wasn't able to get us any information. At least it hadn't reached my office when I left. I feel definitely with only two wells producing, we would have to have a minimum of six to seven hundred feet of cumulative production from the two wells involved before definite drainage would be shown.

(Marked Southern Union's Exhibit No. 2, for identification.)

Q How long do you anticipate it will be, Mr. Wiedikehr, before additional production in the range you have indicated, is likely to have been obtained?

A Well, we need an additional 300,000,000 feet of gas, and we are producing at the rate of 40,000,000 a month. That would be somewhere in the vicinity of eight months to give us a definite break. It is conceivable that within the next few months we'll get a break in our shutin well that would indicate that interference has been proved, but I don't think we can discount our test until our 700,000,000 production figure has been arrived at.

Q Have you prepared tabulations indicating the pressures and monthly production and cumulative production with respect to these two interference tests that you have been talking about?

A Yes, I have.

(Marked Southern Union's Exhibits No. 3 and 4, for identification.)

Q Those are the sheets which have been marked respectively as Exhibits 3 and 4 for interference test 1 and interference test 2?

A That's correct.

Q Were Exhibits 1, 2, 3 and 4 prepared either by you or under your personal supervision? A They were.

MR. GRENIER: We request that such exhibits be introduced in evidence in this case.

MR. PORTER: Let's be sure that those are properly identified since they appear on the same sheet.

MR. GRENIER: Now, at the top of Exhibit 3 it indicates that refers to interference test 1, and Exhibit 4 relates to interference test No. 2.

MR. PORTER: I see. Yes, sir. Without objection, the exhibits will be admitted.

Q Do I gather then from the testimony that you have given, that you think a further continuance is appropriate in this case?

A I certainly do.

Q How long a continuance then would you feel to be appropriate under the circumstances?

A I would like to request that the case be continued for a period of six months.

Q If, during that six-month period, it were to develop that a break, as you say, in these pressures had been obtained, would it be your thought that Southern Union Gas Company should have the privilege of coming in and accelerating the next hearing date on this matter? A Yes, sir, I do.

Q Would it be Southern Union's intention to do that?

A Yes, we would like to get it off the docket as soon as possible.

MR. GRENIER: That concludes our testimony at this time, and we do move for a six-months' further continuance in this case.

That is to say until the regular February hearing in the absence of the request on our part, or any other interest operator or the Commission staff, for the further earlier hearing on the matter.

MR. PORTER: Before we act on the motion, is there anyone that has any questions of the witness? Mr. Utz.

CROSS EXAMINATION

By MR. UTZ:

Q Mr. Wiedikehr, referring to your interference tests in the Tapacito Pool, did you take any pressure information on your first test or the one in which the 2-E was included, to show what the pressure differential was between the producing wells and the shutin well?

A The wells were producing at approximately 500 pounds flowing pressure.

Q Five hundred pounds flowing pressure?

A Yes.

Q Did you take working pressures?

A Well, the wells were producing wide open into a 500 pound system. So, in other words, the wells working pressure would have been five hundred, five hundred fifty pounds.

Q That would be the difference between the working pressure and your friction loss? A That's right.

Q You do have that information available?

A I don't have that with me. It can be taken from the

charts, we have weekly charts on all the production, and we know that the wells were wide open in the line. We can take the line pressure off the chart.

Q You didn't actually take working pressure of the wells?

A No, we did not.

Q In that connection, on this second test that you ran on 4-D, I wonder if you would be willing to take your flowing tubing and working pressures on the offset wells at the same time that you take the shutin pressure?

A I would be very happy to.

MR. UTZ: I would like to have that information if I could.

A If I may ask a question, why --

Q (Interrupting) I would like to know the different pressures between the two wells.

MR. PORTER: You have agreed to furnish that information?

A Yes, sir, we will be very happy to furnish it. No problem.

MR. PORTER: Mr. Cooley.

MR. COOLEY:

I understood your motion to be for a continuance. It would more properly have to be an extension, this Order R794-A expires on its own terms on October 1st, this year. It would be necessary for another Order 794-B to be written extending the provisions of 794 for an additional six-months' period?

MR. GRENIER: Yes, I think that is the mechanical procedure we had in mind then, Mr. Cooley, thank you.

MR. PORTER: Then you revise your motion to request an extension of the rules presently in effect?

MR. GRENIER: Yes, that the provisions of Paragraphs 1 through 6 and Paragraph 8 of the original order in this case, Order No. R-794-A, be continued in effect for an additional period of six months, that is to say, until April 1, 1958. They currently expire on October 1, with the contemplation that there be a further hearing on this matter at the regular February meeting in 1958.

MR. PORTER: Does anyone have any objection to the motion? Does anyone have anything further in this case?

MR. JOHNSON: W. R. Johnson, Northwest Production Corporation. I have a request to make of the Commission concerning this case. The Northwest Production Corporation is an operator at the Tapacito-Pictured Cliffs, and requests that the New Mexico Oil Conservation Commission give consideration to the following: One, that Southern Union Gas Company should furnish all data concerning the two test areas to all operators in and within two miles of the Tapacito Pool so that an engineering evaluation of the tests can be made, both as to possible communication and effective drainage.

~~The data should include gas volumes, liquid production,~~

casing pressures on all wells, bottomhole pressures on all wells, gas analysis and gas gravity.

Two, that any extension granted in this case be subject to any operator being able to reopen the case with the usual notice to the Oil and Gas Commission.

MR. PORTER: You mean to reopen the case during the six-month' period?

MR. JOHNSON: That's correct.

MR. MORGAN: Southern Union Gave that right on their motion.

MR. GRENIER: We had that contemplation that if anyone wanted to get in sooner, they would be able to do so. We felt that the information was definitive enough to let us proceed on a final basis.

MR. PORTER: Is Southern Union willing to furnish the information?

A . . . . : Certainly a portion of the information. A lot of, it involves a lot of expense, the information wouldn't justify the expense to obtain it. As far as the pressure and the production, certainly.

Let me continue, there are some twenty or thirty wells in the field and we would have one man doing nothing but running around and taking pressures, if we did it on all the wells. We would be more than happy to submit it on the wells on which the tests that are being conducted.

MR. JOHNSON: I referred specifically to only the test areas.

A He is talking about only the test wells.

MR. PORTER: Only the test wells, are you agreeable to furnishing that information?

MR. GRENIER: How about the gas gravity and the other information he requested at the last?

A All are readily available except the bottomhole pressure, and the gas analysis. Bottomhole pressure might have value, I seriously doubt if the gas analysis would have any value at all in this case. Consequently, I don't see that that should be required.

By MR. UTZ:

Q You say you don't believe the bottomhole pressure would have any value?

A No, I didn't say that, I said the gas analysis. I said the bottomhole pressure we object, but we will do it.

Q Would it be very expensive?

A We are talking now about three wells. It will only cost three or four hundred dollars, we won't argue about that.

Q Do you feel a calculation of the bottomhole would be as effective? A I'm afraid not.

MR. UTZ: I agree with you.

MR. PORTER: Any further questions? Mr. Morgan.

By MR. MORGAN:

Q Why do you say that the gas analysis would not be of value?

A The gas analysis has no bearing whatsoever as far as I can see on whether producing one well will draw the pressure down on another well. That's what we are trying to prove is that a well shut in will be drained by offset wells, and if the pressure declines, then certainly it has been drained.

Q I think the petitioner is asking for the analysis so that they can determine at any time the source of the gas. Would you agree to that?

A I don't think there is any doubt where the gas is coming from. There is only one completed horizon in any of these wells.

MR. JOHNSON: My contention on the gas analysis is that in my opinion the gas analysis is necessary to calculate an effective drainage from a reservoir engineering standpoint.

A We're not trying to calculate it, if I may say so, we are trying to prove it by pressures. They will hold up more conclusively since we don't know anything about the permeability or porosity. We are trying to show it by pressure decline, and gas gravity would have nothing to do with that, nor analysis either.

MR. PORTER: Anyone else have a question of Mr. Wiedikehr?

RE-DIRECT EXAMINATION

By MR. GRENIER:

Q On those items, we of course, would be willing to make

available to them and any information we do have. We would not want to be under an obligation to be incurring expense in the last ones, particularly of gas gravity and gas analysis, of making periodic tests, merely for that purpose.

A We are willing to have them come and take samples any time they want and have them analyzed.

MR. PORTER: The witness may be excused.

(Witness excused.)

The Commission would like to call Mr. Johnson to the stand, please. (Witness sworn.)

W. R. JOHNSON

called as a witness, having first been duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. COOLEY:

Q State your name and position please.

A W. R. Johnson, Manager of Production Operations, Northwest Production Corporation.

Q Have you previously testified before the Oil Conservation Commission as an expert witness in the field of gas engineering?

A Not in the field of gas engineering.

Q What field?

A Well, completion and petroleum engineer.

Q Would you please state to the Commission why you feel that

gas gravities and gas analysis would lend any evidence in this case to the drainage area of a well in the Tapacito-Pictured Cliffs Pool?

A Well, I feel that any proof of drainage in this case must be proven by some calculation of gas movement, and for any reservoir engineering calculation, it is necessary that you have more data than I asked for, but it is necessary that you have gas analysis, gas gravity and preferably water saturation in the cores permeability, porosity and so forth. Some of it can be estimated, but in my opinion, to prove or disprove this case, it is necessary that those calculations be made and that it cannot be made on pressure information alone.

Q You do feel that drainage area cannot be established by means of pressure interference test?

A Communication can be established, drainage area, in my opinion, cannot be.

MR. COOLEY: That is all.

MR. PORTER: Anyone else have a question?

MR. GRENIER: Yes.

CROSS EXAMINATION

By MR. GRENIER:

Q What is his distinction between communication and drainage. Are they not substantially the same thing?

A No, sir. I might tell you a little parable on that.

You can take water out of the Atlantic side of the ocean, or the New York side of the Atlantic ocean, and you will communicate with the English side, but you are not going to take any fish out of it, and it's the same principle, you can communicate, but you may not drain that particular area.

Q And it is your feeling then that pressure decline can only show communication but cannot show that there is any drainage between wells?

A It can prove it, in my opinion.

By MR. WIEDIKEHR:

Q What causes the pressure to drop?

A Movement of gas, Mr. Wiedikehr.

Q That is all I wanted to know, thank you.

A But the question of effective drainage, for instance, you and I both know that the well drilled every 40 acres in a 320, 8 times those wells would produce more gas than one on 320, but somewhere in between there is an effective drainage pattern. I don't think you can prove it by pressures alone.

Q Let me ask you, with a distance of 3200 feet, or 3300 feet between wells, and with a pressure drawdown on a shutin well of say 20 plus pounds, you don't think that shows any drainage between two wells?

A It shows communication between the two wells providing you had bottom hole pressure data to substantiate it.

Q No drainage?

A I don't know. I would have to calculate it.

Q Can you calculate without permeability and other factors that you don't know about this field?

A No, but I can estimate them, but I would have assumed that you would have attempted to prove the case on that point, or at least to back it up.

Q When you have insufficient information, isn't this a better means than trying to calculate something from a lot of unknowns since all of these factors are known?

A Not from an engineering standpoint.

MR. WIEDIKEHR: That is all.

MR. PORTER: Anyone else have a question? Mr. Utz.

By MR. UTZ:

Q Mr. Johnson, is the thing that you are concerned about more than anything not whether or not we have communication on 320, but as to how efficient that drainage is?

A Or that communication is, that's right.

Q That is the thing you would like to check with the calculations?

A That is correct.

Q In other words, the pressure between the producing well and the shutin well, the pressure drop through the formation?

A That is very correct. At this time I do not know in my own mind if I have any objection to 320 acre spacing in the field,

but I think we should have the information to try to take an engineering look at the whole case.

By MR. GRENIER:

Q Would you be willing, Mr. Johnson, to make these tests in which you are interested, at your company's expense?

A Yes. However, you do take them periodically. We have some of the gas analysis from your Tapacito Field, and you do by your gas contracts, take specific gravities at least every three months, so it is readily available.

Q Do I understand that you are merely asking for the information we have on hand and are not requesting us to make any additional tests out of the ordinary?

A I do not know if you have taken bottomhole pressure. I would think you would have wanted to.

Q That, I believe that Mr. Wiedikehr stated that we were willing to do.

A The rest of the information is available.

Q So youare not asking for anything of particular or unusual on our part other than what we would obtain in the way of data in any event, is that correct? A Not to my knowledge.

MR. PORTER: Anyone else have a question?

By MR. WIEDIKEHR:

Q How often would you like bottomhole pressures?

A The ones I would like to have had would be the initials.

I think one static and one good flowing bottomhole pressure at the end of the test would be adequate from your wells primarily to determine fluid level. We do know, and I would like to add for the Commissions' information, we do know in the field that liquids are produced. We are gathering them from the Pictured Cliff formation in that field, and we do know that the bottomhole pressures can be different and not easily calculated from surface pressures.

Q On a flowing well, but not on a shutin well, that has never been produced? A That all depends.

MR. PORTER: Are there any more questions? The witness may be excused.

(Witness excused.)

MR. COOLEY: Mr. Greiner, the requests by Mr. Johnson have been clarified, is Southern Union willing to furnish the information requested?

MR. GRENIER: What we would like to suggest is that if Mr. Johnson would advise us in writing just exactly what it is that he wants of us, that we will either supply it or notify the Commission of anything that might cause us any difficulty along those lines. We don't wish to be difficult in this case, and we are, of course, very glad to furnish readily obtainable information to anyone, but we don't want to be put into a position of thinking that we are satisfying Mr. Johnson and then not actually doing so. So we would like to have it definite and in writing. We do not

want to be in a position of undertaking to do something that is inappropriately costly. You may have some suggestion on procedure that may accomplish that same result.

MR. COOLEY: I believe Mr. Wiedikehr stated that he was willing to furnish the bottomhole pressure test, that the expense would not be out of line.

MR. WIEDIKEHR: Yes, sir.

MR. COOLEY: And the more specific tests was one static test and one flowing test at the end of the communication test, is that correct?

MR. WIEDIKEHR: That is my understanding, which well does he want the static on, the shutin, the flowing bottomhole, that is the reason I wanted it put in writing so I would know what he definitely requested.

MR. COOLEY: I think we could clarify it here.

MR. JOHNSON: You have it exactly correct.

MR. COOLEY: And you have sufficient information as is readily available without having to run other tests?

MR. WIEDIKEHR: Yes. We are in full accord and are willing to submit to the operators within the pool within a two mile radius.

MR. JOHNSON: I stated that because that is the way the field rules are written.

MR. GRENIER: Is that operators of wells that are completed

now or are completed in the future, that is not all the lease owners is it?

MR. JOHNSON: I presumed operators of wells, lease owners to this extent, there are only about six that might drill wells within the field rules of that Tapacito.

MR. GRENIER: I'm wondering about the possibility of a record check. We will be glad to do it on the basis of what the records indicate, when we might not have up-to-date information.

MR. JOHNSON: They are all Jicarilla 4 section leases and involve ours, El Paso, Magnolia, Humble, Honolulu and I think that's all.

MR. COOLEY: Would it not be agreeable to supply this information upon request to the offset operators?

MR. GRENIER: We would be very pleased to put it on that basis.

MR. JOHNSON: That would be fine. I so request.

MR. PORTER: Anything further in this case? Mr. Grenier, the Commission will not rule on your motion immediately for an extension of this order for six months, but will take the case under advisement and give you an early decision.

MR. GRENIER: Thank you very much, Mr. Porter.

MR. PORTER: We will take the case under advisement.

DEARNLEY · MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

C E R T I F I C A T E

STATE OF NEW MEXICO)
: SS
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this day of August, 1957.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1959.

MAIN OFFICE OCC
1955 DEC 19 AM 8:36

BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

November 16, 1955

IN THE MATTER OF:

CASE NO. 964 and 977

TRANSCRIPT OF PROCEEDINGS

ADA DEARNLEY AND ASSOCIATES
COURT REPORTERS
605 SIMMS BUILDING
TELEPHONE 3-6691
ALBUQUERQUE, NEW MEXICO

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
November 16, 1955

IN THE MATTER OF:

Northwestern New Mexico nomenclature case calling for the following creation:

(e) Creation of a new pool in Rio Arriba County, New Mexico, classified as a gas pool for Pictured Cliffs production, designated as the Tapicito-Pictured Cliffs Pool, and described as:

Township 26 North, Range 4 West
Section 9: NE/4
Section 10: W/2
Section 13: SW/4
Section 14: S/2
Section 15: All
Section 16: SE/4
Section 22: NE/4
Section 23: W/2, NE/4

Case 964

IN THE MATTER OF:

Application of Southern Union Gas Company for an order creating the Tapicito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico, and for the temporary establishment of 320 acre drilling units within the pool to cover the following described area:

Township 25 North, Range 3 West
All of Sections 4 and 5

Township 26 North, Range 3 West
All of Sections 19, 29, 30 and 32

Township 26 North, Range 4 West
Section 3: S/2
Section 4: S/2
All of Sections 9 and 10
Section 11: S/2
All of Sections 13, 14, 15 and 16
Section 21: E/2
All of Sections 22, 23 and 24
Section 25: E/2

Case 977

Furthermore, applicant desires to have 320 acre drilling units established within the pool boundaries and adjacent area within two miles of the pool boundaries and also desires pool rules pertaining to the location of wells.

BEFORE:
Honorable John F. Simms, Jr.
Mr. E. S. (Johnny) Walker
Mr. William B. Macey

TRANSCRIPT OF HEARING

MR. MACEY: The next case on the docket is Case 977.

MR. GRENIER: A. S. Grenier, appearing on behalf of Southern Union Gas Company. We have one witness to be sworn.

A. M. WEIDERKHER,

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. GRENIER:

Q Mr. Weiderkher, will you state your name for the record?

A A. M. Weiderkher.

Q By whom are you employed?

A Southern Union Gas Company.

Q In Dallas, Texas?

A Right.

Q In what capacity?

A Manager of Exploration Department.

Q Have you previously testified before this Commission as an expert witness?

A Yes, I have.

MR. GRENIER: Are the witness' qualifications acceptable?

MR. MACEY: They are.

Q In this case, No. 977, Mr. Weiderkher, will you tell us briefly what is proposed or involved?

A Yes, in Case 977 Southern Union Gas Company is asking that a Pictured Cliff field to be known as the Tapicito-Pictured Cliffs be designated, as set forth in our application, and that a temporary order providing for 320 acre drilling units as well as a spacing order be written by this Commission.

Q Have you had a map prepared under your supervision which indicates the proposed pool outline, Mr. Weiderkher?

A Yes, I have.

Q Do you have some copies of that we can give to the Commission?

A I do.

MR. GRENIER: We would like to have one of these marked for identification as Southern Union Gas Company's No. 1.

(Southern Union Gas Company's Exhibit No. 1 marked for identification.)

MR. MACEY: Before you go any further, this case is consolidated with Case 964?

MR. GRENIER: Yes, I believe the Commission started a similar proceeding in regard to this pool in 964.

MR. MACEY: I think the record should show a consolidation of Cases 964 and 977.

MR. GRENIER: Yes. All testimony is to be presented in the two cases consolidated for hearing. That was a nomenclature proceeding, I think it was paragraph (e) of that case from last month.

MR. MACEY: That is correct.

Q Now, on this map, Mr. Weiderkher, have the proposed pool outlines been indicated?

A The proposed field outline is that enclosed within the red border.

Q Within that area, how many wells have been drilled today?

A Sixteen wells have been drilled.

Q How many of these are producing wells currently capable of production?

A None of the wells are producing, due to the pipeline, but fifteen of the wells are capable of producing.

Q There is one in what status?

A A well located in the southeast quarter of Section 13, 26, 4 known as S. U. G. 1-C Jicarilla well is temporarily abandoned. We would like to say that the well was initially drilled through the Pictured pipe set on top of Pictured Cliff, and cemented, and when we drilled the cement we did not get a good job; we had water from the coal section above, along with some gas. We squeezed off the water and at this time we squeezed off the gas. Even after fracing we were not able to appreciably increase its capacity.

MR. MACEY: Where is that well located?

A Southeast quarter of Section 11, 26, 4.

Q Just to identify the area covered by this map, would you state that please?

A You mean the entire area?

Q Yes. What townships are portrayed here and in what county are these lands located?

A Actually, we have part of Township 25, 26, 27 North, Ranges 3, 4, 5, 6 West, all in Rio Arriba County, New Mexico.

Q That is the area shown by the map. The red outlined area does not embrace all that acreage?

A That is correct.

Q What is Southern Union Gas Company's leasehold interest in the red outlined area, that is to say, the proposed pool limits?

A We have an undivided one-half interest in 11 and a half sections, and a full interest in one-quarter of a section within the pool boundary.

Q Have you made any studies, Mr. Weiderkher, to determine whether or not this proposed pool is inter-connected with any of the other Pictured Cliff pools of the San Juan Basin?

A Yes, I have. We have prepared, or I had prepared under my supervision some cross sections. You will note on Exhibit 1 AA prime, BB prime and CC prime. Actually I have prepared three cross-sections showing the sand development within the pool boundary and the sand disappearing, so to speak, outside the pool boundary.

MR. GRENIER: Let's get this distributed. These would be Southern Union's 2, 3 and 4.

(Southern Union Gas Company's Exhibits 2, 3 and 4 marked for identification.)

Q Now the locations of the wells which are indicated on these three cross-sections, Exhibits 2 through 4, are they indicated on the map, Exhibit No. 1?

A Yes, they are. Actually Exhibit 2, which is the cross-section AA prime, starts with Southern Union Gas Company's No. 1-G Jicarilla well located in Section 1, 26, 5, goes down through the 1-E well in Section 16, 26, 4, the 1-A well in Section 23, 26, 4, and the 2-D well located in Section 29, 26, 3.

Q Referring to that particular AA prime line, describe what the log showed as portrayed on Exhibit 2, if you will.

A The 1-G well located here was cored and tested in the Pictured

Cliffs sand, this is actually where the Pictured Cliff sand is supposed to be, and there is some extremely hard type non-productive sand present in this particular well. Going on to the southeast, we run into the other three wells actually completed as commercial producers. This exhibit tends to show that somewhere between the 1-E well and the 1-G well there is a pinchout of the productive Pictured Cliff sand which would separate that from any Pictured Cliff production to the northwest.

Q That 1-G well is without the limits of the proposed pool boundaries, is that correct?

A Yes, it is. It was non-commercial in the Pictured Cliffs. The well is shown on our exhibit as a producer and producing from the Mesa Verde.

Q What are the wells that are shown on cross-section BB prime as outlined on Exhibit No. 3?

A The Southern Union Jicarilla 1-H located in Section 20, 26, 4, the 1-A which was used, Section 23, 26, 4 and the 2-D, the same one as used before. Actually this is more or less an east-west cross-section but showing in the Southern Union 1-H a dry hole in the Pictured Cliff, showing a pinchout of the sand in about the same manner as it was pinched out in the northwest. It also occurs on the west side of the proposed field.

Q As to cross-section CC prime shown on Exhibit 4, what are the wells involved in that cross-section and what are your findings?

A In cross-section CC prime, it begins with Southern Union Gas Company's Jicarilla 2-K well located in Section 11, 25, 5 which well, if not presently, will be located in the South Blanco-Pictured Cliff field showing a good development of sand within that

well which made some twenty million feet of gas. Then going to the northeast the 3-K Jicarilla located in Section 1, 25, 5 with a much poorer sand section, which well made about two million feet of gas instead of twenty million as the offset well; and going over to Section 27, 26, 4 the Jicarilla 1-F which was dry in the Pictured Cliffs was completed in the Mesa Verde / and going into the main body of the Pictured Cliff, of the Tapicito Pictured Cliff field, showing the 1-A well, Section 23, 26, 4 and 4-A well, Section 14, 26, 4, this being a southwest--northwest cross-section to show separation between the proposed Tapicito field and the South Blanco field line to the west and southwest.

Q Based upon these studies, have you reached any conclusion as to whether this pool is then inter-connected with any of the previously designated Pictured Cliff pools in the San Juan Basin?

A From this study and with the three dry holes separating this proposed Tapicito field with the South Blanco-Pictured Cliff field, the only Pictured Cliff field in the general vicinity, I would say that there's very little, if any, likelihood that these two fields would be connected.

Q In other words, all the evidence that you have to date indicates that they are not connected?

A Yes, it does. We drilled four dry holes in the area trying to find out where the field went and it played out on us.

Q Have you made any studies, Mr. Weiderkher, to determine what the recoverable reserves may be in this proposed field area?

A Yes, I have. Southern Union cored three wells in its drilling program in the area, and only one of the three that we cored was productive, but using core analysis from that particular well --

Q (Interrupting) Which well?

A Southern Union Gas Company's 1-E Jicarilla located in Section 16, 26, 4. Using the data from core analysis and the average field pressure within the area, I have calculated that the in-place gas amounts to approximately 344 m.c.f. per acre foot.

Q What were the factors that went to make up that estimate? From your core analysis what was the average porosity through the pay zone?

A 16.7 percent.

Q Connate water content?

A 42 percent.

Q The sand thickness?

A It was not used in this, it is used in the final reserve. Pressure is the only other factor.

Q What was the shutin pressure?

A 1,090 pounds.

Q That gave you, then, 344 m.c.f per acre foot?

A Right.

Q What did you do to determine the sand thickness in making your estimates?

A Well, I used the actual productive sand from core analysis on this well and then comparing that to electric log, I was able to average out the productive sand on the other wells within the area.

Q What did you find the average sand thickness to be, net sand thickness?

A Somewhere in the vicinity of 23 to 25 feet.

Q Working from your estimate of total reserves per acre foot,

what did you then arrive at as your estimate of total reserves under an average 320-acre tract in this proposed pool?

A 2,540,000,000 feet.

Q Again on a 320-acre tract basis, what do you estimate to be the recoverable reserves?

A I estimate we will probably withdraw gas down to a 250 pound pressure, which would give us a recoverable reserve of 1,960,000,000 feet of gas.

Q Have you made any studies to determine how long it will take to recover this recoverable reserve of 1,960,000,000 feet?

A When you start to determine how long it is going to take to recover any reserves, you have to know at what rate the wells will produce and, secondly, what rate will the pipeline take the gas, which entails an estimate of what line pressures will be prevailing or prevalent during the life of the wells. Actually, these particular wells have a capacity presently, the average well has a capacity in excess of 1,000,000 feet of gas a day. If these wells were produced at full capacity, they would recover their gas in far less than twenty years. Actually, we in the pipeline business try to figure on getting the gas from any particular area in about twenty years and our take should be proportionate to that.

Q If the line pressure were to be lowered so as to keep it generally at about half of the then existing shutin pressure, would these wells still be able to produce their recoverable reserves in the twenty-year period?

A Yes, they will.

Q You said that you found an average deliverability of these wells of a million a day. Did you come to any more exact figure

than that?

A Yes, actually what I did was to take the three-hour initial potentials of the various wells, add them up, and I came out with an average initial potential of 6.8 million feet per day, which would give a deliverability based on 18 percent factor of 1,224,000 cubic feet per day.

Q Where did that 18 percent factor come from?

A That is pretty well standard, a standard factor used in the San Juan Basin for Pictured Cliff wells. Actually, over a long period of time we have found that the wells will produce approximately 18 percent of their three-hour initial potential.

Q Has that been made use of by the Commission?

A Yes, it has.

Q For what purpose?

A In determining deliverables prior to an actual deliverability test.

Q For proration purposes?

A Right.

Q In the other pools?

A Right.

Q In comparison to the other westerly Pictured Cliff producing areas, have you made any studies to determine how hard these wells are going to have to be pulled in order to be taking at a comparable rate of withdrawal in relation to recoverable reserves per acre?

A Yes, I have. I checked the New Mexico Engineer Committee Report showing gas production for all Pictured Cliff pools in the month of January of this year, and the month of July. I find that during the month of January the South Blanco-Pictured Cliff wells

averaged 7,000,000 feet per month, which was the highest average per well of any field. In July that same field was still high with an average of 5.4 million per month. The average for all Pictured Cliff fields runs somewhere in the vicinity of three and a half to four million feet per month. Now the other Pictured Cliff fields have a recoverable reserve per acre of approximately the same amount of gas, which would mean that if we were to produce these wells on 320 acres and recover approximately equal percentages of the reserves, we would have to pull these wells at a rate of about twice the average of the other fields, which would mean that we would only have to produce around 10,000,000 per month per well.

Q In other words, the recoverable reserves for 160 acres in the other areas are about how much, Mr. Weiderkher?

A Somewhere in the vicinity of a billion feet per 160-acre unit.

Q Thank you. Are you saying then that we would then have to produce about 10,000,000 feet per month in order to be producing from the same rate from one of these 320-acre tracts, as the other Pictured Cliff areas are being produced in relation to reserves?

A That is correct, on an average.

Q What is the proportion between that 5,000,000 feet a month for the other Pictured Cliff areas and the deliverable capacity of the wells in that area, what percentage of the deliverable capacity are they having to put out to deliver at the rate of 5,000,000 a month?

A From the latest calculations, it appears that the average Pictured Cliff wells are producing at approximately 65 percent of capacity.

Q In order to be taking 10,000,000 per month from the wells in this area, what percentage of capacity would that mean?

A About thirty percent of capacity.

Q So that these wells relative to deliverable capacity would only have to be pulled about half as hard in order to be producing at the same rate in proportion to unit reserves, is that correct?

A That is right.

Q How much do the wells cost to drill and complete in this area, Mr. Weiderkher?

A Oh, from thirty-five to forty thousand dollars.

Q What has been the average cost of Pictured Cliffs wells in the other producing areas, in the Pictured Cliff areas?

A Our average cost runs between twenty and twenty-two thousand.

Q Why is the cost so much higher in the one instance than the other?

A We are talking about approximately twice the depth and, of course, we are 104 miles from the nearest supply house and back up in the mountains a little bit, and the over-all costs are increased when you get that far away from your home base.

Q Within the pool limits as recommended by Southern Union in this case, how many 320-acre drilling locations would there be?

A It seems to me like there would have been thirty-five.

Q So that if this were spaced on the same 160-acre basis as the other Pictured Cliff pools in the San Juan Basin, how many extra wells would have to be drilled to bring it up to a full development program?

A Thirty-five.

Q Taking an average cost of $40,000 for those wells, how much

of additional investment would that represent?

A $1,400,000.

Q That is an investment which would be saved if it were drilled on 320 as opposed to 160?

A That is correct. Let me finish that. This $1,400,000 additional money that would have to be spent is only on the assumption that we have outlined the total extent of the field. It is our personal opinion that future development will increase the size of the field and every increase means additional unnecessary amounts of money expended if we have to drill on 160 acres.

Q You said, Mr. Weiderkher, that this area had not yet had a pipeline connection. What is in store as respects this pool in that regard?

A Southern Union is in the process of laying a line to the area at the present time. It is my understanding that the contractor is setting up camp and proceeding which his line. I know that the contract has been let.

Q So that would mean a probable start of actual takes about when?

A We are hoping to be able to start taking gas before the first of January.

Q As to the wells within the area which are not Southern Union wells, or the portion of production which is not Southern Union production, what price is contemplated to be paid?

A Our present contracts call for twelve cents a thousand or Mesa Verde price.

Q How does that compare with the price being paid in the other Pictured Cliffs area of the Basin?

A The other Pictured Cliffs gas areas are receiving ten cents a thousand.

Q There are some exceptions, but that is true --

A (Interrupting) With one exception.

Q -- in most of the older areas?

A Right.

Q Why the price differential?

A These wells have sufficient pressure to be put into our main line without compression, and therefore we can pay a higher price for it.

Q Let's summarize, if we may, the recommendations which you are making to the Commission in this case. First, as to field boundaries, are you recommending that the entire area shown in red be included within the pool limits?

A Yes, and I would like to call the Commission's attention to the fact that a well has been completed by Magnolia Petroleum Company in the southwest quarter of Section 7, 26, 3. This well was completed subsequent to the time that we had prepared our exhibits and had sent in our notice for hearing. The Commission might desire to increase the field boundary to include this well. We would recommend that if the Commission feels that they should do so, that they also include the south half of Section 12, 26, 4, the south half of Section 7 and all of Section 18, 26, 3.

Q You mentioned previously this temporarily abandoned well in Section 13 of 26, 4 --

A Section 11 it should have been.

Q Section 11?

A Right.

Q Do you feel that, despite the present status of the well, it is appropriate to include that well's drilling site within the pool?

A Yes, I do. The sand section is there, it was simply a matter of mechanical trouble in completion, not a lack of sand development.

Q You also are recommending 320-acre spacing in this case, is that correct?

A That is right. 320-acre drilling spacing to be in force for one year. At this time we would like to recommend that any wells drilled within two miles of the field boundary be spaced in accordance with this order. Also we would like to recommend that the wells be located in the southwest and northeast quarters of the sections where new wells are to be drilled. It is known that some wells have already been drilled that do not conform to this particular pattern. We would like to see that they are granted an exemption and where one well has been drilled in a section that did not conform to this pattern, we suggest that the second well drilled should be in a catty-corner direction from the presently drilled well. The reason we ask that the wells be located in the southwest and northeast quarters is primarily due to the fact that we believe the area will be productive of Mesa Verde gas, that is, the Mesa Verde spacing pattern, and at some date we might want to twin or dual these wells and of course in that event, if the wells are on the same location, it means less pipeline for us.

Q Going back into the various parts of that recommendation again, why 320 acres? Do you feel that a well on 320-acre unit can economically and efficiently drain that much acreage in this area?

A Certainly do from the present information. The deliverable

capacity of the well certainly indicates that the wells would drain 320 acres. It's a fact that if they won't, we can always go back in and redrill additional wells. A year's time will give us a chance to produce the wells and to get an idea of what the capacities are and what area they might drain. We can't undo drilling; we can't go back to a contractor and say"We want our money back, I drilled the well in the wrong place. I didn't need it." We can always go in and drill additional wells. It appears that we would be spending a lot of unnecessary money to drill on 160 until we know definitely that 160 is necessary. We may find down the years that it would be necessary to do that. Right now it doesn't appear that is the case.

Q You mentioned a one-year period, I believe, as the length of time that is asked for in this temporary order?

A Yes, at the end of one year, I believe Southern Union would be in a position to come back and present a little more information as to the capacity of the wells to drain 320 acres. We will know about the size of the field and the area to be included. During this year's period of time we will collect quite a lot of additional information. You can't get a whole lot of information until you get some production.

Q While we are waiting to get that information, why is even a temporary order necessary in this? Why shouldn't we just let it go until we really know the answer?

A If you wait until we know the answer, you have waited too long in a lot of instances. A good example might be the West Kutz field. Once you start some people drilling on 320 and some people drilling on 160, it is a little bit hard sometime to get them changed.

I would also, though, like to point out here that the Commission has set a precedent in southeast New Mexico of allowing for 160 and 80 and 120 and 640 acre drilling units within the same pool. Why it's good in southeast and not good in the northwest, I haven't been able to decide. In case we do have to have a standard drilling unit within any given field, I think we ought to set one initially and then change it if necessary. Let's don't say, "Just drill them any way you want to and we will decide what's right later."

Q You have included a recommendation that these rules be applicable both to the red outlined area and also within an area surrounding that, within a distance of two miles. Is that in accordance with the Commission's normal pattern of its spacing orders, the two-mile feature?

A Normally the Commission says any well drilled within a mile of any known field will be drilled in accordance with the rules and regulations of that field. We are asking for two miles, since we don't have presently enough information to exactly delineate the field.

Q Do you feel that the fact this is a temporary order makes the two-mile limit more appropriate than it would be if it were a permanent type order?

A I certainly do.

MR. GRENIER: We have no further testimony at this time, although we might wish to make a closing statement. We would like to have Southern Union's Exhibits 1 through 4 admitted in evidence.

MR. MACEY: Without objection they will be received. Any questions of the witness?

MR. SILVER: Caswell Silver. I represent two wells in the

proposed unit 160 acres. Before I can decide whether it would be good or bad for me, I would like to ask the witness some questions.

CROSS EXAMINATION

By MR. SILVER:

Q Will Southern Union Gas be willing to give a limited one-year contract gathering to wells in the unit, terminating at the will of the other operators during the period of this one-year trial?

A You want to bring the gas to us? We wouldn't go after it for that kind of deal. We can't afford to lay a pipeline for that one-year supply of gas.

Q Will you take it if we bring the gas to you?

A That is not something that I have anything to do with. I am not in the gas purchase section. I think we would, we generally have. We certainly would not go after gas on the one-year basis. We couldn't pay out the pipeline in that length of time.

Q Do you recommend any compensation in allowable to operators and royalty owners agreeing to 320-acre spacing during the one-year test?

A I don't believe I understand the question. We have no proration and the allowable will be based simply on what can be produced. I don't know that I understand the question.

Q As I understand, you have asked for no proration?

A There is no production. We can't prorate until we get production. We have had no production and I don't think there is any basis for prorationing yet.

Q If any future Oil and Gas Commission sees fit to prorate production in the area, would you recommend any compensation in

allowable per well?

A If the State decides to prorate gas in the area, Southern Union is going to recommend that we use 320 acres as the standard proration unit.

Q At the present time it is my understanding that the State Oil and Gas Commission allows 25 percent on the basis of acreage and 75 percent on the basis of well potential within the unit, prorationed unit areas. Do you have any plans or recommendations for a change in that formula or an increase in the event that 320-acre spacing is sustained?

A That particular formula is used not only in Pictured Cliffs, but Mesa Verde where 320-acre spacing is in effect. We are not arguing proration, but Southern Union opposed that when it was presented initially and we would not concur with it again.

MR. SILVER: If the Commission pleases, on the basis of the respondent's answers I would like to state our position in the matter. May I do so?

MR. MACEY: You can make your statement later if you want to.

MR. SILVER: I am Caswell Silver, representing Caswell Silver. I own the wells in that Section 4 and 5, part interest. Mr. Florence here also owns part interest in those wells, representing all of Section 4 and the east half of Section 5 put in the unit, and approximately 3400 surrounding acres not in the unit.

MR. MACEY: Anyone else have a question of the witness? Mr. Utz.

By MR. UTZ:

Q Mr. Weiderkher, I notice that in regard to shutin pressures in the area that you have recommended to be called the Tapicito Pools,

that there are variations of as much as 65 pounds. Is it your opinion that even though these variations exist, this is one common source of supply?

A Yes. I think you will find the pressures were taken at various times, some of the wells were oil fraced on completions, part of them were never completely cleaned; as evidence of that, one of the wells was used for gas drilling, a Pictured Cliff well, and when the Pictured well was cored it showed 20 percent residual oil in the cores, where the oil had infiltrated in the cores of the new well. You will get quite a variation in pressure until such time as the wells have been produced and cleaned. At the end of that time I think your shutin pressures will be comparable. I don't think you have true shutin pressures at the present time.

Q Do you think that any of the shutin pressures are stabilized pressures?

A That, I suspect some of them are, but I would hesitate to say which ones. I don't know exactly the length of time on all those tests. I would say it would take somewhere in the area of thirty days to stabilize pressure down there.

Q You believe thirty days will stabilize?

A Yes, the capacity is such that I think they would stabilize pretty much in thirty days.

Q Other than the fact that deliverability, estimated deliverability of these wells are above average for Pictured Cliff wells in the Basin, do you have any data that would indicate that these wells will actually drain 320 acres?

A Actually we do not have any information and won't have until such time as we get production. I think we can say that we know one

well in the area had a natural initial potential of in excess of 3,000,000 feet of gas, which would indicate pretty good permeability and that is your factor with regard to drainage. I would say the fact that we have vertical fracturing as shown from our core analysis and the average permeability as shown from core analysis would indicate that the wells should be able to drain the 320 acres. We can only get conclusive proof with regards to that after some production history.

Q Would you be willing to submit to some sort of an interference test for the area during the trial period?

A We propose to run some tests to that effect if our request is granted.

Q By shutin in one well?

A Shutting in one well and producing the offset wells, watching the pressures to see if there is interference.

Q Would you have any suggestion as to what well that you would run the test on?

A We would prefer to get one somewhere in the middle of the field. I had in mind somewhere over in the vicinity of, probably the 2-E well that's located in the southwest of 15.

Q You think your 1-A well would be a good well to shut in?

A The 1-A well? You won't be producing, you won't be surrounding it by production, it will take a longer period of time to get results. You would get better results by shutting in your 2-E and watching it, because there you are producing from all sides and it will take a lesser shutin period, keep it off the lesser length of time.

Q Your 1-E is considerably closer to 2-E than the 5-E would

be to the 1-A?

A If you take the circular pattern of drainage from 2-E to 1-E, you will find that is in excess of 320 acres.

Q I didn't get the permeability that you gave.

A I didn't give it. Average permeability on Southern Union 1-E for the 223 productive feet was 6,2 million millidarcies with seven feet of that having vertical fractures. Much of that had permeabilities in the range of 15, 18, 2, 29, 10, 18, and most all of it in excess of one million millidarcies which is the average Pictured Cliff production is less than one million

Q Is this permeability above average for the Pictured Cliffs in San Juan Basin, would you say?

A It is from the core analysis that I have seen, yes.

Q I am inclined to agree.

MR. UTZ: I believe that is all I have.

MR. MACEY: Anyone else have a question?

By MR. SILVERS:

Q I got in late, I am sorry if I asked you a question. Did you give reserves, calculated reserves figures in that area?

A Yes, I did. Approximately two and a half million feet per 320-acre unit.

MR. SILVERS: Thank you.

By MR. MANKIN:

Q You indicated the reserves in this particular area to be spaced in Tapicito somewhat comparable to reserves in other Pictured Cliffs areas, did you not?

A That is right.

Q You also indicated that depth was approximately twice the

depth of many other Pictured Cliff pools?

A That is right.

Q Your cost is not twice as much, but it certainly is greater?

A It is nearly twice as much. We average twenty-two to twenty-three on the others and between thirty-five and forty here, so it is at least 80 percent additional cost.

Q In your recommended spacing of the wells in the northeast and southwest and of cross-spacing wells that have already been drilled within a section, you will find that you are going to have as much as three and four wells clustered around a section corner, is that correct?

A You are going to find that in a very few, I think one instance maybe. That always occurs when you don't have spacing pattern set until the field is well along in development. It's happened in the Blanco Field, for instance, where part of the Blanco Field is one pattern and one is in another one.

Q In other words, in the southeast end of the area to be spaced, on your pattern you will have four wells surrounding one corner, is that correct?

A Yes, that is a bad section there. There is one there and there will be one other one.

Q You have two other places where there will be three wells around a section corner, which will amount to 160?

A It amounts to that, as far as the location of the wells, assuming that the wells are going to drain the entire area, you still have so many productive acres and so many wells. There will be drainage and counter-drainage, there always is in any production. It's bad that those things occur, but you can't help them after they

have already taken place.

Q Do you have any recommendation as to the spacing for topographical conditions for the leeway you might have?

A We would recommend that you would use the same one as used in the other Pictured Cliff fields.

Q You did not make any such recommendation?

A We weren't making any recommendations along that line, simply intended to state that the general Pictured Cliff rules with the exception of the drilling unit be used, casing program and all other phases of it.

Q Would you be willing for at least three months interference tests on these wells shut in?

A Yes.

Q At least that period of time?

A Right. We will agree.

MR. MANKIN: That is all.

MR. MACEY: Anyone else have a question of the witness?

MR. GRENIER: I have a couple of questions on re-direct. I think these will give a little broader picture. They will help clarify the total picture.

MR. MACEY: Okay, go ahead.

RE-DIRECT EXAMINATION

By MR. GRENIER:

Q Mr. Weiderkher, is the development that has been had within this area to date anything like complete at this time, or is there any further drilling to be done?

A No, there's still a lot of development to be done within the present boundaries of the known field. We don't know what is

going to happen outside that field. There is a lot of additional development to take place.

Q This is not a static or fully developed situation?

A Certainly not.

Q Does Southern Union have any development plans for 1956 or the remainder of this year?

A Southern Union has already been approached or has already approached one of its partners, Aztec Oil and Gas, and received their tentative approval to drill four additional wells, we also have a partner, Humble, and we haven't talked to them but plan some additional wells with them during the coming year.

Q What is the character of the underlying ownership here of this area, Mr. Weiderkher?

A Well, with the exception of two sections it's all Indian lands, Jicarilla tribal Indians.

Q Is all of Township 26 North, Ranges 3 and 4 West tribal Indian land?

A I believe it is.

Q So that it is only the two sections down in 25 North, 3 West that are not on the Indian lands?

A That is within the present field boundaries, yes.

Q Yes. What is the character of the ownership down in 25 North, 3 West?

A 25, 3 is composed of both Federal and Fee lands.

Q In what approximate proportions?

A About, oh, I would say 80 to 90 percent Federal.

Q That's for the township as a whole and without specific regard to this immediate area?

A That is correct.

MR. MACEY: Anyone else have a question? Mr. Mankin.

RE-CROSS EXAMINATION

By MR. MANKIN:

Q In regard to this being Federal lands, the Southern Union Gas Company has not requested that the wells be drilled on 160, have they?

A No, they have not.

Q They have made no recommendation as to spacing?

A As far as I know, they have not.

MR. MACEY: Anyone else have a question of the witness? Mr. Weiderkher, will you briefly, for me, give me the data that you used in calculation of your reserve estimate?

A Yes, I used the core analysis from Southern Union Jicarilla 1-E, which gave 16.7 percent porosity, 42 percent connate water, 23 feet of net pay. I used 1,090 pounds top hole shutin pressure. We have some other core analyses that give approximately the same results. Their water is a little lower, their porosity is a little lower, and feet about the same, and you come up with about the same reserve, but actually I used the 1-E, the good well that we completed.

MR. MACEY: You arrived at a two and a half million feet of reserve in place?

A Right.

MR. MACEY: Your reserve down to 250 pounds was 1960?

A 1960, that is correct.

MR. MACEY: I am not too sure, you may have testified to this, but what is the status of your No. 3-A Jicarilla well in Section 14, the southeast quarter of 14?

A That is a location that was staked in the wrong place, and we just abandoned the location.

MR. MACEY: Never been drilled?

A No, sir, it has not.

MR. MACEY: Are there any dry holes other than your No. 1-C well within the outline of your proposed pool?

A No, there are not.

MR. MACEY: Can you tell me what the yellow coloration on your cross-sections represents?

A That represents the gross Pictured Cliffs sand development whether it be productive development or not, but it is the Pictured Cliffs sand development, your productive sand. You can tell that readily from your resistivity and s. p. curves of your electric logs.

MR. MACEY: You averaged your net pay at twenty-three to twenty-five feet?

A Based on the Jicarilla 1-E well which was cored.

MR. MACEY: In that well you had approximately fifty feet gross, is that correct?

A Yes.

MR. UTZ: Is that fifty feet?

A About that. We cored, we cored from thirty-four to thirty-four fifty-four and that was all sand.

MR.MACEY: Can you furnish us with a copy of the core analysis?

A Yes, I can.

MR. MACEY: You don't have to give us that one.

A It is all right. I have some others on the dry holes if you want them. The sand is there, but they are non-productive.

MR. MACEY: Anyone else with a question?

By MR. MANKIN:

Q The other two wells, were they dry holes?

A The 1-B well that was cored actually located in Section 26 outside the field limits, the 1-G well up in Section 1, 26, 5 was cored.

Q What was the last one you mentioned?

A 1-G, located in Section 1, 26, 5.

MR. MANKIN: Thank you.

MR. MACEY: Mr. Weiderkher, there is an El Paso Natural Gas in 11, 24, Section 1. You examined that well to determine whether or not the pool might possibly go in that direction?

A I brought the log with me and I don't doubt a bit that the field will extend in a northwest direction to include that well, but we don't have enough proof to include it.

MR. MACEY: The well isn't in any pool at the present time?

A So far as I know, but I think there is Pictured Cliff gas there.

MR. MACEY: Must be, the initial potential on it.

A I show it completed in the Mesa Verde, according to mine, but it is Pictured from 3720 to 3760 in the log.

MR. MACEY: Anyone else have a question of the witness? If not, the witness may be excused.

(Witness excused.)

MR. MACEY: Does anyone have any further testimony in this case?

MR. SILVERS: I would like to have one of the owners on the stand to state his position.

MR. MACEY: All right.

M. J. F L O R A N C E,

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. SILVERS:

Q What is your name?

A M. J. Florance.

Q How long have you been operating in the San Juan Basin?

A Since the winter of '45.

Q I believe you drilled the first four modern wells in the Blanco Field, outside of the Huntington Park No. 1 which was drilled in '29, is that correct, that started the San Juan Basin in the Mesa Verde?

A Correct.

Q You are an interest owner in some 107,000 acres in the San Juan Basin?

A More or less.

Q You have a direct ownership as a producer in Sections 4 and 5, specifically the Gunsite 1 Florance and the Gunsite 2 Florance in this proposed Tapicito unit?

A I do.

Q What was your average cost of the wells in that field?

A Right at $10 a foot.

Q Then Southern Union's testimony that the cost lay between $35,000 and $40,000 per well was correct?

A Correct.

Q You have had reserve figures furnished you which substantially

substantiated the reserves calculated by Southern Union?

A I have.

Q Do you feel that because of the higher cost of the wells, there must be some relief afforded producers in that area?

A I do.

Q Do you have any other suggestions or possible means of facilitating this, other than the increase in well spacing?

A An increase in the allowable, when and if it comes under proration, of approximately 150 percent of a well that is drilled to a quarter-section spacing.

GOVERNOR SIMMS: I think they can't hear you.

A If they put us on 320 acre spacings, I think we should be allowed to sell at least one and a half as much gas as we do out of a quarter-section.

Q What I interpret your statement to mean, that you anticipate or recommend an increase of approximately 50 percent of gas sales from a well spaced on 320 acres over what gas sales would amount to on 160-acre spacing, is that correct?

A I do.

Q Do you have any other solution which might be applied to this problem?

A Of course an increase in price would always help.

Q What increase in price would you anticipate, although it is beyond the jurisdiction of the Board to regulate price, according to the division? What increase in price do you think would be a fair increase to allow for the additional increase?

A I don't believe my thoughts would carry much weight.

Q I would like to have it in the testimony, as bearing a re-

lationship as to the burden of the additional cost of these deeper wells placed on the operator.

A We should get one and a half times as much money or sell as much as one and a half times as much gas.

Q Would you go along with Southern Union --

A (Interrupting) I would.

Q -- on their spacing?

A Yes.

Q Would you impose the condition that they be required to take gas on the short-term one year contract for anybody who brought the gas to them, to their gathering line?

A The only reason that I have any doubt about signing up with a long-term contract is the five to six hundred pound deliverability, I don't know, yet.

Q Then if I may bring that out --

A (Interrupting) I am afraid of putting Pictured Cliffs against 600 pounds to deliver one and a half times, which we should be entitled to.

Q If I may bring that out, the currently proffered gathering of Southern Union anticipates Mesa Verde gathering line pressure, whereas most Pictured Cliff production is delivered to a Pictured Cliff line, which carries approximately half the pressure that the proffered line can offer in the Tapicito area, is that correct?

A That is correct.

Q Am I to understand that you question that the testing of these wells against 500 pound line would be sufficient to tell what the long-range performance of these wells might be against the normal 200 pound line?

A No, I am just a little bit leery about tying up my production on a long-term period under that contract.

Q Do you feel that if Southern Union, who is offering to make the test and also has control of the gathering systems in the area, that you should be allowed to participate in the sales which would come about under this unit, but with the privilege of terminating such sales at the conclusion of the test, if you deliver the gas to Southern Union at the gathering point, at their gathering line at no cost to them?

A I think we should have the protection of the Oil Conservation Commission in determining whether or not we can deliver enough and we are entitled to 150 percent for putting twice the acreage. I am in no position to say whether the well will deliver it against that pressure. I am afraid it won't.

Q You are now in the process of making some back pressure flow tests on your wells, are you not?

A Yes.

Q I neglected to find out if they made any. Did Southern Union make any?

MR. WEIDERKHER: We didn't bring that out. We did run two tests, one on the 1-E and one on the 3-K, which is not in this field but in the same type of reservoir, but they indicate that the wells will deliver at 18 percent of their initial potential into a line pressure equal to one-half of the shutin pressure. Our estimate of deliverables are based on deliberability into a line pressure of one-half of the shutin pressure, which in this case would be somewhere in the vicinity of 550 pounds.

Q Mr. Florance, do you have in the record everything you want

to state about the matter at this time?

A I believe so.

MR. SILVERS: Thank you.

CROSS EXAMINATION

By MR. GRENIER:

Q Mr. Florance, would you be willing to sign a long-term contract if the purchaser were willing to agree to take at 200 per-cent on a unit basis, as compared to what is being taken in the other areas, and to lower the pressure in gathering system to such extent as might be required from time to time to enable it to do so?

A Yes.

MR. GRENIER: That is all.

MR. MACEY: Anyone else have a question of the witness? Mr. Mankin.

By MR. MANKIN:

Q You speak of this as a unit?

A Yes.

Q However, Southern Union acreage may be a unit, but yours, there is no proposal that your acreage be included in any such unit? It is a spaced area rather than a unit, is it not?

A It is a spacing area, yes.

Q It is not a unit in the true term?

A Yes.

MR. GRENIER: I was speaking of a spacing unit.

MR. MANKIN: He spoke of a unit.

MR. SILVERS: One other thing. You noted the variation in wellhead pressure on a shutin wellhead pressure on our wells. We

think that may be due on our particular wells to a slight leak, very slight, around the head, which we corrected but wasn't corrected during the seven-day period, may account for the difference in stabilized pressure at the end of the seven days. There was a slight leak in the ring.

MR. MACEY: Anyone else have a question of the witness? If not, the witness may be excused.

(Witness excused.)

MR. MACEY: Anyone have anything further in this case, any statements?

MR. HINKLE: Clarence Hinkle, representing the Humble Oil and Refining Company. Mr. Weiderkher testified that they had a half-interest in 11 and a half sections in this particular area. The Humble has the other undivided half-interest, and are slightly interested in this problem. We would like to go on record as concurring in the position taken by Southern Union and request the Commission to enter an order in this case setting up 320-acre spacing, temporary order setting up 320-acre spacing in the area.

MR. GURLEY: Do you concur with the two-mile extension?

MR. HINKLE: Yes.

MR. MACEY: Anyone else?

MR. DAVIS: Quilman Davis, representing Aztec Oil and Gas. Aztec owns an undivided one-half interest in approximately eight sections in the designated Tapicito Field. We concur in the testimony and the position of Southern Union in this case and strongly urge the Commission to adopt a temporary order for one year to give all the operators in the area an opportunity to observe and determine what the field will be.

MR. SMITH: On behalf of Stanolind Oil and Gas Company, we have some acreage that will be affected by the two-mile extension. We would like to state for the record that the extension of two miles is satisfactory and we have no objection to it. We would also like to concur in the application of Southern Union for 320-acre spacing units in this area.

MR. ABBOTT: W. G. Abbott. Needless to say, Amerada Petroleum Corporation concurs with the Southern Union testimony and urges the Commission to adopt 320-acre drilling units for this proposed pool unit.

MR. HOY: George Hoy, representing Conger (Honolulu) Oil Corporation. We are the sole owner and operator of two gas wells in the proposed Tapicito Field. We plan immediate additional drilling within the area. We wish to concur with all the recommendations of the Southern Union Gas Company.

MR. WOODRUFF: Norman Woodruff, El Paso Natural Gas Company. El Paso Natural Gas is the owner of property and the operator of the 27, 4 unit immediately north of the area involved. With the two-mile extension limit then we will fall under the provisions of the rules proposed by Southern Union. Our studies of the Pictured Cliffs in the area cause us to concur with Southern Union as to the likelihood of this being a separate pool from the other designated Pictured Cliff pools. We are privileged in the area we operate to develop on 320-acre spacing. We would concur that 320 is appropriate and would sincerely urge the Commission that no other spacing pattern be applied in this area which would affect the properties which El Paso has a privilege of developing on 320. We think it is unnecessary to drill on 160 to determine the nature of a pool. We think it would

be unnecessary to go to the expenditure of 160-acre spacing to develop this area and evaluate it.

MR. MACEY: Anyone else have a statement to be made in this case?

MR. ANDERSON: John Anderson, United States Geological Survey. I would like to point out to the Commission that the area which the applicant asked to have spaced as the Tapicito Pool covers an area of 10,880 acres, of which 1280 acres in 25 North, 3 West is Federal acreage. The rest is Indian land. The two-mile extension around this Tapicito area runs to about 35,000 additional acreage, of which 23,000 are Indian, about 4200 acres are up in the 27, 4 unit. It's always been our opinion that any spacing other than that generally in use for any particular formation should be governed by the terms of the unit agreement which was approved by the Commission. The other 776 acres is down in 25, 3, which is Federal land and some privately owned land. As far as the Jicarilla Apache Indians are concerned, most of this area which the applicant has asked for 320-acre spacing on is Jicarilla land. The leases are 2560 acres, all of them are owned by six companies. At the present time there doesn't seem to be any particular problem as far as someone developing on 160 acres within the confines of the Indian Reservation, at least in the area that is covered by this application. The problem right at the present time on the Federal lands in 23,or 25 North, 3 West and certainly not in 27, 4, all of this area is covered by the application.

Now as we stated once before in the application of Amerada for 320-acre spacing, the United States Geological Survey is not opposed to wide spacing. At the same time they are opposed and the Indians

definitely are opposed to any order that is going to set aside the Jicarilla Indian Reservation as separate and distinct from the other portions of the San Juan Basin where we also have Pictured Cliff production. For these reasons, we are opposed to the issuance of the requested order.

MR. MACEY: Anyone else have a statement to make? Mr. Kellahin.

MR. KELLAHIN: Jason Kellahin, appearing for Elliott and Hall and J. F. Hickman, Jr., both of whom have acreage not within the pool as proposed, but within the two-mile extension around the pool. We are opposed to the application brought by Southern Union and concur in the statement that has just been made by Mr. Anderson. I would like further to point out to the Commission that the testimony offered here today does not support any possible conclusion that one well will efficiently and economically drain 320 acres, one of the requirements under our spacing statute. The only information having been offered on that score is on the deliverability of the well, and some scant testimony on permeability based on a core analysis from one individual well. I would like also to call the Commission's attention to the fact that aside from the pressures involved in this pool, all of the testimony offered would tend to show that the characteristics of the Pictured Cliffs gas formation underlying this area are the same as those in other Pictured Cliffs Pools, which would lead only to the conclusion that there are permeable barriers in existence which have not yet been discovered, which would further show that one well will not drain 320 acres.

In calling the Commission's attention to Exhibit No. 2 showing the location of the cross-sections, I think it clearly appears that

they have been drawn through what we might term the "fairway" of the pool, and we do not feel fairly represents or fairly portrays the characteristics of the Pictured Cliffs Pool in this particular area. The further objection which we have to the application is that even a temporary 320-acre spacing order would result in a slowing of the development in this area and would result in loss to the Indians and to others who are interested in the development here, and the pool should be treated the same as all other Pictured Cliffs Pools.

MR. MACEY: Anyone else have a statement to make in this case?

MR. GRENIER: I would like to make a closing statement.

MR. MACEY: Go ahead.

MR. GRENIER: Southern Union has presented its testimony in this case and I don't want to resummarize what our witness has already stated. I would like to say this with respect to the statements just made by Mr. Anderson and Mr. Kellahin: First, I believe the evidence rather conclusively shows that the Indian acreage here is not going to be set aside for special, unusual, and discriminatorily unfair treatment as a result of this order. That is apparent from two things. First, as hinted at by Mr. Anderson if not directly stated, there is nothing now which requires any development on 160-acre basis within the Indian Reservation, and so this Commission by entering an order for 320-acre spacing in this case won't be cutting down on any current obligations presently existing. They would merely be restating, if anything, what is now perhaps the obligation to drill in that area, although we have never been formally advised by the United States Geological Survey as to what they do regard as a fully adequate development program there. They have just apparently

gone along with us in the 320-acre pattern that we have been following to date.

Secondly, it seems to me that an extremely important aspect of this case is the fact that as testified to by Mr. Welderkher, the wells in this area will have to be pulled only half as hard as wells in other Pictured Cliff areas, in order to be producing the same rate of take per acre of reserves as is being achieved elsewhere in the area. That is to say, this 320-acre spaced well, if pulled at the same rate in proportion to total deliverable as the other areas, will be putting out four times as much as one of the 160-acre wells, or twice as much when you consider that there is twice as much acreage to be pulled.

As to the statement of Mr. Kellahin, I think he is fully aware from his participation in such cases, of the virtual impossibility of getting any sensible approach to a problem which isn't going to hurt somebody and hurt somebody bad if an inter-connected pool before the final spacing order is entered is partially developed on 320 and partially on 160. It imposes very severe problems on this Commission as well as upon the operators. They inevitably end up in conflicting positions. We are only asking here for a one-year temporary order, at the end of that time, presumably, in the absence of further showing that the order is still justified, should be continued either temporarily or permanently, it would lapse and be of no further force and effect, and we would go back to the statewide 160-acre spacing pattern generally prevalent in this area. It seems to me that the interest in favor of this temporary order clearly outweighs the objections to it. I strongly urge the Commission to grant our application.

MR. MACEY: Does anyone else have anything in this case? I have a letter from Magnolia supporting Southern Union's application. I will give it to the reporter and let her copy it into the record.

We will take the case under advisement and adjourn to 1:30.

* * * * * * *

November 11, 1955

Re: Case No. 977 - Application of Southern Union Gas Co. for Designation of Certain Area as the Tapicito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico and Establishment of a Temporary 320 Acre Drilling Unit

C O P Y

Mr. W. B. Macey, Secretary
New Mexico Oil Conservation Commission
125 Mabry Hall, Capitol Building
Santa Fe, New Mexico

Dear Mr. Macey:

I had planned on being present at the hearing in the above case and going on record in behalf of Magnolia Petroleum Company in support of this application. Other matters make it impossible for me to be present.

Will you please enter this letter in behalf of Magnolia in support of the above application, including the designation of the limits of the pool and the establishment of a temporary 320-acre spacing pattern in said pool and adjacent areas within two miles of same.

Magnolia Petroleum Company is the owner of oil and gas leases in the area to be designated as the Tapicito-Pictured Cliffs Gas Pool and producing wells thereon. We feel that the area described should be designated as a new and separate Pictured Cliffs Pool and feel that it would be to the interest of conservation and the prevention of waste and protect correlative rights to require a 320-acre drilling unit as described in the application, both in the pool itself and adjacent areas within two miles of same.

Yours very truly,

/s/ Ross Madole

cc: Mr. A. S. Grenier

STATE OF NEW MEXICO)
: SS
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my hand and seal this 26th day of November, 1955.

Ada Dearnley
Notary Public - Court Reporter

My Commission Expires:
June 19, 1959.

BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

March 14, 1957

IN THE MATTER OF:

CASE NO. 977

MAIN OFFICE OCC

1957 OCT 9 AM 8:35

TRANSCRIPT OF PROCEEDINGS

ADA DEARNLEY AND ASSOCIATES

COURT REPORTERS

605 SIMMS BUILDING

TELEPHONE 3-6691

ALBUQUERQUE, NEW MEXICO

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
March 14, 1957

IN THE MATTER OF:

The hearing ordered to be held by Paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool. Case No. 977

BEFORE:

Honorable Edwin L. Mechem
Mr. Murray Morgan
Mr. A. L. Porter

TRANSCRIPT OF HEARING

MR. PORTER: We will consider next Case 977.

E L V I S A. U T Z ,

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. COOLEY:

Q State your name and occupation, please.

A Elvis A. Utz, Engineer with the Oil Conservation Commission.

Q Do you have a statement to make, Mr. Utz, with reference to Case 977, concerning the Pictured Cliffs Gas Pool?

A Yes, I have.

Q Will you proceed?

A The communications test which was ordered in R-794 was completed December 17, 1956. This test showed a pressure decline of some 20 pounds in the shut-in well on Southern Union's Jicarilla 2-E. As provided for in Paragraph 8 of R-794, the Commission staff requested Southern Union to begin another test in this pool. In conformance with this request, the Southern Union's Jicarilla Well No. 4-D, in the southeast quarter of the northeast quarter of Section 30-26 North, 3 West was shut in on December 17, 1956.

I have shown an outline of the pool so that any interested party may know where in the pool these tests are located. The 2-E, the test completed December 17th, is located in the southwest quarter of 17 in this area in the new outline. The new test is the 4-D, which was in the northeast quarter of Section 30, in this area here. The readings on the 4-D test was taken, and began December 17th, was 1,064 psi. Readings taken January 14th and February 11, 1957, recorded the same pressure. Therefore, we have had no results as of now on this test.

In compliance with Paragraph 10 of Order R-794, the Commission called a hearing on this matter January 15, 1957, at which time the case was continued until March 14, 1957. As of today, as I have stated, this test has not shown any results.

I therefore, request that the provisions of R-794 be continued in effect until October the 1st, 1957, or six months from the date of expiration, which is April the 1st, so that we may have the results of this further test to consider before the final determination of the 320-acre spacing.

I would further propose that the Commission hold a hearing on

this matter in August or September of 1957, in order to give us time to analyze the data and write a permanent order by October 1st, the expiration of the six-months extension.

There has been concurred in this matter. They are the Southern Union Gas Company; the Aztec Oil and Gas Company; the Northwest Production Corporation; the Humble Oil anf Refining Company; El Paso Natural Gas; Honolulu Oil Corporation and Magnolia Petroleum Company. These people have concurred by letter with the thoughts of continuance for six months on this case, or the extension of the provisions of the order for six months.

That's all I have.

MR. PORTER: Have you had any communication from anyone objecting?

A I have had no objections to date.

MR. PORTER: Are you through, Mr. Cooley?

MR. COOLEY: Yes.

MR. PORTER: Does anyone have a question of Mr. Utz? Are there any further witnesses in the case?

MR. COOLEY: No, sir.

MR. PORTER: The witness may be excused. We will take the case under advisement. (Witness excused.)

STATE OF NEW MEXICO)
) SS
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission, Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 29th day of March, 1957

My Commission Expires:
June 19, 1959

Ada Dearnley
Notary Public

DEARNLEY-MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE - SANTA FE
3-6691 2-1869

BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO._____

TRANSCRIPT OF PROCEEDINGS

ADA DEARNLEY AND ASSOCIATES
COURT REPORTERS
605 SIMMS BUILDING
TELEPHONE 3-6691
ALBUQUERQUE, NEW MEXICO

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 16, 1957

IN THE MATTER OF:

Case No. 977

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE - SANTE FE
3-6691 2-2211

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 16, 1957

IN THE MATTER OF: The Hearing ordered to be held by paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.	Case No. 977

BEFORE:
Honorable Edwin L. Mechem
Mr. A. L. Porter
Mr. Murray Morgan

TRANSCRIPT OF HEARING

MR. PORTER: The next case on the docket is Case 977.

MR. GURLEY: In the matter of the hearing ordered to be held by paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

MR. UTZ: If the Commission please.

MR. PORTER: Mr. Utz?

MR. UTZ: Order R-794 is a temporary 320-acre spacing order for the Tapacito-Pictured Cliffs Gas Pool, of Rio Arriba County, New Mexico. The effective dates of the order are from April 1, 1956 to April 1, 1957. The order, however, calls for a hearing at the regular January, 1957 hearing. That, of course, necessitated

the call of the hearing today.

The Interference Test which was ordered in R-794 was concluded December 17, 1956. The shut-in test well of this test showed some 20 pounds per square inch drop. However, the Commission staff is desirous of observing the results of another interference test in this pool before making recommendations for a permanent order.

In conformance with the staff's request, Southern Union Gas Company began the second test on December 17, 1956. It shut in the Southern Union's Jicarilla 4-D, located in the SE NE Section 30 - 26 N, 3 W. The offset producing wells are Southern Union's Jicarilla 5-D, located in the NE SW Section 30, 26 N, 3 W; and the Jicarilla 2-D located in the NE SW Section 29, 26 N, 3 W. I give the locations as a matter of record.

It will take considerable time to determine the results of this test. I would, therefore, urge the Commission to continue this case until the March regular hearing, at which time we should have enough data to determine what course should be taken at that time.

MR. GURLEY: If the Commission please, going along with Mr. Utz recommendation, we have a letter from Southern Union Gas Company, dated December 31, 1956, a portion of which I would like to read into the record.

MR. PORTER: You may proceed.

MR. GURLEY: It is addressed to the New Mexico Oil Conservation Commission, and Mr. Grenier quotes in the letter, that it is the understanding that a continuance will be requested by a member of the staff until the regular February hearing date, and will in all

likelihood keep on requesting further month to month continuances until completion of the interference test now being conducted by our Company on its Jicarilla No. 4-D Well in the NE¼ of Section 30, Township 26 North, Range 3 West, Rio Arriba County, New Mexico.

This is to advise you that Southern Union Gas Company will be agreeable to such continuance of the case from month to month, unless and until we advise you in writing to the contrary. Signed: Southern Union Gas Company, By: A. S. Grenier, Attorney."

MR. PORTER: Do we have any objection to the continuance of the case?

MR. SILVER: I have no objection, but I have an objection to continuance from month to month. I think a definite time should be set for the hearing.

MR. GURLEY: In connection with Mr. Silver's request, I doubt that anyone at this time could make a recommendation as to a definite time. The time would be contingent on the results of the test now being conducted. Whenever results are shown on that test, and we have no idea when they will be shown, would be the time to make recommendations for a permanent order.

MR. PORTER: It is the Commission's decision that Case 977 will be continued to the regular hearing date in March.

We will take a short recess.

(Recess.)

STATE OF NEW MEXICO)
:
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission in Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my notarial seal and hand this 18th day of January, 1957.

NOTARY PUBLIC, COURT REPORTER

My Commission Expires:
June 19, 1959

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
May 14, 1958

IN THE MATTER OF: Case No. 977

TRANSCRIPT OF PROCEEDINGS

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

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BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
May 14, 1958

IN THE MATTER OF:

The rehearing in Case 977, Order No. R-794-D upon the petition of Southern Union Gas Company, et al., to reconsider its application for the establishment of 320-acre drilling units in the Tapacito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico. Case 977

BEFORE:

Mr. A. L. Porter, Jr.
Mr. Murray Morgan

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: The meeting will come to order, please. Mr. Cooley has some thing to say to you.

MR. COOLEY: Mr. Chairman, I would like to call the attention of the Commission to the fact that all issues contained in Case 977, which has now been called, will also be pertinent in Case 1439, the case called for the institution of gas prorationing in the Tapacito-Pictured Cliffs Gas Pool.

While the issue in Case 1439 will be broader, all points raised and testimony brought out in Case 977 as to the area, what area will be drained, will certainly be pertinent in Case 1439.

I would at this time like to suggest that it be stipulated that all testimony which has been heretofore presented and which

will be presented here today in Case 977 be incorporated by reference in Case 1439, thus obviating the necessity of repeating the testimony concerning the area which one well will properly drain and the proper size of the proration unit again in Case 1439.

The parties who are present and intend to make appearances in either Case 977 or Case 1439 should at this time offer any objection that they would have to this motion.

MR. KELLAHIN: Jason Kellahin, of Kellahin and Fox, Santa Fe, New Mexico, representing Gunsite Butte Corporation. We will make an appearance in Case 977. We have no objection to the incorporation of the record in that case in the subsequent prorationing case, and would so stipulate.

MR. GRENIER: A. S. Grenier, representing Southern Union Gas Company. We, too, are agreeable to the incorporation of the full record in Case 977, both past and today's testimony, in Case 1439, the prorationing case.

MR. HINKLE: Clarence Hinkle, representing the Humble Oil and Refining Company. We have no objection to the proposed stipulation to incorporate all testimony in Case 977 in Case 1439.

MR. DAVIS: Quilman Davis, Aztec Oil and Gas Company. We too have no objection to the proposed stipulation and the incorporation of testimony in both of these cases.

MR. HOY: George Hoy, representing Honolulu Oil Corporation. We have no objection to incorporating the testimony in Case 977 in Case 1439.

MR. SELINGER: Skelly Oil Company, George W. Selinger. We have no objection.

MR. BUELL: Guy Buell for Pan American, no objection.

MR. PORTER: Anyone else? We will have the appropriate motion when we take up Case 1439.

MR. COOLEY: Yes, sir.

MR. PORTER: We will proceed with Case 977.

MR. GRENIER: If the Commission please, the proponents of 320-acre spacing in this case will have at least four witnesses. There may be some more people that may want to speak whom I don't personally know about, on behalf of Southern Union. We will be presenting first Mr. Wiederkehr, and then Humble will have a witness that they will present who has made some studies along somewhat different lines. We will then come back with another witness on behalf of Southern Union, and finally a witness on behalf of Aztec Oil and Gas Company.

The four, though represented by separate counsel, will present a fairly well integrated and non-repetitious presentation. Before we put Mr. Wiederkehr on the stand, I would like to make a few general comments.

Whenever anybody loses a case before this or any other body, he always likes to go back and figure out what happened to him and why. One of the conclusions that I have personally reached in that regard is that we attempted in the preceding hearings in this case to be too brief. We felt that the interference tests

which had been presented were socconclusive in their indications as to the ability of wells to drain 320 acres, that we perhaps at that time did not go far enough in our efforts to corroborate that evidence with other evidence. It may take us a little while but today we are not going to make the same mistake. We are going to put on considerable additional testimony at this time, and I hope that the Commission will bear with us. Course, if at any time they are willing to tell us that they have had enough and they were prepared to grant the order, why, we would be prepared to stop.

Mr. Wiederkehr. Would you care to swear all the witnesses?

MR. PAYNE: Why don't we swear all the four witnesses at the same time?

(Witnesses sworn.)

MR. COOLEY: One further comment, Mr. Grenier, before you proceed with your testimony. The Commission, in entering the order granting the re-hearing in this case provided that it would receive new evidence to clarify that point, new evidence on the issues presented in the petition for re-hearing. We will not be willing to hear a repeat of any testimony which was offered in the previous case.

MR. GRENIER: There may be brief references to prior testimoney, purely for purposes of indicating the relationship, what is presented now to what was presented then. But the testimony and the exhibits which we intend to give at this time will, we

believe, be basically new evidence, and we will endeavor to keep them as non-repetitious of what has gone before as possible. It will not merely be an argumentative rehash of what is already before the body.

MR. COOLEY: Thank you.

MR. KELLAHIN: In connection with the statements that have been made, in connection with the testimony to be offered, I would like to point out that the order is limited to the new evidence on the matters raised in the petition for rehearing. We have two petitions for rehearing before the Commission; and insofar as the petition for Southern Union is concerned, as I conceive it, any testimony presented by that company will necessarily, by the nature of their petition, be limited to testimony to show the arbitrary character of the Commission's order in relation to two sections in our New Mexico Statutes, the first being 75-3-14 (b), which pertains to the creation of proration units, proration units of course not being an issue in this case -- it's a spacing case and not proration, it comes up in the subsequent case -- the other statute being 65-3-10, which relates to correlative rights and prevention of waste. I think their testimony should be limited to those two points.

MR. GRENIER: May we proceed?

MR. PORTER: Yes, sir.

A. M. WIEDERKEHR

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. GRENIER:

Q At the last hearing in this case, there seemed to be some confusion with respect to the recoverable reserves that were testified to by yourself, Mr. Wiederkehr on the one hand, and by Mr. Reese on behalf of Gunsite Butte Uranium Company, which stemmed largely from the fact that you two had assumed different bottom-hole abandonment pressures. What were those abandonment pressures?

A I assumed, for purposes of reserves only, an abandonment pressure of 500 pounds per square inch absolute. Mr. Reese in his presentation for Gunsite Butte used a 100 pounds per square inch at bottom-hole abandonment pressure.

Q Now, what did Mr. Reese arrive at at that time as his figure, as the reserves underlying a 320-acre tract?

A I believe at a pressure basis of 1473, he had 3096 mmcf. We should convert it to the New Mexico standard of [illegible] 15025, which will give us 3035 mmcf.

Q Taking your 500 pound abandonment pressure and converting it, what would be indicated if we assumed 100 pound abandonment pressure, the same as Mr. Reese? What would be your figure of the reserves for 320-acre tract at 15025 pounds?

A The average well in the field should have a reserve of

2624 mmcf.

Q That contrasts with the 3035 figure presented by Mr. Reese?

A That is correct.

Q Now, did you all get there by substantially the same route, or were the factors which you employed to arrive at these not too different figures somewhat different one from the other?

A Yes, sir, our prime disagreement was on porosity, connate water, and particularly net pay. Those three factors are the three variables that have to be considered by a reservoir engineer, in coming to a reserve for a given tract of land. I used 19 percent porosity, 30 percent connate water, and an average of 13 feet of net pay throughout the field. Mr. Reese used 15 percent porosity, 38 percent connate water, and net pay of 28.4 feet. The remainder of the factors are constant, pressure, temperature, and so forth, that we wouldn't have any disagreement on.

Actually, the reason we come so close together is the fact that as you go to the edge of the field and take this acreage which may or may not be commercially productive, you get into a low permeability; consequently, a high water saturation; and those two factors sort of offset each other so that our reserves actually come out pretty close. Had I assumed a 21-foot net pay for the field and actually, with the limitations of our micrologs available, and the differences, with one man who will contour one way and one another as far as net pay is concerned -- had I assumed 21 feet instead of 18 feet, I would have come up with 3051 mmcf, which is substan-

tially the same as the one used by Mr. Reese.

Actually, what we are saying, we do not argue the fact there are approximately three billion feet of gas per 320-acre unit in place, recoverable to a hundred pounds. We do question the fact as to whether we can ever pull this reservoir pressure down to 100 pounds, because we feel the deliverability will be so low that the wells will not keep themselves clean. They will load up due to fluid before we get to 100 pounds. We will go ahead on our basis today, that we will use the same general reserves figures as were used by Mr. Reese.

Q I gather from what you just said, then, that you have some disagreement with Mr. Reese, first as to how far down it can be pulled, but second and more importantly, as to what the geographic limits of the producing area should be. Is that correct, Mr. Wiederkehr?

A That is correct. Actually, we feel that the productive limits of the field, insofar as economical production is concerned, will be limited to the area in which there is microlog pay sand.

Q Do you have an exhibit which has been prepared to illustrate what lead you to this conclusion?

A Yes, actually this exhibit is using the foundation of Gunsite Butte Map No. 2, which is a microlog pay map, isopac map of microlog porosity, on which I have plotted --

MR. GRENIER: (Interrupting) Just a minute. May this be marked Southern Union Rehearing Exhibit No. 1 for identification?

(Southern Union's Rehearing Exhibit No. 1 marked for identification.)

A Actually, I have plotted on this particular map three colorschemes, representing wells of various categories. We might look first at the wells that are colored in orange, and those wells were those which, according to the belief of the operator, the sand condition was so poor that it would be ill advisable to run a string of pipe and try to complete. Of those wells, they belong to Pacific Northwest and Southern Union Gas Company. If the next group of wells --

Q (Interrupting) Now just a minute, Mr. Wiederkehr. Was the completion attempt made on any of those wells, was pipe run?

A Not to test the Pictured Cliffs, insofar as I know. Pipe was not run on any of those wells.

Q Thank you. Go ahead.

A The next category of wells are those on which pipe was actually run and completion attempt actually made, but the production was such that the well was subsequently either completed in another zone or abandoned. We have --

Q (Interrupting) What color would that be?

A That would be the red circle with the green border, and there are four wells in that category, two of them drilled and attempted to complete by Southern Union; one by Honolulu; and one by Jackson. Actually in all cases pipe was set, the well was perforated, and a frac attempt made; and yet, even with doing that,

the well was non-commercial. I might go one step farther. One of Southern Union's wells was not only fracked but re-fracked and shot, it still was non-commercial.

The third category of wells we have on here are the ones listed in blue, colored in blue, and they represent completed Pictured Cliff wells that, according to our standards, would be non-commercial. In other words, they won't pay out in a reasonable period of time.

This exhibit, then, is to show that when you leave your microlog pay sand, you get into an area that could not be considered to be commercially productive. Consequently, the field spacing and prorationing should be based on an area where there is microlog pay and commercial gas.

Q Now, how does this contrast, this microlog pay area which would be as indicated on this map, with the net pay area as defined by Mr. Reese and indicated on his other map presented last time?

A There are several things I might call your attention to. The Honolulu Jicarilla No. 6 Well, non-commercial production, with no microlog but with a net pay, supposedly, of 27 feet. The No. 5 Well, which was attempted to be completed in the Pictured Cliff unsuccessfully, I think it had less than a half a million, no microlog, but according to Mr. Reese 34 feet of net pay. Southern Union Jicarilla 1-B Well, no microlog, pipe set, attempted to complete, non-commercial, 10 feet of net pay. 2-B Well, so poor that after looking at the sample, Southern Union decided not to

run pipe and attempt to complete, no microlog, but Mr. Reese gave it 26 feet of net pay. Southern Union Jicarilla No. 1-G Well, which will be mentioned later, a cored well, no microlog, but supposedly 14 feet of net pay. Southern Union Jicarilla 1-C Well, pipe set, attempted completion, no microlog, 25 feet of net pay and no well.

All of those are examples to show that when you get outside of the microlog limit, no matter how much sand you have, if you have no permeability you are not going to produce the gas.

Q At the last hearing in this matter, Mr. Reese, in the course of his testimony, mentioned the Magnolia 2-B Well in Section 19, 29, 3?

A He cited that as an example of a well which was producing where there was no microlog pay.

Q What is the situation as respects that well, Mr. Wiederkehr?

A As far as I can determine, that well has never been put on the line, so we don't know whether it will produce or not, but we do have two wells on either side that had I.P.'s in the same range as the Magnolia well, and they are putting out such a small amount of gas as to be non-commercial.

Q In other words, you would say that the I.P. alone is not indicative here as to whether a well will be or will not be commercial?

A No, we would have to get some production history to find out.

Q Now, do you have any core analyses available, Mr. Wiederkehr, with respect to any of these wells which you have just been discussing?

A Yes, I do. I have core analysis here on Southern Union Gas Company's Jicarilla 1-G Well, and on the Jicarilla 1-B Well.

Q Now, referring first to the core analysis on the Southern Union Jicarilla 1-G Well, which we ask to have marked for identification as Southern Union Rehearing Exhibit No. 2 --

(Southern Union's Rehearing Exhibits 2 & 3 marked for identification.)

Q Referring to what has been marked for identification as Exhibit No. 2, would you describe briefly what this core analysis indicates?

A Yes, first --

MR. KELLAHIN: (Interrupting) We would like to make an objection to this line of testimony as not being within the scope of the rehearing. It amounts to nothing more but rebuttal testimony which should have been properly presented in the previous hearing in this case.

MR. COOLEY: For what purpose is this testimony offered?

MR. GRENIER: This is offered for the purpose of showing that one well in the Tapacito-Pictured Cliffs Pool will adequately and efficiently drain 320-acre tract. Now, this is the basic issue in this case. This goes directly to that issue. It is new testimony. It was not presented at prior hearings, and we believe

it is entirely relevant and pertinent at this time.

MR. PORTER: Objection overruled. You may proceed, Mr. Wiederkehr.

A Southern Union Jicarilla 1-G Well located in the Southwest Quarter of Section 1, 26, 5, drilled originally as a Pictured Cliffs well; Southern Union cored every foot of supposedly Pictured Cliffs sand below the base of the coal section, starting at 3464 and ending up at 3541. This particular well was cored and after core analysis -- if you want to look at it, you will notice there is only one foot of the entire series of sand that had measurable permeability, and that was .3 millidarcies in one foot, where the water saturation was 75 percent. That is a well which, according to past testimony, had 14 feet or thereabouts, you had to sort of guess at it on the map, but it had somewhere between 10 and 14 feet of net pay; and yet there is not a foot of pay within the entire well bore.

In contrast to that, the Southern Union Jicarilla 2-G, which is a northeast offset, it made 20 million feet of gas. I think we are talking about something important, and that is that the limit of your field is your zero limit of your microlog and should not include acreage or theoretical reserves where there is not a half a millidarcy permeability.

Q Referring to Exhibit 3, which is the core analysis on Southern Union Jicarilla 1-B, point out, please, where that well is located.

A Southern Union Jicarilla 1-B Well, located in the Northeast Quarter, Section 26, 26 North, 4 West.

Q And what does the core analysis there indicate?

A Actually this well was cored from 3504, which is the top of the Pictured Cliff, through 3572. The core was analyzed only in the area that, according to our geological department, had any potential shows of gas. That core analysis indicates that there was one foot of sand that had .03 millidarcies of permeability in an area where there was no microlog, and yet there was 10 to 15 feet of net pay, according to previous testimony; and we just offer these to show that again an indication that when there is no microlog separation, no microlog net pay, there is no gas reserves recoverable --

MR. PORTER: (Interrupting) Just a minute. I'm a little confused. You say the purpose of this is to offer proof that one well will drain 320 acres. This seems to be an attempt to prove that this acreage is unproductive.

MR. GRENIER: May I speak to that, sir?

MR. PORTER: Yes, sir.

MR. GRENIER: As Mr. Wiederkehr has just mentioned previously, the average reserves of Mr. Reese and of Mr. Wiederkehr are not dissimilar for the average of the field as a whole, but Mr. Wiederkehr is limiting his reserves to a considerably narrower band down the center of the field than is Mr. Reese, at least on the basis of what was done at the last hearing. This testimony is

intended to indicate that the field is narrowly constructed, rather than being broad; and therefore, that the only area of the field which needs to be considered for purposes of determining what area can adequately be drained is the proper narrow area of the field, rather than a bunch of other stuff on the side here which can't be commercially developed on any sort of a spacing pattern. When we find out what the size of the field is that we are talking about, and eliminate this marginal area, we then can come firmly to grips with the question of what can be drained by one well; but if we start worrying about what these flank wells out here can drain, then patently they can't drain 320 acres, they can't drain 160, or anything, on an economically feasible basis.

MR. PORTER: You may proceed.

MR. KELLAHIN: I want the record to show that we have a continuing objection to this line of testimony.

MR. PORTER: The record will show your objection.

Q (By Mr. Grenier) Mr. Wiederkehr, is this circumstance that you have just outlined of Mr. Reese attributing net feet of pay to areas where there is no microlog pay the only area where he would show more net feet of pay than you believe to be actually there, or is that a condition that prevails throughout even the fairway of the field?

A Yes, actually we could have brought in core analyses on every well in the field that was cored, and each one would indicate that the net pay per core analysis and microlog core of the well,

but there is practically no indication from core analysis that anything that does not have microlog permeability, porosity, should be considered as net pay.

Q On the basis of comparing this microlog pay map of Mr. Reese's with his map on net pay, what,about, was the average separation on the net pay map?

A Throughout the field, I averaged it out, and it appears there is approximately 10 feet of pay attributed on the net pay map over and above what is shown on the microlog porosity, and I would say that the reserve figures are based on 10 feet too much pay.

Q Now, as was just mentioned in my response to Mr. Porter inquiring about this line of testimony, we are dealing now with the question of just where the flank of the field is and how sharply it shelves off into non-productivity. Do you have any cross-sections which have been prepared, Mr. Wiederkehr, along these lines?

A Yes, sir, I do.

MR. GRENIER: We ask that this be marked for identification as Southern Union Rehearing Exhibits 4, 5, 6, and 7, respectively. No. 4 would go to the one with the "A", 5 the one with the "B", 6 the one with the "C", and 7 the one with the "D".

(Southern Union's Rehearing Exhibits Nos. 4, 5, 6, and 7 marked for identification.)

Q Referring to the exhibit which has been marked for identification as Southern Union Exhibit 4 on Rehearing, Cross Section

A to A', is that indicated on the map, Exhibit 1, Mr. Wiederkehr, where this cross section lies?

A It is actually catty-corner to Section 1 from southeast to northwest, 26 North, 5 West.

Q What does that Exhibit 4 show with respect to those two wells there?

A Well, it shows actually that on catty-corner offsets that you go from a well cored dry hole to a well that was completed for an open flow of 20 million feet of gas a day.

Q Which was the dry hole?

A Southern Union Jicarilla 1-G Well was a dry hole, and the 2-G Well made 20 million feet per day.

Q That is the A'?

A Right.

Q What is the red line which appears on this exhibit?

A It is the approximate top of the Pictured Cliffs sand.

Q Where it shows "cored" over on the left, to what does that relate?

A It is the section that was actually cored by Southern Union Gas Company in drilling the well.

Q That is the area that lies between the two black horizontal lines?

A Yes, that's right. Actually, by looking at this exhibit you can see that the sand body, the characteristics of the sand have just gone to nothing.

Q Now referring to this 1-G Well, what was the net pay that was attributed to that by Mr. Reese?

A About 14 feet.

Q Turning next to Exhibit 5, what are the two wells which are compared here?

A Exhibit 5 compares Southern Union Gas Company Jicarilla 2-H Well located in the Northeast Quarter of Section 17, 26 North, 4 West; and Southern Union Gas Company Jicarilla 5-E Well located in the Northwest Quarter of Section 16, 26, 4. Those are the direct offsets, actually occasioned by field rules being set up after certain drilling had been done. These are actually two direct offsets.

Q How far apart are they?

A 3235 feet.

Q Did you state what the I.P. was of the 2-H?

A It was 943,000 cubic feet per day.

Q On the 5-E?

A 36,600,000 cubic feet per day. It can be seen that the sand conditions again here in a direct offset location have gone from an extremely good pay section, commercial production, to non-commercial production.

Q Within a 3,000 foot distance?

A Within the limits of a direct offset, or in this case 3235 foot distance.

Q Referring to Southern Union Exhibit 6, will you point out

the wells indicated on that exhibit?

A Southern Union Exhibit 6 starts with Southern Union Jicarilla 1-A Well, the discovery well in the field, located in the Southeast Quarter of Section 23, 26, 4; goes to a diagonal offset, Southern Union Jicarilla 1-B Well, located in the Northeast Quarter of 26, 26, 4; and then across to Southern Union Jicarilla 2-B Well, located in the Northeast Quarter of Section 25, 26, 4. The 1-A Well completed, the first well in the field to be sand-oil fracked, was completed for an I.P. of 3,989,000 cubic feet per day. The 1-B Well was, pipe was set on it, it was fracked, it was shot, the I.P. was still too small to measure. The 2-B Well sand condition was so poor that the company deemed it inadvisable to set pipe on that pay.

Q How much net pay did Mr. Reese attribute to the 1-B, do you recall, Mr. Wiederkehr?

A 10 to 12 feet.

Q And the 2-B?

A 26 feet.

Q But neither of those was anything like a commercially productive well, is that correct?

A That is correct.

Q Now referring to Exhibit 7, what are the wells which are indicated there?

A Exhibit 7 shows Southern Union Gas Company Jicarilla 1-E Well, located in the Southeast Quarter of Section 16, 26, 4, and

Southern Union Jicarilla 6-E Well located in the Northeast Quarter of 21, 26, 4, distance of 2540 feet, direct offsets. The 1-E Well made 3,087 mcf natural, that is natural flow. The 6-E sand condition was so poor that it was determined by Southern Union and Humble to take the well on down to another pay zone.

MR. PORTER: I didn't get that potential --

A 3,087 natural on that one, Mr. Porter.

MR. GRENIER: That is mcf.

A 3,087,000 mcf.

MR. PORTER: Thank you.

Q Now, based upon the exhibits which have been presented thus far, have you reached any conclusions, Mr. Wiederkehr, as to whether the economically developable limits of the field and the sand body pinch out rapidly or slowly on the flanks?

A I believe that the core analyses and the cross sections definitely prove that your field, and I am using the word "field" as "commercial field", pinches out across one location. In other words, it's only one location from a very good well to a very poor well or a dry hole.

Q At the last hearing there was some indication that there might be possibly some intercommunication or continuous sand bodies lying between the Tapacito Field and the South Blanco Field some few miles to the southwest. Have you reached any conclusions as to that, on the basis of these exhibits that have just been presented?

A On the basis of these exhibits, I think we can conclusively say there would never be any drainage between the two fields due to poor sand conditions and the zero permeability that exists between the fields.

Q In the light of this rapid shelving off of the productive area, do you feel that we should or should not give consideration to how effectively these areas outside the zero microlog porosity line can be drained by wells located thereon?

A I feel that actually your field rules should be based on the majority of the field, where the majority of the gas is coming from, and not on the area that was sort of drilled by mistake, actually. Along the flanks, had we known the kind of wells we were going to get, especially the four dry holes, if we had known that, we wouldn't have drilled them. I feel like we should base the rules on the field, on the part of the field, the majority of the field, which is the area in the field which has microlog pay sections.

Q Of the total area of the field as presently defined up there, you do have the limits as presently established, do you not, on there, Mr. Wiederkehr?

A Those are the limits as existed at the last hearing, with the heavy black border, and that is Mr. Reese's outline, and I agree with it.

Q Now, referring to that area, would you say that a slight majority or a very substantial majority or a minority was in what

you classified as the very good part of the field?

A Actually, about 90 percent of the field as presently determined is in what I would consider good pay sections.

Q So that if you are concerning yourself with the good area, you are concerning yourself with practically all the field as presently defined?

A That is correct.

Q Now, turning next to the relationship of production to date to reserves, have you prepared any exhibits in that regard, Mr. Wiederkehr?

A Yes, I have.

MR. GRENIER: We have a table here which we ask to be marked for identification as Southern Union Exhibit 8.

(Southern Union's Rehearing Exhibit No. 8 marked for identification.)

Q Will you describe for us briefly, Mr. Wiederkehr, what this Exhibit 8 shows?

A Actually, Exhibit 8 was prepared, it shows a lot of the same information as was shown by Gunsite Butte Exhibit last month, but this shows all wells connected to Southern Union's system, and what I have tried to do is to show the percent of reserves produced over a given period of time. Actually, production or percent of reserves produced doesn't mean anything until you tie it to time. That was not done, and I wanted with this exhibit to make that tie-in. Actually, the column 4, labeled "Sand Thickness" is

the sand thickness as shown by Mr. Reese, the microlog sand thickness. I read that off his microlog pay and agree with it. The "Reserve/320 Acre Gross", is the same as presented last time. The only difference, on the 320 Acre, Net Microlog sand thickness, rather than the gross sand.

Q That gross column also corresponds to Mr. Reese's data?

A That is correct. Then I have shown cumulative production through the end of March, 1958.

MR. PORTER: Excuse me, is that March or February?

A Through the end of February, 1958, and then the next two columns are "Percent of Gross Reserve Produced", or "Percent of Microlog Reserve Produced", and then the next column is the days actually produced, and these figures came directly from our chart department and indicate the actual number of days that the wells were on the pipe line. They don't have anything to do with connection dates, but they are days of actual production.

Q Mr. Reese's exhibit, as I recall it, in that regard it merely indicated the connection date, is that right?

A Right. We're trying to tie reserves, producible over a period of time. Now the last two columns show the percent of reserve that either was produced in 365 days or a year's period of time, or if the production rate on wells that haven't produced that long maintains its present position, what they will produce in 365 days.

Q So this is converted over to 365-day standard?

A That's right, tying all production, all wells and their production to a given time.

Q Now, what do these production rates as indicated in the last column, Mr. Wiederkehr, lead you to conclude as to the period of time within which wells located on 320-acre spacing as these wells have been will be able to effectively drain the pool?

A Basing it on the microlog reserve only, we find that with the exception of one well, at the present rate of production, it's a little over ten years and the field will be depleted. Actually, because you do get the cream of the crop in the first few years, I think we can safely say that the reserve will be produced in less than 20 years. Now going to the gross reserves, we find several wells in there that would indicate that they won't produce their gas in 20 years, but if we go back again to what is pay, we'll notice that one of the wells is Honolulu's Jicarilla No. 6, that has no microlog, and yet 27 feet of sand thickness was used in calculating the reserves.

Q That was by Mr. Reese?

A Right. Then we have the Southern Union Jicarilla 2-H Well that had 2 feet of microlog and yet 17 feet of net pay were used. Then Southern Union 1-D Well is another one in this category; that one is one of the wells that Southern Union drilled early in the life of the field and had mechanical difficulties. The 2-D Well is in the same category, the only thing about it is that it has been reworked and if we only use the last four months' production

history since it was reworked, it would indicate that we would drain its reserves in about 12 years.

Q That would bring it up -- well, referring to the last column where you see the 6.97 there, that would bring the figure up after the rework substantially in line with the others there, is that correct?

A Yes, it would, and the only other well that looks like it's questionable was the 4-A Jicarilla Well, which had net 8 feet of microlog, but the reserves were based on 26 feet of pay; so what this is to show is that if we are going to consider the field to be that area that has microlog pay as the field is presently determined, then there's no doubt that the field can be drained by wells on 320-acre spacing in less than 20 years, or over a reasonable period of time. Remember that all of these wells are producing now from 320 acres.

Q Referring to the Jicarilla 4 Well there, Mr. Wiederkehr --

A 4-A?

Q No, the 4 -- excuse me, the Honolulu Jicarilla 4, the fourth one down from the top. That shows only 3.12 produced, in the next to the last column, in 365 days on the gross reserve basis. Would you care to make any comment about that?

A Well, actually that well had a gross sand of 30 feet, but only a net sand of 8 feet.

Q And based on the 8 feet, it again would be back up in line?

A In line --

Q With the others?

A Right.

Q Now, referring to Mr. Reese's Exhibit 3, which was presented at the last hearing, which I think you said was the basis from which you started in preparing Southern Union Exhibit 8 on rehearing?

A That is correct.

Q Did Mr. Reese tie that exhibit at all to time?

A No, showed only completion date but no length of production.

Q Did some of these wells have substantial intervals after their completion date when they were not in fact producing?

A Yes. Actually some of them were sitting there for a year or so before a pipe line was available. There are still some sitting down there unconnected.

Q Are there any wells shown on Mr. Reese's Exhibit 3 which were not in fact Pictured Cliffs wells?

A Yes. Southern Union Jicarilla 2-B Well was shown to be a Pictured Cliff well, when it is actually completed in the Mesaverde and given a Pictured Cliff production and showed percent of its Pictured Cliffs reserve produced, and actually it was a Mesaverde well all the time.

Q Are the production figures shown on Mr. Reese's exhibit in all instances accurate?

A I don't have --

MR. KELLAHIN: (Interrupting) We want to again object to the line of questioning. It is beyond the scope of the rehearing

in this case. It is matters which could have and should have been brought out by Mr. Reese in the last hearing and in rebuttal testimony on behalf of this witness. It is testimony presented at the previous hearing, and they come in and attempt to refute the testimony given in the previous hearing. It goes beyond the scope of the call of this hearing.

MR. GRENIER: If the Commission please, these exhibits not only Mr. Reese last time, but also, I'm sure, to some extent our own this time, are of necessity rather complicated; and they contain a great deal of data. It has always been the habit of the Commission and counsel appearing before the Commission to get through these things as promptly as may be. There was much of the data that was not apparent to us as being erroneous until we got back home and started checking it. These are errors that you can't figure out for yourself sitting here and looking at the exhibit. We are trying to present here some of the things which we have observed about these exhibits and which were presented as matters which ought to be considered and given weight by the Commission. We feel it important that the Commission realize and appreciate what the comparative acreage is of the exhibits which are being presented.

I agree with Mr. Kellahin that this is in a very definite sense rebuttal testimony, but we do submit it is rebuttal testimony of a character which could not have been presented at the last hearing, considering the time table upon which we were working

at that time.

Mr. Porter, may I say one thing further in this connection? If it should be ruled in connection with Case 977 that this is inappropriate testimony, we would, of course, expect to present the same testimony in Case 1439 where it would be plainly admissible and appropriate, since we now have stipulated that the entire record in 977 is to be incorporated by reference into 1439. That being the case, it is appropriate to go forward and rebut and explain the comment on the record in that case as part of the old 977 case, as part of 1439. If, on a technical basis, you want to rule it out here, that will be all right and we will be glad to put it on in the case of 1439 when we get to that case. It does seem, however, that not much is being accomplished that way.

MR. KELLAHIN: I don't want to be in a position of being unduly technical, but the point that brought this up is the testimony in regard to the 2-B Well. It was gone into at the previous hearing. Mr. Reese took the stand, pointed out the reasons he put on that exhibit as a Pictured Cliffs well, and it was reported to the Commission as that, and is in the Aztec office that way.

MR. GRENIER: To the extent that it is repetitious we will be glad to drop this particular point, Mr. Kellahin, if we may proceed and just wipe the thing out on that basis. We have only one other discrepancy -- two others, to mention.

MR. COOLEY: There is still a ruling to be made on the objection.

MR. PORTER: Mr. Grenier, in connection with this whole thing, the Commission will appreciate it if you will approach this thing from an affirmative standpoint on new testimony on the issues raised, refraining from trying to tear down the exhibits which were previously entered in the case, which should have been done on rebuttal testimony at that time.

MR. GRENIER: Well, we have two very brief items further in this connection which we would like to present. I don't think they will take but about another minute of the Commission's time.

One of them relates to the location of the well, one of the wells on this map which would have a rather dramatic effect on the contouring in a portion of the field, at least. We would like permission to do that.

MR. PORTER: Was this brought out in the last hearing?

MR. GRENIER: No, it was not. Mr. Kellahin is correct, the 2-B was brought out at the last hearing. His objection with regard to the 2-B was well taken. I will try to withdraw that question. I frankly had forgotten that we had gone that far into it at that time.

MR. PORTER: Your next point has to do with the location of what well?

Q (By Mr. Grenier) Will you point out the 5-E on the map, Mr. Wiederkehr?

A The important part about it is that the Southern Union Jicarilla No. 5-E Well is located in the Northwest Quarter of Section 16, 26, 4, which makes it a direct offset to the poor well instead of being in the Northeast Quarter where Mr. Reese located it. It materially affects, then, the contouring of the net pay and the isopac pay. That was one of the things in the hurry of the last hearing we didn't pick up until we got back home and got to looking at the thing. It would change your entire contour picture.

MR. PORTER: That fact is now in the record.

MR. GRENIER: All right, sir.

Q (By Mr. Grenier) Mr. Wiederkehr, have you prepared another study similar to Exhibit 8 but based upon your microlog pay analysis of the reserves in these various wells?

A Yes, Southern Union Exhibit No. 9 is prepared --

Q (Interrupting) Wait a minute, let them be distributed, please.

(Southern Union's Rehearing Exhibit No. 9 marked for identification.)

A Southern Union Exhibit No. 9 was prepared similar to Exhibit 8, the exception being that the reserves shown for 320 acres are based on the 30 percent connate water and the 19 percent porosity that I consider to be correct and appropriate for the Tapacito Field. Actually all this does is to show what the wells are producing and can produce, drilled on 320-acre spacing; shows that

they can drain the 320-acre reserve in a reasonable period of time.

Q Now there are certain of these wells which have indicated over on the right-hand column some rather low percentages of reserve produced in 365 days. Are these the same wells which you just mentioned in connection with Exhibit 8 as having special circumstances affecting them?

A Yes, actually two of them were mechanical problems and the third one is two feet of pay and it has taken a long time for the gas to come out of the two feet of pay.

Q Based upon the indications of this exhibit, is it your belief that except for these what we might call "marginal" wells, wells drilled in the good portion of the field will be able to drain 320 acre tracts efficiently and economically, Mr. Wiederkehr?

A Yes, I think beyond a doubt that all wells with any appreciable pay sand will be able to drain their 320 acres in a reasonable time and do so economically.

Q What do you mean by a reasonable period of time?

A Well, I'm saying 20 years is a reasonable time, since most of our gas purchase contracts are based on the assumption that we have to have 20-year reserves to lay the pipe line; so I would say 20 years is a reasonable period of time in which to get this gas out.

Q Referring now again to your Exhibit 1, which is the map, I see that you have on there an area outlined in red. What is that area, Mr. Wiederkehr?

A This is an area that we have taken, we have shut some wells in and got some shut-in pressures to try to show this Commission that not only can you use an individual well and say it will drain 320, but you can take an average of a big area and compare production history and pressure decline and show that you are draining not only 320, but appreciably more acreage. This area covers 3380 acres, on which are located ten producing wells. There's approximately 52,080 acre feet within that area, and using Mr. Reese's --

Q (Interrupting) Of what is that?

A Acre feet of pay.

Q Is that on microlog?

A That's on gross pay, which would give a reserve, using Mr. Reese's recovery factor, of 16,978,000,000 feet.

Q Now that's what, the recoverable reserves at 100 pounds abandonment pressure?

A Right, the production --

Q (Interrupting) How much had been produced through March, '58, from the ten wells in this area?

A From those ten wells has amounted to 5,381,000,000 cubic feet of gas.

Q What would that 5,381,000,000 feet of gas represent in terms of a percentage of the Reese recoverable reserve figure which you just mentioned?

A 31.7 percent of the recoverable gas has been produced in

the past two years, let's say, from that area.

Q What would that be on your figures, Mr. Wiederkehr, if you use your reserve figures for those ten wells?

A Using my figures for the area within the red outline, I would show that 19 percent of the gas within this area has been produced during the past, or approximately, two years that the wells have been on production.

Q Now, what was the original -- you have three wells here which are colored in yellow, is that correct?

A Yes, those three wells are the three Pictured Cliff wells closest to the zero microlog pay line on which Southern Union had good original and good recent shut-in pressures.

Q What was the average of the shut-in pressures of those three wells originally?

A Originally the three wells shut in at a thousand and eighty-seven pounds.

Q What are they now?

A The present shut-in pressure averages eight hundred eighty-one pounds.

Q When was that taken?

A That was taken on May 6th this year. That gives us a two hundred six pound pressure drop, and two hundred six compared to one thousand eighty-seven is 19 percent; so not only from a production history, but we can take a pressure decline curve based on a pretty good-sized area and show that we are effectively

draining all of the reserves under a 320-acre tract. I think we can conclude that a pressure decline curve gives you a very accurate picture of what you can recover over a long period of time.

Q Are these three wells that you have the pressure on in the very best part of the 320-acre tract?

A No, actually there are several wells, four or five additional wells, within that area with more pay sand than these wells have. I took those three because they happened to be just as edge-wise as they could be in the area that has had a good production history. Actually these wells right in this area were the first ones connected to a pipe line, so we have the best production history and consequently our best pressure decline curve from those wells.

Q By "best", you mean the most reliable and most extensive from the point of time?

A That is correct.

Q Now, have all the wells in this tract been drilled on 320-acre spacing?

A There are some wells that were not located according to the spacing pattern, but all of them are drilled on 320; in other words, there is at least 320 acres attributable to all wells, and then there's a little theoretical pay on the very edge that has not been drilled as yet.

Q Now then, on the basis of your reserve figures, do you reach the conclusion that taking this area as a fair example of the

field, a well drilled on 320 acres will or will not be able to drain effectively the full 320-acre tract?

A This proves to me conclusively that wells will drain 320, because if they weren't draining 320, the pressure decline curve would have indicated a higher pressure drop than the comparison on reserve and they are draining it economically and draining it to the edge of the field, because there is a tremendous amount of reserve lying still to the edge of the field from the wells, and if that were not being drained, our pressure would have dropped appreciably more than it did. It probably would have dropped four hundred pounds if we were not draining the area between the location of the wells and the edge of the field.

Q If Mr. Reese's reserve figures are taken as accurate, would your conclusion be weakened or strengthened?

A It would be strengthened because using his figures, we have already taken 31.7 of the gas out with a 19 percent pressure decline.

Q Do you have any further pressure decline curves on these wells or on any others where recent pressures have been taken?

A Yes, I do.

(Southern Union's Rehearing Exhibits Nos. 10, 11, 12, and 13, marked for identification.)

Q Now referring to the pressure decline curve, with respect to the Southern Union Gas Company Jicarilla 1-E Well, which has been marked for identification as Exhibit 10, will you describe for us, if you will, the data which appears on this exhibit and the

basis of its preparation?

A Actually this is simply a manner of determining the recoverable reserves under a given unit, using original shut-in pressure, cumulative production, and then just projecting your decline on down to some abandonment pressure. This 1-E Well, projecting the pressure decline from its original down to 100 pounds would indicate that it is draining an area that has a reserve of 3.82 billion cubic feet of gas.

Q Now that's the solid black line which slants across the page as the upper line there and comes back and starts in again at the left side, is that correct?

A That's correct.

Q And the figure there of 3.82 billion reserves is the point at which that second time around for that line hits 100 pounds?

A That is correct. Actually the paper wasn't big enough to show the decline on it, but we just did continue the line to show that this well is draining. Now remember that these are facts. This is pressures that were taken with a dead weight pressure. These are production figures from our own office and these things then show that the well is actually today draining an area so that it will recover 3.82 billion feet of gas.

Q Were these pressures taken under comparable conditions, Mr. Wiederkehr?

A Yes.

Q What are these other two more sharply angled lines which

appear on this exhibit, one of them rather broadly dashed and then the other more narrowly dashed?

A Actually, if we were only draining 160 acres with this particular well, that's the way the curve would have to look. The dashed line would be what we were draining if we were draining the reserves attributable by Mr. Reese; and the fine line is what we would be draining if you used the reserves as I have attributed to that particular well.

Q The broadly dashed line is Mr. Reese's line?

A Right.

Q Or would be if the projection of his data --

A (Interrupting) Would be. In other words, if we were only draining 160, that is the way the pressure decline curve would have to look.

Q Then does this solid line go out beyond the 160 reserve figure, then, as indicating what it is to recover?

A Yes. Actually the Jicarilla 1-E was given a reserve of 2.086 billion feet of gas by Mr. Reese, and this indicates that it's going to drain 3.82 billion, not 320 but 455 acres effectively.

Q That would be substantially true in case your figures were used, also?

A That is correct. There is very little difference between our figures on any given well as long as it is within a part of the field and not out on the edge somewhere.

Q Now, referring to Southern Union Exhibit 11, which relates

to the Southern Union Jicarilla 4-E Well, is this similar in the data presented to the exhibit you just discussed?

A Yes, actually it is the same type of information and it does indicate that this well is draining an area that has a reserve of 3.3 billion feet of gas.

Q Does it indicate that it is draining 320 acres?

A It indicates that it is draining appreciably above 320 acres. The 4-E Well had a reserve, according to Mr. Reese, of 2.712 billion, and we are draining an area of 3.3 billion, we are draining not 320 but 400 plus acres.

Q Going back to this dot which appears in the running length of the solid black line, that is this May pressure test?

A That is correct.

Q -- which is shown there. You are plotting it on the basis of actual production moving from left to right, is that correct?

A Yes.

Q And pressure from top to bottom?

A That is correct. In other words, this would indicate that we have taken something over 800 million feet of gas out of the well and the pressure is still somewhere above 800 pounds. I could get the exact figures, but this is just a standard engineering reservoir man's back pressure curve, I mean pressure decline curve.

Q Now, referring to Southern Union Exhibit 12, which relates

to the Jicarilla 1-A Well, what is indicated there, Mr. Wiederkehr?

A Well, this one also indicates that this well will drain an area with a reserve of 3.860 billion feet of gas, which is higher than either the reserves that I attribute to that tract or that Mr. Reese attributes to them. He gives them 3.338 -- just a minute, let me check -- and I give them 3.050; and yet the well is draining an area that has 3.860 MMCF reserve.

Q Are these three wells which you have just mentioned the ones which are indicated in yellow on Exhibit 1?

A Yes, they are.

Q Now, where is the 5-D Well located, which is the subject of the curve in Southern Union Exhibit 13?

A The 5-D Well is located in the Southwest Quarter of Section 30, 26, 3.

Q What does the Exhibit 13 show with respect to that well?

A It shows that this well is draining an area that has 2.642 billion feet of gas reserve.

Q Does this indicate that it is draining 320 acres?

A No, it does not.

Q To what do you attribute the failure of the well to drain the 320 acres, as the other three did?

A Actually the reserves in each case,both made by Mr. Reese and by myself, were based on the sand condition at the well bore itself. If you will note on Exhibit 1, the well bore sand condition at this particular location is the thickest sand anywhere

on the 320-acre tract. In other words, we are going from a thickness there down in all directions; consequently, we are using the highest point and not, as far as sand thickness is concerned, and not using the average sand thickness throughout the 320. That is the prime reason that we have a little difference here, and the other reason, of course, is the fact that this is one of the wells that was produced consistently over a long period of time on interference test number two; and consequently, probably has a pressure slump in around the well bore that would take an appreciable time for the well to build up to its maximum pressure. Even though this one doesn't show that it would drain the reserve that has been attributed to the 320, I think that if we would cut it back and go in and contour that thing on a basis of two or three feet and then calculate the acre feet of sand under the 320-acre unit, that we would be draining it. We are getting a little erroneous figure because of the fact that the sand condition in the well bore is higher, than anywhere on the tract.

Q You don't feel that the condition in the well bore is representative of the entire tract and perhaps suggests that a lesser reserve be attributed than those indicated on the plat?

A Yes, if we look at the other exhibits, we go on that 320 acre tracts, the three wells we are talking about, you go thicker one way and thinner the other, so that the well itself is pretty, well, has about the same pay thickness as the 320 acre tract would average, but in the case of the 5-D, that is just not true.

Q Now as I understand the purport of the exhibits which you have been presenting up to now, they tend to indicate that these wells can drain 320 acres and are draining 320 acres. Have you prepared any exhibits tending to show the extent to which these wells can and are doing so effectively?

A Yes, I have.

MR. PORTER: At this point we are going to recess the hearing until 1:15.

I would like to announce the oil allowable for Southeast, 33 barrels; for the Northwest, 49 barrels.

(Recess.)

AFTERNOON SESSION

May 14, 1958

MR. PORTER: The meeting will come to order, and you may proceed with your next exhibit.

MR. GRENIER: It has occurred to me during the lunch hour that it has not been pointed out of record that Mr. Wiederkehr is the same Mr. Wiederkehr who has previously testified in this case, and we did not touch on his qualifications. While nobody objected to him, would you like that material repeated?

MR. PORTER: Let the record show that Mr. Wiederkehr's qualifications are acceptable. He is the same Mr. Wiederkehr that testified in the prior hearing.

DIRECT EXAMINATION (Continued)

By MR. GRENIER:

(Southern Union's Rehearing Exhibits Nos. 14, 15, 16, 17, and 18, marked for identification.)

Q Turning to the first of this group of exhibits which have just been marked for identification, which would be Exhibit 14, which relates to the Southern Union Jicarilla 1-A Well, would you explain what the data is that have been placed on this exhibit and what the exhibit indicates?

A On the bottom of the exhibit in millions of cubic feet is shown cumulative production from the particular well. On the left-hand side shown in MCF per day is the deliverability of the well. Now I would like to go into that. The deliverability here is not the State deliverability test which is run, which is a theoretical deliverability. This is actually the delivery capacity of the well as taken from our chart depth, and it is the average of a seven-day or eight-day chart period. Some of our charts run seven days and some eight. It's the average capacity of the well for a given seven or eight day period, delivering into Southern Union lines at a pressure of between 525 and 575 pounds. That pressure fluctuates a little winter and summer, depending on our load. This exhibit tends to show that this particular well has produced in excess of 550 million feet of gas; that' its delivery capacity today is relatively close to the delivery capacity that it had when it was originally placed on the line; and it was the first, I guess the first well connected to Southern Union's system. It was the first well drilled in this Tapacito Field. The black line running

up approximately the center of the exhibit, and on this one showing 835 MMCF, that 835 represents half of a 320-acre or half of a 160-acre reserve; in other words, taking the reserve that was shown last month as the reserve for 320 acres, and dividing that in two, I get the reserve for 160. Now I have divided that one more time, which would be a fourth of the 320, or would be the point at which this well should be dead, since it is producing against one-half of the original pressure of the well.

Q What was that original pressure?

A The original pressure, the top hole pressures in this vicinity were somewhere just barely below 1100 pounds, so that if you are producing against a system of 550 pounds, then when half of the gas is gone, theoretically the well would die, because it couldn't produce any more; if it weren't draining an area beyond 160 acres.

Q What was the basis of this reserve figure, was that your data or Mr. Reese's?

A That was Mr. Reese's data. We're using that data because it is the most conservative of the two as far as, is the most lenient of the two as far as reserves are concerned. If you use my reserve figures, it would move these curves a little bit to the left. What these exhibits tend to show is that even this well --

Q (Interrupting) Let's just confine ourselves to the one we have been talking about.

A This one actually shows that with better than 550 million

feet of production, the well still has a capacity in excess of one million feet of gas a day.

Q Now, just to clarify exactly what these dots are, whenever there was a weekly period at the end of a month, is that right, Mr. Wiederkehr, where the well was producing fairly continuously throughout that weekly chart period, you would enter that on this chart and would match it up against the cumulative production as of the end of that weekly period?

A That is correct. I was careful not to take a period of a week when the well had been shut-in for a month or so in advance where I would,consequently would have gotten a higher deliverability. Each of these points represent a relatively stable flow that included at least two weeks of production.

Q You mean immediately prior to the week's chart?

A Right.

Q Now, turning to Exhibit 15, which relates to the Southern Union Jicarilla 4-E Well, what is indicated there?

A This particular exhibit shows that even though the well has produced 630 million feet of gas, and when it produces 678 million feet of gas it ought to be dead, it still has a capacity of a million and a quarter per day and still against a line pressure of approximately 550 pounds.

Q The compilation of data appearing here is the same sources as was the case in 14, is that correct?

A That is correct.

Q Referring to Southern Union Exhibit 16, which relates to the Southern Union Jicarilla 5-D Well, what is indicated there?

A This indicates that the Jicarilla 5-D has produced about 640 million feet of gas, has a capacity now of a million and a quarter a day; and if it's only draining 160 acres, it has to go from that point to zero when it produces 200 million feet of gas more, indicating that it is draining appreciably more than 160 acres.

Q If the trend were extended of the production to date, it would cross the vertical line rather than dipping down to zero before reaching it, is that correct?

A That is correct. If the trend were projected, it would supposedly be dead at the point it was still producing approximately three-quarters of a million a day.

Q Turning to the Jicarilla 1-E Well, which is here in Exhibit 17, what is indicated there, Mr. Wiederkehr?

A This indicates that the Jicarilla 1-E Well has produced almost 700 million feet of gas and yet if it were only draining 160 acres, it should have died when it produced 522 million feet, showing that the well had to be draining appreciably more than 160 acres to have the capacity that it has, and this tends to show that not only are we draining 320, but we are doing it efficiently because if we weren't doing it efficiently, these lines would be approaching at least zero when you have used up all of your 160-acre reserve.

Q If you set it on the basis of 320 reserve, would it mean a line about twice as far out here?

A That is correct. None of them look like they are going to hit bottom by the time they get to the 320-acre reserve.

Q How about the Honolulu Jicarilla No. 3, shown on Exhibit 18, what has been the production history of that well?

A That well has produced 790 million feet of gas. It has a capacity now of in excess of a million and three-quarters per day, and it should have died when it produced 678 million if it were only draining 160 acres.

Q Mr. Wiederkehr, have all of these Exhibits Nos. 1 through 18 presented on Rehearing by Southern Union been either prepared by you or under your personal supervision?

A With the exception of the fact that we used Mr. Reese's map, too, as the originating point for Exhibit 1, the rest of the information was prepared by me or under my supervision.

Q You have just stated, I believe, that in your opinion these exhibits and the other exhibits which have been presented to date indicate that in the major portion of the Tapacito-Pictured Cliffs Pool, that is to say the 90 percent of the area thereof which is in the good part of the field, that one well will efficiently and economically drain 320 acres. In your opinion would 320-acre spacing comply with the other standards which are set forth in Section 65-3-14 of the New Mexico Statutes, and particularly Paragraph (b) thereof? Now I appreciate that this

is a statement of the standards which are to be applicable to proration units, and if there is any objection to the asking of this question at this time, why, we would defer it until we get to the portion of the case on the other Case 1439, I believe the number is, but it does seem logically to follow the data which we have been presenting here. May we proceed with a question of this kind, Mr. Porter?

MR. PORTER: Proceed.

A Well, in answer to your question, it appears that very definitely a 320-acre spacing pattern would fulfill the requirements of the law which you quoted, in that we can efficiently and economically drain 320 with one well. It would prevent the drilling of unnecessary wells, and we're talking about the possibility of a million to two million dollars worth of unnecessary wells. It would protect correlative rights, and it would certainly help us to avoid the risk of drilling excessive number of wells and getting a bunch of dry holes. So I think it fulfills quite well the law as set out.

Q You are not going to testify as to the aspect of that section of the Statute which relates to the prevention of reduced recovery which might result from the drilling of too few wells?

A No, another witness will testify on that.

Q So your statements relate to the preceding portions of this paragraph?

A That is correct.

MR. GRENIER: May the Commission please, that concludes our direct case with respect to Case 977. We will have some additional testimony from Mr. Wiederkehr with respect to the proration matters, which will be taken up next, I understand, in Case 1439.

Q (By Mr. Grenier) Did you, incidentally, have anything further that you wish to state, Mr. Wiederkehr, with respect to this aspect of the case?

A I don't think so. I just would like to point out that the exhibits which we have presented on deliverability and on pressure decline were all prepared from information taken from our own records, and these are not something that we guessed at; they are figures that can be backed up if anybody so desires to look at our production reports. This is conclusive proof to me that a well will drain 320 acres and do it very well.

Q Do these exhibits produce results consistent with the results of the interference tests that were testified about in previous hearings where it was indicated that those two wells that were involved in those tests would drain an area of at least 783 acres?

A Actually, since the data presented here was intended to show that the wells would drain efficiently and economically 320 acres, we didn't go to the point of saying that we can efficiently and economically drain 780 acres, but I think that the two work together, that the first series of tests indicated that we could

drain that large area and this series of information show that we can drain at least 320 effectively and economically. We have never said we could drain 780 efficiently and economically. We said we can drain it. This tends to prove that we can at least drain the 320 and do a good job of it.

MR. GRENIER: We ask that our Exhibits 1 through 18 be admitted in evidence.

MR. PORTER: Without objection they will be admitted. Anyone have any questions of Mr. Wiederkehr? Mr. Kellahin.

CROSS EXAMINATION

By MR. KELLAHIN:

Q Mr. Wiederkehr, at the outset of your testimony, as I understood you to say you had no real substantial quarrel with the reserve figures presented by Mr. Reese.

A I said that in the area of the field where there is micro-log pay.

Q You confined it to that area?

A Yes.

Q Now you also said, I believe, that you do not feel that you could pull that field down to 100 pounds abandonment pressure?

A I feel because of your characteristics of the wells and because it's a well-known fact that the Pictured Cliffs has water lying in a coal stream directly above it and that past Pictured Cliffs fields have tended to go to water, started making small amounts of water as produced, and the fact that some of these wells

are already beginning to indicate water production. By that time your velocity of flow through your tubing string is going to be so small that it won't keep the well bore clean, and the wells will be abandoned prior to 100 pounds.

Q Would you say what abandonment pressure you would anticipate?

A I would expect it to be somewhere between two and two hundred fifty pounds.

Q On that basis the pool still has a considerable life left in it?

A Yes, it certainly does.

Q As a matter of fact, there are other Pictured Cliff wells in which the original pressure was 500 pounds or less?

A Yes.

Q You know what the original reservoir pressure was?

A 479, 480, just a little below 500 if I recall correctly.

Q In the West Kutz?

A I was referring to West Kutz. Fulcher Kutz actually had a little over 600.

Q Now, referring to your Exhibit No. 1, you made some reference to the Jackson Well No. 2?

A Yes, sir.

Q Would you say when that well was drilled?

A I couldn't tell you exactly. I looked at the completion card week before last when this exhibit was prepared, and it was drilled, if I recall correctly, sometime within the past year and

a half to two years.

Q You had some trouble on the completion, did you not?

A That I don't know. Actually there's no indication on the scout report that they did have any trouble.

Q You don't know that the casing split after a light frac, then?

A No, I do not know it. I wouldn't be surprised, because if you tried to frac it over in the tight spot, I would be surprised if you didn't because you are going to run into extremely high pressures trying to frac that tight sand.

Q Did you examine the microlog on that well?

A Yes, I certainly did.

Q Would you agree that it showed ten feet of net sand?

A No, sir, I would not.

Q It shows a zero marker, though?

A Yes.

Q You consider microlog in connection with arriving at net sand?

A I consider if you have no microlog you will not have enough net sand to make a well commercial. I am not saying with no microlog you will not get gas. I am saying you won't get commercial volumes of gas, you won't pay for a well.

Q Are you familiar with the Benson Montin Well in Section 22, immediately to the south?

A No, I am not.

Q You never examined the log on that well?

A No, sir.

Q You don't know whether it had zero microlog or not?

A No, sir.

Q Do you know how it was completed?

A No, sir, it's not in the Tapacito Field, so I had no reason to study it for this hearing.

Q Actually it's in South Blanco, is it not?

A I suspect it is, although I don't know what the new field boundaries are on the South Blanco. It is closer to South Blanco than Tapacito.

Q You know whether it is completed in the Pictured Cliffs formation?

A I don't even know that. I will agree to that, I would agree it was if you say so.

Q You just didn't examine that well?

A No, I sure didn't. I will be more than happy to, if you have a log, and give you my interpretation of it.

Q In regard to your B well in Section 25, 26, 4 West --

A Yes.

Q -- There was no effort to complete the well in the Pictured Cliffs, was there?

A No, sir.

Q Did you examine the log on that?

A Yes, sir, I sure did.

Q What sand did that show?

A It shows no micrologand no appreciable sand. Actually, if you wanted to look at the samples, you would find that they are primarily silt-stone and that there was practically no Pictured Cliff sand, there was no clean Pictured Cliff sand in the well bore.

Q Did you make any test in that formation at all?

A No, sir, we tested the 1-B Well very well, which had actually a better log and a better sand section and a better looking sand on samples, and we did it effectively, so we didn't see there was any use in wasting any more money on this one.

Q You have another well, 1-F, in Section 26, 26, 4?

A Right.

Q That was completed in the Mesaverde also?

A That is correct.

Q Did you make any effort to complete in the Pictured Cliffs?

A No, sir.

Q Did you say whether the sands in that well compare with the 7-29 in Section 29 which is completed in an eight-foot sand section in the Pictured Cliffs?

A I suspect there was a little sand there, but the 7-29 well is not commercial and so I don't see any particular reason for us to complete a non-commercial well if we can help it.

Q You say the well is not commercial, and also on your exhibit, colored in blue, you list the wells that you classify as non-commercial. What do you characterize as a commercial well?

A I will say a commercial well is one that will pay for the cost of drilling and the cost of operating, let a man get his money back in six or seven years.

Q Could you pin that down to productivity or the deliverability, or some figure of that nature?

A It would take a productivity of something -- the well costs we are talking about here and the operating costs, it would take something in the vicinity of six to seven million a month capacity. I mean actual production.

Q Do you know that the 7-29 well was completed for 870 MCF?

A I notice that there is an 870 on this exhibit, yes.

Q Had an open flow of a million seventy-eight?

A Right.

Q But you say that is not commercial?

A No. I have said, looking at the I.P., I have not seen the capacity of the well; I haven't seen a deliverability test on it and I haven't seen any production figures on it because it is in South Blanco, and we are completely away from Tapacito again, but --

Q (Interrupting) We are still dealing with the Pictured Cliffs formation.

A Yes, we are dealing with Pictured Cliffs formation, it's a lot different, but it's still Pictured Cliffs. We can go up in Colorado and look at Pictured Cliff, too.

Q There are actually a number of wells producing in the South

Blanco on which the microlog shows zero permeability, is that correct?

A I don't know.

Q You don't know?

A I told you earlier that I hadn't looked at South Blanco.

Q You are just not concerned with South Blanco at all?

A I am concerned with South Blanco where it affects Southern Union Gas Company, and if you want to move over to 25 North and 5 West, I can tell you about it.

Q Mr. Wiederkehr, your testimony throughout this hearing has been based upon a conclusion, that where there is zero microlog there is no reserves--

A No.

Q -- is that correct?

A I didn't say any such thing.

Q Will you explain what you mean?

A I said where there is zero microlog in the Tapacito Field you would not have a commercial well.

Q Would you say where there is zero microlog in the South Blanco, which is a similar sand, that you will not have a commercial well?

A In all probability that is true, but you have a little different conditions in any field. Had I looked at those things, I might be able to give you an answer. Right now I can't answer about that one. I have made my statement on the basis of Tapacito

I have made my analysis and I can prove it,if you want to talk about Tapacito, I will.

Q I am trying to talk about microlog, regardless of where it might be.

A All right.

Q Now, Mr. Wiederkehr, to get it to the Tapacito Pool, the 2-B Well in Section 19, 26. North, 3 West, Magnolia, do you know what the microlog was on that well?

A According to Mr. Reese it was zero.

Q It's a producing well, is it not?

A I called Magnolia's office about that well before I left Dallas, and they told me it was not. I called their reservoir engineering section. Now whether it's producing I can't tell you, but they told me it was not at the end of the year.

Q You don't know whether it's on the line or not?

A It may have been put on the line since then. The information was not available that it was producing. I couldn't find it so I called their office and did not get any information from them to show that it was producing. You'll notice that I didn't show it encased in blue, because I couldn't get any information on it. If I had been able to get any information, I might have been able to do something with it, but I couldn't find any information.

Q Now referring to your Exhibit No. 2, Mr. Wiederkehr, it was a core analysis, as I recall?

A Yes, sir.

Q On the 1-G Well?

A Right.

Q Does that represent total water, total connate water? I mean the water saturation?

A I'm sure it does.

Q There was no correction made for connate water and contamination for drilling while you're drilling fluids?

A I doubt if there was on this particular report. Had there been, it normally runs in the range of three to four percent, so it doesn't matter.

Q It would tend to increase it?

A You mean decrease it.

Q If you made the adjustment?

A It would decrease it to some small amount.

Q Are you familiar with the equipment available to the Core Lab in determining the permeability from core analysis?

A Not specifically what equipment was available. I know there's a continuing development to get better equipment, but the changes that have been made by Core Lab during that time, I couldn't tell you.

Q They have improved their methods?

A Oh, yes, they have improved their methods.

Q The microlog permeability would not as clearly reflect the permeability as a core analysis?

A I think so, because this is non-measurable. If you had a

measurable permeability here, then I would say that you could possibly be right, but where you have non-measurable permeability, under any circumstances I don't think you are going to increase it enough to make a commercial well out of it.

Q Actually gas will move through areas of extremely low permeability?

A Right, at extremely low rates.

Q Sir?

A At extremely low rates.

Q But if you have an area of good permeability or fair permeability, the areas of low permeability will tend to feed into that area as it is produced through the well bore, will it not?

A I think so, I have heard testimony to the contrary, but I think it would.

Q Referring to your Exhibit 3, on the Jicarilla 1-B Well, the core on that well shows good porosity, does it not?

A It shows some pretty good porosity down at the very -- oh, 3544 feet.

Q Actually, in making the cores you missed approximately four feet of pay, didn't you?

A What was that?

Q Actually, in making the cores you missed approximately four feet of pay, didn't you?

A In making the core?

Q Yes, sir.

A No, sir, we didn't miss any of the core. Actually we didn't analyze that particular section, and if you will note on the core graph, that we started analyzing at 3504 and on the core graph itself, it shows that where the sand started, the up-section was shaled according to Core Lab report. My exhibit on the cross-section was a little bit erroneous because I showed where, not where we started coring, but where the analysis was made.

Q In that analysis you did not analyze approximately ten feet, is that correct?

A I imagine. Actually there was a little more than that. There was four feet up at the top, and then there was twenty feet in the center of it.

Q Approximately twenty feet in the center?

A Right.

Q Have you examined a log on that?

A Yes, sir.

Q It shows good permeability in there, does it not?

A The log?

Q Yes.

A No, sir, it certainly does not.

Q It does not?

A No, sir.

Q It shows good porosity?

A It shows fair porosity, not as good as most of the field, but it's a fair porosity.

Q It actually shows the best porosity in that entire well, does it not?

A To be from 3544 to 62.

Q 35 --

A That's the best porosity I see.

Q We have it from 3522 to 3573.

A You are talking about trying to read porosity off an electric log?

Q Yes.

A They haven't found a way to do that yet.

Q Yes, porosity.

A You can't do that off an electric log.

Q That section was not cored?

A Yes, sir, it was cored. It was just so poor our Geological Department said it would be a waste of time to analyze it. The entire section was cored.

Q Mr. Wiederkehr, you use the electric log to pick your sand, don't you?

A In conjunction with the other information that is available.

Q Assuming you had no other information available, you would use the electric log, would you not?

A Right.

Q You would use the porosity as shown by electric log in

order to pick the sand?

A No, you wouldn't use the porosity. You would use the spontaneous potentiality and sensitivity.

Q What do they reflect?

A They reflect the cleanliness of the sand and they also reflect the potentiality of there being both porosity and permeability; but actually you cannot read either porosity or permeability off an electric log.

Q I understand you can't make a measured reading of it, but it does indicate it?

A Yes. As a matter of fact, the electric log and the core analysis with this porosity was such that we decided to set pipe on the well and then it was a dry hole, anyhow.

Q It was shot above that section, though, wasn't it?

A It was sand fracked originally and then shot through the best part of the sand where you said it was, according to you it was the best part of the sand, and then -- I don't know whether it was re-fracked or not.

Q Well, it was shot from 3522 to 3573?

A Well, yes, and you said of your electric log that that was the best part of the sands, so it was shot according to you in the best part of the sand.

Q In the area immediately above what I referred to as the best part of the sand, it's water saturated, isn't it?

A According to the core analysis, the water is high throughout

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the area.

Q That would have a tendency to kill the well, then, wouldn't it?

A The well didn't make any water off shot.

Q It didn't make it?

A It didn't make water off frac. It just didn't make anything.

Q Now, referring to your Exhibit 4, the 1-G Well, you made a core on that well, didn't you?

A On the 1-G?

Q Yes.

A Yes, sir, we cored a lot of that.

Q You never made any completion attempt in the Pictured Cliffs, did you?

A No, sir.

Q You don't know whether it would produce or wouldn't produce?

A Yes, sir.

Q That's your opinion based on the information you have?

A Let's say this, that I supervised the drilling of most of these wells down here directly, that is, the wells that we own an interest in,which is about half the field, and I have a feeling that I know more about what will produce and what won't produce down there than anybody, because we have produced as many producers and as many dry holes. It is my opinion that it would not have produced.

Q In regard to your Exhibit 6, the 2-B Well, you made no

completion attempt there?

A No, sir.

Q With reference to Exhibit No. 7, your 6-E Well, that was completed as a Tocito Well?

A Yes, sir.

Q Again you didn't attempt to complete in the Pictured Cliffs?

A I wish I had the record, I don't believe we did. From looking at the log now, if we did we shouldn't have. I don't think we made an attempt to complete in the Pictured Cliff.

Q In connection with your Exhibit No. R-8, again as I understand it, calculating your reserves, you used only the microlog pay, is that right?

A That is correct.

Q Are you assuming, then, that you are not going to recover any of the gas except that shown in the microlog pay?

A No, I'm not, but I don't think that I or anyone else knows how much gas you are going to get and it's going to be a very small amount. Actually, if you will go one step further on No. 9, I re-did that on the basis of my reserves figures, but as far as 8, all I did there was to show what would happen if you used only microlog pay.

Q Actually you will produce a considerable amount of gas from the entire sand section where there is any porosity at all, won't you, feeding into your area of microlog pay?

A No, sir, if you don't have any porosity you are not going

to produce any gas at all.

Q Where you have that porosity?

A Where you have the porosity.

Q And low order of permeability?

A You will get a little gas out of it, but it will be so small as to have no effect on your overall reserves of a unit.

Q Your reservoir pressure is the same, regardless of whether you have --

A (Interrupting) Initially, yes.

Q -- initially. As you produce from the areas of good micro-log permeability, that would tend to reduce the pressures in there?

A Right. You would start getting a little of the gas out of the hard tight section. How much we are going to get out of there is sort of questionable.

Q In regard to your Exhibit No. 9, that was also based on microlog pay, was it not?

A Yes, sir.

Q It shows two feet as against the seventeen feet that Mr. Reese testified to?

A Yes, sir.

Q Again the same thing would occur, the gas from the areas of low permeability would feed into the two feet section of high permeability?

A I hope it does. If it does, maybe we'll get our money back.

Q Now, in regard to your Exhibits 10, 11, 12, and 13, your pressure decline curves,would you say how those pressures were taken?

A They were taken with a dead weight.

Q How long was the shut-in time on them?

A Oh, I believe about twenty-six days, somewhere in there.

Q On each well?

A It was the same on each well.

Q It was the same?

A Yes.

Q Now actually all of those wells are located in what might be referred to as the fairway or the best portion of that pool?

A No, sir, they are not.

Q You think that's a poorer section of the pool?

A No, it's not a poorer, it's an intermediate section, between the best and the worst.

Q Did you make any such analysis of any other wells in the pool?

A No, I did not.

Q You are not familiar with the production history of pressures on the Florence wells?

A No, sir, I have no information whatosever on Mr. Florence's wells. I took this particular group of wells because they were some of the first wells that were produced, and consequently had the longest production history and the most gas produced and would

consequently give you the best pressure decline curve. The more production you can get, the better your curve is.

Q In regard to your decline curves, is that always a straight line on a graph?

A No, you might get a little variation due to, if you have water encroachment you might get a variation there. You'll get a little variation from other factors, but normally it approaches a straight line.

Q On a graph?

A Right, on a graph. Actually, to plot B over C against cumulative production, if you have no water encroachment, no oil in the rime, it ought to come out a straight line.

Q Mr. Wiederkehr, one more question, please. In connection with your Exhibits 10, 11, 12, are you assuming a drainage in a radial pattern or along the trend of the formation, or --

A (Interrupting) This would actually assume that you are getting probably an elliptical drainage, definitely, to have had a pressure decline curve of this sort, you would have to be draining toward the edge of the sand. If you were not, your pressure decline curve would have dropped off sharply because then you would be leaving a lot of gas in the 320-acre tract. With all of the wells in the vicinity producing, if you weren't draining that edge stuff you wouldn't get a curve like this, because if you were draining only parallel to the sand bars, as Mr. Reese suggested last time, then you would be getting interference between those wells; and

your curve would be a whole lot steeper, show a whole lot less reserve, so this proves that we are draining toward the edge of the field.

Q Would your interference test show a drop in pressure along that --

A (Interrupting) Yes, it showed a drop in pressure.

Q Along the trend of the formation?

A Right.

Q You referred to drainage toward the edge of the field, I believe, at one point in your testimony, there were tremendous reserves in that area?

A I don't know whether that was exactly the wordage, but there is a lot of reserves in there, quite a bunch of gas in there.

Q Do you place that in your zero microlog?

A As far as calculating the reserves, I have used up to the zero point.

Q Up to the zero point?

A Right.

MR. KELLAHIN: Thank you very much, sir.

MR. PORTER: Are there any further questions of this witness?

MR. UTZ: Yes, I have a question.

MR. PORTER: Mr. Utz.

By MR. UTZ:

Q Mr. Wiederkehr, referring to your Exhibits 14 through 18 --

A Yes, sir.

Q It is my understanding that the deliverability that you used in that, in those exhibits was actually a rate of flow into the pipe line?

A Yes, sir. Mr. Utz, this was, what I did, I took a seven or eight day chart period, depending on whether we had seven or eight days on the last chart period of the month; took the average flow for the seven or eight day period and plotted it against the cumulative production at that time.

Q In connection with that, I believe that you referred to a theoretical deliverability. I would like to clarify that. What did you mean by "theoretical deliverability"?

A Actually, in our normal deliverability, the way we calculate it in the Basin, using your casing pressure, then you have to -- I don't take allowance for your friction that is developed in your tubing string, actually it's not quite a true -- Maybe I shouldn't have used the word "theoretical", so actually it is not true that we get from the State test. This actually takes all the factors. It is actually what was delivered into the pipe line.

Q Wouldn't the better word be possibly "calculated" deliverability?

A Right, I'll agree to that.

MR. UTZ: That's all I have.

MR. PORTER: Any further questions?

MR. GRENIER: I have some redirect.

MR. HINKLE: If the Commission please, we, of course, agree

with these exhibits that Southern Union has offered in this case for the purpose of showing that one well will effectively and economically drain 320 acres or more and have no quarrel, but I do not wish to cross examine Mr. Wiederkehr in connection with them. However, when Mr. Wiederkehr comes back to the stand in connection with the other case which involves the proration formula, we might want to ask him some questions with regard to the implication of these particular exhibits with reference to the proposed proration formula. I would like to reserve the right to do so.

MR. COOLEY: That will certainly be permissible.

MR. PORTER: Does anyone else have a question of the witness?

MR. COOLEY: One question, please.

MR. PORTER: Mr. Cooley.

By MR. COOLEY:

Q In answer to Mr. Kellahin's question concerning the contribution, if any, which might be made to the production of a well inside the productive limits as defined by microlog porosity -- do you follow my question?

A Yes.

Q What the question refers to in particular is what contribution will be made, if any, by the pay outside the zero microlog limits.

A Yes.

Q I believe in answer to Mr. Kellahin's question you stated

that you felt it would be very small?

A Yes. Can I explain my answer?

Q Yes, please do.

A I say that on the basis of the fact that the wells that were either completed or completion attempts were made outside the zero permeability line, even though they had a long section of sand that had no microlog, they have produced either negligible quantities or none, so in the heart of the field, then, where we have a pretty good microlog section, but then have some of this other stuff, too, there would be no reason to believe the two kick in any more than the wells we have information on.

Q Those were the particular wells to which I was referring, the wells which I believe you have denoted in blue on your Exhibit R-1?

A Yes.

Q Wouldn't that be the wells that would give you some indication, as to what contribution might be made?

A Yes, they give you an indication.

Q What is the range of productivity in the wells that you have in blue, which are located outside the microlog limits?

A From a million a month up to five or six, I think. I just took an average production over several months period on these wells. Most of them don't belong to us, two of them do, and I can give you the exact production on those by months. The other wells, I just took that information off of the New Mexico Engineering

Committee Report.

Q Those would produce up in the range of two and a half, three, or four, or possibly in the extreme upper limit of five would make some material contribution to the ultimate productivity of the area, would it not, even though they wouldn't be commercial to drill a well just to that sand alone?

A Well, now, let's go back one step. If you took these wells and transported them to the heart of the field --

Q Take that sand or put it in with some good pay?

A Or take that sand, then, that particular sand would have to be trying to buck the pressure created by the good sand, and the productivity of the poor sand that you transported over would be even less than it is getting over here.

Q I thought you stated that the pressures would decline in the more porous, more permeable --

A (Interrupting) Right.

Q -- permeable areas first?

A Right.

Q Thus allowing the less productive areas to seep in and replace some of the gas produced from the better areas?

A Take a theoretical well that has no sand at all, has no microlog -- it's producing, then any production it has is coming from this area outside the microlog pay. If it's producing into a five hundred pound system, then the rate of flow of that well is controlled by the pressure in the well bore and the five

hundred pound system. Now let's take this same well and move this same feet of poor pay over in a well that has, say ten feet of microlog to go with it. This area that has a ten feet of microlog is going to be producing, too; consequently, it is going to raise your pressure, say adjacent to your well bore at the time of production and take away from the capacity of the poor stuff to feed in.

Q Certainly at the early stages of the well's life?

A Until you get down somewhere close to the --

Q (Interrupting) As the pressure declines and as the productive life of the good area declines, then greater contribution, increasingly greater contribution will be made by the poor areas?

A That's right. But you can never expect it to be any more of what we have along the edge. Now actually, since the wells along the edge have such a tremendous thickness of the poor sand, as compared to a relatively small amount of that down in the heart, your comparison would probably be four to one. In other words, if you could make four million a month out of the well over here, if you took the same poor sand development in the other one, you will probably get a million out of it. There will be some contribution, we don't doubt that. All your exhibits indicate that we will drain well over the reserve that I have attributed to the 320, or Mr. Reese has attributed to the 320.

Q Wouldn't it be conceivable that part of the excess that you

attribute to the draining of good acres?

A A portion of it could be, but not anywhere near the volume we have shown here. I didn't know any way to break it down, frankly.

MR. COOLEY: Thank you.

MR. KELLAHIN: I would like to ask one more question, if I may.

By MR. KELLAHIN:

Q Just to clarify a point, Mr. Wiederkehr, in connection with our examination about this microlog pay, as I understood, you said that you did not examine it on any wells outside of the Tocito?

A Outside of the Tapacito.

Q I mean Tapacito, excuse me.

A I don't recall, well, let's put it this way. We have drilled several wells ourselves and on those I did. Now, I didn't go into the microlog on anybody else's wells outside the Tapacito Field.

Q By that I don't necessarily mean the defined limits of the Tapacito.

A I would say anything I consider to be producing from the Tapacito, which is about the limits as the Commission has defined them.

Q Now on the wells shown on Exhibit 1 which lie outside the defined limits of the Tapacito, you did examine the microlog on them, did you not, that is, the ones that you show in color?

A We drilled most of those wells ourselves. Yes, I examined

those.

Q They are non-productive?

A Right.

Q Each one of those in orange?

A Each one shown in orange are non-productive from the Pictured Cliff, and the same holds true with the ones in red circled in green.

Q And those circled in blue are in your opinion non-commercial?

A Non-commercial. In other words, when I say non-commercial, it means they won't pay back the investment in a reasonable period of time.

Q Actually those in blue is non-commercial, are all within the defined limits of the Tapacito Pool?

A I believe so, yes, as far as I can see.

Q Then it would be the effect of your testimony you did not examine the micrologs on anything except what you consider as dry holes or unsuccessful completions outside of the Tapacito Pool?

A Well, now, wait a minute. Are you limiting me to the wells down in the fairway of the pool?

Q No, sir, I'm talking about outside the pool. In other words, I'm talking, primarily, about those wells shown on your Exhibit No. 1 and colored in orange.

A Yes, sir. I examined the microlog on, oh, every well in there with the exception of Pacific Northwest well located in the Southwest Quarter of Section 7, 26, 4.

Q But you did not examine any microlog in the South Blanco?

A Not for this study. I have seen some, but not for this study, and I don't have any specific --

Q (Interrupting) You did not examine the micrologs on the MacMillan well in 28, 25 North, 3 West, and the Benson Montin well in 22?

A No, sir, but I examined the one on Jackson's well which lies between them and segregates the two areas.

MR. KELLAHIN: Thank you.

MR. PORTER: Mr. Utz, do you have a question?

MR. UTZ: Yes, I have another clarifying question here.

By MR. UTZ:

Q Mr. Wiederkehr, referring specifically to your Exhibit No. 14 --

A Yes, sir.

Q -- This is a graph showing the cumulative production on your Jicarilla 1-A. Is the production and reserves shown there from the same source as your Exhibit No. 9?

A The reserves are the same; the production is not, actually this production on this was a month or two later; on Exhibit 9 the production was through February, and I had available March's production by the time Exhibits 14 and so forth were prepared.

Q How about the reserves, is the 835 million cubic feet reserves 160-acre reserve as shown on 14?

A No, it's on 8. All these are Mr. Reese's exhibits, shown

on his Exhibit 3 last time, or repeated again on our Exhibit 8.

Q Then the reserves you show on 14 are Mr. Reese's, and the ones on 9 are your reserves?

A Right.

Q Mr. Reese's reserves were slightly larger than yours, were they not?

A In some cases, and in a case or two I was higher than he was.

Q I can't reconcile the two. Using the reserves on your Exhibit 14, what would be a 320-acre reserve, 1.67 million?

A No, 14, take the 385 and multiply by 4. That would give you the reserve to 100 pounds on 320 acres.

Q What is the 835, is that 160-acre reserve?

A That is half of 160-acre reserve, because since we are producing at half of the wellhead shut-in pressure, that is the point it would die. In other words, first we take the 320-acre reserve and cut it in half to get to 160, and then if you produce that you produce it all the way down to zero pounds or 100 pounds. Since our line pressure is operating at half of the original shut-in pressure, I have to take this and re-cut it in half to find out where the well would die. That is all I was trying to show, is that even though it was to die at this point, all of them indicate that they were going to be producing and producing at good rates to show effective drainage.

Q I was under the impression you were showing 160-acre reserves.

A No, sir.

MR. UTZ: That's all I have.

MR. PORTER: Anyone else have a question of the witness? Mr. Grenier, did you have further questions?

MR. GRENIER: Yes, sir, a little redirect, if we may.

MR. PORTER: All right.

REDIRECT EXAMINATION

By MR. GRENIER:

Q Mr. Wiederkehr, based upon the data indicated on your Exhibit 1 and the other exhibits which you have presented here, was there anything which has led you to believe that data as to wells in the South Blanco Field were of importance to the Tapacito Field, as pertaining to an interconnected source?

A No, I don't feel like there is any way that there would be a connection between the two fields that would be appreciable. The pressures in the two fields are different. They have been there for millions of years and there hasn't been enough migration for the pressures to equalize, so during our lifetime there is not going to be interference between the two fields.

Q In response to one of Mr. Kellahin's questions, with respect to Exhibit 9, did I understand you to state that gas would drain from these low permeability areas into higher permeability areas?

A Well, I don't know exactly how I stated it, but we say that gas will come out of these low permeable areas as the pressure differential is sufficient to let it do so. The volume will be

insignificant, but there will certainly be some amount of gas, as can be shown by the fact that these supposedly dry holes that we tried to complete made a little gas. They might make 100,000 a day and that is not enough to be commercial and would have no material effect on the reserves of the field as a whole.

Q What I'm getting at is, if these wells were producing, the wells that are within a good part of the field but along the flank, if they were producing from only a good part of the field and not at all out in the flank areas toward the area of zero microlog pay, would they have performed as they have?

A No, they wouldn't. The pressure decline and the deliverability and everything else would have dropped off much more rapidly than it did.

Q Does that indicate, then, that they must have been draining across lines of equal permeability?

A It indicates that they had to be draining right on out to the edge of the permeable pay.

Q And not just in a sharply elliptical pattern tilted at the same angle as the field?

A No, sir. They could not be possibly doing that, because if that were the case, we would have had so much cross-drainage that their pressure would be down to where they wouldn't be producing.

Q Referring to your wells in the Exhibits 14 to 18, why were those particular wells chosen out of all those in the field?

A 14 through 18?

Q The ones on the board there now, where you had the production.

A Because they had the best production history, the most cumulative production, and consequently give the most reliable curve.

Q Do you believe that those are representative of the field, or are they special cases only?

A They are representative of what is happening as far as deliverability is concerned. They are special cases in that they have been producing longer and consequently have produced more gas, but there are other wells that are just barely on production indicating this same trend, but you have to have a production history to get a trend that you can follow. We just didn't have that on all the wells.

Q In answer to a question by Mr. Cooley, I believe you indicated that in your opinion a well along the flank of the field here would be able to drain efficiently a 320-acre tract which was partly good sand and partly bad sand. If a well will drain 320 acres efficiently which is mixed that way, would it tend to drain a larger or smaller area in the fairway of the field where it was all good microlog pay?

A Drain better in the center of the field. Of course, you can drain a wider area where you have better pay.

Q So the data presented with respect to the wells along the edge would be showing minimum drainage rather than maximum, is that

correct?

A That is correct.

Q Now on these blue wells, some of those are still on the line and producing, is that correct, although they are not commercial wells?

A Yes, all of them shown in blue are producing. They are not producing at rates that will return to the operator his money in a reasonable period of time.

Q The operator is just bailing himself out and getting back as much as he can, is that the idea?

A That is correct.

MR. GRENIER: That concludes our redirect.

MR. PORTER: Any further questions of the witness? He may be excused.

(Witness excused.)

MR. HINKLE: If the Commission please, we have one witness and four exhibits. If you are going to take a recess, we can put the exhibits up and I think perhaps save time.

MR. PORTER: Let's take five minutes.

(Recess)

MR. PORTER: The meeting will come to order, please. Mr. Hinkle.

JAMES L. HACKNEY

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. HINKLE:

Q Your name is Jim Hackney?

A My name is James L. Hackney, sir.

Q Are you employed by the Humble Oil and Refining Company?

A Yes, sir, I am employed with Humble in Midland, Texas, Senior Petroleum Engineer.

Q Are you a graduate engineer?

A Yes, sir. I'm graduated from the Rice Institute in Houston, Texas, 1947, with a degree of Bachelor of Science in Chemical Engineering.

Q Have you practiced your profession since that time, at all times?

A With the Humble Company I have been engaged in gas engineering and petroleum engineering work.

Q Since 1947?

A Yes, sir.

Q Where have you spent most of your time with the Humble? At Midland, or whereabouts?

A I spent about five years in East Texas in Gasoline Plant operations; about a year and a half in South Louisiana in Gas Production operations; approximately three years in Houston office in our Gas Engineering Section, and have been in Midland for approximately one year.

Q Have you made any particular study with reference to the

Tapacito-Pictured Cliffs Gas Pool in relation to this case or any phase of the issues involved in this case?

A Yes, sir. I have made a study in regard to the quantitative evaluation of the additional gas that might be recoverable on 160-acre spacing as compared to 320-acre spacing, and a comparison of the value of that additional gas that might be recovered as against the cost to drill additional wells required to develop on 160-acre spacing; and also have made a study of the shape and form of drainage patterns which might exist in the pool.

Q Why did you limit your study to these two phases that you have mentioned?

A I was not at the prior hearing. The record I had to go on was the transcript and it appeared that there was doubt as to the quantity of additional gas that might be recovered on 160-acre spacing as compared to 320 insofar as justifying the drilling of the additional well, and there was testimony entered as to the idea of what the shape and form of the drainage patterns might look like in the vicinity of certain wells.

Q You have read the transcript of the previous hearing in this case and are familiar with the testimony that was given at that time?

A Yes, sir.

Q Mr. Hackney, will you refer to the exhibit on the board that has been marked Humble's Exhibit No. 1 and explain to the Commission what it is and what it shows?

A Yes, sir.

Q Go ahead and proceed.

A Looking at the right-hand side of the exhibit, there is indicated a disk-shaped affair having certain radius and a certain thickness. This is intended to indicate a segment or a sector of a reservoir having a constant net pay thickness, and this representing a radius of drainage at any particular pressure existing at that point; and the inner circle representing a well bore, the bore of a well with this much pay being exposed to the well bore, and the well bore radius as indicated by a dimension here. The equation of Darcy's law for radial, horizontal gas flow is a means of relating flow of gas into the well bore in a system like this with various factors existing, such as the radius of the well bore, the radius of drainage, pressure existing in the well bore, and the pressure existing at this drainage radius and the pay thickness, permeability and gas viscosity.

What this simply says is that the rate of flow into the well bore affecting these constants here is directly proportional to the permeability and to gas, the net pay thickness, and a function of the difference in pressure existing at the boundary into the well bore. In other words, the difference in pressure and it's inversely proportional to the viscosity of the gas or the ease at which the gas flows, and is inversely proportional to the function of the radius of drainage divided by the well bore radius.

Re-arranging terms here, we can relate this function of the

ratio of the drainage radius to the well bore radius to the difference in pressure existing in the well bore, as compared to the pressure existing at the drainage radius . We can take a different system here. For example, say we took a permeability of one millidarcy, a net pay thickness of ten feet, and assuming that the pressure in the well bore at the economic limit of production -- or in other words, when the well would be no longer profitable to operate, would be a hundred pounds per square inch absolute, that would be a hundred squares for the P_w term down here; then we could, the gas viscosity taken as .014 centerpoises, which is in the range of gas viscosity we should encounter here and should not vary significantly from that; again for this P_w term here, a hundred again, and then that gets us to this rate at which we would consider economic. In other words, we have assumed when we reach this economic limit we have 100 pounds per square inch absolute bottom-hole flowing pressure in the well, and for the purposes of our calculations, we assume that at that pressure that this flow rate into the well bore was at the rate of 100 standard cubic feet per day. In other words, the well was down to where it would only produce 100 standard cubic feet of gas per day at a bottom-hole flowing pressure of 100 pounds, if you could get that far. But we assumed that you could get down to that pressure. Then by knowing what these terms are, we know what this one is, we would have to refer it back to bottom-hole conditions. That leaves us with the pressure at the drainage radius unknown, and

this ratio of the radius of drainage to the well, bottom radius unknown. Then assuming various pressures existing in this area, or say around this circle here, we can calculate what this ratio of drainage radius to well bore radius would be for these conditions we have set up; and in addition to that, after we have calculated this ratio, we can take into account completion practices to a certain extent.

For example, in the case of a naturally completed well, we might assume that we had a well bore radius of six inches, a radius of three inches, or a three inch diameter well bore, which would be roughly .25 or a quarter of a foot for a well bore radius; and then by knowing this ratio and knowing what this was, we could calculate how far out this drainage radius was to compare to this pressure existing at the drainage radius; and for example, taking into account fracturing, we feel that probably the maximum you could hope to get, at least under present-day fracturing techniques, would be to increase this well bore radius to an effective well-bore radius of 100 feet, which then using the 100 foot value, instead of the 1.25 of a foot we used for the natural completion, we could again calculate what the radius of drainage would be under those conditions.

We made a number of calculations; for instance, I indicated here that we assumed one millidarcy in ten foot pay thickness. We made a series of them for one millidarcy, twenty feet of net pay; one millidarcy, thirty feet; then we changed permeability to

two-tenths a millidarcy, ten feet of net pay; two-tenths in twenty feet; two-tenths in thirty feet; and then in addition we ran some additional ones which we used a permeability of ten millidarcies and varies the pay thickness. In other words, to see what the shape of this profile was, if this represents the well bore, then the pressure away from the well bore is represented by a curve here, and if this is original pressure, this area up in here would represent the amount of gas that was recovered at any particular conditions that you set up there. By doing that, we were able to quantitatively evaluate the additional recovery that you might get at this abandonment condition we have assumed to produce, where you could produce 100 standard cubic feet a day at 100 psi bottom-hole flowing pressure.

Q Is the equation of Darcy's Law that you have explained there one that has been generally accepted by the petroleum industry and petroleum engineers?

A Yes, sir, it is.

Q And it is used extensively for this purpose?

A Yes, sir, it is.

Q Is that all that you have to explain to the Commission with respect to the equation?

A Yes, sir, I believe it is.

Q Will you refer to Humble's Exhibit No. 2 and explain to the Commission what it is and what it shows?

A This is a plot --

Q (Interrupting) You are now referring to Exhibit No. 2?

A Yes, sir. Humble Exhibit 2 is the indicated net value of additional gas recoverable under 160-acre spacing as compared to 320-acre spacing. This is based on the application of Darcy's Law as explained from Exhibit 1, plus a relating permeability to porosity and water saturation from core analysis data and making a calculation of recoverable, or making a calculation of gas in place per acre foot, as compared with permeability.

Using the Darcy's equation to calculate the increase in recovery factor that you might get from 160 rather than 320, and using this estimate of recoverable gas or gas in place per acre foot, we were able to come up with a volume of gas for different conditions here that would be or could possibly be recovered by 160 acre spacing as compared to 320, and assign a value on it to compare with the range of cost to drill and complete a well in the pool. For instance, this line represents a net, average net pay thickness.

Q Which line are you referring to?

A The third line from the top, indicated by "H=30 feet, r_w = 100 feet." That line represents a net pay thickness of 30 feet and an effective well bore diameter of 100 feet, which would have been induced by very effective fracture treatment. The indicated range in additional recoverable gas and value of it on 160 as compared to 320-acre spacing would range from approximately $2,000.00 income of where your average permeability was 10 milli-

darcies, to approximately $9,000.00 where your average permeability was a tenth millidarcy.

In other words, as your permeability gets worse here, that you have a slight tendency to increase the amount of gas that you might recover on 160.

Q That is based on fixed rate for gas of 10.4?

A Yes, sir. That was based on a 12.7 cent price, which I believe Gunsite used, less 8 percent royalty and 6 percent severance tax.

In other words, that was a 10.4 cent net price before operating cost, which actually you had, this was the amount of representative value of the increased recovery you were going to get out of that additional well on 160, and this being the range of cost to drill and complete an additional well. In other words, for this case which might be applicable for the Tapacito Pool, that would indicate that under this condition of a tenth millidarcy, which I had my doubts that you could make a commercial well out of it, but if you could, you would recover an additional $9,000.00 worth of gas, but that $9,000.00 wouldn't begin to pay out the cost of drilling that additional well.

Q But you would only recover about $9,000.00 of the cost of a well which would range from thirty-five to forty thousand dollars?

A Yes, sir.

Q What are some of the other cases which you have shown there

on Exhibit 2?

A Another case is a comparison of the bottom two lines; one is the comparison of the pay thickness of 10 feet and r_w of 100 feet, pay thickness of 10 feet in a naturally completed well, which indicates that for the natural completion that the increased value of gas that you might recover is actually less than in the case of the fractured well, is the significance of that. The significance of the upper line would be assuming that you had a net pay thickness of 100 feet, what would be in a very effectively fractured well, what would be the increased value of recovery for drilling on 160 as compared to 320, and I am not saying, this might represent three times the net pay thickness you have at Tapacito, but if you had that, still you would, the value of the additional gas that might be recovered would be only around $16,000.00, which would not be enough to pay half the cost of drilling the well.

Q What conclusion, then, do you draw from the Exhibit 2? General conclusion.

A The conclusion that I would draw is that for conditions that exist at Tapacito, of estimates given of net pay thicknesses and the permeability ranges that could be considered productive that exist in the pool, that you could never recover the cost to drill the additional well; in fact, it might be very small. You might not even recover ten percent of it, or less than that, depending on where you are out here, but it is a function of permeability.

Q Would this follow that by the drilling of the second well or two wells on 320, that it would be an unnecessary well and an economic waste?

A I believe it would be an unnecessary well, in that you are drilling the additional well in the hopes that you may get this additional recovery. It would in my judgment create an economic waste, in that you have to spend all this money to drill this well, and yet you don't increase your recovery from the pool significantly.

Q Is there anything else concerning Exhibit No. 2 which you would like to state to the Commission?

A I believe not, sir, at this time.

Q Will you refer to Humble's Exhibit No. 3 and explain it to the Commission?

A This is a nine-section area in the vicinity, part of it being in the Tapacito Pool as covered by this section indicated right here.

Q What exhibit are you referring to right now?

A I'm referring to Humble Exhibit 3, as this nine-section area being taken from this isopachous map of microlog porosity that was Gunsite Butte's map No. 2 that has been -- and this is actually, I believe it's Southern Union Exhibit here, but it was taken from the Gunsite map.

Q That's Southern Union Exhibit No. 1, is it not?

A Yes, but it was taken from --

Q (Interrupting) From the Gunsite?

A From the Gunsite. These contour lines are supposed to represent what was shown on the Southern Union Exhibit No. 1.

Q They are the same?

A That is microlog porosity.

Q They are the same contour?

A Yes, sir.

Q Does this Exhibit No. 3 relate to the second phase of the study that you have made?

A Yes, it relates to our calculation of what the drainage patterns, the shape and form of them, might be. We took as an example the Southern Union Jicarilla 2-E, which was located along the fairway. It wasn't in the best or the worst; in other words, it was located in a trend of constant pay thickness in a northwest, southeasterly direction. By the application of Darcy's Law, and taking into account these variations in net pay thickness coming in toward the well from different directions, and assuming a constant permeability in all this net pay section, but that the pay section would vary in thickness according to these contours, this was the shape of the drainage area for that well that was calculated by this application, which is in the form, more or less, of a tear drop, which is extending out toward the boundary of the field or the zero microlog contour.

Q That assumes a uniform permeability but a difference in pay thicknesses?

A Yes.

Q As shown by the contours, in this particular instance?

A Yes. This shaded area represents the shape of the pressure profiles around the well; in other words, in this particular example this 950 pounds is existing out here, as compared to 950 here. In other words, these are isobaric lines around --

Q How did you make this particular calculation, in using Darcy's Law did you do it manually or by computer or what?

A In this particular case, this calculation was done manually. Our next exhibit is one where the calculations were made on a computer by a more complicated procedure and mathematical formula.

Q Is there anything else you wish to explain with respect to this exhibit?

A I noticed on Southern Union Exhibit 1, which was further Gunsite's Map No. 2, that the shape of drainage pattern for the Southern Union Jicarilla 4-E is shown here as being trending in an elongated shape along the fairway of the field, whereas this calculated profile, based on engineering principles and equation of fluid flow, indicates that it's not particularly trending in that direction, but in this case it is more of a tear drop which is tending to become more circular as you get out further away from the well.

Q In other words, it shows that the drainage would not stay principally on the fairway but could go toward the flank of the field as well as on the top?

A Yes. Of course, on this calculation we did not assume interference from any other wells. This was just this one well, any reservoir of this shape producing at a certain rate, to see what these contours should be, but these contours should not be affected until you get out to where you were having interference from other wells, and to that extent they would modify the contours beyond that point.

Q Will you refer to Humble's Exhibit No. 4 and explain that to the Commission?

A Humble Exhibit 4 depicts the same thin section area as was shown on Humble Exhibit 3. The pressure --

Q (Interrupting) Are you using the same well?

A Yes, sir, the Southern Union Jicarilla 2-E well again. In this calculation of pressure distribution in the vicinity of the well bore, it was assumed that from the contour line on which the well was located, on back toward the zero contour line, that permeability was varied in the proportion that the pay thickness was varying. In other words, taking this net pay map, instead of assuming a constant permeability throughout this net pay section, we assumed at least from about this 23 foot contour line where this well appeared, that from there on back to the zero contour line that our permeability was varying. In other words, when we got out to zero, the zero foot contour line, the permeability there was zero.

Q Is that more realistic of actual conditions, you think, than

saying, assuming that there is a uniform permeability?

A I'm not prepared to answer that, Mr. Hinkle. I don't believe I can. I would say this, that it would tend to show what the effect would be if that permeability did vary and we had the other case where it didn't vary. This type calculation was performed on a computer. It was by the use of an unsteady state equation for fluid flow, which requires a computer solution. You can't --

Q (Interrupting) Would it be possible to do this manually?

A In my judgment it wouldn't.

Q Might take several years to do it?

A It might take hundreds of years to do it. Again, these pressure contours as we come out away from the well bore tend to assume this tear shape and actually when we get out here further, they tend to form a more circular shape, but it indicates that actually you are draining all the way out to the line of zero net pay and zero permeability, in that you are getting effective drainage out in there from this well.

Q Can you state in general terms the conclusions which you have drawn now from your study here with respect to drainage?

A The calculated drainage profiles do not indicate any elongated drainage area from down the fairway trend. In fact, they indicated that there is an elongation in any direction, it's out toward the edge of the pool, and that the shape of the pattern calculated is more of a tear shape pattern which extends out toward

the outer boundary here.

Q Is there anything else that you would like to state to the Commission with respect to this or any of the other exhibits?

A Well, to summarize, our calculations have indicated that in no case here can we calculate that we can recover enough gas by drilling on 160 as compared to 320 to pay or near pay for the cost of drilling the additional well, and these drainage, calculated drainage profiles indicate that you are going to get effective drainage out toward --

Q (Interrupting) The flanks of the field?

A -- the flanks of the field, and it would be unnecessary to drill additional wells in here to, for instance, this spot here, to be able to get that effective drainage out there. In fact, this well in my judgment would probably more effectively drain this area than would another well down here, or putting it another way, that this well would also.

MR. HINKLE: That's all of this witness.

MR. PORTER: Do you want to offer your exhibits at this time?

MR. HINKLE: Yes, I would like to offer Exhibits 1 to 4 inclusive of Humble in evidence.

MR. PORTER: Is there objection to introduction of these exhibits?

Q (By Mr. Hinkle) Were these exhibits prepared by you or under your direction?

A Yes, they all were.

MR. PORTER: They will be admitted. Anyone have a question of Mr. Hackney?

CROSS EXAMINATION

By MR. KELLAHIN:

Q Mr. Hackney, I'm sorry, but I was not here when your testimony first started. Am I correct in saying that your field experience had been confined to Southeast New Mexico, Texas. and Louisiana, or have you had experience in the Northwestern part of New Mexico?

A I have not had field experience. I have done reservoir engineering work in certain areas.

Q Have you made a similar study of this nature in connection with any pool other than the Tapacito?

A No, sir, I have not.

Q Are you familiar with the characteristics of the Pictured Cliff sands, generally?

A In a general fashion.

Q Can you say that the assumption that the permeability of those sands is uniform is a valid assumption?

A I don't believe I said that.

Q I know you didn't. I say can you say it?

A Sir?

Q I know you didn't, can you say it?

A No.

Q As a matter of fact, it is not a heterogeneous or homogeneous reservoir, in the sense there is communication throughout, in any of the Pictured Cliffs Pools, is that true?

A I think that's correct.

Q As I understood your testimony in connection with Exhibit No. 4, it is based on the assumption that your permeability varies in proportion to the pay thickness, is that correct?

A Yes, sir.

Q Is there any basis for such an assumption as that?

A No, sir, I mean except to illustrate the effect of the variation in permeability.

Q In other words, it doesn't take into consideration the conditions which may actually exist in the pool. It is a hypothetical situation, is that right?

A It takes into account what is actually happening in the pool insofar as, I mean if this isopachous map of the microlog porosity; in other words, it's taking into account the variations in pay thickness. I don't know the variations in permeability that may exist in there. We were just attempting to show what would happen under different assumptions how the permeability varied.

Q You carried that out to the point of zero permeability. What do you mean by "zero permeability"? Do you mean by that the point where there is just no permeability?

A Yes, sir.

Q That wouldn't necessarily be the same thing as zero microlog?

A No, sir, not necessarily.

Q In other words, you have zero microlog permeability, you still would possibly have some permeability?

A I would say that I am not familiar enough with the microlog or the interpretation of logs to be able to answer that as a qualified witness.

Q Mr. Hackney, do you know what the lowest range of permeability from which gas is being produced from the Pictured Cliffs formation is?

A To my knowledge, I know that gas is being produced from permeabilities ranging between a tenth and two-tenths of a millidarcy.

Q Actually, in connection with your Exhibit No. 2, you carried that on down to a lower permeability range to within, until it continued to approach the cost of drilling a well?

A You could. I don't know of any. I mean when you get on down there you are getting in high water saturations and you are getting on down to where you are not going to be able to produce any gas.

Q Has that been your experience, that you are always getting into high water saturations at that point?

A That is my experience, insofar as I have looked at the core analysis and capillary property data in the San Juan, Pictured

Cliffs.

Q Do you know that there exists good porosity ranging up to 12 percent with no measurable permeability and low water saturation in that pool or in that vicinity?

A I know that there is, that the porosities range up to that range. It would be extremely difficult, to my mind, to determine what the water saturation was in that.

Q Based upon the microlog permeability, the pool tends to range in a northeast-southwest direction, does it -- I mean northwest-southeast?

A Yes, sir, according --

Q (Interrupting) Under those circumstances, wouldn't you normally expect the drainage pattern to follow the zones of higher permeability as shown by that?

A I don't believe I quite understand your question. As I understood that, that was a map of effective net pay or microlog pay, and I don't have any reason, as I said a while ago, to know what the variations in permeability might be.

Q In connection with your Exhibit No. 1, could you tell us what that sub "b" is on that circular diagram?

A That sub "d"?

Q Yes.

A That is the pressure existing at any drainage radius, r_d.

Q What figure did you assume, then, in connection with your chart on Exhibit No. 2 for that factor?

A For P_d?

Q Yes.

A That was related to r_d; in other words, out to 160, equivalent to 160 drainage area and out to 320 drainage area, and that P_d fell wherever it could to contour drainage radius at your economic limit of production.

Q Was all your calculations based on the assumption of radial drainage?

A Yes, sir. I might add, Mr. Kellahin, if I may, and explain your question as to radial drainage, that I have some references in the literature which indicate that the pressure profile for radial drainage is not significantly different from that for a square drainage pattern.

Q How about for an elliptical drainage pattern which would follow the trend of the field? It would still be the same?

A I don't believe I follow that elliptical drainage pattern.

Q Well, for example, Mr. Hackney, if you have a well immediately adjacent to it, say to the west, there's an area of low permeability and trending toward the north it's an area of high permeability, and then you have quite a different situation, don't you?

A If I understand your question, you are saying that if toward this direction that the permeability gets poorer --

Q Yes.

A -- and in this direction the permeability gets better?

Q You can take any direction.

A Well, I assume that you would have some difference there. We made these profiles assuming constant permeability from here out, and then decreasing permeability here out to the boundary of the microlog porosity and did not significantly affect the shape of this pattern.

Q In connection with this particular pool, can you assume radial drainage, Mr. Hackney, as a basis for your calculations?

A I assumed radial drainage but as I said, I have references in the literature that indicate that radial drainage is not significantly different from drainage on a square pattern which would follow.

Q Well, actually, your microlog net pay map tends to disprove radial drainage, would it not?

A I don't -- I mean it tends to, if anything, to prove, I mean, your drainage is not elongated in the northwest-southeast direction, and that your drainage will be affected out toward the boundary conditions.

MR. KELLAHIN: That's all I have. Thank you.

MR. PORTER: Anyone else have a question of the witness? Mr. Cooley.

By MR. COOLEY:

Q Mr. Hackney, referring to Exhibit 2 --

A Yes.

Q -- which shows the additional amounts of gas that would be

recovered on 160-acre spacing as compared to 320-acre spacing under a given set of circumstances, can you pick from this chart what you, after your studies in this pool, would estimate the average amount of additional recovery that may be expected from an average well drilled on 160-acre pattern in the Tapacito Pool?

A I can. You mean my estimate would be based on this 30-foot net pay thickness and the effective well bore radius of 100 feet which would represent your, the maximum that I consider you can get by an effective fracture job, and in that case at a tenth of a millidarcy, the additional gas to be recovered would be about 90 million feet to this economic limit.

Q And,90 million cubic feet of gas --

A Yes, sir.

Q At an approximate value of $9,000.00?

A Slightly over that at the 10.4.

Q Do you think that's an unreasonable figure to use in connection with estimating additional recovery?

A I believe that's too high.

Q Where would you pick it? Assume that you feel that the permeability is too low at the one-tenth --

A For the pool average, I think it's too low.

Q I would assume that to be true. Where would you back it off to, to reach an average permeability which would reach a more reasonable ultimate recovery figure?

A Well, in the case of this Southern Union Jicarilla No. 2-E,

the core data indicated that the average permeability in that well was around five millidarcies, which if you came back, followed that 30-foot line back to five would indicate a value of additional gas to be recovered of $2500.00 or that would roughly be, say 25 million.

Q Would you say that five was an average permeability in the pool, or a little better or a little worse -- where would you peg it?

A It would depend there. I mean this indicates a range that, in other words, for this 30-foot case that you had ten millidarcy permeability, your increase would be from 19 million feet and would increase at a tenth, to where the permeability was a tenth of a millidarcy, to 90 million feet, the range being as shown, as indicated here from 19 million to approximately 90 million, and it would be somewhere in between there. The curve is fairly flat from, say one to ten millidarcies, you could take an average in there which would be from --

Q (Interrupting) Let's say around $5,000.00 there, that would be a rather conservative figure, wouldn't it?

A Yes.

Q How much additional wells would have to be drilled within the area that shows microlog pay on R-1 to develop that area on 160-acre spacing?

A In what area, sir?

Q The area which shows microlog development on Exhibit R-1, the map on the right.

A I have not counted them. I understand there are approximately 46 wells in the pool.

Q It could take about 46 more, couldn't it?

A It could take 40 to 50 more.

Q Assuming an average of $5,000.00 per well and multiplied, let's take that to cubic feet of gas at the average 5,000 figure, 50 million cubic feet of additional gas recovered from 160-acre well, multiplied by 46. Would you calculate that out for me, please?

A It looks like about two billion three hundred thousand if I have my decimal point right.

Q Then you think that it would be reasonable to assume that 160-acre development of that area would result in approximately two billion three million cubic feet of gas in the Tapacito Pool?

A I think that that would be an optimistic estimate.

Q I thought we had agreed on what we thought was a pretty reasonable average before we started.

A That's tied into a lot of factors, Mr. Cooley, as to -- in other words, what the relative production rates of your wells are and if that well will be permitted to drain its assigned acreage or some other well is going to drain it. I can't predict.

Q You think it would be at least within the distinct realm of possibility that that much gas will be recovered on 160-acre spacing, don't you?

A It would be within the realm of possibility, yes, sir.

Q Are you prepared to testify as to whether it is economical to develop on 160-acre spacing in the Tapacito-Pictured Cliffs Gas Pool?

A In what --

Q This is somewhat a rehash of testimony on previous hearing, if it will be conceded by Mr. Grenier that his witness testified at that time that they did not question the fact that the Tapacito could be economically developed on 160-acre spacing.

MR. GRENIER: I believe the testimony at that time was we didn't question that there was enough profit in 320-acre tract to support the cost of drilling two wells. We were saying, we never have indicated that we thought there was sufficient additional gas to be recovered by the drilling of a second well on a tract to justify the drilling of the second well. I don't know which one you are referring to. Those are the two points.

MR. COOLEY: It is admitted that it is economical to drill by Southern Union.

MR. GRENIER: You could pay out on that basis, this testimony is going to the extra gas that would be recovered by the second well.

Q. (By Mr. Cooley) Then assuming it is economical to drill on 160-acre spacing, the Tapacito-Pictured Cliffs Gas Pool could be economically developed on 160 rather than 320, thereby recovering some additional three billion cubic feet of gas?

A I don't consider it economical to make an additional two

million dollar investment to get it.

We're interested in ultimate recovery within economic limits. What would be the most economical operation, probably the most economical operation for one well would be to drill it in the middle of the pool and it would pay out more than any other type of development.

Q Can you tell me how the permeability in the Tapacito-Pictured Cliffs compares with the permeabilities that you have observed in Southeast New Mexico and West Texas?

A Well, that's kind of a --

Q I understand that's a very general comparison. Isn't it true that generally speaking the permeabilities in the Northwestern New Mexico are considerably lower than they are in Southeast New Mexico and West Texas?

A As a general rule; however, in the Tapacito Pool, I believe that they are considerably better than they are in the other Pictured Cliffs Pools that I'm familiar with, anyway.

Q How do the better Tapacito permeabilities compare with Southeast New Mexico and West Texas?

A Well, they may be lower in some pools and higher in others.

MR. COOLEY: That's all the questions I have.

MR. PORTER: Mr. Utz.

By MR. UTZ:

Q Mr. Hackney, referring to your Exhibit R-2, the r_w which you have used there that equals 100 feet, did you assume a hundred

feet due to sand fracking?

A Yes, sir. I assumed that as a maximum that might be obtained by sand fracking.

Q Did you assume an increased well bore radius from any other type of stimulation?

A Well, you could, that could be from any type stimulation treatment that effectively increased your well bore radius.

Q Would you say that that exhibit showed that sand fracking causes an increased gas recovery?

A Yes, it does, and that's what migrations indicate. That is, at least it does in low permeability ranges and as you get on up into higher permeability ranges, the effect of fracturing becomes less and less.

Q The higher permeability range increased recovery due to sand frac?.

A Yes.

Q Referring to your Exhibit 4, R-4 now, the elliptical contours around the Well 2-E, are those pressure contours?

A Yes, sir.

Q Do you know what the value of those contours are?

A No, sir, I do not. They do represent lines of constant pressure.

Q But you have no record, to your knowledge, of what they are?

A I have some numbers here which are not, do not represent what the actual pressures are there, that are relative numbers.

Q Well, let's refer to your Exhibit R-3, the elliptical contours around that well are pressure contours, are they?

A Yes, sir.

Q The outside contour is 950 pounds, is that correct?

A Yes, sir.

Q And the inside contour is 800 pounds?

A That was the inside contour closest to the well shown.

Q Would that indicate that abandonment of a well 2-E there would be 150 pound pressure at the outside contour, left in the reservoir?

A This rate on this, Mr. Utz, for this calculation, was not the economic limit. This assumed a rate of a million and a half feet a day at 600 pound bottom-hole flowing pressure, assuming an average permeability of five millidarcies for this net pay section and that left the well here and the permeability was constant, but the pay sections vary as indicated on this microlog map. That does not represent what would be left in place at abandonment.

Q Would that be an indication that there would be a higher pressure left in the reservoir, say 1320 feet from the well bore?

A Well, these pressure contours are increasing as you go out, of course, they are tending to flatten off, in other words, as you get further away from the well bore, they tend to flatten, being steeper as you come into the well bore.

Q Based on the study that you have made, what would be your opinion as to, well, let's cite a hypothetical case. We have heard

testimony that abandonment pressure of around 200 to 250 pounds would be agreeable. I assume you meant reservoir pressure. At 250 pounds well bore reservoir pressure, would the pressure all over the entire 160 or 320 acres be 250 pounds, or more?

A No, sir, it would not.

Q That's the point I want to find out. It would be more?

A It would be slightly higher for the 320 than it would be for the 160, and that would represent the increase in recovery you could get by drilling to 160, as compared to 320. Mr. Utz, I have some additional graphs and so on here that I could either present now or give to you later, which indicate in more detail --

Q (Interrupting) Do you have any opinion as to what the pressure increase from the well bore to, say 1320 foot radius would be? I'd be glad to have that -- if you don't have it --

A I have it for different conditions. Of course, the tighter the formation is, the steeper this curve is, and the more difference you have in pressure between the pressure at abandonment at 160 and 320, and the pressure in the well bore,where you get up to high permeabilities, this curve is almost flat. In other words, you have a very high recovery factor.

Q What would cause that pressure to remain out away from the well bore? Would it be resistant to permeability?

A Well, in other words, to get a certain flow rate you have to, according to this equation, fluid flow, you have to have a certain pressure gradient existing as you get closer and closer to

the well bore. Say you had another well out here that was draining this man, say this represented the boundary of a 320 and his curve might look something like this, coming back, but this -- then at the time that this well reached the economic limit, still the pressure gradient away from the well bore would follow this curve, at least until you got out to some boundary, or where you had interference, and on these low permeability wells, if they were offset by higher permeability, really the estimate of increased recovery from that well might be too high if this well were tending to drain, drain gas from that acreage.

Q It's your testimony then that the reservoir pressure would not tend to equalize abandonment pressure or would not equalize?

A They would tend to equalize; in other words, after a well was abandoned then of course this pressure sink would tend to fill in with time; and if you opened the well up again, you might be able to produce a quantity of gas out of it until you got down to that rate again, and then let this sink fill in again. I mean if you took an infinite time period, you could drain all the gas out.

Q Then whether or not it will equalize is a matter of time?

A Yes.

MR. UTZ: That's all I have.

MR. PORTER: Mr. Nutter.

By MR. NUTTER:

Q Mr. Hackney, does fracking extend out from the well bore in

a radial pattern?

A Not necessarily. I mean in theory, it should, if you had uniform conditions in all directions.

Q If the fracking did not extend out in a radial fashion, would that affect your calculations of using r_w of a hundred feet as you have?

A It could to some extent. That r_w was used as a means of calculating what an effective well bore radius might be, and if the frac pattern was in a, going out in one direction, why I mean it could have some effect, yes, sir.

Q Well, would the effect of radius of the well be greater or less if one narrow frac extended out three or four hundred feet instead of uniform frac extending out 100 feet?

A In my judgment it would be less if one, the effectiveness would be less if you had one narrow band extending out 400 rather than --

Q (Interrupting) Haven't some studies indicated that is the way a lot of these fracs do occur?

A I'm not familiar with that, sir.

Q Mr. Hackney, now on your Exhibits 3 and 4, or at least on 3, you said that you had assumed a certain bottom-hole flowing pressure and then calculated the isobaric contours from that point out?

A Yes, sir.

Q Is Exhibit 4 prepared in the same fashion?

A Yes, sir, it is.

Q Maybe the contours on that one are labeled, but there is no label on this exhibit that I have.

A As this information came out of the computer, these pressures did not have an absolute value to them. They just indicate where these lines of constant pressure are.

Q They are just relative to each other, then?

A Yes.

Q Well, what would be an abandonment pressure or abandonment flowing pressure in the bottom of the hole in a well such as here on Exhibit No. 4?

A This was not intended to show the gradient at abandonment. It was intended to show the gradient at a particular flow rate of a million and a half a day.

Q So there would be no way of telling what the pressure would be out some distance from the well at abandonment pressure, then, from this exhibit?

A Not from this exhibit.

Q How were these Exhibits 3 and 4 prepared, was a grid laid out and calculations made on various points on the grid?

A In the case of Exhibit 4, a grid was laid out and the computer made a solution for each grid point.

Q Then you connected the solutions by contouring?

A Yes. In other words, there was just a bunch of numbers up here and you had to draw your isobars on here.

MR. NUTTER: Thank you. That's all.

MR. PORTER: Anyone else have a question?

MR. HINKLE: I have one on redirect.

REDIRECT EXAMINATION

By MR. HINKLE:

Q Mr. Hackney, referring back to some of Mr. Cooley's hypothetical questions here in regard to the gas which might not be recovered by the drilling of additional wells, I believe that you assumed that it would be necessary to drill 42 additional wells in order to drill it up on 160-acre spacing. Now what would be, in your opinion, the cost of those 42 additional wells?

MR. GRENIER: It was 46, was it not?

MR. COOLEY: I think I calculated on 46.

A That would be somewhere around a million seven hundred some thousand dollars, plus the cost of the pipe line connections to connect the wells, which hasn't been considered.

Q Assuming, that you drilled the additional wells at that cost and they reached the point of abandonment at, say 100 pound pressure or 200 or 250 pounds pressure, which has been testified to here, that would indicate there's still going to be some gas left in the ground, doesn't it?

A Yes, sir, which you won't be able to get out.

Q Even if you drilled it up on 160-acre spacing, you would have to deduct the gas which is left in the ground at the abandonment pressure from the quantity which Mr. Cooley has questioned

you concerning, would you not?

A Well, in discussing with Mr. Cooley, this in our judgment would represent the maximum that you could get out. In other words, it assumes this 100 pound per square inch abandonment flowing pressure at the well, which I don't know if you can get or not; if the well makes any considerable amount of water I would doubt that you could draw it down to that pressure.

Q There would then be a considerable economic loss, anyway, in your opinion, if you did drill the 42 additional wells?

A Well, I don't see how there could help but be, but in other words, this tremendous investment is going to be made to recover an insignificant quantity of gas. Natural resources of steel, for instance, are going into that well as casing, and I mean --

Q (Interrupting) In other words, it would be a dissipation of other resources such as steel, in order to recover a relatively small amount of natural gas?

A Yes, sir.

MR. HINKLE: That's all.

By MR. GRENIER:

Q Mr. Hackney, you came up with this figure of two million three hundred thousand mcf extra recoverable, assuming this additional well were drilled on the 320-acre tract, I think that's right, with Mr. Cooley. That would represent an extra value for the field as a whole of some two hundred thirty thousand dollars, taking

your approximately ten cent figure, is that right?

A Yes.

Q And you would thus be getting two hundred thirty thousand dollars of additional gas out of the ground by means of an expenditure of, what was it, a million seven hundred?

A A million seven to eight hundred thousand.

Q Plus the cost of the pipe lines?

A Not including the pipe lines.

Q Would you consider any venture, even if it were guaranteed not just speculative, that was guaranteed to get you back two hundred thirty thousand dollars for every seventeen hundred that you put in an economic venture?

A I wouldn't, sir.

Q And in this case, are you guaranteed when you drill a gas well that you are going to get that much back?

A No, sir.

Q Would you say, then, that the drilling of these additional wells was economically justifiable?

A Did you say was or was not?

Q Well, you state which you think it is, please.

A I was trying to find out how you stated the question.

Q I think I said, do you think it was economically justifiable. You can give a direct statement.

A In my judgment, the drilling of the additional wells would not be economically justifiable on the basis of additional

gas, even an optomistic estimate on what could be recovered on the drilling of additional wells.

MR. PORTER: Anyone else have a question? The witness --

MR. COOLEY: (Interrupting) I have one more question.

RECROSS EXAMINATION

By MR. COOLEY:

Q How long would it take to pay out a well on 160 acres?

A How long?

Q Yes, sir.

A It depends, it would depend on the rate at which the well would produce, and if you had proration, what type allocation formula you had.

Q Evidently some calculations have been made in that record because it is assumed by all present here that 160-acre spacing would be economical; in other words, that it would be paid out in reasonable time. If you are not prepared to testify --

A (Interrupting) I have testified that I did not think it would be economical, sir, except if you are going to define economics as the gas under that tract, I mean being able to pay out the cost of the well.

Q That's precisely what I was referring to.

A Well, I mean I can, I don't see that that is a yardstick to go by.

Q I didn't ask you whether you thought it was a yardstick. I asked you how long you thought it would take to pay it out, producing the well at some given rate. The capacity, if nothing else

A I can't say that the well would pay out.

Q Then you do not believe that the recoverable reserves on 160-acre tract in the Tapacito will pay for the drilling of a well to that pool?

A I don't believe that the additional gas would pay --

Q We are not talking in terms of additional gas. I am talking in terms of how much recoverable gas in place in the 160-acre tract in the Tapacito. Will that gas that is in place there pay for a well? We have assumed all through my previous questioning, have you, that it would?

A Yes, sir. As far as I know,in some cases 80 or 40 acre there might be enough gas under 80 or 40 acres to pay for the drilling of additional --

Q You do not have any knowledge of how long it would take to pay out?

A I don't know what, I mean it depends on the rate at which the well can be produced.

Q Assuming that they are produced at capacity --

A At capacity?

Q Yes.

A I can't make an estimate as to that that I think would be reasonable, because I don't know the conditions.

Q Do you know the capacity of the wells in this pool?

A Well, they have been tested that some of them have a million and a half to around a million average producing rates into the

pipe line, based on the days they have been produced.

Q If they produced at capacity, how long would it take them to pay out?

A It would take, if you had a well that could produce at a million, say a million feet a day, that would produce at that rate until, at a constant rate that would be roughly a hundred dollars a day or thirty thousand dollars a year, should pay out maybe in a year or year and a half on that basis.

Q Do you consider a well that pays out in a year or year and a half an economic venture? Just answer yes or no.

A I don't agree with your definition of how a well is paying out, though.

Q This is a completely hypothetical question. Do you consider that a well that pays out in a year and a half is an economic venture?

A I don't know if I am going to get that million. I might get 100 mcf a day, which would never pay out.

Q Either answer my question or tell me you have no opinion.

A I have no opinion, sir.

MR. PORTER: Anyone else have a question?

MR. HINKLE: Let me ask one more question, in view of Mr. Cooley's question here.

REDIRECT EXAMINATION

By MR. HINKLE:

Q Taking the field as a whole, do you believe that it can be

economically developed by drilling one well to each 160-acre subdivision?

A Let me put it this way, Mr. Hinkle, since the pool is already developed on 320 and a certain amount of gas can be recovered from those wells that are drilled on 320, I do not believe that the investment required to drill the additional wells to drill on 160-acre spacing can be justified by the additional gas that can be recovered.

Q Or ever recovered?

A Yes.

By MR. GRENIER:

Q Would the drilling of these additional 46 wells cause, in your opinion, an economic loss to the operators? That is to say, is more money being invested here than is necessary adequately to develop this field?

A In my judgment, yes, sir.

Q So that these would be unnecessary wells, these extra 46, in your opinion, is that correct?

A In my opinion they would be.

MR. GRENIER: Thank you.

MR. HINKLE: That's all.

MR. PORTER: The witness may be excused.

(Recess.)

DAVID L. NICOL, JR..

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

BY MR. GRENIER:

Q Please state your name for the record.

A David L. Nicol, Jr.

Q By whom are you employed and in what capacity?

A Southern Union Gas Company. Employed as an engineer, working on special projects.

Q Are you a graduate engineer, Mr. Nicol?

A Yes, sir. I was graduated from Carnegie Institute of Technology with a Bachelor of Science degree in chemical engineering, and from the University of Michigan in 1950 with a Master of Science in chemical engineering.

Q By whom have you been employed since you graduated from engineering?

A Following my graduation from the University of Michigan, I was employed by the Institute of Gas Technology in Chicago. Since 1952 I have been employed by Southern Union Gas Company.

Q What generally was the scope of your work with the Institute of Gas Technology?

A Well, in that position I was supervisor of the several development laboratories for calculation of distribution flows and for design of appliances.

Q It was largely mathematical calculation work, is that correct, theoretical calculations?

A It included a number of theoretical calculations based on fitting experimental data in theoretical mechanisms.

Q What has been your work with Southern Union Gas Company?

A For the first four years I was attached to the engineering department, and in that connection I have made several studies of pipeline design, gathering system design, all of which required forecasting of estimated reserves, recoverable rates and other chemical studies to determine the best way to supply the gas to our various towns.

Q Did that work also involve you in what might be referred to generally as theoretical mathematics?

A Not to any great degree. There is a certain amount of mathematics involved in any engineering work. The use of various equations which are used in engineering require a knowledge of the theoretical background of those equations.

Q Now, in connection with the present proceeding, have you made any studies on either a specific or theoretical basis to determine what the relative unrecoverable reserves would be at abandonment of a well on a 160-acre as contrasted to 320-acre spacing?

A I was requested by Mr. Widerkehr to investigate some of the methods proposed by Muskat in his books on "Homogenous Liquid Fluid Flows" and from those particular books are derived theories

and the equations which have been called the Darcy equations and several other equations which will directly give you the pressure distribution throughout a reservoir for radial conditions assuming you have constant permeability and constant thickness.

Q Now, you said liquid flow. Would that also be applicable to flow of gas such as natural gas?

A I meant to say fluids. Fluids are considered to be both liquid and gases.

Q So those equations would be applicable to the flow of gases?

A These are in particular applicable to gases.

Q Now, describe for us briefly, if you can, the nature of these studies which you have made, and the results which you obtained therefrom, indicating also for us, if you will, the extent to which, if at all, they collaborate the testimony which has just been given by Mr. Hackney as to the extent of reserves which might be left in place by 320 as contrasted to 160-acre spacing?

A Well, the distribution of pressure throughout a reservoir going from the well bore out toward the radius of drainage could be approximated as a number of concentric circles and the reserves in the reservoir at any given time could be computed by taking the pressure at any given concentric circle and multiplying that by the area of that sum, the average reservoir pressure there, so that by taking the circle one foot out from the well bore you can determine the average pressure multiplied by that area and subse-

quently taking the area from between one foot out and two foot from the well bore and calculating the area. You sum this up and arrive at the total gas left in the reservoir when the well is flowing in a steady state.

Q Now, what does that mean when a well is "Flowing in a steady state," Mr. Nicol?

A Well, in these wells in which we have a rather high degree of permeability, or rather low permeability, it takes a certain amount of time for the well to stabilize at a constant flow rate, and it is presumed that after some lengthy time, it will arrive at that steady state where you will have no further decline on the flow, except for the decrease in the total reservoir pressure.

Q This, then, is assuming that the well has effectively got out and is pulling against the full circle of its drainage as limited by the presence of other wells around it, is that correct?

A This assumes that. Any pattern which is on a rectangle can or demands that sooner or later the wells will reach a point somewhat equal distant from each well in which the gas will be flowing to either well, and there will be a point of no flow, and this was what we now call the radius of drainage.

Q Now, starting from this, where did you go from there?

A Well, as I spoke of, this method of determining the reserves could be done by taking the average pressures over a number of these concentric rings. It also can be done through mathematics

in a calculus method in which I have done on this Exhibit. I don't wish to try to explain this complete derivation at this time, but on the second page of this Exhibit I have an equation which is the solution of disintegration which, in my belief, is the exact ratio of the reserves under a 160 tract and a 320-acre tract at any given time during the steady state condition of flow.

Q Now, this is entirely a theoretical calculation, then, is that correct?

A It is theoretical in the respect that the original equation describes the pressure distribution through the reservoir, and is considered to be theoretical.

Q Does it relate to the Tapacito as contrasted to other fields?

A No, it is applicable to any gas field.

Q In the derivation of this solution on page 2, did you have to use any constants there?

A I had to use the ratio of the pressure at the well bore and the pressure at the edge of drainage, which I assumed to be 80 percent of open flow conditions. In other words, the pressure at the edge drainage divided by the pressure of well bore squared was equaled to .8.

Q Were there any other constants that you had to assume? I see over here on the last page nomenclature that you have several factors there.

A I believe I need to correct myself here. This ratio of

PW divided by P squared for the conditions of this solution actually was .2. Would you please let me have your question?

Q I was asking if, referring to this nomenclature page, such elements as (H) the thickness of the producing zone and (F) the porosity of the producing zone and permeability and viscosity, whether you had to make any assumptions as to those values for purposes of your equation.

A I had to make assumptions as to the relative values. I did not make any assumptions as to the actual values.

Q You assumed they would be the same for 160 and 320, is that right?

A That is right. I assumed the same thickness, the same porosity, the same permeability and same viscosity for the two comparable wells.

Q Now, when did you then apply this solution equation shown at the bottom of Page 2, in an effort to determine approximately how much gas would be left in place under these theoretical conditions, 320 as contrasted to 160-acre spacing?

A Well, I have made an application of this equation by inserting in certain constants, one of the constants being merely the fact that the radius of drainage of 320 is approximately 1.4 times the radius of drainage of 160; this more or less being the fact that the one area is half the area of the other. This second assumption, this ratio I spoke of before, I also have the basic assumption involved in this particular explanation that the pres-

sures at the well bore and at the radius of drainage would be the same for both type spacings.

Q That is at the time of abandonment?

A Yes, sir.

Q What conclusion did you reach, then, if any, as to the additional volume of gas which might be left in the ground on 320-acre spacing as contrasted to 160?

A Well, the amount of gas is practically negligible, and in this particular example it came out to less than one-tenth of one percent.

Q Now, that was based on the assumption that you would be abandoning both wells when they had equaled what, equal the same pressure at the well bore?

A Same pressure at the well bore and same pressures at their respective edges of drainage.

Q That would be somewhat lower than Mr. Hackney indicated in his Exhibits?

A Yes, it would be, for one very good reason and that is, that this particular solution is abandonment based on reservoir pressure alone. Now, his abandonment was based on the economic flow rate. If I set my flow rates at abandonment to be equal, this would cause me to carry a higher pressure at the edge of drainage for the 320-acre spacing, and this increase in pressure at the edge of the 320, will, instead of having a difference of approximately one-tenth of one percent, will increase it up to the range

of two percent.

Q Would that be fairly consistent, then, with the results reached by Mr. Hackney, as set forth in Humble's Exhibit No. 2?

A Yes, sir, it would be representative.

Q So that your studies and his came out to, yours on a theoretical basis, and his on the most immediate studies of the Tapacito Field, came out to substantially the same results?

A If I might say, my result is primarily one point on his curves. And in that respect, I believe that it reproduces his results exactly.

MR. GRENIER: That concludes the testimony of this witness. Excuse me, was Exhibit 8 -- just a moment, was Exhibit 19 for identification, this was prepared by you, Mr. Nicol?

A Yes, it was.

Q And it represents merely your derivation of the formula which you used in verifying Mr. Hackney's work, is that correct?

A That is correct.

MR. GRENIER: We ask that it be admitted in evidence.

MR. PORTER: This will be identified as Southern Union's Exhibit 19. Without objection it will be admitted. Any questions of Mr. Nicol? The witness may be excused.

(Witness excused)

MR. DAVIS: Aztec Oil & Gas Company owns an undivided 50 percent interest in some twenty-four sections within the vicinity of the Tapacito Pool, and Southern Union, the owner of the other

half interest, is the operator. Therefore, this witness' studies and testimony along these lines would be to some great extent repetitious. In the interest of saving time and trying to get this hearing over, we are going to simply limit our direct examination to a few general questions if it is all right with the Commission.

MR. PORTER: Yes, sir.

WARREN MANKIN,

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

BY MR. DAVIS:

Q Will you please state your name?

A Warren Mankin.

Q By whom are you employed, Mr. Mankin?

A Aztec Oil & Gas Company.

Q In what capacity?

A Chief engineer.

Q How long have you been serving in that capacity, Mr. Mankin?

A Since September, 1957.

Q Have you previously testified before this Commission as a petroleum engineer and geologist?

A Yes, I have qualified as such some five years ago.

MR. DAVIS: Are the qualifications of this witness accept-

able?

MR. PORTER: Yes, sir. I think he has been here before.

Q Mr. Mankin, are you familiar with the characteristics of several Pictured Cliffs Fields in San Juan?

A Yes, I am.

Q And you have made studies of the various Pictured Cliffs Pools and the sands and things of that nature?

A Yes, I have.

Q How does the Tapacito Pool generally compare with these other Pictured Cliffs Pools?

A Well, the Tapacito-Pictured Cliffs Pool is laid down quite similar to all other Pictured Cliffs Pools, primarily in northwest, southeast trends due to sand bar development. This pool, in my estimation, is by far the best Pictured Cliffs Pool in the entire San Juan Basin, and this is due primarily to better porosity and permeability development.

Q What, in your opinion, is the apparent drainage pattern for the Tapacito Pool, Mr. Mankin?

A It is essentially a radial type drainage, and it appears to be draining a similar radial pattern to what other Pictured Cliffs Pools do. There is only a few channels to this wherein along the edge of the pool it may be somewhat deflected by the pinch-out or by the microlog development, so that it might be somewhat affected by this edge on the pool, but essentially it is of a radial nature.

Q Mr. Mankin, would you like to refer to Southern Union Gas

Company's Exhibit No. 1, for example, and give us your theory of this radial --

A Yes, I would. Southern Union's Exhibit -- I think I could show it from here -- Southern Union's Exhibit No. 1, I make particular reference to a joint well which we have with Southern Union, which is the Jicarilla 5 Well located in the southwest quarter of Section 30, 26, 3. I am pointing to that particular well which at the present time is along the edge of this Tapacito-Pictured Cliffs Pool. That particular well has produced in the neighborhood of 640 million cubic feet of gas in a period of time from the latter part of 1956 through the 1st of May of 1958. That, on the basis of some exhibits put in by Southern Union, would appear that it has produced approximately 75 percent already of the reserves on a hundred pound abandonment pressure basis of which Mr. Reese had previously given this well, of some 835 million. So, on the basis of that, it must be draining from a much larger area than 160, and certainly, as implicated by Mr. Widerkehr, it must be draining either close to 320 or even greater than 320 because this particular well has not been influenced by the shut-in well which was in the interference test, the 4 "D" Well.

Q Where is that located?

A The northeast quarter of Section 30, just diagonally from the well in question.

Q What is the distance approximately?

A It is approximately, oh, less than four thousand feet,

thirty-five hundred feet. That well has been shut in since completion, until March of 1958, because it was on interference test, and has been producing since that time some million and a half cubic feet of gas a day, so it has not been influenced particularly from any interference from that well and, therefore, on the basis of the reserves given by Mr. Reese, it must be draining essentially in a radial pattern. If it were attempting to drain a rectangle, which was implied by previous testimony, as shown by these other exhibits, shown by this Gunsight Butte Exhibit No. 2, it would be approaching the edge of the pool and could have only produced something less than half of what it has now produced to date. So it is my feeling, from observing other Pictured Cliffs Pools, that this well is certainly draining at least 320-acres and is draining essentially in a radial pattern. It might be in a teardrop pattern as the Humble Exhibits showed previously, and the Isoberg maps.

Q Mr. Mankin, in the Tapacito Pool, is it your opinion that one well will efficiently and economically drain 320 acres?

A Yes, sir.

Q And, therefore, the drilling of two wells on a 320 or 160-acre pattern would be an economic waste to the operators in that area?

A Yes, sir.

Q Do you have any other comments or suggestions in connection with this hearing?

A The only other comment would be to again refer to the inter-

ference tests that were taken on two wells in this area. One was the Jicarilla 1 "E" in the southeast, of which we had no interest in but which was Southern Union's and Humble's well, and the other is the Jicarilla 4 "D", which I just mentioned in the northeast of Section 30, 26, 3. These wells are some five miles apart. They very definitely show interference and they definitely show that these wells are draining in a radial pattern. I believe that's all I have.

MR. DAVIS: That completes our testimony.

MR. PORTER: Any questions of Mr. Mankin:

CROSS EXAMINATION

BY MR. COOLEY:

Q Mr. Mankin, have you made any studies as to what amounts of additional gas would be recovered from the Tapacito Gas Pool if it were developed in on 160-acre pattern rather than 320?

A Very roughly, I estimate it would be a very minute quantity.

Q Are you acquainted with the exhibits presented here and information presented by Mr. Hackney?

A Yes.

MR. COOLEY: Thank you.

MR. PORTER: Any further questions of the witness? The witness may be excused.

(Witness excused)

MR. GREER: Unless we have some unknown allies, that will conclude the presentation for the 320-acre spacing.

MR. KELLAHIN: If the Commission please, it is now 4:30. We do have some testimony to present, but in view of the testimony

that has been presented here tody, we will find it necessary to prepare additional rebuttal testimony which we will not be able to tonight. We would like to go on tomorrow. If the Commission desires, we will go on and put on what we have, but we would rather come back in the morning and complete our case. Certainly, in the light of the exhibits and testimony that has been offered here today, we cannot prepare rebuttal testimony while we are sitting here in the few minutes of time available to us. We would abide by the desires of the Commission, but we certainly couldn't complete our case tonight.

MR. PORTER: Let's hear what you have.

MR. KELLAHIN: We will call as our first witness Mr. Val Reese.

(Witness sworn)

VAL R. REESE,

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A Val R. Reese.

Q Are you the same Mr. Reese who previously testified in this case at the hearing in February?

A Yes.

Q At that time you qualified as a professional engineer and

consultant, and had your qualifications accepted?

A Yes, sir, that's right.

MR. KELLAHIN: Are the witness' qualifications acceptable?

MR. PORTER: Yes, sir.

Q Mr. Reese, in connection with this case now before the Commission, have you made an additional study in regard to pressures in the Tapacito and adjacent areas?

A Yes, I have.

Q Now, referring to what has been marked as Exhibit, Gun Sight Butte's Exhibit R-1, will you state what that is?

A That is a pressure map prepared across the Tapacito-Pictured Cliffs Gas Field and the Blanco-Pictured Cliffs Gas Field.

Q Now, referring to that pressure map, on what are those pressures based?

A Those pressures are based on the seven-day shut-in period that is required for an initial gauge.

Q And how are they noted on the map?

A They are noted on the map by large slanted letters that are underlined in red.

Q There are also other figures on there. What do they indicate?

A The other figures are the depth to the top of the Louis Shale or through the Pictured Cliffs, and that is a large vertical letter, and this smaller figure is the well potential and the number of the well is indicated.

Q And also the well name or designation appears on the map, does it not?

A Yes, that's right; like the 15 J well.

Q What do you mean by this seven-day shut-in term?

A The seven-day shut-in is the period of time required for the gauging of a gas well; that is, the well is completed and then shut in for a normal period of seven days in order to allow the pressure in the well to build up, and then a potential test is taken.

Q Is this done on all the wells when it is completed?

A Yes, sir, it is.

Q That is required by State regulation, is it not?

A That is required by State regulation.

Q Now, referring to this pressure map, what are the pressure readings in the South Blanco and the Tapacito-Pictured Cliffs Field?

A The pressure readings comparatively -- for example in Section 23 of 26 North, Range 5 West, are a thousand and fifteen pounds, a thousand and twenty-six pounds, a thousand, forty-three pounds, a thousand fifty-one pounds. And again in Township 26 North, Range 4 West, in Section 9, the pressures are a thousand and twenty-six pounds, nine hundred forty-two pounds, and in Section 30, thousand fifty-nine pounds, a thousand fifty-five pounds. And then in the southeast part of the South Blanco Field in Section 28, the pressures are nine hundred and ninety pounds, a thousand, eleven hundred and thirty-two pounds and a thousand and sixty pounds. Then in the Tapacito Field, in Township 25 North, Range 3

West, Section 16, the pressure is a thousand and forty-nine pounds; Section 10 the pressure is a thousand and twelve pounds, and a thousand and twelve pounds. And going northward along the Tapacito Field, in Section 16 of 26 North, 4 West, the pressure is a thousand and fifty pounds, a thousand and eighty-four pounds. In Section 36 or 27 North, Range 5 West, the pressure is a thousand and eight-two pounds. In between the two fields in Section 5, there is a pressure of a thousand and thirty-nine pounds, and in Section 4 there is a pressure of seven hundred seventy-five pounds, located in Township 26 North, Range 5 West. In Township 27 North, Range 5 West, Section 32, there is a pressure of a thousand and sixty-four pounds. And in Township 25 North, Range 4 West, Section 10, a pressure of a thousand and twenty-three pounds and a pressure of nine hundred and ninety pounds, that is also between the two fields. In Township 25 North, Range 3 West, Section 21, there is a pressure of a thousand and twenty-two pounds, and in Section 22, there is a pressure of a thousand and thirty-two pounds. It can be seen from this map that the pressure across the two fields and between the fields is within a range of fifty pounds.

Q Now, in connection with the Exhibit, Mr. Reese, I believe in Section 29, Township 26 North, Range 4 West, there is a pressure of some nine hundred and forty-two pounds. Can you account for this pressure being lower than the pressures in the surrounding wells?

A The lower pressure can be accounted for by several causes.

One of them may be that the frac fluid used in completing the well may still be in the well and not allowing the well to build up. Another one may be that the well is in a local low permeability area where the build-up is very slow. Sometimes wells will not build up to the maximum pressure in three months of time, and then an additional reason is that sometimes operators do not leave the wells shut in for seven days. They will often gauge them in twenty-four hours of time and term the gauge as a twenty-four hour gauge, so you don't get the true build-up.

Q Would that same explanation apply to other isolated instances where wells of low pressure appear in the vicinity of high pressure?

A There is another reason and that is that the formation itself may produce some fluids which would tend to minimize the well head pressure.

Q I believe in your previous testimony in this case at the hearing in February, you testified that you had made numerous reserve calculations yourself and in your office, is that correct?

A Yes, that's correct.

Q Now, in making reserve calculations, what do you normally consider in regard to pressures under these circumstances?

A We consider the average pressure of the highest shut-in wells in any given area. That is, we take wells that show the highest pressure, We might say, in a given township, take four wells, and by taking the highest well head pressure, we know that

those wells have the least amount of fluid in the well bore, and, therefore, we know that in calculating the bottom hole pressure that we will come closer to the true bottom hole pressure, and we use that method when there is no bottom hole pressure surveys available.

Q Now, you made no effort to contour this pressure map, did you?

A No, we haven't because of the pressure, as it extended entirely across the map; clear over into Township 27 North, Range 3 West, there is pressures of a thousand and fourteen pounds and a thousand and thirty-four pounds. There would be little point in contouring them because the only variation would be the local low pressure wells in it, and there would be a slight difference overall, maybe fifty pounds clear across.

Q In the hearing in February and basing your conclusions upon information contained on three cross sections which were offered in evidence at that time, I believe you stated, in your opinion, the South Blanco and the Tapacito-Pictured Cliffs Pools are, in effect, one common reservoir, is that correct?

A Yes, that is correct, and in that hearing we presented those cross sections to show our ability to trace those sands.

Q Now, would you say from the information and based upon your pressure study and the information contained upon Exhibit No. R-1, does that support your conclusions as to the factors of a common reservoir?

A Yes, it does. This pressure study supports our conclusions

that both fields are a common reservoir. It also supports our conclusions that the pressures as found in between the fields are indicating permeability. Even though the microlog reads zero, the pressure as indicated by those wells would indicate some measure of permeability because if there were no permeability you could get no pressure build-up in the well. And our microlog study of the main Tapacito Field is, therefore, only based on the measureable permeability on a microlog whereas these pressures in between the field indicate our sands present which are permeable.

Q Have you examined logs on those sands, Mr. Reese?

A I have examined all of the micrologs outside of the Tapacito on fields adjacent to the field.

Q Did you find wells that showed no microlog permeability which are producing from the Pictured Cliffs sands?

A Yes, I have.

Q Would you point out a few of those, please?

A Skelley Well in Section 18 of 25 North, Range 3 West, shows zero permeability. The Magnolia Well, No. 5-B in Section 20 of 26 North, Range 3 West; the one seven well in Section 7 of Township 26 North, Range 5 West.

Q In connection with your testimony of the Magnolia Well, were you referring to the 5-B or 2-B, Mr. Reese?

A I was referring to the 2-B well.

Q Now, have you examined the logs on -- would you just describe what you found, for example, in Sections 29, 30, 31 and 32 in

26 North, 4 West?

A In that area we found one well with a permeability -- measureable permeability on the microlog of two feet, I believe.

Q Two feet. As to the other wells within those sections, did you find any microlog permeability?

A No, I didn't. There are not many micrologs available on those wells in there, but the ones we did look at, the maximum was two feet.

Q On that basis, would you say that just because a well microlog shows zero permeability, it has no reserves?

A No, I would not. The reserves and the permeability are two separate things. We find that many of these sands in the Pictured Cliffs or the Mesaverde have good porosity and low water saturation, and you can calculate large amount of reserves. However, the permeability will occur in those thick sands in streaks.. In other words, you may have a measureable permeability of ten milladarceys in one foot,and then the next foot will be .001 milladarcey, and the next foot .5 milladarceys, so that you have a variation in the permeability. And the very fact that a well even in an area in which there is no measureable permeability will pressure up at the top of the well is an indication or a measure of some kind of permeability by the recent techniques developed by Cole Laboratory. They are not too recent, they started about two years ago in developing instruments to measure lower and lower permeability. The reason was that gas was being produced from inpermeable sand or from sand in

which their instruments recorded no permeability and recorded at zero, and gradually the permeability measurements have gone down to as low as .01, or in some cases indicating less than .01.

Q Were the measurements of these permeabilities in 1954 as accurate and carried down to as fine a point as they are today?

A No, they aren't, and there will probably be newer developments for measuring even lower permeability than there are at the present time.

Q So when you say you have an area of zero permeability or microlog permeability, it doesn't necessarily mean that there is no permeability, is that correct?

A That is correct. The very fact that wells are producing now from what we call inpermeable sands.

Q Are they commercial wells?

A I can answer the word commercial by saying that El Paso is drilling on this low permeability area on 160-acre spacing, and they have just recently made two new locations in Section 24 between the two fields.

Q What township and range?

A 26 North, Range 5 West. And the reserves there are lower in that area than the Tapacito Field, which we have been talking about. However, I believe the word commercial would come back to the market demand, and El Paso is drilling those or is drilling those wells for market reasons.

Q In other words, it is your conclusion that if there is a

market for the gas, the wells will be drilled?

A That is my conclusion. The fact that if there is a demand, the wells will be drilled.

Q Now, on the basis of your pressure map and your previous correlation of the sands, as between the South Blanco and the Tapacito Gas Pools, do you see any reason for a 160-acre spacing pattern in one pool and a 320-acre spacing in the other?

A I can see no reason at all for the difference of the spacing in the same reservoir in the same sand.

Q Is there any geological reason for the different spacing in the two pools?

A There is no reason that I know of.

Q Now, in connection with the Exhibit No. R-1, do you have anything else to draw from that, Mr. Reese?

A I would like to add, on the well potentials obtained in drilling a field, that the thing to look for or the thing at least that I have always watched for is not the real small well or a real high well, but an average. In other words, say, out of fifty wells, you may have ten wells that gauge a half a million or a million, and you might have four or five wells that gauge twenty million, but your average may be four million.

Q Do you have anything else, then, in connection with that Exhibit?

A I would like to add that in talking about the permeability that in our study of permeability we believe that the larger the

spacing the slower the total reserves will be drained out of any given area because of the variation of permeability within the sand reservoir. If a highly permeable streak is present, say throughout a 320-acre or 160-acre, that that permeable streak will be drained faster than the inpermeable streaks and that if the area is drilled on 160's that it will result in the quicker -- more quickly draining of the impervious permeable areas.

Q Would that, then, in effect, mean the recovery of gas which would not be recovered on a wider spacing pattern?

A That would mean the higher recovery of gas because of the double, say, drilling on the two 160 in relation to one 320. In a 320, due to the variation of permeability within a sand reservoir, you may leave gas behind or you may drain the area of 320-acres in, say fifty years of time.

Q Now, you heard the testimony of Humble's witness. I believe one of them used a figure of .5 milladarceys for permeability figure. Would you agree that that is representative of the pool as a whole?

A I would think it would be representative of the permeable streaks, or the permeable pay as measured on our microlog. However, it wouldn't be representative of the additional gas sands that we have indicated and given reference to in that area because of their low permeability which even within the same well are not measureable. However, those gas sands contain considerable reserves, and the permeable streaks serve as a conduit or a pipe draining into the

well, and the areas of lower permeability above and below the permeable streak drain into the permeable channel.

Q Now, extensive tests and Exhibits have been presented here to show that one well will drain in the better portions of this pool 320-acres. Do you agree with that?

A In a direct parallel to the best development of the permeability, there is a strong probability that the wells will drain in excess of 320-acres in the permeable zones and drain across the property lines.

Q Now, would you agree that wells near the edge of the pool would likewise drain and develop 320-acres?

A No. I would say that where the good permeability drops, why your drainage will also drop, and you'll leave areas undrained or that they will drain very slowly in relation to the highly permeable area.

Q Would it be economic, in your opinion, to develop those areas on a 160-acres?

A Yes, it would, and I think it would be economic to develop the good Tapacito area on the basis of 160-acre spacing because of the additional gas that could be recovered, plus the additional gas that can be recovered from the low permeability zones above and below the good permeability which has not been taken into account except in our reserves, and that is why our reserves are a little higher than anyone else's in this particular hearing.

Q So even in the better portions of the pool you advocate

160-acre spacing to avoid leaving gas in the reservoir?

A That's correct, and to avoid draining gas across property lines.

Q Now, in your opinion, could production be carried down to a hundred pound abandonment pressure?

A Yes, I believe it could be. I know of instances also where wells are produced on a vacuum in West Virginia and other areas.

MR. KELLAHIN: At this time we would like to offer in evidence Gunsight Butte's Exhibit No. R-1.

MR. PORTER: Any objection to the admission of this Exhibit? It will be admitted.

MR. KELLAHIN: If the Commission please, we would ask that the hearing be recessed until tomorrow morning to give us an opportunity to examine the new exhibits which have been offered here today. It is extremely difficult for me to present my rebuttal testimony without examining those exhibits and preparing such testimony, and certainly in this case the proponents of 320-acres had ample opportunity to look at our exhibits. I think it would be reasonable to ask that we recess until tomorrow morning, it now being five o'clock.

MR. PORTER: What time do you usually quit?

The hearing will recess until nine o'clock tomorrow morning.

MORNING SESSION,

MR. PORTER: The meeting will come to order, please. We will proceed with Case No. 977. Mr. Kellahin.

DIRECT EXAMINATION (Continued)

BY MR. KELLAHIN:

Q Mr. Reese, referring to your Exhibit R-1 again, examining that Exhibit, there would appear to be a pressure gradient from the southwest to the northeast portion of the Exhibit. How would you account for that?

A I would account for that by greater depth of burial of the Pictured Cliffs as it goes from southwest to northeast. The difference in the pressure is -- in the south Blanco-Pictured Cliffs Field is, in Section 28, 1132 pounds, and the highest pressure in the Tapacito Field is 1094 pounds. And over to the east in 26 North, 3 West, the highest pressure is 1146 pounds. There is some indication that there is a higher pressure due to depth of burial going from east to west. Southeast to northeast, I mean.

Q That pressure gradient would in no way, then, affect your conclusion that this is a common reservoir, would it?

A No, it would not.

Q Now, you heard the testimony of Mr. Widekehr to the effect that you attribute ten feet more net pay to the Tapacito than he would consider as being there. How do you figure your net pay?

A Our net pay was figured on a minimum of 5 percent porosity

and less than 60 percent saturation, based on core information, and then correlated to the Schlumbergers, and in using that method, why we disregarded permeable zones and only took in the higher and more porous sand stones with the lower water saturation.

Q You say you disregarded permeable zones?

A Yes, in figuring our reserves, our permeable zones were plotted on our micro porosity map and our total net sands were plotted on our net sand.

Q Now, referring to Southern Union's Exhibit No. 8, that appears to show reserves on the basis of gross sand thickness and also on the basis of microlog thickness. Does that, in your opinion, reflect in any way that gas will be left in the reservoir on 320-acre spacing?

A Yes, sir. These two comparative reserve calculations shown; the reserves in the good microlog zones, and in the total porous sand reservoir that we have calculated. The net microlog zones is in reality a total of the various, or the varying microlog porosities within a well. As an example of that, the Indian "E" Well located in Section 16 of 26 North, 4 West, has a core record of permeabilities which illustrate the varying permeability within the sand.

Q Now, is the core record to which you are referring an Exhibit in this case?

A It is not an exhibit in this case, but it has been placed in a previous --

Q In a previous hearing in this case, has it not?

A Yes. I would like to read some of these just to show how the

permeabilities vary. From 3414.5, the permeability is .38; 3451.5, the permeability is .81; 3416.5, the permeability is 1.20. These are milladarceys in parts of a milladarcey. From 3417.5, the permeability is .55; 3418.5 the permeability is .55; 3419.5, the permeability is 1.37; 3420.5, the permeability is 1.46; 5421.5, the permeability is 1.03; 22.5, the permeability is .85; 23.5, the permeability is .202; 24.05 the permeability is 5.76; 25.5, the permeability is 15.10; 26.5, the permeability is 2.56; 27.5, 18; 28.5, 10.8; 29.5, 163, and then at 34, 33.5, the permeability is 18; 34.5, the permeability is 27; 34, 35.5, the permeability is 29; 36.5, the permeability is 2.10. That illustrates the variation of the permeability within the sand. The average permeability in this particular well is 7.08 and the average porosity was 18.3, and the average oil saturation was .24, and the connate water saturation was 39.6.

Q Now, referring again to this Southern Union's Exhibit No. 8, if the pool is produced to abandonment pressure as it is now being drilled and produced, which column, in your opinion, that is, reserve column, more nearly reflects the reserves that will be produced on this 320-acre spacing, in other words?

A On 320-acre spacing, in my opinion, the reserves would be produced closer to the microlog reserves. For example, in the Jicarilla No. 1, in Section 10 of 26, 4, the microlog reserves are one million, four hundred sixty million, four hundred eighty MCF. If the field is produced on the 320-acres, I believe that more of

the gas will be produced from the microlog porosities, and the total recoverable reserves would be closer to the net microlog reserve figure.

Q Now, what would be the effect if the pool were drilled and developed and produced on the basis of 160-acre spacing?

A Well, the effect would be that the total reserves which we have calculated as three million one hundred twenty-nine million, six hundred thousand under this same well would -- that the production should, on 160, come closer to that total recoverable reserve figure due to the fact that there would be two wells in that location.

Q Now, why does this result occur, Mr. Reese?

A Well, the one well on 320 would be draining through the permeable zones into the well bore and the permeable zones would be draining the lower permeabilities in between the higher permeabilities at a slower rate, and over a greater distance. The pressure around the well would be lower and the pressure gradient from the highly permeable zones into the low permeable zones would be more effective for drainage, but as you got further away from the well the more porable zones would have less and less tendency to be drained, whereas if you had two wells on the 320-acres, you would have a much greater drainage effect into the inpermeable zones. The high rate of drainage in this area could drain the more coarse zones and leave some quantity of gas between our three million cubic feet of total reserves, and the one and a half million cubic feet of microlog

reserves.

Q Now, you heard the testimony to the effect that the amount of gas which would be left unrecovered on the reservoir on the basis of 320-acre spacing would be negligible. Do you agree with that?

A No, I don't. There is no way of actually calculating how much gas would be left in the reservoir due to the varying permeability, but the best figure that I can arrive at is by referring to these two reserve calculations, and, as I say, there might be as much as a million and a half cubic feet of gas left under this one well, and perhaps it might be that high in the No. 1 Jicarilla.

Q Now, which well are you referring to, the No. 1 Jicarilla?

A The No. 1 Jicarilla in Section 10, 26 North, 4 West. I am just using it as an example.

Q Is that the significance you attach to the figures as to that well which appears on Exhibit 8?

A Yes. It pretty clearly illustrates to me that there is a large percentage in there of reserves that could or coult not be produced on a 320-acre spacing.

Q Now, Mr. Reese, to clarify this, we have been referring to permeable zones and that reference has been made throughout the testimony in this case. Are these permeable zones continuous throughout the pool?

A No, they aren't. One purpose I had in reading these permeabilities was to show their variation within the well bore.

However, comparison between wells in the same sand will show that the exact permeabilities in one well cannot be correlated to the permeabilities in adjacent wells.

Q In other words, these permeable zones are integrated through the formation?

A Yes. They are probably more thought of as permeable streaks; that one particular permeable zone may extend back from the well bore for an unknown distance, and then another one appear in the reservoir at a different elevation in regards to the first one, and that would have a tendency to form or bring up the possibility of permeable barriers across any 320-acre location. In other words, due to the fact that there is not a continuous permeability, there may be on any given location an area that is not drained.

Q In other words, then, you could have two wells on 320-acres with wide differences in the permeability zones found in those two wells?

A That's right.

Q Would that in any way affect the reserve calculations as presented by Mr. Widerkehr and based upon microlog permeability?

A Yes. If any particular 320 has a discontinuous microlog permeability, it would reduce the recoverable reserves.

Q Now, Mr. Reese, do you know how the Jicarilla No. 1 in Section 27, 26 North, 4 West is completed, in what formation?

A Yes. That well is completed in the Meseverde for a gauge of 422 MCF. It was one of the early completions mentioned by Mr.

Widerkehr in the drilling up of the Tapacito Pool.

Q How about Jicarilla 2-B?

A It is likewise completed in the Mesaverde formation.

Q Is it productive from that formation?

A It is 150 MCF.

Q In your opinion, is Mesaverde productive in this area?

A Yes, it is. These two wells established the production to the south of the Tapacito-Pictured Cliffs Field, and there are also wells to the west and east in the Mesaverde.

Q Would present day completion practices have anything to do with increasing or decreasing the productivity of that formation in this area, in your opinion?

A Yes, it would. This original well was shut, and I believe that the sand frac method would result in a larger completion there. Presently, the Mesaverde is being developed to the east, north and west and the Pictured Cliffs in dual wells, and it appears that the Tapacito Field could likewise be completed in both the Pictured Cliffs and Mesaverde.

Q Would dual completions be practical on the present wells in the Tapacito?

A In most cases it would not be, because the casing is five and a half inch or four and a half inch.

Q Could any cost be saved to the operators in the event this Tapacito Pool were drilled on 160-acres as to the Pictured Cliffs formation, by dual completions in the Mesaverde, in your opinion?

A In my opinion, there would be a savings in cost as other operators are already dualling wells in the general area.

Q How about dual completions in the Dakota formation? Is there any indication that that would be possible or practical?

A Yes, there is. Northwest has dual Mesaverde and Dakota completion, and a Pictured Cliffs completion could be dualed with the Dakota.

Q That would tend to reduce the cost, which would be attributable to a Pictured Cliffs Pool in the event a Pictured Cliffs were dualed in some other formation, would it not?

A That is my assumption that it would, and with the number of pays showing in this Tapacito Field. There is also the Tocito in Section 16, of 26 North, 4 West, which gauged five million six hundred and sixty-three thousand. The Tocito is appearing as an additional gas horizon in the Tapacito Field.

Q Referring to Southern Union's Exhibits 4, 5, 6 and 7, what significance do those exhibits have to you?

A They again illustrate to me the change from higher porous and permeable belts into a belt of low porosity and permeability in the Blanco-Pictured Cliffs sand which extend through on the area.

Q You heard Mr. Widerkehr testify to the effect that there was nothing found in the Jicarilla 1-B well. Did you examine the log on that well?

A Yes, I did. And in that particular well we had given the well ten feet of pay, based on the self potential on the log, and

we feel that ten feet of pay was well justified by the fact that in comparison to core analysis that that ten feet would have produced if casing had been run through the pay and the zones selectively perforated. This is borne out by other completions in the area with similar number feet of pay.

Q Referring to Southern Union's Exhibit No. 9, I believe they attribute; on the 2-H well where we show -- where they showed two feet of microlog pay, and we gave it seventeen feet. Is that correct?

A Yes, that is correct. And that again illustrates that there is two feet of micro pay on the log, and that the reserves there in the two feet are calculated at two hundred and ninety million, five hundred and sixty MCF of gas recoverable from the good micro pay.

Referring back to Exhibit 8, reserves under the 2-H well as calculated on the total gross sand is one million seven hundred, and seventy-three million, four hundred and forty MCF of gas. This again illustrates the variation of permeability and the total possible recoverable reserves that would be recovered by draining the entire 320 acres in contrast to two feet of microlog reserves.

Q Would that, then, in your opinion, help in leaving any gas in the reservoir on the basis of 320-acre development?

A Yes, it would.

Q Would you give an estimate as to what percentage might be left?

A The contrast here is two hundred and ninety million cubic

feet of gas as compared to one billion, seven hundred and seventy-three million cubic feet of gas. It might result in -- well, just maybe as much as a billion cubic feet of gas left in there, depending on the varying permeability, of course.

Q In regard to the testimony which was offered by Humble in this case, is it your understanding that this testimony is based upon an assumption of radial drainage? A Yes.

Q In your opinion, can such as assumption be validly made in the Tapacito-Pictured Cliffs formation?

A I can't make an assumption like that because of the concrete information that we have in regards to the microlog permeability which we used in constructing this map. The information on the microlog was measureable and we were able to plot it into a map that showed a definite trend of the entire field northwest, southeast, and in my opinion, that is the direction of the best drainage.

Q Do you have anything you care to add, Mr. Reese, to the testimony you have given?

A I don't believe so.

MR. KELLAHIN: That's all the questions we have. I believe yesterday I offered in evidence Gunsight Butte's Exhibit No. R-1. If I failed to do so, I now offer it.

MR. PORTER: Mr. Kellahin, at this point I don't remember whether you did. I am of the opinion you did, but anyway without objection it will be admitted. Does anyone have a question?

CROSS EXAMINATION

BY MR. GRENIER:

Q Mr. Reese, I believe you stated yesterday that -- and then mentioned again this morning, that the average pressure is somewhat higher in the Tapacito Pool than in the South Blanco. Did I correctly understand you?

A Yes, I believe that our average pressure for the Tapacito Field is one thousand and eighty-six pounds. And I don't know exactly what the average pressure for the South Blanco Field is, but the higher pressures are one thousand and seventy-one, and there is one pressure of eleven hundred and thirty-two pounds.

Q Now, you said something yesterday about a fifty-pound variance in pressure there. What were you speaking of in that connection?

A I was speaking of the higher pressures across --

Q There is approximately a fifty-pound difference between the higher pressures of the two fields, is that correct?

A Yes, excluding the lower pressures which I mentioned, the various reasons for them being lower.

Q Speaking of the higher pressure, it was a fifty-pound gradient between the two, as I understood your testimony?

A Yes.

Q Now, you mentioned this morning that you accounted for that difference in average pressure by the fact that the Tapacito Field generally laid at a greater depth below the surface than the South Blanco Pool. Was that the import of what you were telling us?

A Yes, it is. It is very hard to really distinguish a gradient because we find one pressure that is higher in the South Blanco-Pictured Cliffs Field than in the Tocito Field.

Q But you did indicate that the reason you would feel that there was a pressure gradient was because of the greater depth of the two?

A That's right.

Q Of the one core as compared to the other?

A Yes.

Q How much greater a depth is that, Mr. Reese?

A I see depth here varying from three through to about thirty-three hundred in the South Blanco-Pictured Cliffs, and thirty-five hundred to four thousand in the Tapacito.

Q That would indicate, then, using those figures and average depth differential of about how much?

A I'd say --

Q Five hundred feet, maybe?

A Maybe as much as fifteen hundred.

Q With all other conditions being equal,what would you expect the difference in average pressure to be in one field as contrasted to another with the five hundred foot difference in depth below the surface?

A I haven't calculated that. I know that in comparison to both of these fields, with West Kutz and Kutz Fulcher Fields, that there is quite a difference in the depth which is about two thousand

feet in comparison with these.

Q As between these pools, you don't know whether there is enough difference in depth to account for this difference in pressure that you have just spoken about?

A No, I don't, and I only mentioned it as a possibility.

Q So that you are not certain whether that possibility has any reality to it or not?

A Not with this high pressure over here in the South Blanco Field of eleven hundred and thirty-two pounds. I know that there is some possibility of that, and I pointed it out as one of the reasons for causing some of the minor differences in pressures.

Q Are you familiar with the basis upon which that 1132-pound pressure was taken?

A I am familiar with the information that we have on it.

Q Do you know who took the test and when and how long, and are you sure there is no possibility of error there?

A The only report I have on it is from the Scout report which was reported on Scout Checks, and read as shut-in casing pressure, one hundred fourteen and thirty-two pounds in seven days.

Q That's rather strikingly inconsistent with the pressures around it, isn't it?

A It's not too inconsistent; to the south it is 1060 pounds, in the same section.

Q And just to the offsetting, just to the west, it is 990, I believe?

A That's right, and then due north in the next section is a thousand and twenty-two pounds.

Q That's a difference of over a hundred pounds to the north, isn't it?

A Yes. And about a hundred and forty pounds to the west.

Q Two hundred -- no, one hundred forty pounds.

A It is a high pressure for the South Blanco Field, and I believe more representative pressures, a thousand and seventy-one or a thousand and sixty along the east margin would be a little more representative.

Q You have only the Scout report to base any impression that you may have as to the accuracy of that pressure, is that correct?

A That's right.

Q Now, with two pools lying at substantially the same depth below the surface, say about five hundred feet between them, wouldn't you expect them, Mr. Reese, in normal circumstances, to have approximately the same reservoir pressure whether there was communication or not?

A Yes. That's why I read those figures yesterday which shows approximately the same reservoir pressure between them.

Q So the mere fact that there is a familiarity of pressure doesn't by itself establish intercommunication, does it?

A It establishes that there is some kind of communication or else pressure wouldn't be able to come from the formation and be read at the surface of the well.

Q You possibly misunderstood my first question. I asked you, then if you wouldn't expect that the two fields lying at substantially the same depth would have substantially the same pressure whether there was communication or not, and you answered yes, that you thought that would be so.

A Well, I think that there is communication.

Q Well, I am not asking you whether you think there is communication or not, Mr. Reese. I am asking you -- assuming a situation where there is no communication and here these two pools are lying at this same depth below the surface, isn't there some natural and common correlation between depth below surface and reservoir pressure, particularly so when the same formation is involved?

A Well, there might be and there might not.

Q Well, I thought you just got through telling us that you thought the depth -- the greater depth of the Tapacito as contrasted to the South Blanco was a thing which would have some influence there and causes somewhat greater pressure. Now, does or doesn't it have anything to do with reservoir pressure?

A I would think it has some small effect in this area. The reason why I say small is that it is probably less than fifty pounds on the average.

Q Well, do you feel that these must have been in communication, then, in order to have been this nearly equalized in pressure and just couldn't be accounted for in any other fashion?

A Communication between the two fields, is that your question?

Q Yes.

A Yes, I do.

Q Now, we do have here, I believe you said, an average difference between the two of some fifty pounds, and you just told us that you didn't think depth had any significant effect on these differentials. How, if there is effective communication between these two pools, could it be that there is still that much of a differential after all these millions of years since these sands were laid down?

A I don't know that there is that much differential. I have only pointed out depth as a possibility. I have not gone into finding if there is actually as much as fifty pounds of difference.

Q Well, would there be as much as forty pounds?

A Well, the highest pressure in the Tapacito Field is a thousand and ninety-four pounds, and directly opposite that well in Section 31, there is a thousand and seventy-one pounds, and twenty-three pounds of difference there, which could be accounted for by the variables which I mentioned.

Q You, I believe, don't have any information as to what the average pressure is of the better wells in the South Blanco Pool?

A No, I did not average them up.

Q So you really don't know how much pressure differential there is, then, is that correct?

A Well, I would estimate that the entire difference would not be greater than fifty pounds.

Q All right. Now, referring to other Pictured Cliffs Pools in this area, are you familiar with any of the other pools other than the South Blanco and the Tapacito?

A I am familiar generally with other Pictured Cliffs Pools.

Q You are aware that there are numerous other Pictured Cliffs pools in this area?

A Yes, sir, that's right.

Q Do those, as defined by the Commission in its nomenclature orders tend, like the Tocito Pool, to run in a general northwest, southeasterly direction?

A Yes, most of them tend to. However, that again, is reflecting better permeability belts and a blanket sand, which has already covered better than seven hundred and fifty thousand acres in the various pools, and the tendency is to close the gaps between quite a few of those pools as in this area.

Q Now, has the Commission thrown those pools all together as say the West Kutz with the Fulcher-Kutz, which, I believe, lies to the east of it?

A No, they have not.

Q Or the Fulcher-Kutz with the Aztec?

A No.

Q Or the Ballard with the South Blanco?

A No, they haven't yet.

Q In each instance there is a relative narrow band separating those pools that I have mentioned, is there not, Mr. Reese?

A Yes, there is.

Q And is that, comparing that with the band that you find here, is that band broader or narrower or about the same?

A Well, it's hard to say because this band has been continually closing due to drilling. At one time it was much wider than it is right now.

Q Isn't it a fact that some of the other direct quarter sections offsets are in different fields?

A Yes, that's right. There are some of those fields that have closed in places too.

Q And yet the Commission in those circumstances has still continued to regard those as separate pools and separated by bands of sufficient permeability that they ought to be kept separate, isn't that a fact?

A I don't know how they determine the boundaries between those pools.

Q Are you aware of any particular circumstances that would make this separating zone materially different from the separating zones encountered elsewhere between these various Pictured Cliffs Pools?

A I haven't studied the other Pictured Cliffs Pools in detail as to how they are designated, but I do know that -- I believe that as future development goes in this area that we will find that there will be large areas of Pictured Cliffs joined to either of these pools.

Q Now, in your testimony yesterday, you spoke of the sum of four wells, I believe, in through the band between the two fields which showed no microlog porosity but still were -- did you say those were commercial wells? I am referring to the Skelly Well in 18, 25, 3, and then the Magnolia 2-B, and the others you mentioned at that time.

A I believe it was the 1-7.

Q Yes, the 1-7 was one that you mentioned. Well now, the first one you mentioned was this Skelly Well here in 18 in the northwest quarter of the section?

A Yes, sir. Had a gauge of two million five hundred forty MCF.

Q Are you familiar with what that well has been since producing or are you familiar whether it is producing?

A I am not familiar what has gone on since it was completed.

Q All you know is that you have an initial potential test there?

A That's right.

Q Now then, with respect to the 2-B, which you also mentioned, is that well now producing?

A I don't know. I know that they were; the last time I talked to them about it they were preparing to put it on the line.

Q But so far as you know, it isn't on the line, you just don't know whether it is producing as a commercial well or not?

A That's right.

Q Now, how about this 1-7 well? What --let's see that.

A That's this one.

Q Is this one up here in Section 7? Is it?

A 7 of 26 North, 5 West?

Q Yes. What is the productive history of that well?

A I don't know its productive history. I know it is on the Pacific line.

Q Do you know whether or not it is a commercial well, as considered in the light of its productive activities?

A I don't know what its production actually is. It was triple completion, that is, the well was, and the series of gauges in the Pictured Cliffs, Mesaverde and Dakota were all low.

Q Now, there was a group of wells in Sections 29 through 32, 26 North, 4 West, which you also mentioned at that time. How have those wells be doing since they were put on the line, do you know?

A I believe, according to Mr. Johnson's testimony, in the previous hearing, that they were producing four hundred MCF or thereabouts in that area per day.

Q Four hundred MCF per day. Would you classify that as a commercial well? If you knew that is what you were going to get, would you be willing to go out and drill more wells like that?

A As I stated yesterday, if I were drilling in this area, I would be drilling for an average well, and I have in the past taken all the well potentials, say, or in the South Blanco-Pictured Cliffs Field, and found at that time that there was an average well poten-

tial of one million, and the average deliverability was about one hundred seventy-five MCF. And those wells were still being drilled, so whether they were high or low potentials or high or low deliverability, they still are. The field has been growing and expanding.

Q So that you would feel, then, that these were commercial wells by your definition, is that right?

A Yes, sir.

Q What field are they in? They are in the South Blanco, as a matter of fact, are they not?

A Yes.

Q And they are not between the two fields?

A That's right.

Q Now then, you also mentioned the fact that El Paso Natural was developing this area in Section 24, I guess it is of 26 North, 5 West. Was that the section where you said they were developing on a 160-acre basis?

A The way those two locations are, they are on a 320 spacing there. However, these two locations have been staked to the east of their 160-acre spacing which they have -- during the winter have started on the west side and gradually progressed eastward. Now, I don't know whether they intend to come in here and fill in on 160's on their drilling programs or not.

Q I thought you implied yesterday that they were going to do so and see fit to drill on a 160-acre basis. Maybe I misunderstood you.

A No, I was merely pointing out that they had staked two locations in between the field, and that there is a possibility that they may continue this 160-acre program right on through there.

Q Are you familiar with the contractural situation in which El Paso is operating there, do you know if by the terms of the farm-out agreement, of which they have a portion, they are or are not obligated to develop on a 160-acre spacing pattern?

A No, I am not.

Q Of course, what they are obligated to do, to save some leases and comply with obligations elsewhere might possibly influence what their decision would be as to the drilling of these wells, would it not?

A It could. I know that is Jicarilla Indian land, and it was sold by the Indians in large blocks, and I don't know whether they had any spacing agreement.

Q Now, you got to speaking yesterday and again this morning, Mr. Reese, about these streaks of high permeability which run through this Tapacito Field. Have you been able to correlate these bands of high permeability from one well to the next so as to indicate that they are fairly consistently running things?

A The way we have correlated them is that we have marked the number of feet of total permeability on a log and then plotted that by the individual well and then put it on the map on the number of feet on the micro permeability.

Q Well, I was referring not quite to that, but rather to your

testimony about the fact that these permeable streaks were present, and I thought you were tending to indicate that they wouldn't extend as far as from one location, say in the north half of the 320-acre tract down to the other end of it, or can you correlate these relatively narrow zones of high permeability over substantial distance through the fairway of the field?

A We can correlate the zone over a substantial distance, but we can't correlate a three foot zone in one well to a three foot zone in the next well.

Q So that your thought would be that that little three foot zone of high permeability would probably peter out before it got to the next well?

A It could go to the next well, or it could stop before it got to the next well.

Q Now, in the absence of any such correlation from one well to the next, do you have any information as to the direction in which these streaks of high permeability run?

A Well, yes; yes, we know from plotting the number of feet by each well, that the direction of the belt of high permeability runs northwest southeast, and that it becomes much lower to the northeast and southwest.

Q Now, not looking at the field as a whole, but taking the field as a particular well, and you penetrated the permeability belt, looking at the thing from top to bottom, how do you visualize one of these three foot sections as lying horizontally, is it round

or is it long and narrow, or is it star-shaped or what?

A Well, I would visualize that zone as having its longest length on the northwest, southeast. And the reason why I would is that as the Pictured Cliffs sands were laid down or deposited in the -- along the edges of the seas the sands were derived from the southwest in the Gallup area and deposited in a direction going northwest -- I mean northeast or seaward, and the beach lines would run northwest, southeast, and that is why you have these belts running in that direction, and the better permeability should follow the belts of sand.

Q But you have no -- you have no data as to this particular field which would tend to correlate that running from northwest to southeast?

A Well, our data is pretty positive in that the longest extent of our best micro permeability is northwest, southeast.

Q Now, from that do you conclude that the only direction that a well in this pool can effectively drain is from northwest to southeast within fairly narrow limits?

A No, I wouldn't conclude that in every case because, again, you have another factor entering there that, if you have, say, during the deposition of the sands, arrive at the sands along the line, it might make one particular local area a better belt of permeability due to the deposition of cleaner sands.

Q But on the average, I mean excluding these little local abnormalities such as that, they would probably not cover more than one

section, would they, Mr. Reese?

A That's right.

Q Taking the field as a whole, you would think that they would drain almost exclusively in a northwest, southeast pattern, is that correct?

A I wouldn't say exclusively. They will drain in any direction that there is permeability, but the larger strings would be in the northwest, southeast pattern.

Q They will drain in any direction where there is permeability, is that correct?

A Yes.

Q So that, then these wells along the flanges of the field will, in fact, as indicated by Southern Union's Exhibits and also by Mr. Hackney's Exhibits tend to be draining laterally out toward the more remote flanges of the field?

A Tend to be draining out toward --

Q Tending to pull gas in from the poorer flange areas, is that correct?

A To a limited extent; as your permeability drops your drainage would be slower and slower toward the flanges of the field.

Q Just how limited is that -- this field?

A Well, you can't say in figures how limited that would be, but it would leave areas undrained, say, while the better part of the field was drained or in the higher permeabilities.

Q You don't think it is sufficiently limited to have prevented

communication with the South Blanco Field some several miles to the southwest, you think it is good enough to have done that?

A No, I don't because I don't believe that these sands will drain over a mile or so.

Q Oh, I thought you had all this as a common reservoir. Maybe I misunderstood your prior testimony. Is there or is there not communication between the two fields?

A Let's come back to the time element. If you had a well in this area over a period of unknown amount of time, you would undoubtedly have some drainage, but I don't know what time it might be. It might be a hundred years before it starts affecting gas up in the Tapacito Field.

Q It is a sufficiently short period of time that this Commission ought to consider it as a practical matter, that it has to take into account in solving spacing patterns for these two pools. Why should we worry about a hundred years from now when we are draining out already some ten to fifteen or twenty percent of the reserves in one year's time?

A Well, it looks to me like it is time to consider it now with the way the drilling -- it is not a matter of several miles. There is a completed well in-- a mile from Tapacito, a mile and a half from the Tapacito Field now, and Skelly has just staked an additional well southwest of Section 26, outside of the Tapacito Field.

Q Now, do you feel that there is cross drainage down in that

area?

A Not any cross drainage pressureably; I don't believe there is, but the problem will present itself as the two fields get closer and closer.

Q Well, assuming they butt right up to each other, they are in offsetting tracts. Is there going to be cross drainage then?

A I believe that there will be some cross drainage. There will be areas undrained along the borders of the field, if they were.

Q In order to have any significant amount of cross drainage, there will have to be some cross drainage deviating rather significantly from this northwest, southeast pattern of drainage which you first indicated to us, isn't that so?

A Well, for example, in the west half of Section 8 of 26 North, 4 West, there is an undrilled 320-acres, and across the northern half of it there is a belt of high permeability in relation to the south half of the 320-acres, and if that location were drilled on a 320-acre spacing and the well were placed in the southwest corner of Section 8, the well would have a relatively low deliverability while the north half of the 320-acres would probably be drained by the present well.

Q What evidence do you have as to the reserves underlying that particular 320 and the various parts of it except just the way that you have contoured it, Mr. Reese?

A Well, the evidence that I have is from our net sand pays that we have contoured across the area.

Q That is merely your contouring, though, that leads you to these conclusions, is that correct?

A Yes.

Q There are several other places, are there not, where wells wouldn't have quite conformed to the contouring if they hadn't been drilled and, of course, you would have put rather sharp crinkles or bends in the contour, isn't that so?

A As additional wells are drilled, we have to adjust our contours.

Q If the 5 "E" well which is in the northeast quarter of Section 16 were moved over to its actual location, which is on the northwest quarter of that section, wouldn't that rather radically affect your contouring all through that section of the field?

A Not a great deal. It would widen the permeability belt in there; it would also widen the net footage.

Q Wouldn't it also sort of put a kind of an "S" shape contour in there which you don't have present on the maps as you have drawn?

A Due to the fact that we had a wrong location for the well there.

Q But you haven't adjusted them yet?

A No.

Q Now, you got to -- you mentioned at one point in your testimony that there was a 160-acre spacing in the South Blanco, and that you therefore thought there ought to be 160-acre spacing in the Tapacito because you were aware of no geological or other

reason, if I recall your testimony correctly, as to why the two pools should be -- should have different spacing patterns established for them. Do I correctly remember your testimony in that regard?

A That's correct. We have correlated the sand between the two fields and the pressures, and that's our conclusion. That's it.

Q Now, as between the two pools, what is the relative deliverability capacity of the wells? Is it much the same in the South Blanco as it is in the Tapacito?

A In Tapacito it would be much higher at the present time because there is no proration and because the wells that are drilled are much better wells.

Q Does proration have anything to do with the well's deliverability capacity?

A That's right. It is mainly just because of the better wells in the Tapacito Field as it is defined at the present.

Q So that is one difference between the fields, at least that the average deliverability of the wells in Tapacito are substantially greater than South Blanco?

A Yes. I would like to point out that right in the middle of South Blanco there is another belt of high deliverability wells as compared to the Tapacito.

Q What has been the development pattern through most of that belt? Has it been developed on 160 or 320?

A It has been developed on 320's in the middle part of this belt. However, as you get down into the southern part of the belt,

it is on 160's.

Q A significant portion of it, at least, has been developed on 320-acre basis, is that correct?

A About half of it looks like it has been developed on 320 and half of it on 160.

Q All right. Now, comparing the average permeability of the two areas, which would you say would have the better permeability, the Tapacito Field or the South Blanco, or are they both the same?

A I would say that the present boundary of the Tapacito has the best permeabilities. The fact that the South Blanco-Pictured Cliffs Field covers such a big area would reduce its average permeability.

Q By that, do you mean to infer that this fairway you have been talking about in the South Blanco Field occupies relatively a somewhat smaller portion of the total field area than in the case of Tapacito?

A I don't know exactly how you would compare it, but I think it would compare about the same.

Q Now, you have a very small portion of the South Blanco Field represented on that particular map, do you not?

A Yes, that's right. It runs way up to the northwest.

Q Now, through how much of that area does this band of high deliverability wells that you have been talking about extend?

A I don't know. I haven't traced it that far.

Q Are you prepared to state that it is as large, relative to

the total area of the field as it is in Blanco or substantially so?

A I believe it might be larger due to the fact that it is much more developed.

Q I am talking about in comparison to the total area in the field. Now, you said --

A You are talking about the high permeability --

Q Right.

A -- zone in the South Blanco in comparison to this?

Q Yes, that's right.

MR. KELLAHIN: If the Commission please, I wish the attorney would let the witness answer the question.

MR. GRENIER : Excuse me, Mr. Kellahin.

A It could be larger because we have shown a portion of the South Blanco, and I know it extends further north.

Q I am not asking about the number of acres in that band, I am asking about the percentage of the acres in the total field by the band.

A I don't know about the exact percentage in the South Blanco. I believe that it would be greater.

Q A greater percentage of the South Blanco would be represented by these high deliverability wells than would be the case in Tapacito?

A Yes. However, you would have to take into account completions.. This lower area that is not shown on the map was shot. That is, the wells were completed by the shoot method, while these wells in

here were fraced by Stanolind or Pan American, and resulted in a much greater well potential.

Q Now, disregarding these areas that have been poorly completed, which of the fields would you say would have the higher deliverability capacity?

A The Tapacito Field as it is presently defined.

Q Now, we have seen several differences between these fields already, haven't we, Mr. Reese, that there is considerable -- well, let me ask you one other question. Moving out from the fairway of the South Blanco Field to the point where you reached these non-commercial wells, by any standard, there is a somewhat broader band there than there is in the case of the Tapacito Pool, is there not?

A There is a broad band, yes. The present definition of the Tapacito Field is limited to the -- only to the heart of the field, and the difference, there is really no great difference because both fields have a very good heart or center part with the South Blanco Field extended in a band of low permeability on both sides, whereas the Tapacito Field as it is now is just confined mainly to the porous belt.

Q Well now, referring to Southern Union's Exhibit here, and these orange and blue wells which represented either noncommercial wells or wells where there was such poor sand conditions that no attempt was even made to bring them in, would that lie as close -- a similar band of wells lie as close to the fairway of the South Blanco Field as it does here?

A No, it would not. However, the band of wells as referred to here were drilled in the earlier stages and since then there have been wells drilled in that same permeability. They are not big wells but are --

Q Are they commercial wells?

A I don't know what your definition of commercial is.

Q What's yours?

A Mine is, if the market justifies a drilling of a well, it is a commercial well.

Q Are any of those wells in there, that are marked in orange such that the present market condition would make them commercial wells?

A I don't believe that Southern Union would look at it that way.

Q Do you think that we would want to make more money on a well than anybody else in order to make it commercial, or do you think that our standard would be about the same as anyone else's?

A I assume from your statement that the line in there is already loaded or packed to capacity, that there would be no incentive for you to make wells in that area or drill them for completion.

Q Do you know whether these wells were drilled before or after that line got full?

A I believe they were drilled before. I --

Q And they were not -- excuse me, go ahead.

A I believe they were drilled in the early stages of the field to find out the extent of the field, and the -- at least the initial extent of it, and the various pay rations that are presently under it.

Q Are you aware of any well in either the Tapacito or the South Blanco Pool which has no microlog pay which would be a commercial well at the present time, according to your definition of a commercial well?

A I am aware of the fact that there are quite a few wells drilled in the South Blanco Field that do not have microlog pay, and they are being produced.

Q Now, does the mere fact that a well is being produced make it a commercial well?

A That question has a lot of answers, but I would say on the average the fact that it is being produced within a field indicates it is a commercial well.

Q Now, if you had a well which had cost you forty thousand dollars to drill and you could see that you could sell twenty thousand dollars of gas out of it and no more, would you or wouldn't you attempt to market the twenty thousand dollars' worth of gas in an effort to cut your loss?

A Well, yes, in some instances. However, if you had that same well that cost forty thousand dollars, and you had demand for your gas through a pipeline, you would be able to write off your intangibles and depreciate your tangibles, so your

wells would actually not cost forty thousand dollars.

Q All right. Let's say it cost twenty thousand dollars after you have written off the intangibles, and that you are able to market ten thousand dollars worth of gas, would you go ahead and try to salvage what your actual loss would be, after taxes, or not?

A I don't know how you could say that. You might market ten thousand dollars worth of gas or what you would market out of that well, but regardless of whether it was ten thousand or not, I would go ahead and produce the well to get the ten thousand back and any profit that might be in the well.

Q You would do the very best you could, whether or not you were to get all your money back, is that correct?

A That's correct. If the first well in the area or the first few wells showed that I couldn't make a profit, I wouldn't continue to drill wells like they are doing in this area.

Q Now, along the southern flange of the Tapacito Field there, since these first wells which I think you classified as exploratory wells that you drilled, has there been a continuance of this kind of drilling such as you have just been describing? I mean close along the borders of the pool?

A Since those wells were drilled, there has been continuous drilling, especially from the South Blanco Field toward this area. All these wells in the southwest of 26 North, Range 4 West have been drilled since those wells were drilled.

Q They haven't been coming down from the Tapacito, have they,

Mr. Reese?

A There might be one or two of them, but not to any great extent.

Q Now, within what portion of the pool, either as defined or not defined by Commission nomenclature which would be productive of a commercial well by your standard, that is to say, one that you would drill if you knew what you were going to get for sure? Isn't a great majority of that acreage what I think you classify as pretty good acreage from a porosity and permeability standpoint?

A You mean within the Tapacito Pool?

Q Yes.

A I would say it is excellent acreage.

Q And with substantial majority of the acreage being excellent acreage, isn't that the acreage that should be given most consideration by the Commission in establishing spacing rather than the minority of acreage along the flanges of the pool where there would be less favorable, less excellent conditions?

A I disagree with the minority part because of the fact that the smaller productive wells will be found over a much greater area than the excellent acreage of the Tapacito Field.

Q Do you feel, then, that we ought to be setting rules here in contemplation of areas that are not commercially productive?

A The thing that I feel should be taken into account is that this area will produce gas across here and is an indication of going on clear northeast. There are a lot of completed wells in there,

in Township 27 North, 4 West and 5 West. There are completed Pictured Cliffs wells clear to the north end of both of those townships in both sands.

Q Is it good conservation practice to encourage the drilling of noncommercial wells?

A I disagree with your term "noncommercial," but I know it is good conservation practice to look at it and obtain as much gas as you can from an area; if this area is only developed on 320, why, it would leave gas around the margins unproduced.

Q Now, to return to the question, define commercial as you will, is it good conservation practice to encourage the drilling of noncommercial wells? Is that something that we ought to be doing here before this body?

A I think it is good conservation practice to encourage the drilling of wells where natural gas reserves can be produced and sold to a market.

Q And it doesn't make any difference to you whether the wells are commercial wells or not?

A Well, I think that your term commercial comes back -- of course, your picture or Southern Union's picture -- say that your monthly production is somewhere in the neighborhood of two billion cubic feet of gas a month, and El Paso's production is running around thirty billion a month, and your picture of what would be commercial or wouldn't be commercial in one area would be somewhat different from El Paso or someone else.

Q You think we want a better well, and we would call it commercial, than most operators, is that right?

A It is not so much that, you would have to take into consideration whether you could sell the gas or not.

Q Are you aware of the fact that Southern Union is selling El Paso Natural approximately a hundred million MCF of gas per day in the San Juan Basin?

A I have heard of the fact that they are, but I didn't know how much and the main thing that I was looking at here is your statement that the line was full and that you could not move any more gas through there.

Q That, of course, doesn't mean that the line can't be looped or compression facilities put in there, does it?

A No, and that's why I was pointing out that with the multiple pays that you have in there that dual completion or even triple completion may be practical.

Q Now, are any of these dual or triple completion wells that you have been talking about commercial wells in the Pictured Cliffs, or even in all three of them?

A There, again, we get into the variable factors on the commercial wells, but I believe that they are because they wouldn't be drilled if they weren't, and also a dual makes more available a smaller deliverability per well.

Q Is it the fact that they are being produced that makes them commercial, to your point of view?

limits in this pool, and this will be approximately, is owned by Gunsight Butte Uranium Company?

A I don't know the exact percentage. I haven't figured it out.

Q How much does it appear to be, which I think you have cross-hatched in your map?

A A section and a quarter within the limits.

Q And how many acres did you find to be within the pool as a whole when you were discussing total pool reserves?

A Referring back to my previous testimony, it was twenty-one thousand, six hundred acres. That was February, 1958.

Q Which approximately eight hundred acres would be -- that would be a section and a quarter would be Gunsight Butte, is that correct?

A That's correct.

Q That would be somewhere around two to tree percent, wouldn't it, Mr. Reese, of the total acreage perhaps?

A I assume that's right.

Q How many additional locations would Gunsight Butte have available to it if a 160-acre spacing were authorized?

A Five Pictured Cliffs locations.

Q I am speaking within the limits of the pool as presently defined, Mr. Reese.

MR. KELLAHIN: If the Commission please, I object to the wording of the question for the reason that the pool rules established for the Tapacito Gas Pool extend two miles beyond the boundaries of

the pool as defined by the Commission, and any locations available to Gunsight Butte would be affected by the pool rules. So it would be wholly immaterial as to how many locations you had inside or outside, if he has so many locations which are governed by the pool rules. The proper prospective locations would be included within this two-mile limit.

MR. GRENIER: He has already stated that. I am trying to find out how many of the five that are within the requirement of the pools are within the requirement of the pool as presently defined.

A There are two within the present limits of the pool.

Q (By Mr. Grenier) Now, taking either the five or the two, I believe you testified yesterday that it would take some forty-six additional wells to drill up the pool, as a whole, as presently defined on 160-acre spacing, is that correct?

A I believe it was testified to that effect yesterday.

Q Go ahead. I didn't mean to interrupt.

A I just said that I recall that is the figure.

Q So the five locations which you have just mentioned would represent about ten percent of those additional -- of those wells, wouldn't it?

A Yes, of those.

Q And the two locations within the actual limits of the pool along the fairway would represent maybe two and a half percent, something of that sort?

A That's correct.

Q Doesn't it strike you a little bit that this is kind of a tail trying to wag the dog for the operator of that small segment of the pool to be attempting to impose its well upon the entire remainder of the operators in the pool?

MR. KELLAHIN: If it please the Commission, I want to make an objection to that question.

MR. GRENIER: We will withdraw it, Mr. Kellahin.

MR. KELLAHIN: All right.

Q (By Mr.GRENIER) In your testimony this morning, I believe you said that you had classified as net pay anything that had five percent porosity and some percent of connate water as a limit. What was that percentage, Mr. Reese?

A That was sixty percent.

Q Should have not more than sixty percent connate water content?

A Yes.

Q And you disregarded permeability entirely in determining net pay, is that right?

A That's right. For our reserves.

Q So are these, then, total reserves or are they recoverable reserves?

A They are recoverable reserves down to one hundred pounds abandonment pressure.

Q And you feel that you can recover these reserves regardless

of whether there is any permeability there or not?

A I didn't say that there wasn't any permeability or not. I said we calculated our reserves separately so as to know how much reserves are there and whether they are recoverable.

Q Well, are the reserves that you really feel are there, the ones that are indicated by your microlog sand thickness or by this net pay sand thickness?

A The net pay sand thickness.

Q And that's the one where you said you computed without regard to the presence of permeability, isn't that correct?

A That's right.

Q So that -- and then I come back to the question, can you produce or can you recover any reserves without permeability?

A You have to have some permeability.

Q But you didn't seek to determine whether or not there was permeability throughout your net pay section, you went only on porosity and connate water?

A In calculating the total reserves. However, in this area we know that there is permeability whether you can measure it or not. I did want to point out that in regard to permeability, that when we calculate the reserves in an area, if there are completed wells in the area, that are actually producing, that is an evidence of permeability, and then we come to areas like in the San Juan where there are these large blanket sands extending over many

square miles, and there are approximately five thousand wells or better in both the Pictured Cliffs and Mesaverde sand. We know that we are in areas of large stratographic traps where the permeability is low and it's so low on the average that there is little else other than gas that could be produced from it. And when we make a reserve calculation on an area like the Tapacito Field or any other field in that area, we basically assume that there is some permeability. As an illustration, it is not within the Pictured Cliffs sand but in the Mesaverde. We have cored one well to the north which had permeability of 142 feet, and there were four feet of the entire core that had fractures, yet the well was a six-million cubic foot Mesaverde Well. The Magnolia in this area was done the same. In one particular core, their average permeability was a .31 and that's the kind of permeability we are dealing with in the Mesaverde, and the Mesaverde is related in lithology to the Pictured Cliffs sand and they are the same type of stratographic areas.

Q You mentioned that in the Mesaverde there was rather substantial fracing, is that correct?

A No. I said there were four feet in the entire core of 152 feet of -- or 148 feet of net sands that had some fracing in it, so we couldn't attribute the production to fracing.

Q You couldn't attribute it to fracing?

A No.

Q Six feet of fractured sand wouldn't produce six million in

a day?

A There were four square feet.

Q Four square feet went to that?

A It could or couln't, but we attributed it to production in the low permeability.

Q Now, is there any significant amount of fracing in the Pictured Cliffs formation?

A I would say that it varies in some areas. There is quite a lot of fracing.

Q Can you give us an example of any core that shows any significant amount of fracing?

A This particular core I just read off has seven feet of vertical fractures indicated in it. In the No. 1 Jicarilla Well in Section 16 of 26 North, 4 West.

Q That you say is vertical fracing?

A That is the indication on the core.

Q Could you expect that to extend over any large amount of area, vertical fracing as opposed to horizontal?

A It could or couldn't.

Q Are there any other logs that you know of which show any such fracing, or cores, I should say?

A I know of no others. I have heard of others.

Q You know of no others yourself, is that correct?

A I know of a lot of logs with vertical fracing indicated here and there on the core analyses.

Q In the Pictured Cliffs?

A There is hardly any core that is taken in any of the Pictured Cliffs or any of the other zones, if it doesn't have one or two feet of fracing. However, there is not enough to indicate that it would be fracing reservoir.

MR. PORTER: Take a ten-minute break, please.

(Recess)

MR. PORTER: The meeting will come to order, please.

Q We have just a few questions more, Mr. Reese. You stated, I believe, at one point that you thought that there might be as much as a billion cubic feet per 320-acre tract left if that second well weren't drilled, is that correct? Some of these tracts, at least?

A Yes, I did. I used that only as an illustration of what there could be.

Q How did you claculate that figure, Mr. Reese?

A By estimation.

Q From what?

A From comparing Exhibit 9 to Exhibit 8. And comparing on Exhibit 9 the micro reserves on the Jicarilla 2-H Well of two hundred and ninety million, five hundred and sixty MCF of gas as compared to the total reserves under the same acreage of one billion, seven hundred and seventy-three million, four hundred and forty MCF of gas.

Q Do I understand you to be telling us, then, that the basis upon which reserves are estimated will in some direct fashion affect

the amount of gas that is going to be left in place?

A No, on the basis of this. I am merely pointing out that there will be some amount of gas between the microlog reserves and our gross reserves left in place.

Q But you don't know exactly how much that will be, do you?

A No, I don't. It will be somewhere between the microlog reserves and the total reserves.

Q If the well drilled in the other half of that 320 were like the first one, would it be as much as a billion feet left in that circumstance?

A It could be.

Q Would that be recoverable in a reasonable period of time?

A It would be more recoverable in a reasonable period of time on a 160-acre spacing.

Q I asked, would it be recoverable in a reasonable period of time?

A You mean the billion cubic feet of gas that is left?

Q Yes. Here we have on the 2-H in a hundred and sixty-five days a total of forty thousand, eight sixty-seven MCF which represented, according to Exhibit 9, 3.12 percent. On an annual basis, our figures which are indicated on Exhibit 8 for the same well, it would be producing at the initial rate of 5.09 percent of our reserve per year. Would you say that a well producing at those rates would be able to produce the recoverable reserve in a reasonable period of time?

A Which rate do you mean?

Q Either of them, either rate. Take the 5.09 as being the higher.

A Well, I would say that the -- that at the rate of 5.09 percent, that there should be two wells drilled on a 320 in order to bring the production within a reasonable rate of time.

Q Assuming the second well is just like the first one, would that still be a reasonable period of time in which the two could recover, if your billion, seventy-three million figure is correct?

A Yes, that would be a reasonable rate of time.

Q One last point. Do you recall the core analysis on the Jicarilla 1-G Well which was introduced as one of Southern Union's Exhibits yesterday, or were you familiar with that core already?

A I am familiar with it. I just don't recall the details on it.

Q Do you recall any portion of the sand as indicated in that core analysis having less than a sixty percent connate water content?

A Having less than a sixty percent --

Q Sixty percent connate water content?

A No, and that is why we asked the question yesterday, if this represented the total water which would be connate water plus any infiltration from drilling mud and also the date of this core is in July 1954, and it was about that time that Cole Laboratory had made some collections on their water saturation. But as

the core is presented here, there is no core analysis lower than sixty percent. We did give this well some pay on the basis of the log and assumed that the water saturations as shown on the core were too high.

Q You just assumed that the core was wrong?

A Well, from our experience with core analysis, we know that in the past that they were giving too high water saturation to some of those sands, and we also know that any time you get some of the higher porosities that your higher porosities will invariably result in lower water saturation.

Q In other words, -- to come back to the question, you just assumed that this must be wrong and so disregarded what the core actually showed in determining net pay for that particular well?

A We determined the net pay of the Slumber J as compared to other Slumber J's and cores.

MR. GRENIER: I think that completes our questions.

MR. PORTER: Mr. Cooley, do you have a question?

MR. COOLEY: Yes.

QUESTIONS BY MR. COOLEY:

Q Mr. Reese, have you made any estimates of what the total amount of gas that you feel would be left unrecovered on 320-acre spacing that might be recovered on 160-acre spacing in the Tapacito Pool? You have made some estimates as to particular wells and stated ranges that you thought this unrecovered gas could possibly be in. Have you made any estimate as to what the total might be for the

whole pool?

A No, I haven't.

Q Could you do so now?

A The only estimate that I would make would be a general one; that our total reserves for the whole pool, that there might be as much as fifty percent of the reserves left in place. It could be that high or range from there down to ten percent. The total reserves that we have given the pool are a hundred and ninety-nine billion, nine hundred and seventy-two million, eight hundred MCF of gas.

MR. PORTER: Is that recoverable reserves?

A That is recoverable reserves.

Q (By Mr. Cooley) Do you feel that the loss for drilling on 320 would range somewhere between ten percent and twenty percent of that figure?

A Yes.

MR. COOLEY: That's all the questions I have.

MR. HINKLE: I would like to ask Mr. Reese two or three questions.

QUESTIONS BY MR. HINKLE:

Q Mr. Reese, I believe you have testified that you have made estimates, that some additional gas would be recovered by developing on a 160-acre spacing over 320-acre spacing. Now, did you use any accepted principals of reservoir engineering in making those estimates?

A The things that I have used are presented here, have been presented here today in pointing out the varying permeability and contrasting the reserves calculations, which are based on engineering principles.

Q Did you use anything that shows a relation of fluid flows and porous media to factors of pressure, permeability, thickness, fluid viscosity, well bore or distance of drainage?

A No, I have not used any of those just as you have stated them. I have used a general knowledge on the permeability and the knowledge that these low permeable sands do not transmit gas over into any gravity distance.

Q The facts that I have mentioned are generally accepted in the industry for determining those factors, are they not?

A Yes. I have not used them in the manner in which they were illustrated yesterday, by your witness, you might say.

Q Then, the estimates that you have made are based upon your judgment and experience and just your idea of what might happen in this particular case, is that right?

A No. The estimate is based on actual core analysis, reserve calculation, the known amount of water saturation, the known permeability as compared to the relative permeabilities on micrologs, the pressures, temperatures, and everything that is generally applied in calculating reserves.

Q Did you make a concerted effort by any known accepted method or principle of reservoir calculations to arrive at this

figure?

A Well, yes. Just as I stated, I used all those factors that I enumerated.

Q Now, I also believe that you testified that, in your opinion, the drainage pattern was kind of an elongated affair; northwest and southeast. Did you use any accepted principles of reservoir engineering in arriving at the drainage that you have testified to?

A I used the accepted principles of constructing a microlog map showing the direction and the extent of the permeable zone, which is generally accepted.

MR. HINKLE: That's all.

MR. PORTER: Does anyone else have a question of the witness? The witness may be excused.

(Witness excused)

MR. PORTER: Anyone else have any more testimony?

MR. KELLAHIN: We have one further witness, if the Commission please. I believe he will be quite short.

MR. PORTER: You have one more witness?

MR. KELLAHIN: Yes, sir. Call Mr. Thomas A. Dugan.

(Witness sworn)

THOMAS A. DUGAN,

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A Thomas A. Dugan.

Q By whom are you employed, Mr. Dugan?

A Val R. Reese, .

Q In what capacity?

A As an engineer.

Q Are you a graduate petroleum engineer?

A Yes.

Q Mr. Dugan, have you heretofore qualified before this Commission as an expert petroleum engineer and had your qualifications accepted by the Commission?

A Before examiner hearing.

MR. KELLAHIN: Are the witness' qualifications acceptable to the Commission, or do they desire to hear them?

MR. PORTER: I believe he should be qualified at this time, briefly, please.

Q Would you briefly outline your education and experience in the field of petroleum engineering, Mr. Dugan?

A I am a graduate from the University of Oklahoma in 1950, and have worked as a petroleum engineer since that time for Phillips Petroleum Company, Pacific Northwest and Val Reese, and worked in the San Juan Basin five and a half years, and I am a registered engineer in the State of New Mexico.

Q How long did you work for the companies which you mentioned?

A Four and a half years for Pacific, and three years -- no,

four and a half years for Phillips, and three years for Pacific.

Q Where was most of that work done, for the most part?

A For Phillips I worked in Kansas, Oklahoma, Texas and Colorado, and also in New Mexico. And all of my work for Pacific has been in San Juan Basin.

MR. PORTER: His qualifications are acceptable.

MR. KELLAHIN: Thank you.

Q Now, Mr. Dugan, have you examined Southern Union's Exhibits 10, 11, 12 and 13?

A Yes.

Q Would you make a simple calculation as to the wells operated by Gunsight Butte?

A Yes. We made a graph in the same manner that Southern Union made theirs. And the Florence 1 came out very well in substantiating 160-acre spacing in that the pressure decline versus cumulative production came out practically the same as Mr. Reese' reserve would come out; slightly less, it would be drained approximately 139 acres, using this method from the Florence 1.

Q Now, insofar as you know, did you use the same method of calculation in preparing that --

A Yes.

Q -- as was used by Southern Union?

A Yes, as far as I know. Florence 2 didn't come out quite as well.

Q Will you show what the results were on that?

A Using Mr. Reese's reserve, the drawdown should be in this manner as this curve shows here, and the actual pressure decline is showing that it is going to drain something like 69 acres.

Q Now, did you prepare an exhibit to demonstrate this, Mr. Dugan?

A No, I didn't.

Q For what reason?

A Actually, I don't believe this method on a one-well basis or four-well basis is very applicable. It's a very good approach if it were taken on an entire reservoir status, but just using individual wells it can be pretty hard to draw a conclusion from just a few wells.

Q For what reason, Mr. Dugan?

A Well, there is a lot of variables in one well such as pressure buildups and securing accurate bottom hole pressures and possibly as Southern Union has done to quite some extent, showing communications between particular wells.

Q Would that affect this type of computation?

A Certainly would on a single well basis.

Q Now, with reference to Southern Union's Exhibits 14 through 18, have you examined those?

A Yes.

Q You heard Mr. Widerkehr's statement to the effect that these wells were used because they had a good productive history, and I believe he had another reason perhaps. Are these wells

representative of the wells in the Tapacito?

A Yesterday I understood Mr. Widerkehr to say that they were representative. However, just by using his Exhibit 8, on the 23 wells he has shown there, these are outstanding wells. In fact, there are five. Their average daily productivity or actual average daily production to date is one million, six hundred ninety-four MCF or cubic feet per day, while the overall average of the 23 wells is something like nine hundred and fifty-five thousand cubic feet per day. So, therefore, it is pretty easy to see, if you go through and examine it, that there is seven outstanding wells in the twenty-three, and he accidently picked five of those seven.

Q Now, with regard to Southern Union's Exhibit No. 8, have you made a calculation of the payout period on the twenty-three wells shown on that exhibit?

A Well, just a rough calculation.

Q What factors did you consider in making that calculation?

A Well, I just divided the cumulative production by the days produced, which -- and got an average daily production for the twenty-three weeks which was nine hundred and fifty-five thousand cubic feet per day.

Q And then what did you do with that figure?

A Then, using ten cents -- value of ten cents for the gas, and a well cost forty thousand dollars, it worked out that the payout would be approximately 1.15 years. Four hundred and eighteen days.

Q Four hundred and eighteen days?

A Yes, and by the way, those average -- the twenty-three wells produced an average of three hundred and sixteen days apiece. That was as of February the 28th.

Q Mr. Dugan, are you familiar with the ownership of the properties within the vicinity of the Tapacito-Pictured Cliffs Pool?

A Well, only as they are shown on maps that I have looked at.

Q Now, in regard to that acreage lying adjacent to the Tapacito in the southwest portion of Township 26 North, Range 4 West, could you say who owns that?

A You mean this line here?

Q Yes, sir.

A Well, it is pretty obvious that Southern Union owns the main portion from here to -- well, from what is shown on here, Southern Union owns practically all of that down to here. From here to here.

MR. KELLAHIN: That's all the questions we have.

MR. PORTER: Any questions of Mr. Dugan?

MR. GRENIER: May Mr. Widerkehr question on behalf of Southern Union?

CROSS EXAMINATION

BY MR. WIDERKEHR:

Q Mr. Dugan, on your first decline curve on the first two Florence Wells, how was that pressure taken and who took it? Who took the shut-in? You used the shut-in pressure versus cumulative

production?

A Yes, sir.

Q Who took the pressure?

A Karl Hamstock.

Q With Debley?

A Yes.

Q How long had the well be shut-in when you took that pressure?

A Thirty-three days, five days longer than usual.

Q How much production have you had out of the well?

A This is on Reese' Exhibit 3. It was cumulative production as of -- this is as of December 1st.

Q All right.

A Was two hundred and ninety-two thousand, two hundred and eighty-eight MCF.

Q And when was the shut-in pressure taken?

A The well was shut in December the 4th, '57, and the pressure was taken January the 6th, '58.

Q You don't know whether that is representative of the true reservoir pressure or not?

A No, I don't. I sure don't.

Q How about the other one, the same situation?

A The same, exactly the same days.

Q Mr. Dugan, isn't it well known in engineering circles that a pressure decline curve on a well gives you the best possible answer

as to the anticipated ultimate recovery of a well?

A Not a l., surely not.

Q For a given well, a pressure decline curve on a given well?

A No.

Q Gives you the reserve, recoverable reserve of that well?

A If you had a series of points, perhaps, and with -- under stable conditions with say, the offset wells producing all the time or shut in all the time, yes, it is an excellent way. But l. here, where there has been offset wells shut in, or there is a well that has produced several -- a long time before the other wells were drilled in the field, it's pretty erroneous.

Q Just to clear that thing, how long was that produced before any other wells were started on production?

A I don't know. Quite a while.

Q Okay, tell me.

A Well, just the wells --

Q We are talking -- which well are you talking about specifically?

A That one is the 5-D.

Q When was it connected? If you look at Exhibit 8, I believe it will give you that information.

A 5-D has produced four hundred and thirty-five days.

Q And just looking at the rest of the wells in the vicinity, how long has the l-D produced?

A l-D?

Q Yes. A 402.

Q How about the 2-D? A 476.

Q So those -- it really -- it hadn't been produced a long time before the other wells had been produced, had it?

A 3-D, 184.

Q Those are the wells in the vicinity of it?

A Yes.

Q As a matter of fact, they circled it completely, I believe.

A Yes.

Q So, actually, it didn't produce a lot of gas before the rest of the wells did?

A I was wondering. You said --

Q I asked you a question, Mr. Dugan.

A Excuse me. What was your question?

Q I asked you if it had been produced a long time before the other well in the vicinity, before the other well had been produced?

A Considerably longer. before the 4-D.

Q How about the other one?

A Approximately the same time.

Q No. 2. If the other wells had been on production at the time this particular well was shut in, would that have tended to make this shut-in pressure less or more than the other well? In other words, if all the surrounding wells were on production and this well was shut in, in one instance and in the other instance

all the wells were shut in, in which case would you expect the highest pressure?

A Well, that -- this is of the group that you --

Q Just answer my question.

A I am answering it. This is of the group, one of the groups that you established communication between particular wells, isn't it?

Q Yes, it is.

A Well, I'd say, then, if the other wells -- you have pretty well definitely proved communication if the other wells were producing; I would expect a lower pressure.

Q If the other wells were producing, you would expect a lower pressure?

A Yes.

Q So then, actually in this case when all the other wells were producing to get a representative pressure -- to get a truer pressure, that pressure would have had to be higher and consequently, the recovery reserves indicated by my curve would be greater?

A Possibly.

Q So is -- this is a conservative estimate on that basis?

A If the pressure is low; is that a bottom hole pressure?

Q No, top hole pressure. If it had fluid in there, it would still be higher? A Yes.

Q So it is still conservative? A Yes.

Q You say that it is not a good way to do it. Tell me how,

you might have gotten a lesser answer than I got on this particular well.

A You happen to pick out the vest best wells. We have always agreed that probably the better wells will drain more than 320 acres. I was wondering why you didn't pick out, for instance, the 1-D or the 2-D.

Q Well, I am not on the stand, but I will answer that question because it had mechanical difficulties in completions. You say I picked out the best wells. Would you like to refer to Exhibit 9?

A Okay.

Q The present reserves produced in the well in question, the 5-D, is 15.79, I believe for 365 days produced.

A 5-D. Yes.

Q Look at 3-D, and what is the present reserves produced on the basis of 365 days? A 3-D?

Q Yes.

A 19.7, according to your calculation.

Q All right, look at the 2-C.

A 17.85.

Q How about Honolulu's Jicarilla 2?

A 24.87.

Q Were any of those used by me?

A Let me look.

Q I asked you a question. A No.

Q All right. My next question, then, is, as an engineer, if you were going to calculate reserves using a pressure decline curve, would you not want to take wells with the highest total volume of production to get the best curve?

A The highest number of days produced, perhaps.

Q Not the higher number of gas produced.

A Well, the highest volume of gas. You are picking your best wells, naturally. You can see that easily by taking the average daily deliverability from each well.

Q But I said, isn't that the way, as an engineer, that you would go about it to try to pick out --

A If you would do that, you wouldn't get a representative picture of the field.

Q How do you know you wouldn't?

A Because you are not picking representative wells, you are picking the best wells, you are not picking the average wells or the below average wells.

Q Well, I just showed you four more wells that were above this one, and --

A Above it in percent of reserves calculated by your calculations, but not above it in daily deliverability.

Q You made the statement that you couldn't do that on just a few wells.

A I don't think you can get a representative picture of fields by two wells.

Q What if you took ten wells covering ten hundred acres, would that give a better picture?

A To give you a proper picture, with that type of approach, I would suggest that you take a -- the entire production from the reservoir and the average bottom hole pressure.

Q Have you done that?

A No, sir.

Q Do you think that it is feasible to do any such things as that?

A Well, if I were going to try to prove reserves, that's the way I would do.

Q Do you think that is feasible, to do that with three pipeline companies operating there? Do you think that is feasible, to show this and get that kind of information?

A No, I don't think it is feasible to try to show reserves this way.

Q As one engineer to another, I disagree with you, but that's another matter. Do you feel that you can, by any means, from a pressure decline curve, calculate reserves? Do you think it is possible to do so?

A Well, I think I just pointed out how I would have done it, if --

Q Do you think it can be done, then?

A Yes, sure do.

MR. WIDERKEHR: That's all.

QUESTIONS BY MR. HINKLE:

Q Mr. Dugan, does extrapolation of a pressure decline cumulative production plot indicate the recoverable gas in place underlying the particular tract assigned to the well?

A Would you repeat that again, please?

Q Does the extrapolation of a pressure decline cumulative production plot indicate the recoverable gas in place underlying the particular tract assigned to the well?

A Not the particular tract, no.

Q Could it indicate the manner in which the well had been produced in relation to other wells in the area?

A It certainly could.

Q So it is not indicative, then, of the amount of gas in place under any particular well or under any unit assigned to the well, is that right?

A Yes, I would say, if you took the entire reservoir, you could come up with your reserves in that manner but not by taking one unit or one well or two wells.

MR. HINKLE: That's all.

MR. PORTER: Anyone else have a question?

QUESTIONS BY MR. DAVIS:

Q Mr. Dugan, as an engineer, do you feel that as much as 50 percent of the recoverable gas here would be left in the ground if you drilled on 320?

A I really haven't made a study of that, so I don't feel

qualified to answer that question at the present time.

Q Well, that is pertinent to this hearing.

A It certainly is.

MR. MORGAN: Are you qualified to say any gas would be left in the ground?

A Yes, I am.

MR. MORGAN: All right. What estimate would you make for the benefit of the Commission?

A Well, I would say somewhere perhaps 25 percent to 30 percent.

Q (By Mr. Davis) What basis did you use in making that estimation?

A Well, as I pointed out, I haven't made a study of that.

Q You have used some, I mean.

A Well, as Southern Union pointed out, the permeability, there is a pretty drastic change in permeability from the fairway of the field, you might say to the edge. I feel that on 320 acres you would drain most of the better permeability areas, but you would not drain lower permeability areas where there is considerable amount of gas reserves, and that's just a rough estimate as to the percentage of the permeabilities of lower nature, and as to the better permeabilities in the now designated Tapacito Field.

MR. PORTER: Anyone else have a question?

MR. HINKLE: I have one.

QUESTIONS BY MR. HINKLE:

Q Mr. Dugan, do you think that this Commission ought to base their order on a rough estimate or upon the best engineering accepted principles that are available in determining the proper spacing?

A Well, of course, that's a loaded question. They've got to base their decision on a lot of other things.

Q You said you believed this is just a rough estimate?

A Yes, it is.

Q Do you think the Commission ought to give my weight to a rough estimate?

MR. KELLAHIN: I submit that the witness ought to be allowed to answer the first question before the second one is asked.

A Well, maybe to answer that question, I might do a bit of explaining. I thought Humble's Exhibit on the Darcy Flow Equation was excellent, but it is highly theoretical. It is based upon sound engineering principals, but it has very little application, or the way it was presented, there was very little application to the actual field conditions in Tapacito. That's my opinion.

Q Even at that, it would still be better than making a rough guess, wouldn't it?

A Well, if you accepted radial flow as completely applicable, the entire calculation was based on that. Actually, you'll have to admit that it is a rough estimate also.

Q Your estimate is not based upon any calculation whatsoever, is that right?

A No, I told you I had made no study on this problem three

times.

MR. MORGAN: In answer to my question whether it would be 25 or whether it would be as low as 10 percent or 50 percent, you don't feel qualified to --

A No, I don't feel that I should be qualified to answer an exact percent. I feel there will be considerable amount of gas left.

QUESTIONS BY MR. GRENIER:

Q Mr. Dugan, are you familiar with anything in technical literature or anything in your own experience which would indicate to you that known radial drainage is to be expected as a normal thing --

A Yes.

Q -- in a pool such as the Tapacito Pool?

A Yes.

Q What would that be, please?

A Well, I can't quote the exact paragraphs or -- but I attended several lectures by pretty outstanding reservoir engineers and radial drainage is highly theoretical. I would say in a beach-type deposit, particularly as elongated as Tapactio, that the elongated type pattern is more normal.

Q And you still would think so in the phase of the Southern Union's Exhibit which shows a rather substantial drainage out to the flanges of the field?

A I don't think they showed that. They showed drainage but not where it was coming from.

MR. GRENIER: That's all.

MR. EVANS: I have some questions.

MR. PORTER: Would you identify yourself, please.

MR. EVANS: G. B. Evans, Honolulu Oil.

Q In the phase of the actual testimony that has been presented, I wonder what data you have to base your statements on.

A What statements?

Q The statement that you feel that 320 wouldn't adequately drain --

A Well, we have been listening to that for about a day and a half now. The main thing I based my opinion on was this permeability trend on this map.

Q Where is your data, though, production data?

A Production data?

Q That is what we all have to depend on, that is what we make the money out of.

A Well, the best production data I have was compiled by Mr. Widerkehr.

Q I agree with that.

A The better wells in the field, he has shown that these wells possibly can drain 320 acres.

Q I take exceptions to the wells. Our Jicarilla No. 3 Well on there is --

A That's one of the wells he used, the Jicarilla 3. He used that.

Q It is hardly a better well.

A You mean the average daily deliverability of two million, seven hundred eighty thousand a day is not a better well? That's the best well in the field.

MR. PAYNE: Please don't argue with the witness.

MR. EVANS: That's all. Thank you.

QUESTIONS BY MR. MANKIN:

Q Mr. Dugan, do you agree that the Tapacito-Pictured Cliffs Pool is by far the best Pictured Cliffs Pool in the basin?

A Well, that's a pretty rough question. It depends on whether you are basing your opinion on total gas reserves on individual deliverabilities from single wells. I would say it has a larger percent of better wells in the presently outlined area than the other fields, but as far as having larger wells, it doesn't, and as far as having more gas in place, I don't believe it does.

Q Would you agree that it has better permeability and porosity than most other Pictured Cliffs Pools in the basin?

A As a whole --

Q Yes.

A -- or taking an individual well in this pool and an individual well in that pool?

Q As a pool.

A As a pool, the way it is outlined now, I would say that it has a better percentage than the other pools.

Q In your dealings in the San Juan Basin, have you had occasion to study other Pictured Cliffs Pools in the basin?

A Yes.

Q And do you find that other Pictured Cliffs Pools, if they had been developed on 320-acres, would have left, say, 30 percent gas in place, I mean of recoverable gas, if it wasn't drilled on 160 acres?

A Well, now, I have never studied that particular point or made any calculation with Unevac on it, but just as a general rule, I would say that there would be a percentage of gas left in place, fairly large percent of gas left in place if the other field had been completed or drilled on 320 acres.

Q There are other pools that had been developed on 320 spacing, have they not, even though the pool is on 160? Such as South Blanco?

A Not entirely.

Q Then, would you -- apparently you do not agree with Mr. Reese that you might leave as much as 50 percent of gas in place if you developed on 320 acres?

A I stated before I have not made a definite study on that, and I don't want to argue with him on it, but that might seem rather high to me.

Q Even 30 percent you feel is rather realistic?

A I would say possible.

MR. MANKIN: That is all.

MR. PORTER: Any further questions of the witness?

MR. UTZ: I have one question.

QUESTIONS BY MR. UTZ:

Q Mr. Dugan, have you had any occasion to make any studies of the reservoir in the Ballard-Pictured Cliffs Pool?

A No, I haven't.

Q You have no idea how homogeneity and permeability compared to the Tapacito?

A No, I don't.

MR. PORTER: Anyone else have a question? The witness may be excused.

(Witness excused)

MR. PORTER: Any further testimony to be presented in this case?

MR. KELLAHIN: If the Commission please, that completes our presentation at this time. However, pursuant to Rule 1208 of the Commission's Rules and Regulations, I would like to -- I feel that we have already entered an appearance in this case as provided by said Rule. We were not notified, except by notice through the Commission's regular channels, of this rehearing, and for that reason I want at this time to give notice that we desire to beserved with any pleadings or motions to be filed in this case, and said notice or pleadings to be served upon me, Jason Kellahin, Kellahin and Fox, Box 173, Santa Fe, New Mexico, by Southern Union, Humble Oil & Refining Company, Aztec Oil Company, The El Paso Natural Gas Company, Pan American, Petroleum Honolulu and Northwestern Production. Thank you.

MR. GRENIER: Are you requesting past documents or future

documents?

MR. KELLAHIN: Future documents, Mr. Grenier.

MR. COOLEY: I address this remark to all parties in this proceedings. I call your attention to Rule 1208, that any pleadings, motions or other matters that might be filed in this matter of necessity must be served upon all parties.

MR. PORTER: Does anyone else have anything further in this case? Any statements?

MR. KELLAHIN: If the Commission please, since the time is quite short, and I know the Commission is tired of listening to us, I would like personally to file a written statement within a reasonable time and serve copies, of course, upon all parties.

MR. PORTER: Is that the desire of the other petitioners in this case?

MR. GRENIER: Well, I am not sure exactly what the Commission's time table is on this matter. I understood that with respect to Case 1439, which of course we haven't gotten to yet, that we have to, if we are going to have proration instituted as of the normal six months balancing period effective in the San Juan Basin, that we ought to be getting nominations in some time in June, and I don't know what the Commission's time table is in that regard, but it would seem to me rather confusing to visualize the Commission coming up with one spacing pattern in the case we are in, and another one in 1439. I would think that the two would naturally have to go together. Of course, all the issues that we have here, as pointed out

at the start of the hearing, embrace 1439. I don't know how much time Mr. Kellahin regards as reasonable, but I think we ought to consider this in light of the Commission's time table.

MR. PORTER: The Commission will entertain oral statements at this time in order to get this matter -- the record made and the matter disposed of, please.

MR. GRENIER: I don't see any very useful purposes to be served by a lengthy statement at this time. This is a case which has probably been as thoroughly presented and analyzed now, after this rehearing, as any that I can recall here in some while. We have here on the surface of the thing, it seems to me, a rather striking contrast of one side presenting data on the basis of recognized engineering techniques, using all of those techniques available to them to try to arrive at a proper result, and the people endeavoring to do that represent 95 percent of the total area of the pool, and in contrast to that, we have a small minority interest who, of course, are entitled to be here and have their evidence given as much as the majority, but who have, for the most part, presented data based upon rather subjective interpretations, which are not subject to quantitative analysis or calculation in the same respect as the data presented by Southern Union and Humble in this matter. We, therefore, feel that these are things which should be taken into account by the Commission in weighing the evidence as it must do, which is in conflict in many points, and we submit that the great preponderance of the evidence adduced in this case, which

is based upon sound reservoir engineering principals, does clearly indicate that one well will adequately and efficiently drain 320-acres; that it is an appropriate acreage for the establishment of spacing in this pool, and we move and request once again that the 320-acre spacing pattern be established for the Tapacito-Pictured Cliffs Gas Pool.

MR. HINKLE: If the Commission please, I am sure the Commission is familiar with sub-section (b) of Section 65-3-14. It says, "The Commission may establish a proration unit for each pool, such being the area that can be efficiently and economically drained and developed by one well." I think that that same unit applies here for spacing. Of course, as Art has already stated, the evidence clearly shows here that one well will effectively and economically drain 320 acres. Now, in establishing this spacing unit, it goes further and says, "in so doing the Commission shall consider the economic loss caused by the drilling of unnecessary wells." It has been pointed out here clearly that 456 additional wells drilled, and as the preponderance of the evidence shows, that there would be an economic loss by the drilling of those additional wells.

MR. DAVIS: Aztec concurs with the statements made by Mr. Grenier and Mr. Hinkle and I won't repeat them. One other fact that I think is important in this hearing is the fact that the proponents of the 320-acre spacing, I believe, have shown from the evidence, that perhaps there might be as much as two percent of recoverable reserves left by drilling on 320-acres based on the total recoverable

reserves in this Tapacito Pool. That is a very insignificant amount when compared to the two million dollars that might be required to develop that sort of reserve, and we feel that is always a consideration in pools of this nature, with the drainage pattern that we have found here in this hearing, and we urge the Commission to adopt a 320-acre spacing pattern.

MR. BUELL: Pan American is in favor of the 320-acre unit. In my opinion, the essence of Gunsight's recommendation to the Commission here today is that they are asking the Commission to base their regulations not on the average part of the field, not the better portion of the field, but the poorer portion of the field. In my opinion, that is a pretty weak foundation upon which to base any proration regulation. The preponderance of the probative efforts certainly demands 320-acre units.

MR. SELINGER: If the Commission please, I am appearing on behalf of the Skelly Oil Company. There has been several references to Skelly's wells on the southeast portion of Tapacito Field, and the northeast portion of the south Blanco Field. We have found, through bitter experience in early development on a 160-acre spacing, that the wells are not warranted. Therefore, we feel that the 320-acre spacing should be permitted. those operators that desire to space their wells in accordance with their own production practices and experience. Now, I may be invading Case 1439, but we believe that a solution to that whole problem of proration or 160-acre versus 320 might be solved by a compromised order of permitting 160-acre

with credit up to 320 acres for proration purposes.

MR. PORTER: Anyone else have a statement?

MR. EVANS: Honolulu Oil requests consideration of 320-acre spacing.

MR. PORTER: Any more statements to be made?

MR. KELLAHIN: If the Commission please, as has been pointed out, this has been somewhat a lengthy hearing, and the Commission is pretty well informed of the testimony in this case. I would like, however, to make a few comments in regard to the relative positions of the proponents of 320-acre as against 160-acre spacing. It is to me rather striking that we are in substantial agreement on many points in this case. For example, we have no quarrel with the contention that one well located in the heart of the pool would drain in excess of 160, perhaps 320, perhaps even more acreage. It is our contention, however, that the illustration used by Aztec Oil & Gas Company, and I believe we substantially proved that they used the best wells in the pool to support their contentions on drainage, and that infomation was then taken by Humble Oil & Gas Company and -- Humble and Refining Company, pardon me, and a theoretical computation made; a very excellent engineering computation, which to us does not apply to this pool because of the impermeable character of reservoir rock at various places throughout the pool.

We are also in agreement in regard to the statute which was read by Mr. Hinkle.

Mr. Widerkehr testified that it was economical to drill on the

basis of 160-acres. What they were really talking about, then, is their contention that the gas to be recovered on 160-acres will be substantially recovered on a spacing pattern of 320-acres. It is our contention that it will not. I think we have amply demonstrated that because of the low permeability in portions of the reservoir, unless this pool is developed on 160-acres, reducing the distance which that gas has to flow, and facilitating the flow of the gas through the areas of higher permeabilities, and further because of the interlapping nature of these permeability streaks which do not necessarily connect and, we do not believe they do connect, that we will not get the gas unless it is drilled and developed on 160-acres.

Now, Mr. Buell stated that it was our contention, that we were adopting this to the poorer portions of the reservoir. Certainly we do not feel that we are in a poorer portion of the reservoir. If we did, we wouldn't be wanting to drill it on a 160-acres. We think that the area held by Gunsight Butte is more nearly representative of reservoir conditions as a whole than the small area studied and presented to the Commission by Aztec Oil & Gas Company. There is another point that was made in regard to Tapacito being the best Pictured Cliffs reservoir in northwestern New Mexico. If you take the heart of the reservoir, that is probably true, depending on what your definition of the best may be. However, to make a valid comparison, you would have to take that area of the Tapacito and compare it to the belt area in any of the other given pools, all of which have an area of relative hign permeability lying practically

in the same direction as this pool does. From that area, drilling has extended out, and that is exactly what is happening in the South Blanco-Pictured Cliffs Pool, it is extending toward the Tapacito, and to way whether it is an extension of the Tapacito or extension of the South Blanco is merely to quibble with terms. The infill wells are being drilled, and if they were not economical, I am certain that these companies would not be drilling.

As to the close approach between two reservoirs, which we all know exist at various points, the South Blanco and the Tapacito are quite close together at many points along here. Other Pictured Cliffs Pools approach each other within a quarter of a mile, and that has no real significance if the pools are drilled and developed and produced on the same basis. But if one pool is drilled and developed on 160-acres and the adjacent pool -- and our testimony shows it is common reservoir -- is drilled on 320, inequality will result, and we submit that the Commission should sustain the order heretofore entered.

MR. GRENIER: May I speak very briefly in regard to the matter brought out by Mr. Kellahin?

MR. PORTER: Yes, sir.

MR. GRENIER: I merely wish to point out again, according to Mr. Widerkehr's testimony, that the good, the fairway part of the Tapacito Pool occupies approximately 90 percent of the field as presently defined and delineated by the Commission. That certainly represents the great majority of the pool. It would hardly seem

appropriate for the Commission to be considering at this time the circumstances possibly surrounding the pool, and I think that they must confine them in their essential decision here as to what is happening in the pool as it now exists. Later on, if things look definitely certain, they can change the ruling, but we must proceed on what is there, and that is what this decision should be based on.

MR. PORTER: Mr. Cooley, do you have a statement to read?

MR. COOLEY: Yes. I have a statement from P. T. McGrath, District Engineer, U. S. G. S. And I quote: "The U. S. Geological Survey is opposed to the issuance of a 320 acre spacing order in the Tapacito gas field because we feel that this field can, and probably will, join with other Pictured Cliffs gas fields that are on 160 acre spacing. In such a case we could have wells drilled on 160 acre spacing draining an area in which 320 acre spacing is in effect. In such a case, especially where Indian land is concerned, it could create a problem as the U. S. G. S. would have to call for offset wells, on 160 acre spacing, this being in opposition to a commission order." Signed P. T. McGrath, District Engineer, U. S. G. S.

MR. PAYNE: Mr. Commissioner, I have a statement to read, on behalf of El Paso Natural Gas Company submitted by F. Norman Woodruff. "Because of the need to depart for Austin prior to the termination of this hearing, it is requested that the following statement be entered on El Paso's behalf in Case 977. El Paso Natural Gas Company considers that existing conditions in the Tapacito-Pictured Cliffs

Gas Pool warrant the establishment of 320-acre drilling units, with an operator being privileged to drill on 160-acre drilling units if authorized by the Commission through administrative procedure, such as presently exists for non-standard units in the Jalmat Pool of Lea County, and recommends the adoption of an order which will so provide.

MR. PORTER: Anyone have anything further in this case?

MR. GRENIER: With respect to Mr. McGrath's comments, this, of course, is looking substantially down the road to when these things may come up, and when drainage occurs from pool to pool. This is not a situation which is presently there. This is a situation which may occur in the future. I repeat the same thought that I expressed just a moment ago, that the Commission should properly proceed at this time in light of what now exists, not in the light of what may be the cause at some future time. Certainly, if that change and circumstance that Mr. McGrath mentioned occurs, it might be sound reasoning at that time for considering a revision for anything done at this time.

MR. PORTER: Anything further in this case? We will take the case under advisement and recess until 1:20.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

We, Ada Dearnley and J. A. Trujillo Notaries Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by us in Stenotype and reduced to typewritten transcript by us; that same is a true and correct record to the best of our knowledge, skill and ability.

WITNESS our Hands and Seals, this, the 25th day of June, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
Notary Public

My Commission Expires:

June 19, 1959

J. A. Trujillo
Notary Public

My Commission Expires:

Oct. 5, 1960

BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

March 14, 1957

IN THE MATTER OF:

CASE NO. 977

TRANSCRIPT OF PROCEEDINGS

ADA DEARNLEY AND ASSOCIATES

COURT REPORTERS

605 SIMMS BUILDING

TELEPHONE 3-6691

ALBUQUERQUE, NEW MEXICO

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
March 14, 1957

IN THE MATTER OF: The hearing ordered to be held by Paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.	Case No. 977

BEFORE:

Honorable Edwin L. Mechem
Mr. Murray Morgan
Mr. A. L. Porter

TRANSCRIPT OF HEARING

MR. PORTER: We will consider next Case 977.

E L V I S A. U T Z ,

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. COOLEY:

Q State your name and occupation, please.

A Elvis A. Utz, Engineer with the Oil Conservation Commission.

Q Do you have a statement to make, Mr. Utz, with reference to Case 977, concerning the Pictured Cliffs Gas Pool?

A Yes, I have.

Q Will you proceed?

A The communications test which was ordered in R-794 was completed December 17, 1956. This test showed a pressure decline of some 20 pounds in the shut-in well on Southern Union's Jicarilla 2-E. As provided for in Paragraph 8 of R-794, the Commission staff requested Southern Union to begin another test in this pool. In conformance with this request, the Southern Union's Jicarilla Well No. 4-D, in the southeast quarter of the northeast quarter of Section 30-26 North, 3 West was shut in on December 17, 1956.

I have shown an outline of the pool so that any interested party may know where in the pool these tests are located. The 2-E, the test completed December 17th, is located in the southwest quarter of 17 in this area in the new outline. The new test is the 4-D, which was in the northeast quarter of Section 30, in this area here. The readings on the 4-D test was taken, and began December 17th, was 1,064 psi. Readings taken January 14th and February 11, 1957, recorded the same pressure. Therefore, we have had no results as of now on this test.

In compliance with Paragraph 10 of Order R-794, the Commission called a hearing on this matter January 15, 1957, at which time the case was continued until March 14, 1957. As of today, as I have stated, this test has not shown any results.

I therefore, request that the provisions of R-794 be continued in effect until October the 1st, 1957, or six months from the date of expiration, which is April the 1st, so that we may have the results of this further test to consider before the final determination of the 320-acre spacing.

I would further propose that the Commission hold a hearing on

this matter in August or September of 1957, in order to give us time to analyze the data and write a permanent order by October 1st, the expiration of the six-months extension.

There has been concurred in this matter. They are the Southern Union Gas Company; the Aztec Oil and Gas Company; the Northwest Production Corporation; the Humble Oil anf Refining Company; El Paso Natural Gas; Honolulu Oil Corporation and Magnolia Petroleum Company. These people have concurred by letter with the thoughts of continuance for six months on this case, or the extension of the provisions of the order for six months.

That's all I have.

MR. PORTER: Have you had any communication from anyone objecting?

A I have had no objections to date.

MR. PORTER: Are you through, Mr. Cooley?

MR. COOLEY: Yes.

MR. PORTER: Does anyone have a question of Mr. Utz? Are there any further witnesses in the case?

MR. COOLEY: No, sir.

MR. PORTER: The witness may be excused. We will take the case under advisement. (Witness excused.)

STATE OF NEW MEXICO)
: SS
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission, Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 29th day of March, 1957

My Commission Expires:
June 19, 1959

Ada Dearnley
Notary Public

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE - SANTE FE
3-6691 2-2211

BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO._____

TRANSCRIPT OF PROCEEDINGS

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BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 13, 1958.

IN THE MATTER OF: Case No. 977

TRANSCRIPT OF PROCEEDINGS

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BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 13, 1958

IN THE MATTER OF:

The hearing order to be held by Paragraph 7 of Order No. R-794-B to permit Southern Union Gas Company and all other interested parties to appear and show cause why the Special Pool Rules for the Tapacito-Pictured Cliffs Gas Pool, as set forth in Order No. R-794, should be continued in effect beyond April 1, 1958.) Case 977

BEFORE:

Mr. A. L. Porter, Jr.
Mr. Murray Morgan
Governor Edwin L. Mechem

AFTERNOON SESSION

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: The meeting will come to order. The Commission will take up next Case 977.

MR. COOLEY: Case 977: In the matter of the hearing order to be held by Paragraph 7 of Order No. R-794-B to permit Southern Union Gas Company and all other interested parties to appear and show cause why the Special Pool Rules for the Tapacito-Pictured Cliffs Gas Pool, as set forth in Order No. R-794, should be continued in effect beyond April 1, 1958.

MR. GRENIER: If the Commission please, this is the fourth hearing which has been held in this matter. It involves generally the question of the propriety of 320-acre spacing in the Tapacito-

A Southern Union Gas Company, Manager of Exploration Department.

Q You have previously testified in this same case at the prior hearings thereon?

A I have.

MR. GRENIER: Are the witness's qualifications still acceptable to the Commission?

MR. PORTER: Yes.

Q Now as was mentioned in the opening statement, Mr. Wiederkehr, there were two interference tests made in the Tapacito Field area by Southern Union Gas Company, is that correct?

A Yes, that's right.

Q Is there a map on the board which indicates generally the location and outlines of the Tapacito Field and the relationship of the two interference test areas to the pool outlines?

A Yes. In general, the area outlined in our Exhibit No. 5 in red is the pool boundary. Now, one order came in after I had left town on the extensions of this field, and actually there are a few extensions along the northeastern edge that have been approved by the Commission that are not on this map. The area of test number one centered in the center of 26 North, 4 West. The second interference test was in the southwest part of Township 26 North, 3 West. Both of these test areas lying along the southern extremities of the productive pay in the Tapacito Field. I think it's worthwhile to point out that the Southern Union Jicarilla 1-E Well in the

interference in the southeast quarter of Section 16, 26, 4, is a direct offset to the 6-E Well located in Section 20, Northeast quarter, which was non-productive in the Pictured Cliff formation.

These interference test areas are not limited to the fairway of the field, but actually in the instance mentioned and also in the second interference test area, both wells,or two of the wells are very definitely on the edge and are offset with dry holes.

Q Now in addition to this Exhibit 5, at the prior hearings in this matter there were also introduced as Southern Union Exhibits No. 1 and 2 smaller plats showing the detailed locations of the wells involved in the respective interference tests. Those exhibits, I believe, have now been placed on the board again, is that correct?

A Yes. Interference test number one, Exhibit No. 1, had three producing wells with one shut in well in the center. Number two interference test, we had two producing wells with one shut in well.

Q Now, at the first -- now as to the first test, the results of that were given at the prior hearing, but in order that we may compare the results of that test intelligently with the results of the second, can you briefly state to us now again what that test indicated?

A Interference test number one, with three producing wells, these three wells during the time of the test produced a cumulative total of 1,340,450,000 cubic feet of gas, with the shut in well

losing 22 pounds casing pressure, 21½ pounds tubing pressure during the time of this interference test. That amounts to about two percent of the original gas in place being withdrawn during the time this well was shut in.

Q Now then, the data as to that was presented in Exhibit No. 3, I believe, at the last hearing in this matter, and in Exhibit 4, the data up to the date of that hearing was presented as to the second interference test. Have you now prepared additional exhibit bringing down to date the data as to the second interference test?

A Yes, I have, showing the same general type of information as shown in one, with the monthly production, the cumulative production, and the monthly shut in casing and tubing pressures on the shut in well, and on the bottom of that, as per the Commission's order, we have two sets of bottomhole pressures run on both the two flowing wells and the one shut in well. Those pressures were run on October 8 and January 30, respectively.

Q Now, may we have this exhibit marked as Southern Union Exhibit 6?

(Southern Union Gas Company's Exhibit No. 6 marked for identification.)

Q Can you summarize the results, then, as to cumulative production which was obtained from the two wells offsetting the Southern Union well, and what if any pressure drop was noted?

A Yes. The cumulative production for the two wells through

the month of January, 1958, amounted to 700,654,000 cubic feet of gas. During that time the pressures were recorded, the maximum pressure was 1,066 pounds on the casing and the minimum pressure was 1,056 pounds, or a ten pound pressure drop. On the tubing, the maximum pressure was 1,064½ pounds, and the minimum pressure was 1,054 pounds, or 9½ pounds. It's interesting to note that approximately fifty percent as much gas was withdrawn during this interference test, and we had a pressure drop of approximately fifty percent as much; in other words, we had twenty-two versus ten and a billion three versus seven hundred million.

Q You are speaking in comparison to the first interference test, is that correct?

A Right, that is correct. On the bottomhole pressures, on October 8, 1957, the shut in well bottomhole pressure amounted to 1199 pounds. The tophole pressure at that same time was 1,061 pounds. On January 30, 1958, the shut in pressure on the 4-D Well was 1193 pounds, that's the bottomhole, and the tophole shut in was 1,055 pounds. We had there a six pound pressure drop between October 8 and January 30 on the bottomhole from bomb, and at the same time we had a six pound pressure drop tophole, deadweight measurement, which indicates there was no fluid in the hole and we are actually getting then true tophole pressures.

Q Now what do those two tests indicate as to the area which a well in these portions of the field, at least, is capable of draining?

A The area, assuming a drainage pattern of a circle, circular drainage pattern, the minimum area drained under interference test number one would have to have been 785 acres; in other words, we were getting interference out of an area of 785 acres. The second test indicated interference over 783 acres.

Q What was the basis on which those figures were derived? How did you arrive at your respective acreages?

A Actually taking the diameter of a circle between the locations of the various wells and drawing a circle with it.

Q A radius?

A A radius, rather. Drawing a circle, using as the radius the distance between the producing well and the shut in well.

Q That is to the closest of the producing wells, is that correct?

A That's correct.

Q Would you say, then, that that is the minimum area which is indicated to be drained?

A Yes. I think we have conclusively proved that you can move gas over an area of 780 acres.

Q Do you feel that these two tests, considering their relationship geographically to the remainder of the field, are fairly representative of the conditions which may be expected to be found in the field as a whole, or are they of somewhat more local significance only?

A As pointed out a while ago, the fact that the test areas

are on the extreme boundary and they are offset with dry holes, and I might point out that Jicarilla 5-D Well, located in the southwest quarter of Section 30, 26, 3, which was the closest well to the 4-D shut in well and which is the extreme well next to the edge of the field, produces 546 billion of the 700 million feet that was produced from the field. In other words, what we're saying is that you have good sand development right up to a breaking point, and then immediately you go in a period of one location, you go from good sand development to practically nothing. That can be pointed out again by looking at Section 1, 26, 5, in which Southern Union completed its 2-G Jicarilla well for 20 million I.P., and the southwest quarter was a dry hole in the Pictured Cliff and cored, and we had pretty good information. Yet across that section we went from a sand body that would give an I.P. of 20 million to nothing.

So then we have in reality a very definite breaking point that could be carried on further through, one of Pacific Northwest's wells offsetting a 20 million foot well that made a million, just about a million feet, I believe. I have pointed out another example here, I might point out between Southern Union 2-HJ and 5-EH, the 5-E I.P. for 6 million, and that was through a three-quarter inch choke, and the 2-H direct offset I.P. for 920 thousand, so there is a very definite edge point along which the sand just goes completely to pot.

Q So that the entire length of the field rather closely

resembles itself in that regard, is that correct?

A That is correct. We can trace it all the way from the northernmost edge right on down to the south end of it.

Q To reiterate the question, then, do you feel that these two tests areas then are representative of conditions to be found in the field as a whole?

A Yes, I do.

Q Have you made any estimate of the reserves in this Tapacito-Pictured Cliffs Pool, Mr. Wiederkehr?

A Yes, actually we keep our reservoir calculations based on what our operating line pressures are. At the present time we are operating, or we have a system that will operate at about 500 pounds in this area, and the recoverable reserves to 500 pounds have been calculated to be 835 million feet of gas on 160 acres, or 1,670,000,000 cubic feet of gas on 320 acre unit.

Q What was the basis upon which you arrived at those reserve estimates?

A Using the porosity, water saturation, and sand thickness, it was a volumetric calculation based on all the information we had available.

Q Now, what does it cost, on the average, to drill a well in this area?

A We have drilled some nineteen or twenty wells with an average cost running between thirty-nine and forty-one thousand dollars.

Q What would --

A (Interrupting) I would say forty thousand is a good round number.

Q Now, would an investment of that kind be economically justifiable in the event 160-acre spacing were established for this pool, considering the reserve computations which you have made and the other known facts about the pool?

A Yes, a well drilled on 160 acres would pay for itself.

Q Then why is it that 320-acre spacing is being recommended by Southern Union in this case, since as you state, 160-acre spacing, rather, drilling on 160 acre basis would be economically justifiable?

A Simply because it appears that we can recover approximately as much gas from wells on 320 as we could on wells on 160. Right now there are approximately forty-six wells in the field developed on 320. If we have to go back in there and develop on 160, we are talking about an additional forty-six wells, or an expenditure of about two million dollars. That two million dollars can be used very well other places.

Q Well, now, if 160-acre spacing were established by the Commission's order in this case, or it were just left under the area 160-acre spacing order, what effect would that have upon this two million dollar investment? Would it necessarily have to be made?

A Well, of course, each operator would have the prerogative

of drilling either on the 160 or 320, but in the event of proration, which we suspect might come about, if one operator drilled on 160, drilled two wells then to the 320, and the other operator only had one well on the 320, there might be drainage across lease lines. So we should have a uniform pattern, and we feel like the 320 is the most logical pattern to set.

Q Do I infer from that, then, that if an operator who had developed his lands on 320 were being offset by another operator on 160, that 160-acre spacing pattern might in sort of a chain reaction force the 320 developed operator to go to 160?

A It certainly could and probably would in certain areas of the field where there are varied ownerships, both operators and royalty owners, and to protect correlative rights of the royalty owners, I wouldn't be a bit surprised if we weren't forced to offset additional wells.

Q Now, you stated, I believe, that prorationing has not yet been instituted in this pool, is that correct?

A That is correct.

Q Has it been instituted in other Northwestern New Mexico Pictured Cliff pools?

A In all but one, I believe, of the major pools.

Q Would you think it likely that this pool would go on for much longer time in an unprorated condition?

A Of course, I can't second-guess the Commission, but with three pipe line companies taking gas out of the area at varied

rates, it wouldn't surprise me any if it were prorated.

Q Well, I gather from that then that you feel that there might be some reasonable likelihood of prorationing hearings being held in the fairly near future?

A I suspect there will be.

Q Now, if that is the case, would it be your recommendation that the Commission proceed in this case without regard to the problems which they might encounter in establishing prorationing?

A I think certainly that we have to look at this case in line with the Commission's policy to prorate gas in the Northwestern New Mexico area.

Q In Section 65-3-14 of the New Mexico Conservation Commission Act, it provides in sub-paragraph (b) as follows: "The Commission may establish a proration unit for each pool, such being the area that can be efficiently and economically drained and developed by one well, and in so doing the Commission shall consider the economic loss caused by the drilling of unnecessary wells, the protection of correlative rights, including those of royalty owners, the prevention of waste, the avoidance of the augmentation of risks arising from the drilling of an excessive number of wells, and the prevention of reduced recovery which might result from the drilling of too few wells." Now, considering the standards set up in the section of the law just quoted, do you feel that 160 acres or 320 acre spacing is best adapted to meeting the standards which the Commission is going to have to consider when and as it gets to the point of

prorationing orders?

A I think definitely that the 320-acre unit is the most logical at this stage of the field development.

Q Would 320-acre spacing be sufficient to, and I quote: "...efficiently and economically drain"...Will one well in this area efficiently and economically drain a 320-acre tract?

A From all the information we have presently available, it certainly appears that it would.

Q Would 320-acre spacing or 160-acre spacing be best calculated to prevent economic loss caused by the drilling of unnecessary wells?

A Certainly drilling on 160 would be an economic loss due to the fact that you would be drilling unnecessary wells.

Q Would that be so at the 320-acre spacing?

A It might be, but we don't have enough information to prove that we can drain any larger area at this time, effectively.

Q Your interference tests have indicated that possibly they could?

A Yes, but these interference tests don't run into effectiveness. They just show you can drain an area, and I would be skeptical that you would drain that far an area effectively.

Q Now, would you feel that institution of 320-acre spacing would adequately protect correlative rights, including those of royalty owners?

A If the field was developed on that spacing, it certainly

would.

Q Would you feel that there was anything to choose between the 320 and the 160 acre spacing patterns as to the prevention of waste?

A That is a question that in all probability there may be a very small amount of additional gas recovered on 160 drilling versus 320 drilling, but as I pointed out earlier today, the area where you go from good sand to poor sand is extremely narrow, you just run out of sand in one location offsets, and as a consequence I doubt that there is much additional gas that could be recovered even by drilling on 160-acre spacing.

Q In contrast to the other Pictured Cliffs Pools in this area, would it be your opinion that there is better than average or poorer than average communication in this pool as between wells?

A This seems to be in all probability the best Pictured Cliff field in the northwest or in the San Juan Basin.

Q As contrasted to the presently prorated pools, just slightly so or substantially so?

A Appreciably so.

Q Which as between 320 and 160 acre spacing would better avoid augmentation of risks arising from the drilling of an excessive number of wells?

A As pointed out on the map, if we will look on the southwest side of the map, we know three or four wells that Southern Union drilled in there, that 320-acre spacing even with dry holes being

less than a mile from production, so certainly drilling on 160, you are taking a greater risk of drilling additional dry holes.

Q Now, as the pool has been developed to date, have all of the wells within it been drilled on 320-acre spacing pattern, in accordance with this temporary order that we have now had in effect for, well, since April of 1957?

A I think there's one well that was drilled on 160-acre spacing. A special hearing was held on a Pacific Northwest well.

Q To your knowledge, there's only that one exception of a well less than 320?

A That's the only one that I know of.

Q In which corners of the sections does the Commission order contemplate that these wells are to be drilled?

A Southwest and northeast.

Q Are there some wells in the pool which have not been drilled in accordance with that?

A Yes, there are.

Q Now, do I understand then that each of those wells, even though irregularly located within the section, is still so located as to permit the assignment of 320 acre unit to it, is that correct?

A That is correct. There are no more than two Pictured Cliffs in any other section,or any section.

Q This may be a little premature, Mr. Wiederkehr, but still looking down the road just a little bit to this prorationing problem which you have indicated may well be upon us in the near future,

wouldn't further continuance of 320-acre spacing as the standard spacing pattern for this pool necessarily have to preclude anybody from drilling up his acreage on 160-acre basis, if he so desired in a particular situation?

A I think that if the Commission so desires, that an order of 160-acre spacing could be allowed with the thought in mind that wells drilled on 320 acre would be given a 320-acre unit rather than a 160 as has been done in the other areas of the State of New Mexico.

Q In other words, you would give a double allowable to a well drilled on 320, as contrasted to a single allowable to the well on the 160?

A Assuming the deliverability is the same, the formula would work out that way, yes.

Q Would it be your thought, if a man wanted or company wanted to put in two wells on 320 acre tract and produce the unit allowable from the two of them, that he should be in effect permitted to do so in this fashion?

A I would think they would be permitted to do so as individual wells, each one getting 160 acres allocated to it.

Q If it can be accommodated to either 160 acres or 320, then, in the prorationing process, assuming that there is a double allowable to 320 acre well, why is it that you are now suggesting a 320 acre spacing pattern?

A Because I think it more nearly conforms to what the law says

should be done. I believe I feel like the 320 is. I think it is a waste of money to drill wells on any closer pattern.

Q Do you have any further comment?

A Yes, I would like to make one comment further with respect to production. The question was brought up at a previous hearing as to whether these wells in Tapacito, if they were allowed to be drilled and produced on 320-acre spacing, could or would produce twice as much as wells on 160-acre spacing in other Pictured Cliffs fields, and just for my own information, I ran through the month of December production figures for all the Pictured Cliff fields, and here is the results on Pictured Cliffs-Tapacito wells, average 16.15 million feet per month per well. The next closest field is Otero at 6.1 million feet per month per well. 5.9 for South Blanco, Aztec-Pictured Cliffs, 4.4; West Kutz, 3.8; Ballard, 3.1; Fulcher Kutz, 2.6; Canyon Largo, 1.5. In other words, the average production from these Tapacito field wells drilled on 320-acre spacing produced approximately two and a half times as much as any other field average. I think that that is something else that could influence the Commission, because this does indicate that the Tapacito wells are well above average as far as deliverable capacity is concerned, and consequently well above average as far as being able to recover in the same number of years the gas that is in the field.

We are not talking about deferring income for twice as long as other Pictured Cliffs fields, but we are talking about wells

that can probably recover the gas from under the tracts in lesser time than the other wells in Pictured Cliffs fields, even on 320-acre spacing.

Q Would that last comment that you made be true as respects both working interest owners and also the royalty owners?

A That is correct. In other words, we'll just get, the field is of such characteristics that it can be drained much more rapidly than any of the Pictured Cliffs fields we know of in the area.

Q That would be to the benefit of not only the working interest but the Indians, the Government?

A Anybody else.

Q Equally as the working interest owners themselves?

A That is correct. One other thing, speaking strictly for Southern Union, we have already laid a gathering line into the area, about 20 or 30 miles of it across there with the wells that we have developed and the wells committed to our company. That line is so packed right now that the average wellhead working pressure is running about 600 pounds. If we drilled additional wells, we couldn't cram any more gas through the line anyhow. We as a company could not take additional gas, or appreciable quantities of additional gas without expending additional sums of money for additional pipe lines, which we don't feel like the reserves would justify, so even if we went to drilling of additional wells in there, in all probability all we would do would be cut back the production from the ones we have, and the net production from

the field would probably be about the same. At the present time, Southern Union has, either owns or under gas purchase contract, about half the wells in the field. I believe that's all I have.

MR. GRENIER: I have a concluding statement, but I think it might be appropriate to reserve that until after we see if anybody else has testimony in this case.

MR. PORTER: Does anyone have a question of this witness? Mr. Kellahin.

MR. KELLAHIN: Jason Kellahin, representing the Gunsite Butte Uranium Corporation.

CROSS EXAMINATION

By MR. KELLAHIN:

Q Mr. Wiederkehr, in connection with your interference test and in reference to Exhibit No. 5, I believe you stated that the wells on which the tests were run were located along the southern extremity of the pay zone?

A Actually southwestern extremity. It depends on how you look at the field, being southwest-northeast, it has to be on the southwest side of the field.

Q They are not located, then, in the fairway of the field, is that your testimony?

A What I was saying was that one well in each of the interference tests was located adjacent to dry holes, so they are located pretty close to the edge of the field.

Q Is that based solely on the fact that they are located

closely or adjacent to a dry hole, is that the basis of your testimony that they are at the edge of the field?

A Yes. They're also at the edge of the field as determined by the state under the field boundary.

Q That I will agree to. Now, in connection with that, have you made any study of the micro-logs as to porosity through the field?

A Yes, as a matter of fact, I have core information on quite a number of wells in the field.

Q On the basis of that study, do you still say they are not located in the fairway?

A Well, it depends on how you define "fairway". I define fairway as the middle, in the middle of the field. If you do that, they are not in the middle, they are on the edge.

Q Actually it is a relative question as to porosity and sand thickness?

A That is correct.

Q In general, the areas which were subject to the interference tests are in a good micro-porosity area, are they not?

A The wells in general are pretty good, but we took them as close to the edge of the field as we had available.

Q I'm referring to characteristics of the wells as compared to the pool as a whole. They are relatively good?

A The wells that we used on the interference test, not necessarily, they were about average.

Q You had good sand characteristics there, did you not?

A Yes, pretty good sand.

Q Now, in connection with these interference tests, I would like to go over those again with you; as to interference test number one, I believe you said you had a shut in pressure drop on the casing of 22 pounds, is that correct?

A That is correct.

Q What was your total production?

A 1,340,450,000 cubic feet of gas.

Q How far was the shut in well from the producing wells?

A Let's see, about 3300 feet, that was the nearest one.

Q Over what period of time did you achieve that pressure drop?

A There was no production in January, '56, so the first production was in February of '56, and the conclusion of the test was in December of '56, we are talking about eleven months.

Q You are talking about eleven months, with a 22 pound pressure drop?

A Right, over a 3300 foot interval.

Q Now, as to your interference test number two, give us the same information on that.

A Yes, the distance between wells is 3295 feet, the pressure drop was 10 pounds, the production was 700,654,000 cubic feet of gas, and actually the majority of that production was in a 13-month period prior to the time of the test; 60,000,000 feet of gas had been produced from the Jicarilla 2-D well.

Q Would that have any effect on your interference test?

A I seriously doubt it, that small amount of gas, because we didn't find a definite break in pressure until about six months had elapsed. It took about that length of time before we actually started moving gas from the well that was shut in. Then after it started, it started moving pretty rapidly.

Q In connection with your interference test, I believe your test does not show the effectiveness of the drainage, is that correct?

A I would say that it doesn't prove that you could effectively drain 785 acres.

Q It does not effectively prove it?

A That's right. It does prove, as far as I am concerned, that you can dril 320 acres.

Q Effectively?

A Yes, sir, effectively.

Q And economically?

A And economically.

Q In connection with those dry holes which you said the pressure tests offset, does completion method have anything to do with that, in your opinion?

A It would not in this case, because we drilled the wells in this case, and I happened to have the supervision of the drilling in the wells.

Q So you know they were completed properly?

A I know they were completed properly.

Q There are some producing wells to the south and west of the Tapacito not shown on your map?

A Producers south and west?

Q Between the Tapacito and the South Blanco?

A There may be, because I was only interested in the Tapacito property.

Q You don't have your well data up to date on that map?

A Yes, inside the Tapacito.

Q Outside the Tapacito?

A No. Actually it was only brought up to date for the Tapacito Field, only.

Q Give us the method you used in calculating reserves.

A I said that I used the volumetric method.

Q You used an abandonment pressure, in effect, of 500 pounds?

A I pointed out that we carry our reserves on the basis of what we can get at our presently anticipated operating line pressure. Certainly I do not doubt before this thing is over with, we will be down to a lesser pressure. I said recoverable to 500 pounds, I wanted that pointed out very definitely.

Q Other pipe lines operate at considerably lower pressures in that area?

A I don't know about El Paso's, I believe Pacific Northwest is appreciably higher.

Q You wouldn't know if El Paso's was 250?

A I don't know. I didn't ask them.

Q As a general proposition in calculating reserves other than in the operation of your pipe line, you calculate them in 100 pounds?

A Depending on the characteristics, and I suspect that one of these days we will be down to that point on this field. I'm not arguing that there is not plenty of gas to support 160 acre.

Q In connection with your calculation of reserves, could you give us what porosity you used?

A I used a 19 percent porosity figure, taking only the area that I considered to be, to have the permeability that would be productive. Actually you can take from core analysis, you can go throughout the entire section, which is 100 feet or so, if you want to, and because of the variations in porosity up and down, you can get a much lower average porosity, and then you just increase your sand thickness.

Q You just took the effective permeability?

A What I figured was the effective area that could be drained because of the fact of the no permeability in much of the section.

Q What range of permeabilities did you find that you considered effective?

A Oh, I would say from about two-tenths of a millidarcy. We have fracted wells with as little as that, and made wells out, and the permeability runs up; we had some as high as two or three hundred millidarcies.

Q What water saturation?

A Thirty percent water saturation, which may or may not be exact. I have seen certain core analyses that showed a water saturation of twenty percent, and I have seen some showed as high as fifty and sixty, yet they made producers; for my calculation I used thirty percent. If it is higher than that, it will reduce your reserves a little bit.

Q You referred to a Pacific Northwest well drilled off pattern subsequent to the last order. Tell us which well that is, please.

A Northwest quarter of Section 7, 26, 4; that well has not been spotted, that is where it is, northwest quarter of Section 7, 26, 4.

Q Mr. Wiederkehr, I don't know if you touched on this directly in your direct examination, but in referring to your line pressure operating at 500, does that indicate that you are loaded in that line, there is a limited market in this pool?

A As far as Southern Union is concerned, there is a limited market.

MR. KELLAHIN: Thank you very much.

MR. PORTER: Anyone else have a question of the witness? Mr. Cooley.

By MR. COOLEY:

Q Mr. Wiederkehr, in relation to the information that the information tests give us, I believe you reiterated at least twice that it does not show that it will effectively drain, or how long it will take to drain a particular area. Do you have any estimates

as to how much longer it will take to drain the Tapicito-Pictured Cliffs Pool on 320-acre spacing, as compared to 160-acre spacing?

A Well, as I said, as far as Southern Union, it would be about the same because we can only take so much gas. Assuming all wells were produced at the same proportionate part of their capacity, then you would drain the wells in approximately twice as fast if you drilled it on 160 as on 320.

Q You think it would be just a direct relationship?

A Relatively close, I don't think there is going to be much gas on the edge drained in anyway, because of the relatively thin area where you go from productive to non-productive.

Q In your arguments in favor of 320-acre spacing, I believe you stated that you felt that it would be undesirable to have 160-acre spacing in there or that 160-acre spacing would cause, necessitate offsets?

A Yes. That would be, of course, in the event of prorationing and in the event, regardless of your acreage, you were prorated on the same basis.

Q Assuming those facts to be the case, you feel that correlative rights of at least the royalty owners would be violated or impaired if the offset was not drilled?

A Yes.

Q Would this not also be true if, as you proposed, the Commission permits or goes to 320 proration units, but permits 160-acre wells, two wells on 320-acre unit?

A If the acreage, well, assuming that deliverability of the two wells on the 320 was the same as the deliverability on the one well on the offset 320, there would be no violation because their allowables would be the same.

Q Why does this hold true in one instance and not the other? I don't understand your reasoning.

A What I said originally was that if you did not drill, if somebody drills on 160 and the offset operator did not drill on 160, and you prorated on the basis of 160, the two 160 wells get twice as much allowable as the one on the 320, so then you have drainage. If you double the allowable, the 320 will get twice as much as either of the two 160, but the same as both combined.

MR. COOLEY: Thank you very much.

MR. PORTER: Mr. Mankin, do you have a question?

MR. MANKIN: Warren Makin with Aztec. I have some questions, Mr. Wiederkehr.

By MR. MANKIN:

Q A while ago, Mr. Kellahin mentioned about some development extending out of the south part of the Tapacito in the South Blanco. Is it not true that the trends of the Pictured Cliff normally line up and that this trend would go into the Gavilan rather than the South Blanco?

A If it doesn't die behind it, it probably will some day end up down there, but as far as we know, all Pictured Cliffs trends found in the Basin, quite a number of them have followed the north-

west - southeast trend.

Q Also it was mentioned that there were certain exceptions given, I believe when this order was originally written there was at least two Southern Union wells and one Gunsite well recognized as exceptions to the wells by wells previously drilled?

A That is correct, that was asked for at the outset.

Q Some time later, Southern Union had a hearing and asked for an exception for the No. 5-E well occasioned by prior drilling of one of the excepted wells?

A That is correct, we overlooked it the first time.

Q Some time later, Gunsite Butte had a hearing and made a point of asking that the well be drilled in the northwest section of 3, and later drilled the well in the northeast quarter?

A Yes, as I understand, that was a true fact. I was not present but had a report.

Q Do you have any reason to doubt that some of the testimony that was given previously might not have been somewhat changed by conditions on development?

A Well, since I wasn't at that hearing, I had better not make any statement on that. I do know that Pacific Northwest, when they got their exception, didn't do any better than they would have the first thing.

Q But the exception was granted for the Gunsite in the northwest quarter of Section 3, 25, 3, but the well was drilled in the proper place in the northeast quarter?

A That is my understanding.

Q So apparently some condition must have changed. Also I wanted to ask you here if you now would recommend that this test on the 4-D well be discontinued due to proving that there has been interference?

A Yes, sir, I would like to ask that this test be discontinued because we have had over this period of time at least two wells shut in now for two years.

Q So there has been, in your estimation, sufficient proof of interference, and therefore it would be to the benefit of both Southern Union and Aztec that this well could revert to production?

A Yes, that is correct.

MR. MANKIN: That's all.

MR. PORTER: Mr. Kellahin.

By MR. KELLAHIN:

Q I would like to ask a question to clarify a matter brought out by Mr. Mankin. My question, Mr. Wiederkehr, originally was directed to wells outside the Tapacito Pool lying to the south and west of the Pool, between it and the South Blanco. Now did you understand it that way?

A Yes, I understood you to ask me if there were not additional wells.

Q And your answer was there are?

A Yes, there are some wells and some dry holes.

Q In connection with your exhibits showing the circle of

influence of those wells, they assume a uniform porosity and permeability, do they not?

A Yes, since we don't have enough information to go beyond that, we had to make that assumption.

MR. KELLAHIN: That's all. Thank you.

MR. PORTER: Mr. Utz, did you have a question?

MR. UTZ: Yes, sir.

By MR. UTZ:

Q I wonder if you would give me your 160 - 320 reserves figures again.

A Based on 500 pounds abandonment pressure --

Q Is that bottomhole or reservoir?

A Reservoir. On 160 acres, 835 million cubic feet of gas. On 320 acre unit, 1,670,000,000 cubic feet of gas.

Q Do you consider those recoverable reserves?

A To that pressure, that is correct.

Q Then that would mean that you consider your 320-acre drainage as efficient as the 160-acre drainage?

A Yes, as I mentioned earlier, I think there will be very little difference in this particular field.

Q Your statement --

A (Interrupting) May I go ahead on that last question first?

Q Go ahead.

A Particularly at this point, certainly at 500 pounds, we wouldn't have made any difference with respect to the reserves.

Now there may be a variation in recoverable reserves by the time you get on down to the final abandonment, but that would be very minor.

Q Well, you made a statement that you would recover approximately as much gas on 320 as 160. You have just qualified that, is that right?

A No, I haven't qualified it. I said that on my first statement of reserves, on 835 million on 160 and 1,670,000,000 on 320, that since they were based on 500 pounds pressure, that you wouldn't have left anything in the reservoir at that time. Now I say as you take it below 500, there will be a slight amount of gas, a little more gas left in the reservoir on 320 than on 160, but that is not nearly enough to offset the additional expenditure that would be required to get it.

Q How many wells did you say were in the Tapacito Pool?

A I believe there were 46 at the last count, I added up to 46.

Q Do you know that all those wells are connected?

A As far as I know, there are two or three that are not connected. The majority are, though.

Q Do I understand your testimony to the effect that you had no objection to either 160 or 320 acre spacing in the Pool?

A I said that, I don't think I said I wouldn't object to it. I said if the Commission should desire to do that, we felt like some provision should be made in the proration order. I think

320 is justified and think that is the proper order. I think it would be a waste of money to drill them on any other spacing.

Q If an operator saw fit to drill on 160, would you object to that?

A Well, I would object to it, because of the effect it might have on the field as a whole. I just think you ought to try to develop a field, if possible, on a common ground, particularly where you are starting out with a new field, but I wouldn't object near as strenuously if we knew the proration order was going to read two to one allowable on 160.

Q Let's assume for the moment that the proration order did read two to one allowable, what would be your recommendation?

A Then I would say that would be up to the individual company. My company policy would certainly be not to drill them on 160, but some other company might think they could do so.

MR. UTZ: I believe that's all I have.

MR. PORTER: Anyone else have a question of the witness? Did you offer your exhibits?

MR. GRENIER: I have one or two questions on redirect, Mr. Porter.

MR. PORTER: All right.

REDIRECT EXAMINATION

By MR. GRENIER:

Q Now we don't have a proration order yet, do we?

A No, sir.

Q We don't have any guarantee that one is going to come along on 160 or 320 acre basis?

A That is correct.

Q I gather, then, that we don't have any idea whether there will be a two to one protection in the proration order or not?

A That is the problem we are facing right now.

Q Now then, pending the arrival of prorationing and without any certainties as to what the prorationing order might do as to providing a two to one ratio, do you have any firm recommendation as between 160 and 320 during this interim period?

A I certainly do. I think we should continue our 320 acre spacing that the Commission has granted us up to date.

Q In other words, going back to Mr. Utz's line of cross examination, if anything were to be done along the lines that he is thinking about, do you think it would be better to do it after we had a proration order rather than before, is that correct?

A That is correct.

MR. GRENIER: I don't believe we have introduced, asked to have Exhibits 5 and 6 introduced in evidence, but we do so request now.

MR. PORTER: Without objection, Exhibits 5 and 6 will be admitted. Are there any further questions of this witness? The witness may be excused.

(Witness excused.)

I believe you stated that you just had the one witness?

MR. GRENIER: Yes, sir. That completes our direct presentation.

MR. PORTER: Does anyone else have testimony to present?

MR. KELLAHIN: Jason Kellahin of Kellahin and Fox, representing Gunsite Butte Corporation. We will have one witness, Mr. Val Reese.

(Witness sworn.)

If the Commission please, we will have some exhibits. It might be helpful to put them on the board.

(Recess.)

MR. PORTER: The hearing will come to order, please. Mr. Reese, would you stand and be sworn?

MR. COOLEY: This man has been sworn already.

MR. PORTER: Let the record show that the witness has been sworn.

VAL R. REESE

called as a witness, having been first duly sworn on oath, testified as follows:

DIRECT EXAMINATION

By MR. KELLAHIN:

Q Would you state your name, please?

A My name is Val R. Reese, and I make my home in Albuquerque, New Mexico.

Q By whom are you employed and what is the nature of your employment?

A I am employed by Val R. Reese and Associates, Inc., consulting geological and engineering firm located at 2929 Monte Vista Boulevard, Northeast, Albuquerque, New Mexico.

Q In connection with your employment, would you describe your duties?

A The nature of my duties is in a consulting capacity as a geologist in recommending wellsites, pre-determining of well depths, fixing casing points, determination of production zones for purposes of perforation, calculation of oil and gas reserves, recommending the development of leasehold of oil and gas acreage, and recommending the acquirement of gas and oil acreage for clients. These are dictated by geological studies and surveys and surface information.

Q Do you have a staff available to you?

A My staff consists of Thomas A. Dugan of Farmington, New Mexico, who is a petroleum engineer specializing in the drilling and completion of wells. He is assisted by Mr. Jim Jacobs, a geologist. The other member of my staff is Mr. Louis C. Jamison, a geological engineer. Mr. Jamison is an expert on the calculation of oil and gas reserves. He has worked under my supervision in the preparation of oil and gas reserves which we are submitting for your considerating in this hearing.

Q Have you ever testified before this Commission before, Mr. Reese?

A No, I haven't.

Q Would you describe your formal education and experience prior to your association with Val R. Reese and Associates?

A I attended San Jose State College in California for a period of three years prior to my entering the Army in 1941. While in San Jose State College, I majored in Geology, also was actively engaged in Mining Geology in the States of California and Arizona before and during my attendance at San Jose College. Following my discharge from the Army in 1946, I enrolled in Stanford University, and in 1947 graduated from Stanford with a Bachelor of Science Degree in Geology. I was thereafter employed by Associated Engineers, Palo Alto, California, for approximately a year until April, 1948, as a pipe line superintendent. In April of 1948 I was employed with Phillips Petroleum Company as an exploration geologist.

Q In connection with your work with Phillips Petroleum Company, have you had any experience in the San Juan Basin?

A My exploration activities for Phillips first took me into the San Juan Basin during the latter part of 1948. I have been actively engaged in geological studies relating to the San Juan Basin since that time, a period of approximately nine years. In April of 1951, I became District Geologist for Phillips in the San Juan Basin. My chief duty with Phillips Petroleum Corporation was to find and develop gas reserves in approximately 5,000 acres in the San Juan Basin. These gas reserves it later dedicated to the Pacific Northwest Pipe Line Corporation. In September of 1954,

I became Chief Geologist for Pacific Northwest Pipe Line Corporation, and later I also became Chief Geologist and in charge of the Land Department for Northwest Production Corporation, a subsidiary to Pacific Northwest Pipe Line Corporation. In June of 1957, I organized Val R. Reese and Associates, Inc.

Q Now, in connection with the Tapacito Pool, have you made any special study of that pool in connection with this case, Mr. Reese?

A Yes, we have.

(Gunsite's Exhibit No. 1 marked for identification.)

Q Referring to what has been marked as Exhibit No. 1, would you state what that is?

A Exhibit No. 1 is an isopacous map of the net pay sands of the Tapacito-Pictured Cliffs Field. The yellow outline shown on the map is the present outline of the Tapacito Field, and the yellow outline in the southwest part of the map is the northeast edge of the South Blanco-Pictured Cliffs Field.

Q What do the contours on that exhibit indicate?

A The contours represent an isopacous map or a thickness map of the net pay gas sands in the Tapacito Field. The thickness of these sands has been determined by studying the core information available in the Pictured Cliffs. Pay gas sandstones from the core information were determined as pay when they had more than five percent porosity and less than sixty percent water saturation. The electrical Schlumberger logs on wells that were not cored were

then correlated with the cored wells and the net sand thickness which corresponded to the cored information was determined as the net sandstone gas pay for each well.

Q On that map there are some triangles. What are those triangles?

A Those triangles are the cored wells on which we had core information.

Q Now how many wells did you have core information on?

A There were seven wells altogether, four cored wells within the area of the Tapacito Field, and three cored wells outside of the area of the Tapacito Field. In addition to the cored wells, we had forty-seven wells on which we had Schlumberger information within the Tapacito Field, and thirteen wells outside of the Tapacito Field.

Q Now, on the basis of that information, do the gas-bearing sands in the Pictured Cliff extend beyond the Tapacito Field?

A Yes, they do. We have shown these contours on the southwest side of the Tapacito Field extending over and into the South Blanco-Pictured Cliffs Field.

Q Is that also illustrated by cross-sections to be offered later?

A Yes, that is.

Q Is the area on which you have prepared cross-sections shown on Exhibit No. 1?

A Yes. The line of cross-sections are shown by lines drawn between wells. The first cross-section extends from the northern

end or northwestern end of the Tapacito Field down through its center to the southeast end.

Q Now how is that designated?

A That is designated as Cross-Section A-A'. The second cross-section extends from the northwest part of the Tapacito Field southwestward into the Blanco-Pictured Cliff Field. It is designated as B-B'. Likewise, Cross-Section C-C' extends from the middle of the Tapacito Field into the South Blanco-Pictured Cliff Field and Cross-Section D-D' extends from the southeastern end of the Tapacito Field into the South Blanco-Pictured Cliffs Field.

Q In connection with that, Mr. Reese, is there any producing wells lying south and west of the Tapacito Pool between it and the South Blanco?

A Yes. Skelly Oil Company has completed Pictured Cliffs wells in Section 18 of 25 North, 3 West; and Humble has completed a Pictured Cliff well, Humble has completed three Pictured Cliff wells in 25 North, Range 4 West. In Township 26 North, Range 5 West, there are Pictured Cliff dual completions by both Humble and Northwest Production Corporation.

Q Have you made any study, based on the information you have given, of the gas reserves in the Tapacito Pool?

A Yes. The area within the Tapacito Field was found to comprise 21,600 acres.

Q In that connection, you are referring to the Tapacito as it is presently defined by the Commission?

A Yes, that's right.

Q Proceed.

Q In our reserve study, we took the area between the contour lines and perimitered it and gave it weighted average thickness, which was determined between each contour interval of five feet.

(Gunsite's Exhibit No. 2 marked for identification.)

Q Is this information you have compiled shown on Exhibit No. 2?

A Yes, it is.

Q Would you please continue, then?

A The contour lines as shown on this map, the interval is five foot between contours. It was found that the entire average net sand thickness for the Tapacito Field was 28.4 feet. The porosity and oil saturations of the sandstones was determined from core analysis, the cored wells which lay in the most permeable areas, and which showed the best porosities on electrical logs were averaged together. These wells were the No. 3 Honolulu in Section 9 of Township 26 North, Range 4 West, and the No. 1-E well in Section 28 of Township 26 North, Range 4 West. The other five cored wells were averaged on their porosity and connate water and oil saturations; the averages of the first two wells were then weighted twice and counted two-thirds to one-third against the second group of cored wells. The average porosity of the sands was found to be 15.3 percent, water saturation was found to be

38.3 percent, oil saturation of the sant, .4 percent. The calculated bottomhole pressure for the field was then determined to be 1190 pounds. Reservoir temperature is 109 degrees Fahrenheit. The compressibility factor is .865, the gas per acre foot originally in place is 352 MCF. The gas per acre foot remaining at 100 pounds psi, abandonment pressure is 26 MCF, the recoverable gas per acre foot is 326 MCF. The average recoverable gas per acre for the Tapacito Field is 9,258 MCF. The total recoverable gas is 199,972,800 MCF.

Q Now in connection with that, you testified that two wells in the high permeability zone were weighted twice. Why did you do that?

A These are the two wells that were weighted twice, and the reason why we did that is because part of the cored wells are outside of the Tapacito Field, and after studying the Schlumbergers or electrical logs, it was found that these two cored wells represented approximately two-thirds of the porosity development or the better porosity development in the Tapacito Field.

Q Now is that information then reflected in Exhibit No. 2 designed to show the reserves for the entire pool?

A Yes, it is.

Q Have you made a study of the reserves of the producing wells within the pool?

A Yes, we have.

(Gunsite's Exhibit No. 3 marked for identification.)

This is reflected in Exhibit No. 3, and we made a study of each well within the pool, and on Exhibit No. 3, we have the number of the well, its location, and its completion date, total depth, its initial potential, deliverability when available, sand thickness, cumulative production, reserves per acre, reserves per 320 acres and percent of reserves produced.

(Gunsite's Exhibit No. 4 marked for identification.)

Q Referring to what has been marked as Exhibit No. 4, would you state what that is?

A Exhibit No. 4 is an isopacous map of the microlog porosity of the Tapacito Field. The porosity is again represented in contours, the contour interval is five feet. The contours on the map show the microlog feet of porous and permeable sandstones that produce the larger volumes of gas into the well bore. The number of feet of microlog porosity and permeability are plotted beside each well. The use of the microlog has been correlated with core analysis which show the most permeable sandstones to be in the areas of the best porosity. Where no measurable microlog porosity was found, a zero footage was plotted beside the well. The microlog porosity was then contoured, beginning with zero and going up to thirty feet. We used twenty-eight logs which were available for microlog porosity study within the Tapacito Field, and nine logs outside of the Tapacito Field.

Q Where you assigned a zero microlog porosity, does that

indicate there is no production in those areas?

A No. A zero microlog porosity merely indicates that the porosity and permeability is so low that we are not able to measure it. The zero areas to the southwest of the Tapacito Field have producing Pictured Cliff gas wells in them.

Q Would an example of zero microlog porosity be found in Section 19 in 26, 3, on Magnolia's 2-B Well?

A Yes, that would be an example.

Q That is a producing well, is it not?

A That is a producing well within the Tapacito Field.

Q What is the calculated absolute open flow on that well?

A 2,610,000 cubic feet of gas.

Q Then where you have assigned a zero microlog porosity, that indicates a conservative approach to your reserve figures, is that correct?

A Yes. The area in which we are able to measure the microlog porosity indicates that the sandstones are porous and permeable.

Q What do the contour results on this map indicate, Mr. Reese?

A The microlog contours as shown on the map fairly clearly illustrate that the porous sandstone in the Pictured Cliffs are trending in a northwest to southeast belt. Actual gas production extends to the northeast and southwest. I do not know the contour lines in the zero microlog area. However, the area of the best gas production is shown by the microlog contours to be a belt of highly permeable and porous sand.

Q Is there any connection between the microlog contour map and the gas production in the Tapacito Pool?

A The effect of the porous and permeable belt of sandstones trending northwest to southeast is such that the drainage of gas from the reservoir is accomplished in a northwest to southeast pattern parallel to the porous and permeable belt.

Q In other words, then, you are saying an irregular pattern of drainage has been established in the Tapacito Pool, is that what you mean?

A Yes. The drilling blocks of 320 acres are being irregularly drained due to the northwest-southeast trend of the drainage. For example, on the 4-E drilling block located in Section 22 of 26 North, 4 West.

Q Is that the block colored in green that you are referring to?

A Well, the 4-E drilling block would be running north-south comprising 320 acres. The block colored in green is our estimate of the area that is being drained by the 4-E Well. That block has been drawn on the map parallel to the trend of the porous belt of sandstones and a little closer toward the higher or the greater thickness of permeable sandstones. It can be seen from looking at this green block that the area of drainage of the 4-E Well would not only be in the northeast corner of the Section, but also in the Section to the north of it in the southeast corner.

Q That is assuming that it will drain 320 acres?

A That is correct. It will also have a drainage effect in the Section to the southeast of the regular drilling block.

Q That would leave part of the gas in the southern portion of the unit committed to that well undrained, is that right?

A That is correct. The micro-porosity in that Section goes from fifteen feet down to zero feet in the southeast portion of the standard drilling block, and that area would be relatively undrained.

Q I take it from your testimony there you do not agree with Mr. Wiederkehr's assumption that you have a radial drainage in the Tapacito Pool, is that correct?

A Yes, that is correct. We have definite information from the microlog porosities and by plotting that information on the map, we find that there is a definite permeable trend northwest to southeast.

Q Do you have other examples of unequal drainage due to the trend in this porosity belt?

A Yes, a second example is the Honolulu No. 4 Well, located in Section 4 of 26 North, 4 West. The cross-hatched area colored green on the map shows the area in which the greatest drainage will take place. Drainage will take place in the southeast of Section 5, and in the northwest of Section 9, as well as in the southwest portion of Section 4. This is because the zone of the most porous and permeable sands lie to the southwest of the No. 4 Honolulu Well, that's the zone in this area. The eastern part of the normal 320

acre drilling block on which the No. 4 Honolulu is located will be relatively undrained by the No. 4 Well, due to a decrease of the permeable sands in that direction. The permeability in the western part of the No. 4 320 acre drilling block totals ten feet, and in the center part of the 320 acre drilling block it drops to five, and on the eastern edge it drops to zero.

Q Is this irregular drainage that you are talking about compensated by offset drainage under the present development of the Pool?

A Under the present development of 320 acres, it is not compensated. In this example, in order to protect the drainage, or effectively equalize the drainage, a well should be drilled in the southeast of Section 5, and a well should be drilled in the northwest of Section 9.

Q In your testimony there, you are referring to this No. 4 Honolulu Well, are you not?

A Yes. There's a diagonal well, the No. 7-8 in Section 8.

Q Wells drilled at the locations that you have mentioned would then be on 160 acre pattern, is that correct?

A That is correct.

Q Now, you made a study of the effect of this drainage trend upon the acreage held by Gunsite Butte Uranium Corporation?

A Referring to the green-colored 320 acre drilling block located in Township 25 North, Range 3 West, it can be seen that the drainage is again northwest to southeast across the trend of the

regular 320 acre drilling blocks. The Southern Union well located in the southwest of Section 3 will drain parts of Section 4 and 9 of Gunsite Uranium acreage. The Gunsite acreage in Section 3 and 4 will be drained by Southern Union before the normal 320 acre block on which the Southern Union well lies is drained in its eastern portions. Again the permeability in the eastern part of the Southern Union 320 acre block has decreased from twenty-five feet to twenty feet and less. Close examinations of the wells drilled by Southern Union and Gunsite show that Gunsite acreage has been offset by Southern Union wells on 160 acre spacing. The Gunsite acreage in Section 5 has been offset by the No. 3-D Well in Section 31 of Southern Union.

Q Section 32, is it not?

A That is correct, Section 32. Northwest Production has drilled a well in the southwest of Section 33; the two Gunsite wells, the No. 1 Florence is located in the northwest of Section 4 and the No. 2 Florence is located in the northeast of Section 5.

Q Southern Union and Northwest Production have protected their acreage from drainage, have they?

A Yes, this is a case of where we have 160 acre spacing around a common corner, and the drainage would be equalized. The Gunsite Florence No. 1 and 2 Wells were drilled in 1955, and the 3-D well in Section 33 in October of 1956. The No. 1-33 well was drilled in the sou hwest quarter of Section 33 by Northwest Production in October of 1956, Southern Union 1-B was drilled in the

southwest of Section 4 of Township 25 North, Range 3 West, in April of 1957.

Q Now, is the acreage owned by Gunsite in the western part of Section 3 and the eastern part of Section 4 protected from drainage by Southern Union and Northwest Production?

A At the present time it is not, with the permeability trend of the sandstones northwest to southeast, this acreage will be drained by the Northwest Production Corporation Well No. 3-34, and the Southern Union No. 1-33.

Q How could that acreage be protected against drainage?

A That acreage could be protected by the drilling of 160 acre well locations in the northwest of Section 3 and the northeast of Section 4 on Gunsite Uranium acreage.

Q In connection with your testimony, I believe you said Southern Union Well 1-33. You mean Northwest Production Well 1-33?

A Yes.

Q You heard Mr. Wiederkehr's testimony in regard to the interference tests made by Southern Union. Have you examined the reports filed with the Commission on these tests?

A Yes, I have.

Q Do you have any comment to make on those tests?

A The comment that I would have on those tests is that the interference wells are located in the most porous and permeable part of the Tapacito Field, and that the drainage effect would be in a northwest to southeast direction. There is question as to

whether one of those wells would drain 320 acres, even along the most permeable trend. The is the only significance I can attach to interference tests.

Q On the basis of that, in your opinion will one well, considering the Pool as a whole, effectively and economically drain 320 acres?

A In my opinion it won't, because of the variations of permeability within the sandstones. It will leave gas undrained in a normal 320 acre drilling block, and it will also drain offset owners.

Q Now, is it a fact that those test wells are located in the most permeable zones indicated on your Exhibit No. 2?

A Yes, it is. The first set of test wells are indicated by circles --

Q (Interrupting) I said Exhibit No. 2. I mean Exhibit No. 4.

A Three of the interference wells are located within the twenty foot contour line of permeability. The No. 1-E is located on the fifteen foot contour line of permeability. The second set of wells on the second interference test are located between the fifteen and twenty-two foot contours of permeability. This is relatively a very high permeability measurement.

Q Now, referring to what has been marked as Exhibit No. 5, would you explain cross section A-A'?

(Gunsite's Exhibit No. 5 marked for identification.)

A Exhibit No. 5 is the line of cross-sections showing the development of the Pictured Cliff sandstones. Cross-Section A-A' has been drawn in a northwest to southeast direction in the Tapacito Field. It's this top cross-section. The cross-section shows a highly developed and very porous sand as indicated by the potential on the Schlumberger. This section bears out the porosity and the permeability as indicated by the microlog porosity map. The depth to the Pictured Cliffs formation as shown by the cross-sections varies between 3500 and 3850 feet. The thickness of the Pictured Cliff sands on this cross-section varies between thirty and fifty feet.

Q Would you explain the Cross-Sections B-B', C-C', and D-D' in the same fashion?

A The three cross-sections, B-B', C-C', and D-D', have been constructed to show that the Pictured Cliff sandstones can be correlated and traced with accuracy into the South Blanco-Pictured Cliffs gas field. Cross-Section B-B' extends from the No. 18-36 Well at the northwest end of the Tapacito Field and southwestward toward the Jicarilla 12-J Well in the south end of the field. The sandstones are easily traced, and variations in porosity can be observed. We have indicated the variations in porosity by the lack of coloring on the cross-section. The C-C' cross-section extends from the Jicarilla 2-A Well in the Tapacito Field southwestward to the Jicarilla 2-K Well in the South Blanco Field. Marked variations in porosities can be observed on these cross-sections. D-D' starts

with the Florence No. 2 Well at the south end of the Tapacito Field, and extends southwestward to the Phillips Government No. 1 Well in Section 32 of 25, 3. All three of these sections show variations in the amount of total Pictured Cliff sands present and indicate loss of porosity on the southwest side of the Tapacito Field. The thinning of the Pictured Cliff sandstones again bears out the microlog, in the Tapacito Field in the northwest to southeast direction.

It should be added that the lesser amounts of Pictured Cliff sandstone lying to the southwest of the Tapacito and on the northwest side of the South Blanco-Pictured Cliffs gas field have much less gas reserves present in comparison to the Tapacito Field area. Likewise, the measureable permeability is zero.

Q Do you know what the spacing in the South Blanco-Pictured Cliffs is?

A The spacing is 160 acres.

Q Has the Pool been developed on that basis?

A It has been partially developed on that basis. At the present time, El Paso Natural Gas is developing this part of the field --

Q (Interrupting) What part of the field are you referring to?

A The part of the South Blanco Field lying in 26 North, Range 3 West. That area has been drilled on 160 acres.

Q Is that 6 or 5 West?

A That's 5 West, excuse me.

Q Do you mean then that the Pictured Cliff sandstones in the South Blanco in the interval between the South Blanco and the Tapacito have less reserves than the Tapacito and are being drilled on 160 acre spacing?

A Yes, that is true. Northwest Production has drilled an Indian, Jicarilla Indian block in the southwest of Township 26 North, Range 4 West, in Sections 29, 30, 31, and 32, on 160 acre spacing, and in the Tapacito Field, Northwest has again drilled Sections 5, 6, 7, and 8 of 26 North, 4 West on 320 acre spacing. The comparatives reserves being about twice as great in the Tapacito Field. Additional 160 acre spacing has been drilled within one to two miles of the Tapacito Field in Township 25 North, Range 3 West. This drilling has been accomplished by Skelly, Sun, and MacMillan, and I guess that's all in that area.

Q Now, about the gas reserves in that area you just referred to --

A The gas reserves are again less than the reserves in the Tapacito Field.

Q Have you plotted a production decline curve on the Tapacito-Pictured Cliffs Pool?

A Yes. We have constructed this curve marked Exhibit No. 6 to determine the average price for gas over a period of twenty years on which Gunsite Butte Uranium would receive income.

(Gunsite's Exhibit No. 6 marked for identification.)

This curve shows approximately fifteen percent of the reserves produced in the first year and then declines on out to twenty years.

Q How was this curve plotted, Mr. Reese? Does that information appear on the exhibit?

A This curve was plotted from the basis of actual production on Gunsite Uranium wells.

Q How did you determine the price of gas on this exhibit?

A We determined the price of the gas by using a weighted average of 12.7 cents per MCF, taking into consideration the probability of slight additional drop in production in early years, and production continuing after the twenty years.

Q Do you have anything to add in connection with that exhibit?

A Well, the price of the gas takes into account the increase in each five years of the price on production paid to Gunsite.

Q That is based upon the contract?

A Yes.

Q Have you calculated return on the investment to Gunsite drilled on 160 acre locations, which they have?

A Yes, we have.

Q Referring to Exhibit No. 7, would you state what that shows?

(Gunsite's Exhibit No. 7 marked for identification.)

A Exhibit No. 7 shows the average sand thickness on the undrilled 160 acre locations to be 30.75 feet, recoverable gas per acre foot is 326 MCF. The recoverable gas per acre is 10,024 MCF.

The average price of the gas is 12.7 cents per MCF, royalty interest is 12.5, production and ad valorem tax is 6 percent, well spacing 160 acres, well cost is $35,000, and the total recoverable revenue from 160 acres is $203,688. The net value of the gas from 160 acres is $167,533. This shows a return on the well investment of 4.79 to 1.

Q Do you consider that an economic operation, Mr. Reese?

A Yes, I would.

Q If you have a well cost of $35,000, you heard Mr. Wiederkehr testify on well cost ranging, an average cost of $40,000, I believe it was. What is the basis of your figure here?

A The basis of our figure is a well cost estimate furnished by Gunsite Butte Uranium Corporation on their No. 1 Florence and No. 2 Florence.

Q Is the average price of gas recoverable based upon your production decline curves as shown in Exhibit No. 6?

A Yes, it is.

Q You made a calculation of the payout on these 160 acre locations?

A Yes, we have. We have calculated, based on the present pipe line production, an estimated payout of 1.12 years on the undrilled 160 acre well locations. In this payout calculation we used an average price of 11.9 cents per MCF, and a well cost of $35,000 with an operating cost of $50.00 per month. We also included the production and ad valorem taxes.

Q Your estimated production to the time of payout, what is that based on, Mr. Reese? Is that based on the average production from the two wells that you presently have?

A Yes, that is based on the actual production and the average production at the present time is 890 MCF per day. That 890 MCF per day was taken from eight months of production.

Q Have you taken into account operating expense?

A Yes, cost of $50.00 per month.

Q Mr. Reese, on the basis of your study of this reservoir and the information that you have obtained from it, in your opinion if this pool is developed on the basis of 320 acre spacing as the present order requires, would that leave any gas unrecovered in the reservoir at the time of abandonment?

A Yes, in my opinion it would. It would leave gas within the reservoir due to the unequal drainage.

Q Is this gas that is economically recoverable on the basis of 160 acre spacing?

A Yes, it is.

Q Mr. Reese, you heard Mr. Wiederkehr testify that they had no need for any further gas from this pool at the present time. Do you have any information that will indicate there will be an increased demand in this area?

A The history of the demand for natural gas has been one of continual increase. At the present time Pacific Northwest Pipe Line Corporation has been interested in a hearing before the

Federal Power Commission in Washington, at which hearing the granting of a certificate will take an additional hundred cubic feet of gas per day out of the Basin, and this gas will go eastward into Chicago. El Paso at the same time has applied for additional gas to California. The market appears, from the fact that it is steadily increasing, that all the gas available will be used in supplying the market to California and the market to the Pacific Northwest, and an additional new market to the East.

MR. KELLAHIN: That's all the questions we have, if the Commission please.

MR. PORTER: Anyone have a question of Mr. Reese?

MR. HOY: My name is George Hoy, representing Honolulu Oil Corporation.

CROSS EXAMINATION

By MR. HOY:

Q Mr. Reese, on your various exhibits you had information concerning Honolulu wells. Was that information derived from core analysis and logs which have been released by Honolulu to the industry?

A Yes, as far as I know it has been.

Q They are then subject to interpretation and analysis by anyone interested?

A That's right.

MR. HOY: Thank you.

MR. PORTER: Any further questions? Mr. Johnson.

By MR. JOHNSON:

Q What rate of decline did you assume in your curve, starting from your 890,000 MCF per day the first eight months?

A During the first year we assumed a fifteen percent rate of decline. During the second year, an eleven percent, third year eight percent, fourth year six percent, and then it was graduated on down. The sixteenth year was 3.25 percent. This is on our reserves.

Q It is on reserves, not on deliverability?

A No, this is on the reserves produced.

Q You made no assumption as to deliverability, then?

A No, we did not.

MR. PORTER: Anyone else have a question?

MR. WIEDERKEHR: Yes, please. I would like to look at the exhibits, if I may, along with some of the questions.

By MR. WIEDERKEHR:

Q Going back to your Exhibit No. 1, I believe in the northeast quarter of Section 25, 26, 4, you have shown Southern Union Gas Company Jicarilla 2-B Well with a net isopac net pay sand of 26 feet?

A Yes.

Q Are you familiar with the fact that is a dry hole in the Pictured Cliff?

A I have a gauge of 150 MCF on it.

Q Yes, sir, and you calculated reserves and showed production

on it on your Exhibit 3, but that is all from the Mesaverde.

A That would still not influence the net sand pay in the Pictured Cliff, even if it is a Mesaverde well, because the log goes through the Pictured Cliff, and we obtained that net sand footage of that log.

Q You have a net sand and consequently, what I'm trying to do is question net pay sand. In other words, if it is pay sand, I believe it would have produced, I don't believe it would have been a dry hole.

A Has there been a completion attempt in the Pictured Cliffs?

A Not on that particular well, but on other wells with the same type log.

A Based on our information, that well should have been produced, or would produce if it was completed in the Pictured Cliffs. The fact that it was completed in the Mesaverde does not alter the information in the Pictured Cliffs.

Q You said you were a consultant geologist and one of your jobs was to recommend well locations?

A Yes.

Q Would you recommend that some company farm that out and drill that location?

A Well, I would recommend, I would recommend that the small gauge in the Pictured Cliff would justify,the small gauge in Mesaverde would justify recompletion in the Pictured Cliffs, because of the amount of net sand pay in that well. Now there's one point

on this well,we were not able to determine the micro-porosity on it, due to the lack of the log, so there is no indication of the micro-porosity.

Q There was no microlog porosity. I believe you have zero microlog porosity on your map?

A That is correct.

Q So you did have a microlog, I guess, you put zero in there?

A Yes.

Q You mentioned several wells, you mentioned a Humble well over here in 26, 4, that's outside of the Pictured Cliffs-Tapacito Field?

A 26,5.

Q 26, 5, in about Section 4?

A Yes.

Q And as being completed in the Pictured Cliff sand. What initial potential do you show?

A We showed a Pictured Cliff I.P. of 102 MCF, and a Mesaverde I.P. of 2,424 MCF.

Q Well, then, as a practical geologist, wouldn't you consider that to be a dry hole in the Pictured Cliff sand? You wouldn't drill a well for 104 or 102 MCF I.P., would you?

A Not if I knew it. However, in Section 5 we drilled a Pictured Cliff well which was a triple completion and we obtained a gauge of two million one hundred twenty-four MCF in the Pictured Cliff.

Q What I am getting at, though, this could very well be a trend of non-permeability, since that well is for all practical purposes a dry hole. That is a dry hole in the southwest quarter of Section 1, that is a dry hole in the Tapacito; 1-H is a dry hole. The 1-F is a dry hole in the Pictured Cliffs; the 1-B is a dry hole in the Pictured Cliffs; here is another well down here in Section, looks like 15, 25, 3, Jackson Well, that is a dry hole. Isn't there a line of dry holes that we could draw between those which would, for all practical purposes, make it appear there is a zone of non-permeability between South Blanco and Tapacito?

A At one time we thought that was true, and we did draw a zone of non-production between the two fields which was much larger than the present boundaries of the field. However, additional drilling to the Mesaverde in this area shows that there are sufficient Pictured Cliff sands for a gas production, and in Section 29, Northwest Production has completed the No. 7-29 in the Pictured Cliffs in eight feet of sandstone, so that it's a question of how little sand can you complete in. This contour interval that we have in this thin area which we illustrated on the cross-sections goes down to ten feet, and there is actually, or there has been actually wells completed down into that area.

Q With this low sand thickness in here, you wouldn't think there would be drainage between Blanco and Tapacito?

A No, not in that low sand thickness area; however, to effect any drainage you would have to drill at least 160 acre spacing.

Q Up here where you had twenty-five feet of pay, would you think there would be effective drainage in there across from one field to the other?

A Well, what we are looking at is the present distance between the fields;as far as effective drainage between the two fields, I don't believe there would be. However, the drilling is continually decreasing the distance between these two fields and all of these Mesaverde wells show that the Pictured Cliff is present in the shallow horizon and it is my belief that they will be,eventually be produced in the Pictured Cliffs.

Q Except for quite a number of locations drilled as dry holes?

A Some of these dry holes were drilled in the earlier days of drilling. The 1-F was drilled by Southern Union, I believe, right after its discovery well in the Tapacito Field, and the sand was ten foot or less and no completion attempt was made in it. The same way with the No. 1-H, Southern Union, and I assume from the way those early wells were drilled that they were exploration wells. They at that time outlined generally the most porous belt in the Tapacito Field, however, that -- the lean area or the thin areas continually being narrowed by wells coming from the southeast.

Q All right. Let me go to your Exhibit No. 4, I believe it is, on your drainage area around Southern Union Jicarilla 4-E Well. I believe you stated that the drainage there would be northwest-southeast, and the gas lying to the southwest of the 4-E well would be left, that we hadn't drained any of that gas at the present time?

A Yes, it would be relatively undrained.

Q What causes drainage?

A Well, it's the ability of the sands to transmit the fluid or gas.

Q Because of a differential in pressure?

A Differential in pressure.

Q If we began to drain the area around the 4-E well, consequently we reduce that pressure; as gas comes out, the pressure is dropped?

A Yes.

Q Then the gas remaining on the edge having higher pressure, wouldn't it migrate toward that then?

A Very slowly.

Q Well, then let me -- following that line of reasoning --

A (Interrupting) There's a good chance that the drainage would take place over a period of forty to fifty years.

Q You pointed out that Southern Union 1-E Well located here in Section 16 was on a poorer part of the sand than the 5-E or the 4-E or the 3-E?

A Yes, it's on the twenty foot microlog porosity line, while the others are between the twenty and thirty foot.

Q Would that, refer to your Exhibit 3, the 1, 5, and 4 E Wells in the interference test area. That is 1, 5, and 4 were the three wells in the interference test turned on within a month of each other and produced correspondingly against the same line pressure.

Now, would you please note that you show that thirty-eight percent of the reserves out of the No. 1 well have been produced, while only ten percent of the reserves under the No. 3 well and thirteen percent of the reserves under the No. 5 well have been produced to date, and yet according to you, your theory of better wells being in the middle of the sand looks to me like that that well should have produced the least of all, and yet it has produced in excess of twice of the amount of the others. How do you account for that, please?

A The only way I can account for that production is that there may be some higher permeability streaks within the 1-E well. In other words, there might be two or three hundred millidarcies of permeability present in the 1-E well.

Q Doesn't it look like, then, that there could be just as good a wells on your thinner section of sand as there are over in the center? In other words, the producing capacity of this well would so indicate, would it not?

A Well, now, we're using a net footage of permeability of between twenty and thirty feet, which is relatively a very high permeability for Pictured Cliff sandstones in any of the fields, and whether one well in that twenty or thirty feet may produce more than the other two wells or the other three wells would be open to question, because within that twenty or thirty feet of permeability, we made no measure as to how many millidarcies were in there. There could be an average of two or three hundred millidarcies in several

feet of that sand.

Q You pointed out, I believe, that your drainage area runs northwest-southeast in this field?

A Yes.

Q And using 320-acre spacing unit, that you would have cross-drainage in the field, draining out from one unit into another unit and vice versa?

A Using 320-acre --

Q You would be draining back and forth?

A Yes.

Q Have you ever in your life known of a field where that was not the fact, that actually all production was cross-drainage where you locate a well in 330 feet out of a 40, actually it is not in the center, actually it is, all fields that we know of are produced in that same manner where you have drainage and cross-drainage on leases? Isn't that one of the things we can't control?

A It is one of the things that is very common and it is controlled by offset wells. It is controlled as much as possible by offset wells.

Q But this is not an uncommon situation to occur?

A Well, this is an uncommon situation in that your most porous belt runs northwest-southeast, and the drainage from a well is not circular in fashion.

Q You mentioned, I believe, an area where there were four wells sort of developed on 160-acre spacing?

A Yes.

Q Two of the wells being Southern Union wells, or one well being Southern Union and one Pacific Northwest?

A Northwest Production.

Q Northwest Production. Actually Northwest Production Well 1-33 is drilled on the spacing pattern as set up by the Commission?

A That is correct.

Q Do you know that the Southern Union Jicarilla 3-D well was drilled in that position because the 1-D well had been drilled prior to any spacing order, and then the exception was granted the 3-D well on that basis?

A No, I wasn't aware of that.

Q Are you aware that Gunsite Butte's, I don't know what the name of that is --

A No. 1 Florence.

Q -- No. 1 Florence had a special hearing and was granted an exception to the spacing pattern as set out, and that if the well had been drilled where the normal spacing is in the northeast quarter of Section 4, 25, 3, that situation you are talking about would not have occurred to the great extent that it has?

A Yes, I am aware of that.

Q Then it is not entirely Southern Union's fault that situation exists?

A That is correct. I don't know the past history on it, but I was merely concerned with it, there are four wells already in

this common corner.

Q Two of them would normally have been there, one of them was forced because a well had already been drilled in the same section prior to the time spacing was set, and then the last one was just because Gunsite Butte wanted to move over into that location. Now, you pointed out some Skelly wells down in 25, 3, the west side of it, that are drilled on apparently 160-acre spacing?

A Yes.

Q Would you not consider that those wells were in the -- or would be included in the South Blanco Field, since they are within a mile of the boundary of that field?

A I don't know how to, what to consider. They are within a mile, about a mile and a half of the Tapacito and a mile of the South Blanco.

Q How far from Tapacito? I believe you will find that is two miles, at least.

A About two miles.

Q Diagonally?

A Diagonally.

Q You quoted your cost of Gunsite Butte being $35,000, I believe?

A Yes.

Q Those wells, were they not drilled sometime ago?

A Yes, that is correct.

Q Are you familiar with the terrain in the area of the Gunsite

Butte wells?

A Not right on the well site.

Q Well, I am. If I might say so, that is a generally flat area, while the area in which Southern Union has been drilling, it is not uncommon for the location costs alone, road and location, to run five to ten thousand dollars. That would increase it, and on top of that, any new drilling, isn't it true that drilling costs have gone up and are going up all the time?

A Yes, they are.

Q So any future development, don't you think it would be appreciably higher than the cost of the wells you drilled several years ago?

A Well, we were taking into accountthe new locations for the undrilled 160 locations on Gunsite acreage, and I believe that if the terrain is as you described it, that the cost would be about what Gunsite has incurred for their other wells.

Q But isn't it just a known fact that the cost of drilling is going up?

A Yes, it is.

Q All right. Now, you mentioned, I believe, that there would be additional gas left in place if the wells were drilled on 320 versus 160. Do you think there would be enough gas in there to pay for the additional development that would be required to develop on 160?

A In this Tapacito Field, reserves are adequate to justify

the drilling on 160, and on the amount of gas left on 320 could only be estimated, I don't believe it should be approached that way.

Q That is not what I asked you. That is what the lawyers say, I believe. I asked you if in your opinion there would be enough gas left abandoned because of drilling on 320, enough gas there to pay for the drilling of an additional well?

A Yes, I believe there would be.

Q Throughout the field?

A Yes.

MR. WIEDERKEHR: I believe that's all the questions I have.

MR. PORTER: Mr. Mankin.

MR. MANKIN: Warren Mankin with Aztec.

By MR. MANKIN:

Q Mr. Reese, on your Exhibit No. 5, you didn't intend to infer that with electric log you could determine permeability from that log, did you?

A No, I didn't. Our Exhibit No. 5 does not show the microlog there which is on the lower part of the electrical log. We do intend to infer that the microlog part will indicate permeability, I mean by this cross-section where we show the electrical log showing the porosities of the sand, does not indicate the permeability that we have shown on this map. However, the lower part of the electrical log does indicate permeability from the microlog.

Q Isn't all, actually, that would show would be the porosity?

A No, the microlog is an indication of porosity and permeability.

Q Is it a very interpretative sort of thing?

A It is a very interpretative sort of thing when you are using the microlog in zero areas of permeability, because the lower permeable sands do produce gas, but in an area like this where we have marked microlog permeability, it is a very useful method of determining permeability.

Q You have developed that there is possibly some communication across from the portion in the South Blanco in 26, 5, into the Tapacito. Do you have any indication as to pressures in those areas, comparative pressures? Is there pressure communication?

A The distance between the two fields is such that I don't know if there is any pressure communication. The main correlation that we have established between these two fields is our ability to trace the sands between the two fields and variations in permeability and local variations in sand may in places form a pressure barrier.

Q Just take one particular point. Since you indicate there is considerable distance, let's take a point here in the southwestern portion of 26, 4, where Northwest Production has drilled several wells, as compared to going directly northeast in Tapacito where it is less than a mile across that area, would you expect there would be similar pressure across that area?

A I would expect they would be fairly, at least the information that we have, that they would be similar.

Q Have you seen such pressure?

A I have some of the pressure here. I could look them up to see what they are. I have never looked at them, I might say.

Q Is your knowledge, do you remember whether they were the same as in the Tapacito?

A I think they were similar. I don't know whether they are exactly the same per pound. You get some variation between these pressures within the same field, depending on the time that you read the pressure at the top of the well.

Q Then you don't believe that there is considerable difference in pressures across that area?

A I don't believe there is. I just don't recall just right at this moment.

Q You inferred a while ago, also, that Skelly had started their 160-acre development down in 25, 3. Didn't they likewise change that development to revert to 320, even though it was in the South Blanco?

A If they did, I am not familiar with it.

Q Also, are you aware that on a hearing today there is that area that you suggested might be in Tapacito, or you didn't know, is being considered to be taken into the South Blanco?

A I am aware of that, it will be in the order of hearing today.

Q Are you also aware that there has been considerable development in South Blanco on 320-acre development by Ohio and others in the area nearby the Tapacito?

A Yes, I am. Also there's considerable development on 160

in the South Blanco, in fact, all this north part that is not shown on this map is 160, Northwest Production has drilled their edge wells on twelve section blocks in this area and 160 pattern, and their center wells on 320 on the inside of their Indian leases.

Q Are you familiar with the pressures of those wells drilled on 320 in the South Blanco, as compared to the wells drilled offsetting on 160-acre development? I am mentioning the El Paso development versus the Ohio development.

A I am not familiar, I made no detailed study of that pressure.

Q As a geologist, isn't it known that there is considerable development previously known to be in sand bars, therefore the permeability and porosity development has been considerably less in some areas?

A Yes, that is very true, that is what we are looking at here. We are finding the best development in the northwest and southeast.

Q Not only --

A (Interrupting) The trend in the sand bars, however, you get the sand extending between the two fields, and there is actual connection between the two fields.

Q To what do you attribute some of these very tight and practically impermeable zones coming into the edge of the Tapacito Field? I will take a particular example, what was brought out a while ago about Southern Union Jicarilla 2-B Well, to what would you attribute such a zero permeability?

A I would attribute that to variations in the deposition of the sand in this zero permeability area. There is probably a higher content of ventilated clays in that one area, and that's why you get your variations.

Q Then is it your recommendation that this entire area, whether called the Tapacito or South Blanco, would best be developed on 160 acre development?

A Yes, that would be my recommendation, in order to get as much gas as possible from the sands.

Q Let's return again to the amount of gas that would be left on 320 acre development. Can you calculate the amount of gas that would be, would remain in formation and not be recovered by wells drilled on 320, as compared to wells on 160; and if so, would a well be paid for by the additional drilling in that area?

A I can't calculate the amount of gas that would be left. I can only estimate, depending on where the well is located and the type of the sands developed in that area that a well might leave as high as fifty percent of the gas, depending on its location. In an area of real good permeability, the 320 acre block might drain the entire 320 acres on one well.

Q Let's get down to Gunsite Butte leases here. That's in a very nice developed area as far as your microlog porosities, is that not true?

A Yes, that's true.

Q To run again to a question Mr. Wiederkehr mentioned, I

believe he mentioned that there were two Gunsite wells drilled there previously, one, of course, drilled prior to rules, and one drilled sometime later. I believe the record will indicate that the two wells were drilled previously by Gunsite, and one of them was given exception in the original order, is that correct?

A I'm not familiar with the original order.

Q Then sometime later, Gunsite had a hearing and asked that a well be drilled in the northwest quarter of Section 3, this position right here?

A Yes.

Q Sometime later, after the well was never drilled in that location but drilled in the northeast quarter, is that correct, which is the Riddel No. 1?

A Yes. I'm not familiar with that hearing, but I assume that is correct.

Q I take it that you do not agree with the testimony put on by Gunsite Butte at that hearing, that that would be an area that would be a dry hole if drilled in the southeast quarter of Section 3?

A I am not familiar with that testimony. This Gunsite well in the northeast of 3, I believe, was drilled to the Mesaverde. I would have to check that.

Q But it is presently completed as a Pictured Cliff well?

A As far as I know, that is correct.

Q Then you indicated that, as I say, you did not agree with

the previous testimony. I believe Caswell, Silva, and others indicated there was considerable string development, and this would be a dry hole which did not prove to be a fact?

A In the northwest of Section 3?

Q In other words, it was shown that it was tested to that, that would be a dry hole, but apparently conditions changed that?

A Well, yes, I don't agree that that would be a dry hole. That would be a very nice producer there.

Q To get back to leaving fifty percent if you drill on 320 acres with good sand development and permeability and porosity as you found on the Gunsite lease, particularly in Sections 3 and 4, is it known reservoir conditions that cause you to assume that that would be the fact? Do you have knowledge of other reservoirs where it would leave fifty percent?

A I only used the fifty percent as an estimate. It might be even a greater percentage or lesser percentage than fifty percent.

Q You don't have reservoir knowledge that would indicate that might be considerably less than fifty percent, then, by infill drilling that was later determined?

A In this condition where we have high permeability and good porosity and well developed sands, our average gas per acre is ten million cubic feet recoverable; if the two Gunsite locations are left undrilled there is a good chance that gas will be drained from them and that percentage could go up to maybe fifty percent over a period of time, or more.

Q I don't follow your testimony when you say there would be gas drained from these particular wells, particularly when all the other development has been on 320 acre development. It looks like it would go the other way.

A This would be a case of a reverse in the direction that it would go, because the trend of the permeability is northwest to southeast, and the No. 1-33 Well in Section 33 would have a tendency to drain into the Gunsite acreage there in that undrilled 160 acre location.

Q In other words, you would recover Northwest Production gas in that case, or Southern Union, is that correct?

A No, Southern Union would recover Gunsite's gas.

Q I don't follow your line, but I'll leave it at that. My next question is this, you put some 320 acre units trending in a northwest-southeast direction, and I assumed if there was 320 acre put in that, you would suggest that possibly maybe the northeast half of a section be one unit, and southwest half be another, if that was put in?

A Well, you mean that the unit would run east-west?

Q That you would have a diagonal line running from the northwest to the southeast which you would have 320 acres which would be the northeast half, if there was such a designation, to be a unit in the southeast half if there was such a designation?

A Well, that would, my only assumption in showing this is to show that at present there is unequal drainage across a section on

which ownership has been based, the only way that I would change that would be by putting spacing on 160 acres.

Q All right. Let's revert to your assumption of 160 acres. On your assumption that there would be unequal drainage and compensating drainage might not be proper, I assume from that that you would not suggest a proper legal quarter-section as a proration unit, if and when it was prorated. In other words, it would have some peculiar shape outside of a quarter-section, which is fantastic, of course.

A These 320 acre blocks are not what we would assume would be the regular spacing pattern or a northeast or southwest half of the section. These are merely put on here to illustrate the present trend of the drainage. I would only assume that the proration would be developed on a regular 160 acre tract in a section or a 320 acre tract, if this is left at 320.

Q Going back again to your statement previously, did I understand that you did not believe that these interference tests proved anything?

A If anything, they proved that this is a very excellent field due to the fact there has been so little pressure drop over the period of time. Most Rocky Mountain fields show a rather rapid pressure drop throughout the whole field in a very short period of time. The interference test proved that there is some effect on a well as they are set up, and the pressure drop; there is some question as to whether, prove whether there has been gas produced

from that well site yet.

Q You don't believe because there was some pressure differential from one period of time to another that that proved there was any gas traveling from a shut-in well to the other wells, then?

A There may have been some gas traveling; however, it would be normal for the well to show some pressure drop because of the pressure throughout the reservoir at least showing a drop.

Q Do you know whether that pressure drop was the same as the pressure throughout the reservoir?

A Well, the pressure drop indicates that the reservoir pressure was dropped.

Q In the same proportion?

A I don't know what the proportion would be. It would have something to do with the distance. It should be somewhat similar, though.

Q To get to another something that you weren't sure about, the pressures between the South Blanco and the Tapacito, if there was some two to three hundred pounds difference across the field, would you feel that was good pressure communication?

A No, I wouldn't feel that was good pressure -- in that short distance.

Q There might be some permeability or other barriers in between?

A Yes. Now that gets back to your interference test again somewhat, in that before this pressure would affect this area, you

would have a certain amount of time involved in production from this area or the other way around, due to the permeability barriers.

Q The development is going on in the Tapacito the same as South Blanco is at the same time, is it not?

A Yes, but your rate of production is not the same; in more impermeable sands, the rate of production is very slow, and it would take maybe two or three times the amount of time to produce the same amount of gas from the Tapacito Field as compared to this area right in here.

MR. MANKIN: That's all.

MR. PORTER: Does anyone else have a question of the witness? Mr. Utz.

By MR. UTZ:

Q Mr. Reese, turning to your Exhibit No. 2, I note that your recoverable gas per acre is 9258, and referring -- that figure is an average for the field?

A Yes, sir, that is correct.

Q On your Exhibit No. 7, you give a figure of 10,024 MCF per acre. Is that for your Gunsite Butte properties?

A Yes, that's on the undrilled well locations.

Q Would that indicate, then, that your Gunsite properties are a little above average?

A Yes, it would.

Q What reserve per acre would you consider a minimum economic risk for this area?

A I haven't calculated what would be a minimum economic risk. I would say that the reserve should show at least the payout of the well with some excess above it.

Q You have no idea how to convert that to cubic feet per acre, is it five million, four million, three million?

A I know that the reserves in some of the other Pictured Cliffs fields are as low as four and five million cubic feet of gas per acre. However, generally those lower reserve areas you have a shallower drilling depth and less well cost. There may be some reserves drilled as low as three million per acre.

Q I was attempting to pin it down to this area with the well cost of 35,000, if you can do it.

A I would say a well should have at least five million cubic feet of gas per acre, just as an estimate on it.

Q The point which I think might well be cleared up, we have had two reserve figures given to us at this hearing. One was 1.6 million for 320 acres, yours I believe calculates on the basis of 9258 per acre, 2.9 for 320 acre tract.

MR. WIEDERKEHR: That is at different recoverable pressures. That makes a lot of difference.

MR. UTZ: That's the point I want to clear up.

Q Your pressure was 100 pounds, is that correct?

A Yes, that is correct.

Q Theirs was 500?

A Yes.

Q Would that account for approximately twenty-five percent of the difference between Southern Union reserves and yours?

A I believe that it would.

Q Also, they have used the porosity of nineteen percent as to your fifteen percent, is that correct?

A That is correct.

Q Then actually their calculation would give you approximately twenty percent more reserves, would it not?

A On the basis of porosity.

Q On the basis of porosity alone?

A I haven't calculated, but I assume that it would.

Q It is a ratio of fifteen to nineteen. You have used thirty-eight percent water, where they have used thirty percent water, so on the basis of connate water alone, that would be about eight percent more than the Southern Union calculation?

A That is correct.

Q On the basis of pressure alone, you could account for about twenty-five percent, but when you come back to porosity and connate water, why you do away with twenty-five percent, don't you?

A Yes.

Q Well, then, what is left in your reserve calculation that would make such a difference in reserves?

A Well, I just don't know what would make the difference.

Q Just about have to be net pay, wouldn't it?

A I assume that it would be, yes.

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Q You used twenty-eight feet, twenty-eight point four, is that right?

A Yes, that's right.

Q So just looking at it in a glance, Southern Union must have used something like fourteen feet, is that about right?

A I assume that that's correct.

Q So there is quite a difference in the two reserves, and particularly the two methods of net pay picked for the field?

A I believe that I saw one figure, going through the previous notes on this hearing, where there was an indicated twenty-three feet of net pay on the Indian E Well from core analysis. However, I'm not sure about that figure, I think it was twenty-three feet as made by Southern Union.

MR. UTZ: I think that's all I have.

MR. PORTER: Mr. Mankin.

By MR. MANKIN:

Q I believe, Mr. Reese, there was some difference here in the net pay, probably some eight to ten feet difference between what Southern Union used and you used, and also considerable difference in abandonment pressures. Wouldn't those two factors be reflected in the probable differences in the reserve calculations?

A Yes, they would.

Q Possibly the addition of those two factors together. Also I wanted to ask you this one question, you indicated to get some fifty percent more gas or some other figure, if you would drill on

160 versus drilling on 320. If you took the thing even further, on 80 acre drilling would you gain anything in drilling on 80 acre development, necessarily?

A I don't know. I hadn't considered 80 acre drilling. I don't see where you would gain anything on it, but I haven't considered it.

Q It would seem to tie together, if you convert down from one wider spacing to another, and then you certainly don't get it all in one spacing, do you?

A Well, there still may be a percent of gas left, a certain percentage of your gas left on 160 acre, but I don't see where there would be any point in considering an 80 acre spacing.

Q I meant on the same analogy that you have used, that you won't get it all on 320. Probably there is some assumption you might get more if you went on 80, though it might be uneconomic?

A You would get more gas on 80, however, when the recoverable gas is exhausted, there would still be a small quantity of gas left in the sands.

Q In other words, you finally run out of time and money on this sort of thing?

A Somewhere along the line you do, yes, sir.

MR. PORTER: Does anyone else have any questions?

MR. KELLAHIN: I have a couple on redirect.

REDIRECT EXAMINATION

By MR. KELLAHIN:

Q Mr. Reese, in connection with your exhibits, you showed certain production figures on Pictured Cliff wells. Where did you obtain that information?

A We obtained that information from the figures furnished to the Commission.

Q Did you check the figures furnished to the United States Geographical Survey?

A No, we did not. We took the annual report through 1956 and used those figures, and then we went to the State office at Aztec and copied off the figures reported there to the State and used those figures.

Q Now, in connection with your Exhibit No. 2, Mr. Wiederkehr questioned you about the Jicarilla 2-B well. I believe your Exhibit No. 2 shows production from that well. Do you know where you obtained that figure?

A Well, the production was obtained from the figures reported to the State.

Q In connection with the payout on wells, Mr. Wiederkehr used the figure of $40,000 per well, would that appreciably affect the payout time if your figure of 35,000 were increased to 40?

A No, it would not.

Q Would payout time of 1.29, as compared to 1.2 years sound reasonable to you?

A Yes, any payout time in that order would be very reasonable.

Q Now, Mr. Utz questioned you as to what you thought would be

an economic reserve to produce. I believe in connection with your testimony, you testified that the return on the well investment at the present time on 160 acres would be 4.79 to 1. Would you consider the ratio of 2 to 1 economical, if it were not a wildcat well?

A Yes, under the circumstances I would, because of the fact that that gas will be available for markets.

Q Then if you took that as an economic well, you would then reduce your recoverable gas per acre in proportion and say that that would be an economical well, would you not?

A Yes, I would.

MR. KELLAHIN: That's all the questions I have. Thank you.

MR. PORTER: Mr. Grenier.

RECROSS EXAMINATION

By MR. GRENIER:

Q Mr. Reese, at one point you were speaking about the South Blanco Field as having been drilled on 160 acre basis with somewhat less reserves there than we have in the Tapacito Field. Do you recall that portion of your testimony? I believe it was on cross examination by Mr. Mankin.

A I think it was in reference to this Northwest Production block in the South Blanco Field.

Q Generally speaking, do you know enough about the South Blanco reservoir to be able to express an opinion as to whether or not the general permeability of the sands in that field are as

good or better or poorer than they are in Tapacito?

A I haven't made a detailed study of the South Blanco-Pictured Cliffs Field. However, I suspect that such a detailed study would show a permeable belt through the center of it and as you go outward from the center toward the edges you will get a decrease.

Q You are not prepared, on the basis of your study of this problem to date, then, to indicate whether South Blanco permeabilities are comparable, taking the field as a whole, to Tapacito, or better or poorer?

A I am not prepared, however, I think if they were compared over all, there would be some similarities in the better part of the field.

MR. GRENIER: Thank you.

MR. PORTER: Does anyone else have a question of the witness? The witness may be excused.

(Witness excused.)

MR. PORTER: Did you offer your exhibits?

MR. KELLAHIN: At this time, I would like to offer Gunsite's Exhibits 1 through 7 inclusive.

MR. PORTER: Any objection to the admission of the exhibits? They will be admitted.

MR. PORTER: Mr. Johnston.

MR. JOHNSTON: I would like to introduce one short exhibit and testimony in this case.

MR. PORTER: We'll take a ten minute break.

(Recess.)

MR. PORTER: The meeting will come to order. Mr. Johnston.

(Witness sworn.)

W. R. JOHNSTON,

a witness, having been first duly sworn on oath, testified as follows:

MR. JOHNSTON: I am W. R. Johnston, manager of production operations, Northwest Production Corporation. Our company has been mentioned in this case on several occasions today. I have testified on this particular case previously as an expert witness, and at least one additional case in the Tapacito. I would like to be admitted as an expert witness.

MR. PORTER: Your qualifications are acceptable.

A I have one exhibit I would like to introduce.

(Northwest Production's Exhibit No. 1 marked for identification.)

A This is a hypothetical set of curves plotting daily average deliverability of any gas well against cumulative production, both plotted against years. I took an assumption of an initial year's settled production, then declined that production yearly in ten percent increments. I do not know nor do I think anyone else knows the exact decline percentage-wise of deliverability in the Tapacito Gas Pool. We have eleven producing wells in the Tapacito Field and one unconnected, a total of twelve at this time. They have been

on the line an average of eight months per well, and have delivered right at a million cubic feet of gas per day per well, against a line pressure in excess of 600 pounds continuously. At that rate you produce reserves reasonably fast. If you will refer to the top curve and the dashed line which is the cumulative reserves of a well producing a million cubic feet per day, in the first year you will have the reserves that we think our wells might follow.

I would like to state that I do not know this curve is exact, but I do know the wells will decline to some extent. If this curve is right, and using the highest reserve figure I have heard today, which is in the range of a billion and a half cubic feet of recoverable gas per 160 acres, if you refer to a billion and a half on the right hand side, that's 1500, and draw a line across the chart, it will intersect the dashed line at five years; in other words, all of the gas under that 160 at 100 pounds abandonment pressure will be depleted in five years.

At the present line pressures on our wells of 600 pounds, the reserves will amount to something like 835 million, using Southern Union testimony, and our wells will cease producing, if my curve is right, due to line pressure in two years. Well, now, I know that is not true, but I do think that something occurs there and it has to be one of three things, either there are much larger reserves under the area than we think; secondly, the wells are going to decline exceedingly rapidly; or else we're draining a much larger area, and from my standpoint we are draining much

larger than 160 acre area. It was brought up today in testimony that Northwest Production is drilling wells on 160 acres in the South Blanco Field. This curve clearly illustrates why we do so. Those wells will average in the first year only 400,000 per day or less. If you will refer down the fourth curve, down to 400, and the fourth dotted curve down to 400, you will find that that same a billion and a half under the 160 is reached in 23 years, so consequently, to drain the gas in anything like a reasonable well life, we have to develop on 160 acres on a low deliverability well.

Using this as a basis, I would like to put Northwest Production on record as supporting 320 acre spacing in the Tapacito Pool. That's all.

MR. PORTER: Does anyone have a question of Mr. Johnston? Mr. Grenier.

CROSS EXAMINATION

By MR. GRENIER:

Q Are you familiar, sufficiently familiar with the South Blanco Pool and with the Tapacito Pool to be able to express an opinion as to which of the pools has the greater permeability?

A Well, I am familiar with our wells, and due to their producing characteristics, which I just stated that the average South Blanco well we have will have an initial first year daily deliverability of 400,000 against the million in the Tapacito, there is bound to be a better producing mechanism in the Tapacito, whether it is permeability or fracturing, I could not answer.

Q In any event there seems to be communication of some kind?

A There definitely is.

Q Are most of your wells drilled in the portion of the South Blanco Pool that has been drilled on 160 acre spacing? Do I understand you correctly there?

A Yes.

Q So you are speaking about that portion of the pool?

A That is entirely right.

Q With this differentiation that we have seen between the two pools as to deliverability characteristics, in which pool would you think that 320 acre spacing would leave the most gas behind it that could have been recovered by 160 acre spacing?

A Well, I would think it would leave more behind it in the South Blanco, where there are tighter sands.

Q Substantially more?

A To some extent. I couldn't say how much more.

Q So that on that basis, to some extent, then there would be a justification on that basis, too, for drilling --

A (Interrupting) That is correct.

Q -- to 160 acre density in South Blanco, as contrasted with the 320 acre density in Tapacito?

A Right. I might for another comment compare this curve with one that Mr. Reese submitted, showing his initial first year deliverability of 890,000 a day. If you pair a curve in on my curve, using 890,000 a day, they will have produced their gas

against 500 pounds line pressure in three and a half years, and they will have depleted the reservoir in 5.2 years under 160 acres. Now Mr. Reese's curve assumes one of the exceptions I mentioned that could be possible, that the deliverability was going to decline over or approximately 100 percent of the second year, and I question that. Southern Union has one well that has produced over 800 million and its present deliverability is still roughly eighty to eighty-five percent of its initial deliverability, so we have some indication that the wells are not going to decline at that rate. That is the basis we must be draining larger than 160 acres.

Q Are you sufficiently familiar with the Tapacito Pool, Mr. Johnston, to be able to express an opinion as to whether the additional volume of gas which could be expected to be recovered through 160 acre spacing as contrasted to 320 would be sufficient to justify the drilling of an additional well to recover that gas alone?

A I feel very firmly it would not be, that you would not have enough gas remaining to afford to drill that other well.

Q Now then, if you waited until the tenth year or twentieth or fiftieth or whatever it is that we get down to the point where nothing more can economically be gotten out by 320, you are stating to us then that you would not think an additional well would be justified to be spotted in there to pick up,in each of these 320's to pick up the remaining gas?

A I'll clarify that slightly. If the Tapacito Field extends into areas where the initial deliverabilities are so low that it

would require, which it could do, as the field extends eastward to a well that is only capable of delivering 300,000 per day, it would probably have to be drilled on 160 to drain it, but the return from that well would be so small that you would question wanting to drill it.

Q Is the pool developed sufficiently far to the northeast to reach these areas to which you are referring?

A Not to my knowledge. Our average--and we have wells on both ends of the pool--our average is a million a day. The range we have is 400,000 a day and the highest, 2100 a day after a month's production.

Q So the pool has been more accurately defined to the southwestern border as to the northeastern border?

A There are some good wells going northeast. There is eventually going to be a development to where you have small wells.

Q I am talking about development to date.

A It is developed both ways, it is better defined, you might say, to the southeast.

Q I said the southwest, I meant the border closest to South Blanco.

A It is definitely defined there.

Q The one up to the northeast has been sketchily defined, if at all?

A That's right.

Q Now suppose we move this well that you said would be

unjustified to drill, at the tail end --

A Yes.

Q -- of the field's history, moved it forward in time to right now, all the additional gas that that one well is going to recover in any event is going to be just what it would have recovered if it had been drilled on at the tail end?

A That's right. It wouldn't matter when you did it.

Q Actually it would be erroneous to attribute any more gas to that well and its investment now than if drilled twenty years from now?

A That is my opinion.

MR. PORTER: Anyone else have a question of the witness? Mr. Cooley.

By MR COOLEY:

Q Do you have any method of estimating what quantity of gas would be left in the reservoir on 320 acre spacing as compared to 160 acre spacing?

A No, sir, I do not.

MR. COOLEY: That's all.

MR. PORTER: Mr. Kellahin.

By MR. KELLAHIN:

Q Mr. Johnston, I would like to hand you one of the exhibits offered in this case by Gunsite Butte and as I understand the exhibit which you have offered, Exhibit No. 1 is based entirely upon your own wells, is that correct?

A Well, the exhibit is based on nothing but figures.

Q Nothing but figures?

A And assumes decline curve. I put our wells on it because our wells happened to be in the million class.

Q If you refer to Southern Union Jicarilla No. 2-A, No. 2 well on page 2 of the exhibit --

A Yes.

Q -- that shows that well has been producing since 1954, would it not?

A It shows the completion on the 5th of May, 1954. It does not show when it started producing.

Q Then it shows that it produced 8.84 percent of its reserves?

A That is correct.

Q That would agree then with your curve here, would it?

A No, it would not, but the Gunsite well that has produced fifteen percent would fall right in.

Q That would only agree on the first year?

A Well, but we don't know anything about the second year.

Q Do you know of wells producing from the Pictured Cliffs formation for a period of more than twenty years?

A I understand that there are several wells in the San Juan Basin that have produced for over twenty years.

Q There are such wells in the Fulcher-Kutz?

A Yes. They start delivering 100,000 a day, don't they?

Q Do you know of wells that according to the production records

of the Commission show production of over two billion feet per 160 acres over a period of twenty years?

A I don't know of any particular wells. I suppose there are some. I don't think they got it under 160.

Q Sir?

A I don't think they got it under 160.

Q Then they are draining gas from somewhere else?

A That's right.

Q If you continue development of this pool on 320 acre basis, then you are going to drain gas from acreage other than the acreage dedicated to the well, in your opinion, is that correct?

A It's possible. I think these fields are going to produce a long time, and it may be that the spacing, actual draining pattern, might be 500 acres. I know it is more than 160 by the way the wells are producing.

Q Do you think that the South Blanco and Tapacito Pools will eventually --

A (Interrupting) Not anywhere near our acreage, because we have the stringers outlined between the two of them now.

Q Did you make a reserve calculation?

A I did not in this case. I heard enough of them I didn't have to make one.

Q Is this exhibit based on the reserve calculations made by Gunsite Butte?

A No, it is not based on anyone's. I took yours and used it

on the right hand side. That is the highest one I have heard mentioned for the Tapacito area. I have seen some reserve estimates made by other companies and they were lower, although I couldn't tell you exactly how much.

Q Do you know what companies and what the reserves were?

A One of them was a reserve made by Mr. Reese for Northwest Pacific Pipe Line.

Q That included acreage outside the Tapacito?

A It included all our wells, too.

Q It included all the good and bad acreage?

A Yes. The other one was made by MacNaughton for our company.

Q Was that confined to the Tapacito alone?

A No, to our wells.

Q That included acreage outside the Tapacito?

A No, just individual wells.

MR. KELLAHIN: Thank you.

MR. PORTER: Anyone else? Mr. Grenier.

By MR. GRENIER:

Q You just stated in answer to Mr. Cooley that you had no basis for estimating how much gas would be left in this pool. Did you mean by that no specific basis, or that based on your general knowledge and experience in other pools?

A No, you couldn't calculate it without a pressure from the depleted reservoir. You could calculate it nicely if you would

drill the other well and get the bottomhole pressure to find out how much gas was left there. In a good gas field you can drain a lot of acreage, in a good gas field you are going to leave very little gas. I think this is a good gas field. It is so far better than the average Tapacito gas field that it deserves different treatment.

Q Your opinion is that there would be little gas left in the Tapacito?

A In my opinion, there would be very little left in the Tapacito.

By MR. KELLAHIN:

Q Did you take into consideration the variations in the permeability and porosity in this field in connection with your testimony?

A No, I did not. I have a fairly good indication that the wells are quite similar because most of them seem to produce very well. Your two wells that you speak of making 890,000 a day for eight months, our eleven that have averaged out a million, Southern Union's average well is pretty high, so I assume there are pretty good characteristics throughout the field.

Q That's down the center of the field?

A No, that is all over the field. We have 1-33 just north of the Gunsite wells are good. Our wells up in 5, 6, 7, 8, of 26, 4, that is six miles away. Southern Union has wells located in between, El Paso and Pacific have a well in 36, 27, 35 that is a

beautiful well. It will produce three to four million a day.

Q All those wells are right in the heart of the field?

A That is a big heart.

Q Is it your testimony --

A (Interrupting) It's twelve miles apart.

Q Is it your testimony that the pool pinches out suddenly at the edge?

A I know it pinches out suddenly.

Q Very suddenly?

A Yes, sir, because I drilled a well to find out and got permission from this Commission to do so, because I thought it would be a much better well, but it was not.

MR. PORTER: Are there further questions of the witness?

MR. WIEDERKEHR: I would like to make a statement with respect to Mr. Kellahin. This Southern Union which was supposedly on production in '54, we didn't have a line in there until 1956, so that would make it fall pretty well in line with your work, wouldn't it, Mr. Johnston?

A Yes, it sure would.

MR. PORTER: Any further questions? The witness may be excused.

(Witness excused.)

MR. PORTER: Anyone else have testimony to present in the case? Any statements? Mr. Buell.

MR. BUELL: Guy Buell for Pan American Petroleum Corporation.

In our opinion the data are conclusive that a well in this pool will effectively drain any tract of 320 acres. We therefore urge that the Commission adopt a permanent 320 acre order.

MR. PORTER: Mr. Anderson.

MR. ANDERSON: John Anderson, United States Geological Survey, Roswell. We have a particular interest in this case, inasmuch as about sixty or seventy percent is Jicarilla Indian Tribal land. I don't think these Indians want any special consideration;at the same time, in addition to having some assurance that all of the recoverable gas in the lands will be produced and they will get their royalties, they want some assurance that this gas will be produced in a reasonable time. I would take reasonable time to mean that the withdrawals from the Tapacito area should be comparable to other Pictured Cliff fields, and I think in the testimony that has been given today by Mr. Wiederkehr, he mentioned the withdrawals from Tapacito and Otero and South Blanco and other fields during December, which if we bring them down to the common denominator of 160 acre tracts would make the withdrawals from the Tapacito area about one-third more than Otero and South Blanco, which will have the highest withdrawal per well during that month.

Our own figures on withdrawals from Tapacito and other Pictured Cliff Pools bear this out. From Tapacito the withdrawals per acre have been slightly in excess of the other fields. Of course, going into the future, the only thing that we have had introduced today is Mr. Johnston's deliverability curve we might

look at to see whether Tapacito on 320 acre spacing is going to be able to continue this rate of withdrawals. If his curve is correct and which I think he testified that it was an arbitrary curve, why certainly this would occur.

We in the Survey have nothing to confirm this or to refute it, and other than urging that the Commission consider the time element in production from the Tapacito area, we have no other matters to discuss.

MR. PORTER: Mr. Woodruff.

MR. WOODRUFF: Norman Woodruff, representing El Paso Natural Gas Company. El Paso is the operator in the 27-4 unit and 27-5 unit. The wells in both units are included in the northwest extremity of the Tapacito Pool. El Paso considers that the communication tests which have been testified to here today by Southern Union show that a well can effectively and economically drain a 320 acre tract. For this reason we would concur with Southern Union in the recommendation for a permanent 320 acre spacing order in the Tapacito Pool.

MR. PORTER: Mr. Hinkle.

MR. HINKLE: Clarence Hinkle, representing Humble Oil and Refining Company. We concur in the position of Southern Union that these special field rules should be continued and made permanent as far as 320 acre spacing is concerned. We believe that the evidence clearly shows that one well will effectively and efficiently drain more than 320 acres.

MR. HOY: George Hoy, Honolulu Oil. We concur in the position of Southern Union Gas Company. Southern Union's 320 acre spacing will adequately drain this reservoir. We concur in that.

MR. PORTER: Mr. Mankin.

MR. MANKIN: Warren Mankin, representing Aztec Oil and Gas. Aztec's name hasn't been particularly mentioned here today, but at this particular time I want to state that Aztec has an undivided fifty percent interest in ten of the nineteen wells of Southern Union, so we have a sizeable stake in this particular pool.

We have analyzed the data that has been presented by Southern Union as to the interference tests and we feel that it conclusively shows that there is interference and that one well will drain at least 320 acres both economically and efficiently. Also, in addition to this, we would like to urge the Commission to put in a permanent 320 acre order, and likewise to authorize the discontinuance of the interference test that is now being carried in Order R-794-B, that the test be discontinued and the well returned to production.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: At the outset of this case there was a brief review made of the history of the orders in the Tapacito, and I will not, on account of the time involved, review that, but I do want to point out that for the first time in the history of this case, an attempt has been made to offer to this Commission some reservoir information on which they can base an order. The proponents have never seen fit to offer the type of testimony given

by Gunsite Butte, and it is normally the type of testimony presented to the Commission and the type of testimony that the Commission has a right to expect in connection with any spacing case.

We feel that the interference tests which were made upon the order of the Commission failed to show any significant drainage, particularly when you consider the small pressure drop involved in these wells over the period of time and as against the amount of the production of gas from the producing wells.

It is also significant that there was no pressure information given upon the producing wells which would show whether there was any appreciable drop in the pressures in those wells, which in fact would be significant if we are considering the effective radial drainage. Certainly those tests leave a great deal to be desired and can hardly support a contention that one well will effectively and economically drain 320 acres.

I think the testimony offered by Gunsite Butte also clearly shows that in order to protect correlative rights, as this Commission must do under the statutes, the area would have to be developed upon 160 acre basis; otherwise many of the operators within the pool will suffer drainage which is not compensated by offset drainage, a factor which this Commission should consider very carefully.

Of course, every company in here has its own economic problem and,as was testified by the Southern Union witness, they would like to use their two million dollars somewhere else. We also have our own peculiar economic problem, in that we have taken a small amount

of acreage upon the basis of 160-acre spacing. A few months after acquiring it, the 320-acre order was entered. We are sitting there without a way for developing that acreage, and it creates a problem to the Gunsite Corporation, just as they have testified the expenditure for the wells would create one for them. We submit, on the basis of the testimony that has been offered, the rule on 320-acre spacing in the Tapacito should be terminated and the pool allowed to revert to the normal 160-acre units, which is in effect in all of the other Pictured Cliffs gas pools in the San Juan Basin.

I am also authorized to state that Elliot and Hall, who have acreage which I understand is within the two-mile radius governed by the present pool rules, are opposed to the continuation of the 320-acre spacing order.

MR. PORTER: Mr. Grenier.

MR. GRENIER: To touch briefly first on one point of Mr. Kellahin, data has been regularly furnished to the Commission with respect to the pressures of the producing wells involved in these interference tests. We had not thought that those pressures were particularly significant. The significant thing, of course, being the pressure drop realized in these shut-in wells. There has been several, there has been considerable amount of suggestion in the preceding statements that this order should be made permanent. I don't know that there is such a thing as a permanent order, it was just an order that stands until the next time we have occasion to take a look at the thing. That is the way all these Commission

orders have been, and that is what we would suggest should be done now, that the normal pattern of standing order be instituted, subject to being reopened at any time when anyone feels there is new evidence or testimony that should come in,and that very possibly might be necessary on a number of accounts after we get prorationing in this area. When that thing comes along, we will then have the full picture before us in a way that we have not got it in front of us now.

The Commission may remember my having made the comment in some previous cases here that you can always drill them up, but you can never undrill them once they have been drilled. The same principle is patently applicable to this situation here.

We therefore do urge that the Commission grant us an order, subject to further revision upon its own motion and after hearing, or upon the motion of any interested party after hearing 320-acre spacing be established in this pool. We feel it has been clearly established that one well will effectively drain more than 320 acres. We feel on that basis it is clearly justified and proper under the circumstances. Thank you.

MR. PORTER: Anyone else have a statement? Mr. Johnston, I believe we overlooked your exhibit. Do you wish to offer it as an exhibit?

MR. JOHNSTON: Yes.

MR. PORTER: Have you identified the exhibit?

MR. JOHNSTON: It is Northwest Production's Exhibit No. 1.

MR. PORTER: Is there objection? If not, the exhibit will be admitted.

Is there anything further in this case? We will take the case under advisement.

* * * * * * * * * * *

C E R T I F I C A T E

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in stenotype and reduced to typewritten transcript under my personal supervision, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this 21st day of February, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My commission expires:

June 19, 1959.

CORE ANALYSIS REPORT

FOR

SOUTHERN UNION GAS COMPANY

NO. 1 - E JICARILLA WELL

WILDCAT

RIO ARRIBA COUNTY, NEW MEXICO

LOCATION: SEC. 16 - T26N - R4W

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

June 30, 1954

REPLY TO
1020 PATTERSON BLDG.
DENVER, COLORADO

Southern Union Gas Company
Box 815
Farmington, New Mexico

Attention: Mr. Bill Vanderslice

Subject: Core Analysis
No. 1-E Jicarilla Well
Wildcat
Rio Arriba County, New Mexico
Location: Sec. 16-T26N-R4W

Gentlemen:

Diamond conventional cores from the subject well in the Pictured Cliffs formation have been sampled and quick-frozen by a representative of Core Laboratories, Inc., and analyzed in our Farmington, New Mexico laboratory. The results of analysis are presented in tabular and graphical form on the attached Coregraph. Water base mud was used as the drilling fluid.

Pictured Cliffs formation analyzed from 3414 to 3437 feet is interpreted as being essentially gas productive. A vertical fracture system was observed from 3420 to 3427 feet and this will add to the effective permeability of the section.

Asterisks in the production column denote those feet which have higher than normal water saturations and probably would produce water-cut during production history.

Average data for the zone, 3414 to 3437 feet, are presented on page one of the report.

We hope these data prove beneficial in the evaluation of this well.

Very truly yours,

Core Laboratories, Inc.

J D Harris (PB)
J. D. Harris,
District Engineer

JDH:ma

Distribution of Final Reports

3 Copies	Southern Union Gas Company Box 815 Farmington, New Mexico Attention: Mr. Bill Vanderslice
4 Copies	Southern Union Gas Company Burt Building Dallas, Texas Attention: Mr. A. M. Wiederkehr
1 Copy	Humble Oil & Refining Company Box 4085 Albuquerque, New Mexico Attention: Mr. A. A. Phillips

FORM F-11A

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS

File FNML-129 FC
Well No. 1-E Jicarilla

CORE SUMMARY AND CALCULATED RECOVERABLE OIL

CORE SUMMARY

FORMATION NAME	Pictured Cliffs			
DEPTH, FEET	3414.0-3437.0			
% CORE RECOVERY	100			
FEET OF PERMEABLE, PRODUCTIVE FORMATION RECOVERED	23.0			
AVERAGE PERMEABILITY MILLIDARCYS	6.2			
CAPACITY — AVERAGE PERMEABILITY × FEET PRODUCTIVE FORMATION	142			
AVERAGE POROSITY, PERCENT	16.7			
AVERAGE RESIDUAL OIL SATURATION, % PORE SPACE	0.2			
GRAVITY OF OIL, °A.P.I.				
AVERAGE TOTAL WATER SATURATION, % PORE SPACE	46.9			
AVERAGE CALCULATED CONNATE WATER SATURATION, % PORE SPACE	42			
SOLUTION GAS-OIL RATIO, CUBIC FEET PER BARREL (1)				
FORMATION VOLUME FACTOR—VOLUME THAT ONE BARREL OF STOCK TANK OIL OCCUPIES IN RESERVOIR (1)				
CALCULATED RECOVERABLE OIL	Prediction dependent upon complete isolation of each division. Structural position of well, total permeable thickness of oil zone and drainage area of well should be considered.			
BY NATURAL OR GAS EXPANSION, BBLS. PER ACRE FOOT (2)	(4)			
INCREASE DUE TO WATER DRIVE, BBLS. PER ACRE FOOT	(4)			
TOTAL AFTER COMPLETE WATER DRIVE, BBLS. PER ACRE FOOT (3)	(4)			

Core Laboratories, Inc.

J. D. Harris (PS)
J. D. Harris

NOTE:

(*) REFER TO ATTACHED LETTER.

(1) REDUCTION IN PRESSURE FROM SATURATION PRESSURE TO ATMOSPHERIC PRESSURE.

(2) AFTER REDUCTION FROM ORIGINAL RESERVOIR PRESSURE TO ZERO POUNDS PER SQUARE INCH.

(3) RESERVOIR PRESSURE MAINTAINED BY WATER DRIVE AT OR ABOVE ORIGINAL SATURATION PRESSURE.

(4) NO ESTIMATE FOR GAS PHASE RESERVOIRS.

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees assume no responsibility and make no warranty or representation, as to the productivity, proper operation, or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

605 SIMMS BUILDING
ALBUQUERQUE, NEW MEXICO
Telephone 3-6691

DEARNLEY-MEIER AND ASSOCIATES
INCORPORATED

106 BOKUM BUILDING
SANTA FE, NEW MEXICO
Telephone 2-1869

March 26, 1958

Bobby Postlewaite
Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Dear Bobby:

Please send me a copy of case 977 as soon as possible.

Thanks

ADA

I took this Ada

Ex 3

TAPACITO FIELD

Interference Test #1

Producing Wells:

Jicarilla 1-E	SW/4 16-26-4
Jicarilla 3-E	NE/4 15-26-4
Jicarilla 4-E	NE/4 22-26-4

Shut in:

Jicarilla 2-E	SW/4 15-26-4

Month	SICP	SITP	Monthly Production	Cumulative Production
January 1956	1090	1087.5	0	
February 1956	1088	1086	72,787	
March 1956	1089.5	1086.5	95,289	168,076
April 1956	1089.5	1087.5	140,648	308,724
May 1956	1089	1086	170,881	479,605
June 1956	1088.5	1085.5	145,098	624,703
July 1956	1086	1083	135,196	759,899
August 1956	1083	1080	145,782	905,681
September 1956	1079	1077	134,289	1,039,970
October 1956	1072.5	1074.5	121,394	1,161,364
November 1956	1070	1068	79,830	1,241,194
December 1956	1068	1066	99,256	1,340,450

TAPACITO FIELD

Interference Test #2

Producing Wells:

Jicarilla 2-D — SE/4 29-26-3
Jicarilla 5-D — SW/4 30-26-3

Shut in:

Jicarilla 4-D — NE/4 30-26-3

Month	SICP	SITP	Monthly Production	Cumulative Production
November 1956				60,455*
December 1956	1065	1064	56,278	116,733
January 1957	1065	1064	58,555	175,288
February 1957	1065	1064	47,744	223,032
March 1957	1065½	1064½	47,572	270,604
April 1957	1066	1064½	37,901	308,504
May 1957	1066	1064½	47,147	355,651
June 1957	1065½	1063½	37,819	393,470

*Cumulative for 2-D well only, 4-D well on production in December 1956.

Case # 977

MAGNOLIA PETROLEUM COMPANY

A SOCONY MOBIL COMPANY

LEGAL DEPARTMENT

P. O. BOX 900
DALLAS 21, TEXAS

EARL A. BROWN
GENERAL COUNSEL
ROY C. LEDBETTER
RAYMOND M. MYERS
CHAS. B. WALLACE
R. T. WILKINSON, JR.
FRANK C. BOLTON, JR.
JACK VICKREY
SAM H. FIELD
ROSS MADOLE
FLOYD B. PITTS
ROY L. MERRILL
ALBERT E. AIKMAN
JACK E. EARNEST
ASSISTANTS

November 11, 1955

Re: Case No. 977 - Application of Southern Union Gas Co. for Designation of Certain Area as the Tapicito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico and Establishment of a Temporary 320 Acre Drilling Unit

Mr. W. B. Macey, Secretary
New Mexico Oil Conservation Commission
125 Mabry Hall, Capitol Building
Santa Fe, New Mexico

Dear Mr. Macey:

I had planned on being present at the hearing in the above case and going on record in behalf of Magnolia Petroleum Company in support of this application. Other matters make it impossible for me to be present.

Will you please enter this letter in behalf of Magnolia in support of the above application, including the designation of the limits of the pool and the establishment of a temporary 320-acre spacing pattern in said pool and adjacent areas within two miles of same.

Magnolia Petroleum Company is the owner of oil and gas leases in the area to be designated as the Tapicito-Pictured Cliffs Gas Pool and producing wells thereon. We feel that the area described should be designated as a new and separate Pictured Cliffs Pool and feel that it would be to the interest of conservation and the prevention of waste and protect correlative rights to require a 320-acre drilling unit as described in the application, both in the pool itself and adjacent areas within two miles of same.

Yours very truly,

Ross Madole

Ross Madole

RM:u

cc: Mr. A. S. Grenier

Put in file
Case 917

AZTEC OIL & GAS COMPANY
920 MERCANTILE SECURITIES BUILDING
DALLAS 1, TEXAS

December 12, 1955

Mr. John A. Anderson
Regional Oil and Gas Supervisor
U. S. Geological Survey
Roswell, New Mexico

Re: Jicarilla Apache Indian Lands,
Rio Arriba County, New Mexico

Dear Mr. Anderson:

Application has been made to the New Mexico Oil Conservation Commission for establishment and designation of the Tapicito Pictured Cliffs Gas Pool to embrace the following described lands:

Township 25 North, Range 3 West, N.M.P.M.

Sec. 4: All Sec. 5: All

Township 26 North, Range 3 West, N.M.P.M.

Sec. 19: All Sec. 30: All
Sec. 29: All Sec. 32: All

Township 26 North, Range 4 West, N.M.P.M.

Sec. 3: S½ Sec. 15: All
Sec. 4: S½ Sec. 16: All
Sec. 9: All Sec. 21: E½
Sec. 10: All Sec. 22: All
Sec. 11: S½ Sec. 23: All
Sec. 13: All Sec. 24: All
Sec. 14: All Sec. 25: E½

All of the above lands, except Sections 4 and 5, Township 25 North, Range 3 West, are Indian lands situated within the Jicarilla Apache Reservation.

Aztec Oil & Gas Company owns an undivided one-half interest in oil and gas leases issued by the Jicarilla Apache Indians covering the following described lands which are located within the boundaries of the proposed gas pool and adjacent areas within two miles of same:

Township 26 North, Range 3 West, N.M.P.M.

All of Sections 29, 30, 31, and 32

Township 26 North, Range 4 West, N.M.P.M.

All of Sections 1, 2, 11, 12, 13, 14, 17, 18, 19, 20, 23, 24, 25, 26, 35, and 36

By reason of the completion of several wells in the area of the proposed gas pool and in light of the geological and well log data currently available, it is our opinion that all of the lands within the proposed gas pool may reasonably be expected to be productive of natural gas in commercial quantities in the Pictured Cliffs formation. Such geological and well log data also indicate that the Pictured Cliffs Gas Pool underlying the lands referred to hereinabove is and should be regarded as a different pool from any of those heretofore designated by the New Mexico Oil Conservation Commission as such in northwestern New Mexico.

According to geological and well log data currently available, it is our opinion that a well drilled and properly completed in the Pictured Cliffs formation within the limits of the proposed gas pool may reasonably be expected to drain in an efficient and economic manner at least 320 acres. Therefore, pending further development and production from such area, it is respectfully requested that you approve and temporarily establish, for a period of one year from the date of this letter, 320-acre drilling units for the Jicarilla Indian lands under lease to Aztec Oil & Gas Company and described above. It is also requested that your order provide that each such unit will consist of either the N½, S½, E½, or W½ of a standard section according to United States land surveys, with the wells located in the SW¼ or the NE¼ of the section, subject to exception because of an existing Pictured Cliffs gas well in the section, and that no well will be drilled on such lands (in the absence of special topographical conditions justifying some other location) closer than 990 feet to a boundary of a quarter section upon which it is located.

With thanks for your prompt and favorable action on this request, I am

Yours very truly,

AZTEC OIL & GAS COMPANY

By Van Thompson
Vice President

F-C
Case 977

December 13, 1955

Re: Oil Conservation
Commission
Case 977

COPY

Governor John Simms
State Capitol
Santa Fe, New Mexico

Dear John:

In considering the application of Southern Union Gas Company for 320 acre spacing and designation of a Tapacitos Pool, I would like to suggest the following points in consideration:

1. The area described could possibly be a separate pool inasmuch as several dry holes have been drilled around it and no positive trend has been developed connecting it to other fields.

2. The cost of wells in this area is definitely greater (about twice) than the majority of Pictured Cliffs wells presently drilled because of the greater depth and the remoteness of the area under consideration.

3. Southern Union has agreed to a three months shut in period which would be a good chance to test the drainage pattern of these much higher pressure Pictured Cliffs fields.

4. The request is for a temporary one-year permit and extension could be denied later if factors warranted it.

5. While granting 320 acre spacing in this Pictured Cliffs area would break a pattern, it would not

necessarily open the door if at the same time Amerada's request in Case 954 is denied.

I would favor a test of the 320 acre pattern in the Southern Union case and a denial of same to Amerada.

Very truly yours,

John P. Wiedemer

JPW/pg
cc: Mr. Bill Macey

COPY

Memo

1/17/56

From WWO

Re: Case #977 (heard on 11/16/55)

To JWG

OK to go ahead & write order:

FIND ① That Case #964(e) should be consolidated with this case

② that the pool should be created & delineated to be slightly less than that advertised (taking in primarily only acreage of completed wells)

③ that the applicant failed to prove that one well would drain 320 acres

ORDER: ① that the pool should be created as shown on attached sheet.

② That the 320 acre spacing request be denied.

Memo

From

To

T 25N R 3 W
Sec. 4: NW/4
Sec 5: NE/4

T 26N R 3 W
Sec. 7: SW/4
Sec. 18: W/2
Sec. 19: W/2 & SE/4
Sec. 29: all
" 30: all
" 32: all

T 26N R 4W
Sec. 9: E/2
Sec 10: S/2
Sec. 11: S/2
Sec 12: S/2
Sec. 13: all
" 14: all
" 15: all
Sec 16: E/2
Sec 22: NE/4
Sec. 23: all
Sec 24: all

Aztec, PNW & Hondale

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P. O. Box 6721
Roswell, New Mexico

January 18, 1956

Southern Union Gas Company
Burt Building
Dallas 1, Texas

Gentlemen:

Reference is made to your application dated December 7, 1955, for approval of 320-acre spacing for Pictured Cliffs gas wells on Jicarilla tribal oil and gas leases owned by you in the following described Tapicito area:

Township 26 North, Range 3 West, N.M.P.M.			
Sec. 19:	All	Sec. 30:	All
Sec. 29:	All	Sec. 32:	All

Township 26 North, Range 4 West, N.M.P.M.			
Sec. 3:	S½	Sec. 15:	All
Sec. 4:	S½	Sec. 16:	All
Sec. 9:	All	Sec. 21:	E½
Sec. 10:	All	Sec. 22:	All
Sec. 11:	S½	Sec. 23:	All
Sec. 13:	All	Sec. 24:	All
Sec. 14:	All	Sec. 25:	E½

Said spacing is approved for one year from December 1, 1955, covering the Jicarilla Indian leases owned by you in the area described in the foregoing and adjacent land within two miles of such area.

The 320-acre spacing unit shall be the N½, S½, E½, or W½ of a standard section or its near equivalent, and the wells shall be located in the SW¼ and NE¼ of the section, not less than 990 feet from the exterior boundary of such quarter-section, with reasonable tolerance for topographic conditions. Exceptions for wells now drilled are recognized.

The Geological Survey reserves the right, at any time upon not less than 90 days written notice, to require that such well density be increased to one well to 160-acres when in our opinion such action is required by proper protection of the interests of the Jicarilla Indian lessors.

Very truly yours,

(Orig. Sgd.) JOHN A. ANDERSON
JOHN A. ANDERSON
Regional Oil and Gas Supervisor

Copy to: Farmington
Supt., Dulce, N.M.
Oil Conserv. Comm. ✓

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P. O. Box 6721
Roswell, New Mexico

January 18, 1956

Humble Oil & Refining Company
Midland,
Texas

Gentlemen:

Reference is made to your application dated December 12, 1955, for approval of 320-acre spacing for Pictured Cliffs gas wells on Jicarilla tribal oil and gas leases owned by you in the following described Tapicito area:

Township 26 North, Range 3 West, N.M.P.M.

Sec. 19:	All	Sec. 30:	All
Sec. 29:	All	Sec. 32:	All

Township 26 North, Range 4 West, N.M.P.M.

Sec. 3:	S½	Sec. 15:	All
Sec. 4:	S½	Sec. 16:	All
Sec. 9:	All	Sec. 21:	E½
Sec. 10:	All	Sec. 22:	All
Sec. 11:	S½	Sec. 23:	All
Sec. 13:	All	Sec. 24:	All
Sec. 14:	All	Sec. 25:	E½

Said spacing is approved for one year from December 1, 1955, covering the Jicarilla Indian leases owned by you in the area described in the foregoing and adjacent land within two miles of such area.

The 320-acre spacing unit shall be the N½, S½, E½, or W½ of a standard section or its near equivalent, and the wells shall be located in the SW¼ and NE¼ of the section, not less than 990 feet from the exterior boundary of such quarter-section, with reasonable tolerance for topographic conditions. Exceptions for wells now drilled are recognized.

The Geological Survey reserves the right, at any time upon not less than 90 days written notice, to require that such well density be increased to one well to 160-acres when in our opinion such action is required by proper protection of the interests of the Jicarilla Indian lessors.

Copy to: Farmington
Supt., Dulce, N.M.
Oil Cons. Commission

Very truly yours,

(Orig. Sgd.) JOHN A. ANDERSON
JOHN A. ANDERSON
Regional Oil and Gas Supervisor

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P.O. Box 6721
Roswell, New Mexico

January 18, 1956

Aztec Oil & Gas Company
920 Mercantile Securities Building
Dallas 1, Texas

Gentlemen:

Reference is made to your application dated December 12, 1955, for approval of 320-acre spacing for Pictured Cliffs gas wells on Jicarilla tribal oil and gas leases owned by you in the following described Tapicito area:

Township 26 North, Range 3 West, N.M.P.M.			
Sec. 19:	All	Sec. 30:	All
Sec. 29:	All	Sec. 32:	All

Township 26 North, Range 4 West, N.M.P.M.			
Sec. 3:	S½	Sec. 15:	All
Sec. 4:	S½	Sec. 16:	All
Sec. 9:	All	Sec. 21:	E½
Sec. 10:	All	Sec. 22:	All
Sec. 11:	S½	Sec. 23:	All
Sec. 13:	All	Sec. 24:	All
Sec. 14:	All	Sec. 25:	E½

Said spacing is approved for one year from December 1, 1955, covering the Jicarilla Indian leases owned by you in the area described in the foregoing and adjacent land within two miles of such area.

The 320-acre spacing unit shall be the N½, S½, E½, or W½ of a standard section or its near equivalent, and the wells shall be located in the SW¼ and NE¼ of the section, not less than 990 feet from the exterior boundary of such quarter-section, with reasonable tolerance for topographic conditions. Exceptions for wells now drilled are recognized.

The Geological Survey reserves the right, at any time upon not less than 90 days written notice, to require that such well density be increased to one well to 160-acres when in our opinion such action is required by proper protection of the interests of the Jicarilla Indian lessors.

Copy to: Farmington
Supt., Dulce, N.M.
Oil Cons. Commission ✓

Very truly yours,

(Orig. Sgd.) JOHN A. ANDERSON

JOHN A. ANDERSON
Regional Oil and Gas Supervisor

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P. O. Box 6721
Roswell, New Mexico

January 18, 1956

Pacific Northwest Pipeline Corporation
Simms Building
Albuquerque, New Mexico

Gentlemen:

Reference is made to your application dated December 22, 1955, for approval of 320-acre spacing for Pictured Cliffs gas wells on Jicarilla tribal oil and gas leases owned by you in the following described Tapicito area:

Township 26 North, Range 3 West, N.M.P.M.			Township 26 North, Range 4 West, N.M.P.M.		
Sec.	19:	All	Sec.	30:	All
Sec.	29:	All	Sec.	32:	All
Sec.	3:	S½	Sec.	15:	All
Sec.	4:	S½	Sec.	16:	All
Sec.	9:	All	Sec.	21:	E½
Sec.	10:	All	Sec.	22:	All
Sec.	11:	S½	Sec.	23:	All
Sec.	13:	All	Sec.	24:	All
Sec.	14:	All	Sec.	25:	E½

Said spacing is approved for one year from December 1, 1955, covering the Jicarilla Indian leases owned by you in the area described in the foregoing and adjacent land within two miles of such area.

The 320-acre spacing unit shall be the N½, S½, E½, or W½ of a standard section or its near equivalent, and the wells shall be located in the SW¼ and NE¼ of the section, not less than 990 feet from the exterior boundary of such quarter-section, with reasonable tolerance for topographic conditions. Exceptions for wells now drilled are recognized.

The Geological Survey reserves the right, at any time upon not less than 90 days written notice, to require that such well density be increased to one well to 160-acres when in our opinion such action is required by proper protection of the interests of the Jicarilla Indian lessors.

Copy to: Supt., Dulce, N.M.
Oil Cons. Commission ✓

Very truly yours,
(Orig. Sgd.) John A. Anderson

JOHN A. ANDERSON
Regional Oil and Gas Supervisor

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P. O. Box 6721
Roswell, New Mexico

January 18, 1956

Honolulu Oil Corporation
P. O. Drawer 1391
Midland, Texas

Gentlemen:

Reference is made to your application dated December 12, 1955, for approval of 320-acre spacing for Pictured Cliffs gas wells on Jicarilla tribal oil and gas leases owned by you in the following described Tapicito area:

Township 26 North, Range 3 West, N.M.P.M.			
Sec. 19:	All	Sec. 30:	All
Sec. 29:	All	Sec. 32:	All

Township 26 North, Range 4 West, N.M.P.M.			
Sec. 3:	S½	Sec. 15:	All
Sec. 4:	S½	Sec. 16:	All
Sec. 9:	All	Sec. 21:	E½
Sec. 10:	All	Sec. 22:	All
Sec. 11:	S½	Sec. 23:	All
Sec. 13:	All	Sec. 24:	All
Sec. 14:	All	Sec. 25:	E½

Said spacing is approved for one year from December 1, 1955, covering the Jicarilla Indian leases owned by you in the area described in the foregoing and adjacent land within two miles of such area.

The 320-acre spacing unit shall be the N½, S½, E½, or W½ of a standard section or its near equivalent, and the wells shall be located in the SW¼ and NE¼ of the section, not less than 990 feet from the exterior boundary of such quarter-section, with reasonable tolerance for topographic conditions. Exceptions for wells now drilled are recognized.

The Geological Survey reserves the right, at any time upon not less than 90 days written notice, to require that such well density be increased to one well to 160-acres when in our opinion such action is required by proper protection of the interests of the Jicarilla Indian lessors.

Very truly yours,

(Orig. Sgd) JOHN A. ANDERSON
JOHN A. ANDERSON
Regional Oil and Gas Supervisor

Copy to: Farmington
Supt., Dulce, N.M.
Oil Cons. Commission

Case File
977

HUMBLE OIL & REFINING COMPANY

MIDLAND, TEXAS

J. W. HOUSE

January 27, 1956

Mr. W. B. Macey
New Mexico Oil Conservation Commission
Santa Fe, New Mexico

Dear Sir:

With reference to Case No. 964 and 977, we submit photostatic copies of Mr. John A. Anderson's letter of January 18, 1956 in which he approves 320-acre spacing for Humble Oil & Refining Company leases in the Tapacito Area for one year from December 1, 1955.

If it is permissible, we request that Mr. Anderson's letter be made a part of the record in the above cases.

Yours very truly,

HUMBLE OIL & REFINING COMPANY

J. W. HOUSE

BY: R. S. DEWEY

APPROVED:

RSD/rs
Attachments

cc: Mr. Clarence E. Hinkle,
Roswell, New Mexico

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P. O. Box 6721
Roswell, New Mexico

January 18, 1956

PET. ENG. FILE
Initial and Forward
REPLY REFER TO:

RSD		RAB
TWG		RLP
		DLD
WRW		JEW
MCH		JLC
GLP		SJL
		CHK
		WSD
		VES

Humble Oil & Refining Company
Midland,
Texas

Gentlemen:

Reference is made to your application dated December 12, 1955, for approval of 320-acre spacing for Pictured Cliffs gas wells on Jicarilla tribal oil and gas leases owned by you in the following described Tapicito area:

Township 26 North, Range 3 West, N.M.P.M.

Sec. 19:	All	Sec. 30:	All
Sec. 29:	All	Sec. 32:	All

Township 26 North, Range 4 West, N.M.P.M.

Sec. 3:	S½	Sec. 15:	All
Sec. 4:	S½	Sec. 16:	All
Sec. 9:	All	Sec. 21:	E½
Sec. 10:	All	Sec. 22:	All
Sec. 11:	S½	Sec. 23:	All
Sec. 13:	All	Sec. 24:	All
Sec. 14:	All	Sec. 25:	W½

Said spacing is approved for one year from December 1, 1955, covering the Jicarilla Indian leases owned by you in the area described in the foregoing and adjacent land within two miles of such area.

The 320-acre spacing unit shall be the N½, S½, E½, or W½ of a standard section or its near equivalent, and the wells shall be located in the SW¼ and NE¼ of the section, not less than 990 feet from the exterior boundary of such quarter-section, with reasonable tolerance for topographic conditions. Exceptions for wells now drilled are recognized.

The Geological Survey reserves the right, at any time upon not less than 90 days written notice, to require that such well density be increased to one well to 160-acres when in our opinion such action is required by proper protection of the interests of the Jicarilla Indian lessors.

Very truly yours,

JOHN A. ANDERSON
Regional Oil and Gas Supervisor

Case 977

In the matter of the hearing
called by the Oil Conservation
of New Mexico for the purpose
of considering:

The application of Southern Union
Gas Company for an order creating the
Tapicito-Pictured Cliffs Gas Pool in
Rio Arriba County New Mexico and
for the purpose establishing 320 acre
units with said pool.

Order of the Commission

By the Commission

This cause came on for hearing at 9 o'clock
a.m. on November 16, 1955 at Santa Fe, New Mexico,
before the Oil Conservation Commission hereinafter
referred to as the "Commission".

Now on this ____ day of _____, 1956, the
Commission a quorum being present having considered
the testimony presented and the exhibits received at
said hearing, and being fully advised in the premises

Finds:

That the subject acreage of Paragraph (2) of
application for creation of new pool in Rio Arriba County
as set forth in Case 964 was consolidated with
Case 977 by paragraph (2) of Order Number R-709.
Subject acreage is described as follows:

Township 26 North Range 4 West
Section 9 NE/4

T 26 N R 4 W

Sec 9 E/2

Sec 10 S/2
Sec 11 S/2
Sec 12 S/2
Sec 13 all
Sec 14 all
Sec 15 all
Sec 16 E/2
Sec 22 NE/4
Sec 23 all
Sec 24 all

2. That applicant request for an order ~~temporarily~~ ~~[redacted]~~ Spacing ~~[redacted]~~ 320 acre drilling units be and the same is hereby denied.

in the Topsy PC Gas Pool

Share al _____

Section 10: W/2
Section 13 SW/4
Section 14 S/2
Section 15 all
Section 16: SE/4
Section 22 NE/4
Section 23 W/2, NE/4

2. That there is imminent evidence of [illegible] creation of a new gas pool said pool to be designated as the Tapacito Pictured Cliffs Gas Pool.

3. That the delineation of said Tapacito Pict. Cliffs Gas Pool should conform to the area [illegible] by development.

4. That there is imminent evidence of [illegible] established of 320 acres, directly west of said gas pool.

It is therefore ordered.

1. That the Tapacito Pictured Cliffs Gas Pool be and the same is hereby created; said pool to consist of the following described lands in Rio Arriba Co. N.M.

T 25 N R 3 W.

Sec 4 NW/4
Sec 5 NE/4

T 26 N R 3 W

Sec 7: SW/4
Sec 18: W/2
Sec 19: W/2 SE/4
Sec 29: all
Sec 30: all
Sec 32 all.

February 24, 1956

Sou. 4/28-56

MEMORANDUM

TO: Mankin, Gurley & Utz

FROM: W. B. Macey

SUBJECT: Case 977

Please write the order in this case approving Southern Union's application (Do not destroy the original rough draft of the order which you have already written).

I believe the order should contain a provision for the spacing rules to apply to all adjacent areas within two miles of the pool and also should contain some provision for interference tests to be conducted on wells during the one-year duration of the order. By this I mean that interference tests should be conducted for a period of time after the initial production from the pool and later on during the one-year period other wells should be shut-in, particularly those on the edges of the pool to determine whether or not there is any interference. A further requirement might request a monthly report on the wells involved in the test area.

WBM:brp

add: (1) eff. 2/1/56 to 2/1/57

(2) Rehearing to be held 12/13/56 to show cause why the drilling wells & rules shall not be discontinued

(3) 320 Rules - 320 acre unit either N/2, S/2, E/2 or W/2 wells located in either SW/4 or NE/4

(4) grant exception to all quarter-quarter sections containing a well which wells not less than 990 from outer boundary of 1/4 section

(5) Extend? area to cover how drilled?

3 wells

BEFORE THE OIL CONSERVATION COMMISSION

OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF SOUTHERN UNION GAS COMPANY FOR AN ORDER DESIGNATING CERTAIN LANDS IN TOWNSHIP 26 NORTH, RANGES 3 AND 4 WEST, N.M.P.M., RIO ARRIBA COUNTY, NEW MEXICO, AS THE TAPICITO-PICTURED CLIFFS GAS POOL AND ESTABLISHING 320-ACRE DRILLING UNITS FOR SAID POOL.

T 25 N 3 W

CASE NO. 977

Temporarily

Amended APPLICATION

Southern Union Gas Company (herein referred to as "Applicant"), a Delaware corporation with its principal place of business in the Burt Building, Dallas 1, Texas, hereby makes application to the Commission for an order designating certain lands in Rio Arriba County, New Mexico, more fully hereinafter described, as the Tapicito-Pictured Cliffs Gas Pool and establishing 320-acre drilling units for said pool. In support of such application Applicant respectfully states and shows the following:

(1) The lands, all located in Rio Arriba County, New Mexico, herein requested by Applicant to be designated as the Tapicito-Pictured Cliffs Gas Pool are as follows:

Township 26 North, Range 3 West, N.M.P.M.

Section 19: All
Section 29: All
Section 30: All
Section 32: ~~N/2~~ all

Township 26 North, Range 4 West, N.M.P.M.

Section 3: S/2
Section 4: S/2
Section 9: All
Section 10: All
Section 11: S/2
Section 13: All
Section 14: All
Section 15: All
Section 16: All
Section 21: E/2
Section 22: All
Section 23: All
Section 24: All
Section 25: E/2

(2) As of the date of this application, approximately 12 14 wells have been completed by Applicant and others in the Pictured Cliffs formation within the requested pool boundaries set forth above. By reason of the completion of said wells, and in the light of the geological and well log data available to Applicant, Applicant is of the opinion that all of the lands within the requested pool boundaries may reasonably be expected to be productive of natural gas in commercial quantities from the Pictured Cliffs formation. Such geological and well log data also indicate that the Pictured Cliffs Gas Pool underlying the lands referred to hereinabove is and should be regarded as a different pool from any of those heretofore formally designated by the Commission as such in northwestern New Mexico.

(3) In the light of the geological and well log data available to it, Applicant is of the opinion that a well drilled and properly completed in the Pictured Cliffs formation within the requested pool limits referred to above may reasonably be expected to drain in an efficient and economic manner not less than 320 acres of land, and that it is appropriate for the Commission, for the purposes of preventing waste and protecting correlative rights, to establish 320-acre drilling units for the Tapicito-Pictured Cliffs Gas Pool, each such unit to consist of either the N/2, S/2, E/2 or W/2 of a standard section according to the United States Land Surveys, and to order that no well within said pool be drilled (in the absence of special topographical conditions justifying some other location) closer than 990 feet to any boundary of the quarter section upon which it is located.

(4) At the hearing regarding this matter Applicant will be prepared to present further evidence relating to (a) the propriety of designation of the proposed area as a new and separate Pictured Cliffs Gas Pool and (b) the propriety of the well-spacing provisions proposed in paragraph (3) above.

WHEREFORE, premises considered, Applicant prays that the Commission, after such hearing and upon such notice as the Commission may direct, issue its order designating the lands described in paragraph (1) hereof as the Tapicito-Pictured Cliffs Gas Pool, and Temporarily establishing drilling units and providing for the location of wells within said pool in the manner outlined in paragraph (3) hereof.

Respectfully submitted,

SOUTHERN UNION GAS COMPANY

By J. C. Reid
Vice President

THE STATE OF TEXAS)
)
COUNTY OF DALLAS)

J. C. Reid, being first duly sworn, hereby states that he is the Vice President of Southern Union Gas Company, the Applicant in the foregoing application, that as such officer he has executed said application on behalf of Southern Union Gas Company; that he has read said application and, to the best of his knowledge, information and belief, all statements of fact therein contained are true and correct.

J. C. Reid

SWORN TO AND SUBSCRIBED before me, the undersigned authority, this 12th day of October, 1955.

Faye Griffin
Notary Public in and for
Dallas County, Texas

My Commission Expires:

June 1, 1957

M

Insert (5)

(5) That all wells shall be located at least 990 ft. from the outer boundary of the quarter quarter section in which the well is drilled, provided however that a tolerance of three or minus 200 feet will be permissible. Provided further that the wells shall not be drilled closer than 130 feet to any quarter quarter section, or subdivision, inner boundary.

In order

Insert (6) (7) That the applicant, Southern Union Gas Company, shall run an interference test involving four wells. Said test shall be for a period of one year or until definite proof of communication among the wells has been established in a lesser period. The applicant's Jicarilla well No. 2-E located in the NE/4 SW/4 section 15, Township 26 North, Range 7 West shall be shut-in for the duration of the test. Shut-in pressure tests on this well shall be taken each month beginning April 1, 1956. The valves on said well shall be sealed in the interim between pressure tests. All tests shall be witnessed by a commission representative or a thereunto-authorized personnel. The other three wells involved in this interference test shall continue to be produced unrestricted as of April 1, 1956 and

edly into the pipeline for the duration of the test. Said wells are the applicants Jicarilla well 3-E located in the NW/4 NE/4 section 15 Township 26 North, Range 4 West, Jicarilla well No. 1-E located in NW/4 SW/4 section 16, Township 26 North, Range 4 West, and the Jicarilla well No. 4-E located in the NE/4 NE/4 section 22, Township 26 North, Range 4 West.

Insert (3)

(a) Southern Union Gas Co. Jicarilla 1-E, NW SE 16-26-4W

(b) " " " " 1-B NW NW 4-26-3W

(c) Aztec Oil & Gas Co. Jicarilla #, NE NW 4-25N-3W

Insert (5)

That all wells completed within the area affected by this order shall

Insert (9)

(9) That the completion data and the results of a one point back Pressure test, as prescribed in the Commission Memorandum No. 1-56, on all wells completed within the area affected by this order be reported to the Commission before any of the wells are put on production. All wells completed between April 1, 1956 and the effective date of this temporary order shall be so reported.

Cause 177

Recommended Limited Deficiency P. E. Pool.

25 N - 3 W

Sec. 1 - N/2

" 5 - N/2

26 N - 3 W

Sec. 7 S/2

" 18 All

" 19 All

" 29 All

" 30 All

" 32 All

26 N - 4 W

Sec. 9 E/2

" 10 S/2

~~" 11 S/2~~

~~" 12 S/2~~

" 13 All

" 14 All

" 15 All

" 16 E/2

" 22 E/2

" 23 All

" 29 All

" 2

1. Call for interference test on S.W.D. Sec. 1-A. IT 23-26N-4W
2. This title should be for a duration of 1 year plus ~~so~~ Recommend ~~that~~ on S.W.D. Sec. 4E A-22-26N-4W and S2 W. Sec. ~~#5~~ A-A-23-26N-4W or until there is definite proof of Communi/

between the three wells.

3. The pumping of the 5 W & L, 1-A should be continued over each month of the initial production of the 4-E and 5-A. The test should be witnessed by a commission representative and all valves on the well sealed in interim between pumping tests to avoid loss such tests.

4. At least two other such tests should be conducted as soon as drilling is sufficient density. The beginning of such tests and the wells to be tested should be at the discretion of the Commission.

5. Approve 3 unorthodox wells now drilled.
S. W. & L. Inc. 1-E NW/SE 16-26N-4W
" " 1-D SW/4W 32-26N-3W
Granite Butte - Moreau. #1 NE/4W 4-25N-3W

Rough draft

(4) That there is sufficient evidence to justify establishment of 320 acre drilling units within said gas pool.

IT IS THEREFORE ORDERED:

(1) That the Tapacito-Pictured Cliffs Gas Pool be and the same is hereby created. Said pool to consist of the following described acreage in Rio Arriba County, New Mexico:

TOWNSHIP 25 NORTH, RANGE 3 WEST, NMPM
N/2 Section 4:
N/2 Section 5

TOWNSHIP 26 NORTH, RANGE 3 WEST, NMPM
S/2 Section 7
All Section 18
All Section 19
All Section 29
All Section 30
All Section 32

TOWNSHIP 26 NORTH, RANGE 4 WEST, NMPM
E/2 Section 9
S/2 Section 10
All Section 13
All Section 14
All Section 15
E/2 Section 16
E/2 Section 22
All Section 23
All Section 24

IT IS FURTHER ORDERED:

(2) That applicant's request for an order granting temporary establishment of 320 acre drilling units in the Tapacito-Pictured Cliffs Gas Pool, be and the same is hereby approved.

(4) That all wells shall be drilled in the NE/4 or the SW/4 of the governmental sections of all units in said Tapacito-Pictured Cliffs Gas Pool.

Insert 5

(5) That all wells shall be drilled 990 feet from the outer boundary of the quarter sections in which the well is drilled, provided, however, that a 200 foot tolerance will be allowed for surface obstructions.

(6) That the following wells having been drilled prior to the effective date of this order shall be exceptions to the spacing rules provided for Paragraph 4 above:

(3) Any well drilled a distance of two miles or more from the outer boundry of the Tapacito-Pictured Cliffs Gas Pool shall be classified as a wildcat. Any well drilled less than two miles from the outer boundary of said pool shall be spaced, the temporary rules and regulations

1. Southern Union Gas Company, Jicarilla Well No. 1-E, located in the NW/4 SE/4 Section 16, Township 26 North, Range 4 West.

2. Southern Union Gas Company's Jicarilla Well No. 1-D located in NW/4 NW/4 Section 32, Township 26 North, Range 3 West.

3. Gunsite Butte & Uranium Corporation Florence Well No. 1 located in NE/4 NW/4 Section 4, Township 25 North, Range 3 West.

~~IT IS FURTHER ORDERED:~~

That applicant, Southern Union Gas Company shall run monthly interference ~~test~~ and pressure tests on its Jicarilla Well No. 1-A, located in NE/4 SW/4 Section 23, Township 26 North, Range 4 West. Said test shall be for the duration of one year and shall commence on the day production into a pipeline begins from applicant's Jicarilla Well No. 4-E, said well located in NE/4 NE/4 Section 22, Township 26 North, Range 4 West on applicants Jicarilla Well No. 5 A, located in NE/4 NE/4 Section 23, Township 26 North, Range 4 West whichever date is later, or said test shall continue until there is definite proof of communication among the 3 wells. All tests shall be witnessed by a Commission representative. All valves on Well No. 1 A shall be sealed in the interim between the times of the test.

That the Commission, at its discretion may order additional interference tests on any of applicants wells.

~~IT IS FURTHER ORDERED:~~

That a rehearing will be held on ~~December 13, 1956~~ at January, 1957 monthly hearing of the Commission at which time applicant will make an appearance to show cause why rules hereinafter shall be continued.

The effective date of this order shall be ~~February~~ April 1, 1956 and unless otherwise adduced shall remain in full force and effect until ~~February~~ April 1, 1957.

DONE etc.

LEGAL DEPARTMENT
WILLIS L. LEA, JR.
GENERAL ATTORNEY

SOUTHERN UNION GAS COMPANY
BURT BUILDING
DALLAS 1, TEXAS

A. S. GRENIER
MILLARD F. CARR
EDWARD G. TAYLOR
JACK HERTZ

October 24, 1955

Advertised Correctly the amended application on 10/28/55. WWM 10/27/55

Mr. William B. Macey, Secretary
New Mexico Oil Conservation Commission
Santa Fe, New Mexico

Dear Mr. Macey:

In line with our telephone conversation this morning, I am forwarding herewith for filing with tne Commission four copies of Southern Union Gas Company's amended application in Case No. 977, relative to the temporary establishment of 320 acre drilling units in the Tapicito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico.

The enclosed amended application supersedes in its entirety the original application filed in this case on October 13, 1955.

Thank you once again for your much appreciated co-operation in this matter.

Very truly yours,

A. S. Grenier

ASG:ek
encls.

cc-Mr. John A. Anderson (w/2 encls.)
Mr. J. C. Reid
Mr. A. M. Wiederkehr
Mr. Q. B. Davis (w/encl.)
Mr. Clarence Hinkle (w/encl.)

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

April 26, 1956

COPY

Mr. A. S. Grenier
Southern Union Gas Co.
1104 Burt Building
Dallas 1, Texas

Dear Sir:

We enclose a copy of Order R-794 issued on April 18, 1956, by the Oil Conservation Commission in Case 977, which was heard on November 16, 1955.

Very truly yours,

A. L. Porter, Jr.
Acting Secretary - Director

ALP:brp
Encl.

February 24, 1956

MEMORANDUM

TO: Mankin, Gurley & Utz

FROM: W. B. Macey

SUBJECT: Case 977

Please write the order in this case approving Southern Union's application (Do not destroy the original rough draft of the order which you have already written).

I believe the order should contain a provision for the spacing rules to apply to all adjacent areas within two miles of the pool and also should contain some provision for interference tests to be conducted on wells during the one-year duration of the order. By this I mean that interference tests should be conducted for a period of time after the initial production from the pool and later on during the one-year period other wells should be shut-in, particularly those on the edges of the pool to determine whether or not there is any interference. A further requirement might request a monthly report on the wells involved in the test area.

WBM:brp

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

April 19, 1956

COPY

Mr. Foster Morrell
P.O. Box 933
Roswell, New Mexico

Dear Sir:

We enclose a copy of Order R-794 issued on April 18, 1956, by the Oil Conservation Commission in Case 977, which was heard on November 16, 1955.

Very truly yours,

A. L. Porter, Jr.
Acting Secretary - Director

ALP:brp
Encl.

The attached letter was sent to the following:

Honolulu Oil Corp., Box 1391, Midland, Texas, Attention Mr. George Hoy
Pan-American Petr. Corp., Box 899, Roswell, N.M., Attention C. L. Kelley
Delhi-Taylor Oil Corp., 823 Corrigan Tower, Dallas, Tex., Attn. R. G. Carlin
Pacific Northwest Pipeline Corp., Box 1526, Salt Lake City 10, Utah,
Attention Mr. Leslie G. Truby, Jr.
Magnolia Petr. Co., Box 900, Dallas, Tex., Attn. Mr. Ross Madole
El Paso Nat. Gas Co., Box 1492, El Paso, Tex., Attn. John Woodward
Gunsite Butte Uranium, Box 516, Farmington, N.M., Attn. Lee Kilgore
Mr. J. F. Hickman, Jr., 2929 Monte Vista Ave., NW, Albuquerque, N.M.
Elliott & Hall, c/o Federal Abstract Co., Box 1681, Santa Fe, N.M.
Mr. Jason Kellahin, Box 597, Santa Fe
USGS, Box 6738, Roswell, N.M., Attn. John Anderson
Amerada Petr. Corp., Box 2040, Tulsa, Okla., Attn. R. S. Christie
Aztec Oil & Gas Co., 920 Mercantile Securities Bldg., Dallas, Tex.,
Attn. Quilman B. Davis
Mr. Clarence Hinkle, Box 547, Roswell, N.M.
Mr. M. J. Florance, Aztec, N.M.
Mr. Caswell Silver, 323 Simms Bldg., Albuquerque, N.M.
Humble Oil & Refining Co., Box 1600, Midland, Texas

GOVERNOR
EDWIN L. MECHEM
CHAIRMAN

New Mexico
OIL CONSERVATION COMMISSION

LAND COMMISSIONER, MURRAY E. MORGAN
MEMBER

STATE GEOLOGIST, A.L. PORTER JR.
SECRETARY DIRECTOR

P. O. BOX 871
SANTA FE, NEW MEXICO

March 6, 1957

Re: In the matter of the hearing ordered to be held by Paragraph 10, Order R-794, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320 acre spacing should be continued in the Tapácito-Pictured Cliffs Pool.

Dear Sir:

The communications test ordered in R-794 was completed by Southern Union Gas Company, December 17, 1956. This test showed a decline of some 20 psi in the shut-in well which was their Jicarilla 2-E.

The Commission staff requested Southern Union to begin another test in this pool. In conformance with this request, the applicant's Jicarilla Well No. 4-D, SE/4 NE/4 30-26N-3W, was shut-in on December 17, 1956.

In compliance with Order R-794, the Commission called a hearing on the matter January 16, 1957, at which time the case was continued until March 14, 1957. It is now apparent that the present test will not be completed by that date. It will, therefore, be the recommendation of the Commission staff that the provisions of R-794 be continued in effect until October 1, 1957, in order that the results of the test may be considered in the final determination of this matter. Southern Union Gas Company and Aztec Oil and Gas Company have concurred in this proposal.

It is proposed by the staff that another hearing on this case be held in August or September of 1957.

Yours very truly,

A. L. Porter, Jr.
Secretary - Director

ALP:bp

NORTHWEST PRODUCTION CORPORATION

ALBUQUERQUE, NEW MEXICO

REPLY TO:
520 SIMMS BUILDING
ALBUQUERQUE, NEW MEXICO

March 12, 1957

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Secretary-Director

Gentlemen:

Northwest Production Corporation has been advised that the Commission staff will request at the March hearing a further continuance until the regular hearing date in September, 1957, Case No. 977 involving 320-acre spacing for the Tapacito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico.

Northwest Production Corporation, as an Operator in this field, is in accord with the request of the Commission's staff.

Very truly yours,

NORTHWEST PRODUCTION CORPORATION

Ray Phillips

Ray Phillips, Assistant Manager
Production Operations

RP/nw

cc; El Paso Natural Gas Company
Honolulu Oil Corporation
Magnolia Petroleum Company
Delhi-Taylor Oil Corporation
Humble Oil & Refining Company

WWM 3/7/57
ETV
Case Filed

Case 977

HUMBLE OIL & REFINING COMPANY

MIDLAND, TEXAS

J. W. HOUSE

March 5, 1957

6-1

New Mexico
Pro-ration

New Mexico Oil Conservation Commission
125 Mabry Hall, Capitol Building
Santa Fe, New Mexico

We have been advised by the Southern Union Gas Company that at the March hearing there will be a request for a further continuance until the regular hearing date in September 1957, of Case No. 977, involving 320-acre spacing for the Tapacito-Pictured Cliffs Gas Pool.

Humble is in accord with the proposed continuance of Case No. 977.

Sincerely,

HUMBLE OIL & REFINING COMPANY

J. W. House

KCH/md

El Paso Natural Gas Company

El Paso, Texas

March 7, 1957

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Jr. Secretary-Director

Gentlemen:

It is our understanding that at the March 15, 1957 Hearing the Commission Staff will request a further continuance of Case No. 977 involving 320-acre spacing for the Tapacito-Pictured Cliffs Gas Pool until the regular hearing date in September, 1957.

El Paso Natural Gas Company is in accord with this request of the Commission Staff.

Yours very truly,

F. Norman Woodruff

F. NORMAN WOODRUFF
Gas Proration Engineer

FNW:mgs
CC: Honolulu Oil Corporation
Pacific Northwest Pipeline Corp.
Magnolia Petroleum Company
Delhi-Taylor Oil Corporation
Humble Oil & Refining Company
Aztec Oil & Gas Company
Southern Union Gas Company

Wm 3/6/57
ENV
Case file

Case # 977

HONOLULU OIL CORPORATION
P. O. DRAWER 1391
MIDLAND, TEXAS

March 5, 1957

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Secretary-Director

Gentlemen:

Honolulu Oil Corporation has been advised that the Commission staff will request at the March hearing a further continuance until the regular hearing date in September, 1957, Case No. 977 involving 320-acre spacing for the Tapacito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico.

Honolulu Oil Corporation, as an Operator in this field, is in accord with the request of the Commission's staff.

Very truly yours,

HONOLULU OIL CORPORATION

A. S. Donnelly
Vice President

ASD:led

cc: Mr. F. Norman Woodruff
El Paso Natural Gas Company
Box 1492
El Paso, Texas

Mr. R. N. Richey
Pacific Northwest Pipe Line Corporation
10th Floor, Simms Building
Albuquerque, New Mexico

cc: Mr. Russ Carlin
Delhi-Taylor Oil Corporation
823 Corrigan Tower
Dallas, Texas

Mr. Quilman B. Davis
Aztec Oil & Gas Company
920 Mercantile Securities Bldg.
Dallas, Texas

Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas, Texas

SOUTHERN UNION GAS COMPANY
BURT BUILDING
DALLAS 1, TEXAS

LEGAL DEPARTMENT
WILLIS L. LEA, JR.
GENERAL ATTORNEY

A. S. GRENIER
MILLARD F. CARR
JACK HERTZ
WM. S. JAMESON
JAS. R. WETHERBEE

February 27, 1957

New Mexico Oil Conservation Commission
Santa Fe, New Mexico

Gentlemen:

Re: Case No. 977

We are advised that when the above case comes up for hearing in March, 1957, the Commission's Staff will move for a postponement of such hearing until the regular hearing date in September, 1957. This is to advise you that Southern Union Gas Company will be agreeable to such a continuance of the case.

Very truly yours,

SOUTHERN UNION GAS COMPANY

A. S. Grenier, Attorney

fg

cc: Mr. A. M. Wiederkehr

AZTEC OIL & GAS COMPANY
920 MERCANTILE SECURITIES BUILDING
DALLAS 1, TEXAS

QUILMAN B. DAVIS
SECRETARY AND GENERAL ATTORNEY

March 1, 1957

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Secretary-Director

Gentlemen:

We have been advised that the Commission's staff will request at the March hearing a further continuance until the regular hearing date in September, 1957, of Case No. 977, involving 320-acre spacing for the Tapacito-Pictured Cliffs Gas Pool.

Aztec Oil & Gas Company is in accord with this proposal of your staff.

Yours very truly,

Q. B. Davis

QBD:NL

cc - El Paso Natural Gas Company
Honolulu Oil Corporation
Pacific Northwest Pipeline Corp.
Magnolia Petroleum Company
Delhi-Taylor Oil Corporation
Humble Oil & Refining Co.

MAGNOLIA PETROLEUM COMPANY

A SOCONY MOBIL COMPANY

LEGAL DEPARTMENT

P. O. BOX 900
DALLAS 21, TEXAS

CHARLES B. WALLACE
GENERAL COUNSEL
R. T. WILKINSON, JR.
ASSOCIATE GENERAL COUNSEL
FRANK C. BOLTON, JR.
WENDELL J. DOGGETT
JACK E. EARNEST
SAM H. FIELD
ROY C. LEDBETTER
ROSS MADOLE
WALLACE G. MALONE
ROY L. MERRILL
RAYMOND M. MYERS
FLOYD B. PITTS
WILLIAM S. RICHARDSON
WILLIAM H. TABB
JACK VICKREY
ASSISTANTS

March 4, 1957

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Gentlemen: Attention Mr. A. L. Porter, Secretary-Director

We have been advised that the Commission staff will request at the March hearing a further continuance until the regular hearing date in September, 1957, Case No. 977 involving 320 acre spacing for the Tapacito-Pictured Cliffs Gas Pool.

Magnolia Petroleum Company is in accord with this request of the Commission's staff.

Yours very truly,

Ross Madole

RM:as

Ross Madole

cc: Mr. F. Norman Woodruff
El Paso Natural Gas Company
Box 1492
El Paso, Texas

Mr. A. S. Donnelly
Honolulu Oil Corporation
Drawer 1391
Midland, Texas

cc:

Mr. R. N. Richey
Pacific Northwest Pipeline Corporation
10th Floor, Simms Building
Albuquerque, New Mexico

Mr. Russ Carlin
Delhi-Taylor Oil Corporation
823 Corrigan Tower
Dallas, Texas

Mr. Quilman B. Davis
Aztec Oil & Gas Company
920 Mercantile Securities Bldg.
Dallas, Texas

Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas, Texas

MAIL OFFICE OCC
1957 JAN 2 PM 1:20

LEGAL DEPARTMENT
WILLIS L. LEA, JR.
GENERAL ATTORNEY

SOUTHERN UNION GAS COMPANY
BURT BUILDING
DALLAS 1, TEXAS

MAIL OFFICE OCC
1957 JAN 2 PM 1:17

A. S. GRENIER
MILLARD F. CARR
JACK HERTZ
WM. S. JAMESON
JAS. R. WETHERBEE

December 31, 1956

New Mexico Oil Conservation Commission
Santa Fe, New Mexico

Re: Case No. 977

Gentlemen:

As contemplated by paragraph (10) of Order No. R-794, issued by the Commission in the above case, a hearing has been set for January 16, 1957, for the purpose of determining whether or not it is appropriate that the present temporary 320-acre spacing for the Tapicito-Pictured Cliffs Gas Pool should be continued in effect.

We were advised by telephone today by a member of the Commission's Staff that the Staff, when the matter comes up for hearing on January 16, will request a continuance of the case until the regular February hearing date, and will in all likelihood keep on requesting further month to month continuances until completion of the interference test now being conducted by our Company on its Jicarilla No. 4-D Well in the NE¼ of Section 30, Township 26 North, Range 3 West, Rio Arriba County, New Mexico.

This is to advise you that Southern Union Gas Company will be agreeable to such a continuance of the case from month to month, unless and until we advise you in writing to the contrary.

Very truly yours,

SOUTHERN UNION GAS COMPANY

By A. S. Grenier
A. S. Grenier, Attorney

ASG:FG

cc: Mr. J. C. Reid

Mr. A. M. Wiederkehr

Mr. N. P. Chesnutt

Continuance of Case 777 — R-794

1. Order R-794 is a temporary 320 Ac. spacing order for the Dapicito-P.C. Ext. Pool of Rio Arriba County, N. Mex. The Director duly issued said order from April 1, 1956 to April 1, 1957. The Order however called for a hearing at the regular Jan. 1957 hearing. Which of course necessitated the cost of Hearing Today.

2. The interference test which was ordered in R-794 was conducted Dec. 17 1956. This shut-in test on all of the test showed some 20 psi drop. However the Commission staff is desirous of observing the results of another interference test on this pool before making recommendations for a permanent order.

In Conformance with this above request, Southern Union Gas Co. began the second test on Dec. 17, 1956 The S.U.G. used for this test is the S.U.G. Jicarilla #4-D, SE NE 30-26N-3W, the offset producing wells are Southern Union Gas Co. Jicarilla 5-D NE SW 30-26N-3W, and the Jicarilla 2-D NE SW Sec. 29, 26N-3W.

It will take considerable time to determine the results of this test.

I would therefore like to recommend to Continue this Case until the March Hearing at which time we should have enough data to determine what course

Order 79-4

4-0 Tentative Dec. 17, 1957

Dec. 17 - 1069 p.s.a.
Jan. 14 - 1069 "
Feb. 11 - 1069 "

Concurrence has been received by.
1. Southern Union.
2. Ayles O & G.
3. Northwest Prod. Corp.
4. Humble Oil & Refining Co.
5. El Paso Natural Gas Co.
6. Honolulu Oil Corp.
7. Magnolia Pet. Co.

GOVERNOR
EDWIN L. MECHEM
CHAIRMAN

New Mexico
OIL CONSERVATION COMMISSION

LAND COMMISSIONER, MURRAY E. MORGAN
MEMBER

STATE GEOLOGIST, A.L. PORTER JR.
SECRETARY DIRECTOR

P. O. BOX 871
SANTA FE, NEW MEXICO

March 6, 1957

Re: In the matter of the hearing ordered to be held by Paragraph 10, Order R-794, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320 acre spacing should be continued in the Tapacito-Pictured Cliffs Pool.

Dear Sir:

The communications test ordered in R-794 was completed by Southern Union Gas Company, December 17, 1956. This test showed a decline of some 20 psi in the shut-in well which was their Jicarilla 2-E.

As provided for in Para 8. of R-794 S.U.

The Commission staff requested Southern Union to begin another test in this pool. In conformance with this request, the ~~applicant's~~ Jicarilla Well No. 4-D, SE/4 NE/4 30-26N-3W, was shut-in on December 17, 1956.

Para 10

In compliance with Order R-794, the Commission called a hearing on the matter January 16, 1957, at which time the case was continued until March 14, 1957. ~~It is now apparent that the present test will not be completed by that date. It will, therefore, be the recommendation of the Commission staff~~ that the provisions of R-794 be continued in effect until October 1, 1957, in order that the results of the test may be considered in the final determination of this matter. ~~Southern Union Gas Company and Aztec Oil and Gas Company have concurred in this proposal.~~

It is proposed by the staff that another hearing on this case be held in August or September of 1957.

Yours very truly,

A. L. Porter, Jr.
Secretary - Director

':bp

OK to approve Extension to 10/1/57 WAMM 3/18/57

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 3-18-57

CASE 977 Hearing Date 3-14-57

My recommendations for an order in the above numbered cases are as follows:

I recommend that order R-794 be extended to Oct. 1, 1957.

Paragraphs (7), ~~and~~ (10) & (11) are ~~not~~ applicable.

The Test well now is S.W.N.W. Jicarilla 4-D SENE 30-26N-3W

Staff Member

Case 977
Order R-794-A

In the matter of the hearing ordered to be held by paragraph 10 of Order R-794, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

This cause came on for hearing at 9:00 o'clock a.m. on March 14, 1957 at Santa Fe, N.M. before the OCC of N.M., hereinafter referred to as the "Com."

Now on this ___ day

Findings

1. notice

2. that ~~in accord~~ under the authority granted by paragraph 8 of Order R-794, the Commission ordered ~~made~~ an additional interference test to be conducted ~~by~~ the applicant, Southern Union Gas Company. ~~said test was commenced~~

3. that the applicant began ~~an~~ ~~the~~ ~~additional~~ ~~test~~ interference test ~~on~~ ~~the~~ Dec 17, 1956 on its Jicarilla No 4-D Well located in the SE/4 NE/4 ~~of~~ Sec. 30, T-26 N, ~~R-3-W~~ R-3-W, NMPM, Rio Arriba County, N.M.

4. That the applicable provisions of Order R-794 should be extended until October 1, 1957 in order that the results of the additional test may be considered in the final determination of this matter.

5. That a hearing should be held on the date of the regular August 1957 monthly hearing of the Commission, at which time the applicant will make an appearance to show cause why the rules promulgated by Order R-794 should be continued in effect.

It is therefore Ordered:

1. That the provisions of paragraphs 1 through 6 of Order R-794 be and the same are hereby ~~extended~~ continued in effect until Oct. 1, 1957.

2. copy order par. 9
except last sentence. Change it to read "between April 1, 1956 and October 1, 1957, shall be so reported.

3.

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

COPY

January 16, 1957

Mr. A. M. Wiederkehr
Southern Union Gas Company
1104 Burt Building
Dallas, Texas

Dear Al:

This is to advise you that Case 977 was continued until the regular March 14th hearing at which time I will make further recommendations depending on conditions.

Very truly yours,

Elvis A. Utz
Engineer

EAU:bp

ISSION

Memo

From

To

DUPLIMATED COPIES OF THE ORDER WERE SENT TO:

Ross Madole, Magnolia
Q. B. Davis, Aztec
A. S. Donnelly, Honolulu
Norman Woodruff, El Paso
J. W. House, Humble
Ray Phillips, Northwest

ed April 5, 1957, by
, which was heard on

rs,

Jr.
rector

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

April 9, 1957

COPY

Mr. A. M. Wiederkehr
Southern Union Gas Company
1104 Burt Building
Dallas, Texas

Dear Sir:

We enclose a copy of Order R-794-A issued April 5, 1957, by the Oil Conservation Commission in Case 977, which was heard on January 16th and March 14th.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION OF THE STATE OF NEW MEXICO FOR THE PURPOSE OF CONSIDERING:

CASE NO. 977
Order No. R-794-A

IN THE MATTER OF THE HEARING ORDERED TO BE HELD BY PARAGRAPH 10 OF ORDER R-794, CASE 977, TO PERMIT SOUTHERN UNION GAS COMPANY AND OTHER INTERESTED PARTIES TO SHOW CAUSE WHY 320-ACRE SPACING SHOULD BE CONTINUED IN THE TAPACITO-PICTURED CLIFFS GAS POOL.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on January 16, 1957 and again on March 14, 1957, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 5th day of April, 1957, the Commission, a quorum being present, having considered the application and the evidence adduced, and being fully advised in the premises,

FINDS:

1. That due notice having been given as required by law, the Commission has jurisdiction of this case and the subject matter thereof.

2. That under the authority granted by Paragraph 8 of Order R-794, the Commission ordered an additional interference test to be conducted by the applicant, Southern Union Gas Company.

3. That the applicant began an additional interference test on December 17, 1956, on its Jicarilla No. 4-D Well located in the SE/4 NE/4 of Section 30, Township 26 North, Range 3 West, NMPM, Rio Arriba County, New Mexico.

4. That the applicable provisions of Order R-794 should be extended until October 1, 1957, in order that the results of the additional test may be considered in the final determination of this matter.

5. That the case should be heard at the Commission monthly hearing on August 15, 1957 to show cause why the rules promulgated by Order R-794 should be continued in effect.

IT IS THEREFORE ORDERED:

1. That the provisions of Paragraphs 1 through 6 and Paragraph 8 of Order R-794 be and the same are hereby continued in effect until October 1, 1957.

2. That the completion data and the results of a one-point back pressure test, as prescribed in the Commission's Memorandum No. 1-56, on all wells completed within the area affected by this order will be reported to the Commission before any of the wells are put on production. All wells completed between April 1, 1956 and October 1, 1957 shall be so reported.

3. That the case be heard at the Commission monthly hearing on August 15, 1957, to show cause why the rules contained in OrderR-794 should be continued.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

A. L. PORTER, Jr., Member & Secretary

ir/

No. 2-57

DOCKET: REGULAR HEARING JANUARY 16, 1957

Oil Conservation Commission 9 a.m., Mabry Hall, State Capitol, Santa Fe, New Mexico

ALLOWABLE: (1) Consideration of the oil allowable for February, 1957.

(2) Consideration of the allowable production of gas from the six prorated pools in Lea County, New Mexico, for February, 1957; also consideration of the allowable production of gas from the six prorated pools in San Juan and Rio Arriba Counties, New Mexico, for February.

NEW CASES

CASE 977: (Continued) In the matter of the hearing ordered to be held by paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

CASE 1197: The application of the New Mexico Oil Conservation Commission upon its own motion for an order promulgating pool rules for the North Mason-Delaware Pool in Eddy and Lea Counties, New Mexico. Applicant, in the above-styled cause, seeks an order promulgating permanent pool rules for the North Mason-Delaware Pool in Eddy and Lea Counties, New Mexico, for the purpose of establishing the allowable for said pool.

CASE 1198: Southeastern New Mexico nomenclature case calling for the creation of new pools and the extension of existing pools in Lea, Chaves and Eddy Counties, New Mexico.

(a) Creation of a new oil pool for San Andres production, designated as the Dayton-San Andres Pool, and described as:

Township 18 South, Range 26 East
Section 35: NE/4

(b) Creation of a new oil pool for San Andres production, designated as the Lakewood-San Andres Pool, and described as:

Township 19 South, Range 26 East
Section 4: SE/4

(c) Creation of a new oil pool for Queen production, designated as the Lucky Lake-Queen Pool, and described as:

Township 15 South, Range 29 East
Section 15: NE/4

(d) Creation of a new oil pool for Pennsylvanian production, designated as the Reeves-Pennsylvanian Pool, and described as:

Township 18 South, Range 35 East
Section 14: NE/4

(o) Extension of the Gladiola Pool to include:

Township 12 South, Range 38 East
Section 18: S/2 of the SE/4

(p) Extension of the Grayburg-Jackson Pool to include:

Township 17 South, Range 29 East
Section 15: E/2 SW/4, W/2 SE/4

(q) Extension of the Millman Pool to include:

Township 19 South, Range 28 East
Section 17: W/2 SW/4, SW/4 NW/4

(r) Extension of the Saladar-Yates Pool to include:

Township 20 South, Range 28 East
Section 33: NW/4, NW/4 SE/4

(s) Extension of the Square-Lake Pool to include:

Township 16 South, Range 29 East
Section 25: E/2 SE/4
Section 36: E/2 NE/4

Township 16 South, Range 30 East
Section 29: S/2
Section 30: S/2
Section 31: N/2
Section 32: NW/4

(t) Extension of the Young-San Andres Pool to include:

Township 18 South, Range 32 East
Section 28: NW/4

(u) Extension of the Warren McKee Pool to include:

Township 20 South, Range 38 East
Section 19: E/2 SE/4, SE/4 NE/4

CASE 1199: Northwestern New Mexico nomenclature case calling for the extension of existing pools and the creation of a new pool in San Juan and Rio Arriba Counties, New Mexico.

(a) Extension of the Aztec-Pictured Cliffs Pool to include:

Township 28 North, Range 9 West
Section 21: E/2
Section 22: All

(e) Creation of a new oil pool for Grayburg production, designated as the Shugart-Grayburg Pool, and described as:

Township 18 South, Range 31 East
Section 35: SW/4

(f) Creation of a new oil pool for Devonian production, designated as the Townsend-Devonian Pool, and described as:

Township 16 South, Range 35 East
Section 15: SE/4

(g) Extension of the Anderson Pool to include:

Township 17 South, Range 29 East
Section 10: N/2 of the NW/4

(h) Extension of the Artesia Pool to include:

Township 18 South, Range 28 East
Section 1: NW/4 and W/2 NE/4

(i) Extension of the Atoka Pool to include:

Township 18 South, Range 26 East
Section 2: SE/4
Section 11: NE/4

(j) Extension of the Bough Pool to include:

Township 9 South, Range 35 East
Section 24: NE/4

(k) Extension of the Cave Pool to include:

Township 17 South, Range 29 East
Section 5: S/2 of the SW/4
Section 8: W/2 of the NE/4

(l) Extension of the Crossroads Pool to include:

Township 9 South, Range 36 East
Section 22: NE/4
Section 23: NW/4

(m) Extension of the Dean Permo-Pennsylvanian Pool to include:

Township 15 South, Range 36 East
Section 36: W/2 of the SW/4

(n) Extension of the South Eunice Pool to include:

Township 22 South, Range 35 East
Section 1: E/2 of the NW/4

(b) Extension of the Ballard-Pictured Cliffs Pool to include:

Township 25 North, Range 8 West
Section 9: N/2

(c) Extension of the Blanco-Pictured Cliffs Pool to include:

Township 29 North, Range 9 West
Section 4: NW/4

(d) Extension of the Canyon Largo-Pictured Cliffs Pool to include:

Township 26 North, Range 7 West
Section 29: S/2

(e) Extension of the Fulcher Kutz-Pictured Cliffs Pool to include:

Township 27 North, Range 9 West
Section 16: N/2

(f) Extension of the South Blanco-Pictured Cliffs Pool to include:

Township 27 North, Range 8 West
Section 33: All
Section 34: All

Township 27 North, Range 9 West
Section 22: E/2

Township 28 North, Range 8 West
Section 31: All

Township 28 North, Range 9 West
Section 33: SE/4

(g) Extension of the West Kutz-Pictured Cliffs Pool to include:

Township 28 North, Range 11 West
Section 27: SE/4 and W/2
Section 28: All
Section 29: NE/4
Section 33: N/2
Section 34: NW/4

(h) Extension of the Blanco Mesaverde Pool to include:

Township 26 North, Range 5 West
Section 3: All
Section 4: All

Township 27 North, Range 3 West
Section 10: (Partial), All
Section 11: (Partial), All
Section 12: (Partial), All
Section 13: All
Section 14: All
Section 15: All
Sections 19 through 36 incl.,: All

Township 27 North, Range 4 West
Section 24: All
Section 25: All
Section 26: All
Section 35: All
Section 36: All

(i) Creation of a new oil pool for Gallup production, designated as the Verde Gallup Oil Pool, and described as follows:

Township 31 North, Range 15 West
Section 10: E/2
Section 11: SW/4
Section 14: SE/4, W/2
Section 15: E/2, SW/4
Section 20: SE/4
Section 21: SW/4, E/2
Section 22: N/2
Section 29: N/2

CONTINUED CASES

CASE 727: (Readvertisement) Application of the Oil Conservation Commission upon its own motion as provided for in Order R-610-C, to hear testimony and receive evidence regarding the amending, revising or abrogating existing rules and regulations of the Oil Conservation Commission, and/or promulgating rules and regulations relating to gas pool delineation, gas proration and other related matters affecting or concerning the Blinebry Gas Pool, Blinebry Oil Pool and Terry-Blinebry Oil Pool.

CASE 1052: Application of the Oil Conservation Commission upon its own motion for an order establishing the maximum efficient production rate for the Denton (Devonian) Oil Pool, Lea County, New Mexico. Operators are requested to furnish all available production data, reservoir data, and any other pertinent information in order to determine if the present existing system of allocation in the Denton (Devonian) Oil Pool might result in waste and to enable the Commission to establish the proper producing rate.

CASE 1102: (Rehearing) Application of the Ohio Oil Company for rehearing in Case 1102, Order R-892 which established pool rules for the Dean Permo-Pennsylvanian and Dean-Devonian Pools, Lea County, New Mexico. Applicant, in the above-styled cause, seeks reconsideration by the Commission of the spacing and allowable provisions for the Dean Permo-Pennsylvanian Pool with particular attention to the allowable for existing wells on 40-acre tracts. Applicant contends that such wells should retain the normal 40-acre allowable rather than one-half of the normal 80-acre allowable as established by Order R-892.

CASE 1187: Application of the New Mexico Oil Conservation Commission upon its own motion for an order changing the name and information required on Form C-128, as established by Rule 1127 of the Commission Rules and Regulations. Applicant, in the above-styled cause, seeks an order changing the name of Form C-128 to "Well Location and Proration Plat" and to change certain of the information required to be reported thereon.

CASE 1189: Southeastern New Mexico nomenclature case calling for the abolishment of the Hardy Pool in Lea County, New Mexico, and for the extension of the Eumont and Penrose-Skelly Oil Pools in Lea County, New Mexico.

(a) Abolish the Hardy Pool in Lea County, New Mexico.

(b) Extend the Eumont Pool boundary to include:

Township 20 South, Range 37 East
Section 25: NW/4 and S/2
Section 36: E/2

Township 20 South, Range 38 East
Section 31: All

(c) Extension of the Penrose-Skelly Pool to include:

Township 21 South, Range 37 East
Section 4: W/2
Section 8: NE/4
Section 9: W/2
Section 16: NW/4

CASE 1127: Southeastern New Mexico nomenclature case calling for the creation of a a new pool in Lea County, New Mexico.

(d) Creation of a new oil pool for Tubb production, designated as the Tubb Oil Pool, and described as:

Township 21 South, Range 37 East
Section 10: SE/4 SW/4

No. 24-57

DOCKET: REGULAR HEARING AUGUST 15, 1957

Oil Conservation Commission 9 a.m., Mabry Hall, State Capitol, Santa Fe, NM

ALLOWABLE: (1) Consideration of the oil allowable for September, 1957.

(2) Consideration of the allowable production of gas for September, 1957, from the seven prorated pools in Lea County, New Mexico; also consideration of the allowable production of gas from the six prorated pools in San Juan and Rio Arriba Counties, New Mexico, for September, 1957.

NEW CASES

CASE 977: In the matter of the hearing ordered to be held by Paragraph 3 of Order R-794-A, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

CASE 1291: Application of Tidewater Oil Company for approval of an oil-oil dual completion in an undesignated Drinkard Pool and an undesignated McKee Pool underlying Section 24, Township 25 South, Range 37 East, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order authorizing an oil-oil dual completion, by means of parallel strings of tubing, in an undesignated Drinkard Pool and an undesignated McKee Pool underlying Section 24, Township 25 South, Range 37 East, Lea County, New Mexico, for its Coates "C" Well No. 8 located 660 feet from the North line and 1880 feet from the East line of said Section 24.

CASE 1292: Application of John H. Trigg for an order authorizing a pilot program for the injection of gas into the Caprock-Queen Pool, Chaves County, New Mexico, for purposes of pressure maintenance, and further, authorizing the transfer of allowables for the injection well to other wells on the same basic lease, and further, to exempt certain of his wells from gas-oil ratio penalties. Applicant, in the above-styled cause, seeks an order authorizing the injection of gas into the Caprock-Queen Pool through his Federal Trigg No. 10-9 Well located in the NW/4 SE/4 of Section 9, Township 14 South, Range 31 East, Chaves County, New Mexico. Applicant further requests that the allowables assigned to the injection well be transferred to another well or wells on the same basic lease, and further, that during the period of the pilot program all wells in Section 9, which are on the same lease as the injection well, be exempt from gas-oil ratio penalties.

CASE 1293: Application of Amerada Petroleum Corporation for an order amending the Special Rules and Regulations for the Justis Gas Pool, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order amending the Special Rules and Regulations for the Justis Gas Pool provided by Order R-586, as amended, to provide for 320-acre gas proration units in the Justis Gas Pool, Lea County, New Mexico.

CASE 1294: Application of Ambassador Oil Corporation, Graridge Corporation and Gulf Oil Corporation for an order authorizing a pilot water flood project in the Caprock-Queen Pool in Lea and Chaves Counties, New Mexico, and further, authorizing the applicants to produce at capacity their wells located within and offsetting the pilot water flood program. Applicants, in the above-styled cause, seek an order authorizing the injection of water into the Queen formation of the Caprock-Queen Pool through six wells located in Sections 1 and 12, Township 13 South, Range 31 East, Chaves County, New Mexico, and further, authorizing capacity production from ten wells located within and offsetting the pilot water flood area located in Sections 1, 11, and 12, Township 13 South, Range 31 East, and Section 6, Township 13 South, Range 32 East, in Chaves and Lea Counties, New Mexico.

CASE 1295: Application of Southern Union Gas Company and Southern Union Gathering Company for the suspension for a period of not less than six months of the cancellation of underproduction in the six prorated gas pools in San Juan and Rio Arriba Counties, New Mexico. Applicants, in the above-styled cause, seek an order extending until a date not earlier than January 31, 1958, the date upon which accumulated underproduction accrued to certain of their connections as of January 31, 1957, will be cancelled for non-production under the provisions of the Special Rules and Regulations for the Aztec-Pictured Cliffs, Ballard-Pictured Cliffs, Fulcher Kutz-Pictured Cliffs, South Blanco-Pictured Cliffs, West Kutz-Pictured Cliffs, and Blanco Mesaverde Gas Pools in San Juan and Rio Arriba Counties, New Mexico. Applicants further request similar relief for any and all wells of other producers in the same pools if the facts and circumstances are such as to make similar relief necessary.

CASE 1296: Application of the Oil Conservation Commission of New Mexico upon its own motion for the suspension for a period of not less than six months of the overage shut-in provisions of the Special Rules and Regulations for the six prorated gas pools in San Juan and Rio Arriba Counties, New Mexico. Applicant, in the above-styled cause, seeks an order suspending until a date not earlier than January 31, 1958, the overage shut-in provisions of Special Rules and Regulations for the Aztec-Pictured Cliffs, Ballard-Pictured Cliffs, Fulcher Kutz-Pictured Cliffs, South Blanco-Pictured Cliffs, West Kutz-Pictured Cliffs, and Blanco Mesaverde Gas Pools in San Juan and Rio Arriba Counties, New Mexico.

CASE 1297: Southeastern New Mexico Nomenclature case calling for an order creating new pools and extending and deleting certain areas from existing pools in Lea, Roosevelt and Eddy Counties, New Mexico.

(a) Create a new oil pool for Paddock production, designated as the Grayburg-Paddock Pool, and described as:

TOWNSHIP 17 SOUTH, RANGE 30 EAST
Section 18: SE/4

(b) Create a new oil pool for Ellenburger production designated as the Justis-Ellenburger Pool, and described as:

TOWNSHIP 25 SOUTH, RANGE 37 EAST
Section 24: NE/4

(c) Create a new oil pool for San Andres production, designated as the Premier-San Andres Pool, and described as:

TOWNSHIP 17 SOUTH, RANGE 31 EAST
Section 30: NE/4

(d) Create a new oil pool for Grayburg production, designated as the Teague-Grayburg Pool, and described as:

TOWNSHIP 23 SOUTH, RANGE 37 EAST
Section 20: SE/4

(e) Create a new oil pool for Seven Rivers production, designated as the Vacuum-Seven Rivers Pool and described as:

TOWNSHIP 17 SOUTH, RANGE 35 EAST
Section 34: NW/4

(f) Extend the Atoka Pool to include:

TOWNSHIP 18 SOUTH, RANGE 26 EAST
Section 23: N/2 NE/4

(g) Extend the Crossroads Pool to include:

TOWNSHIP 9 SOUTH, RANGE 36 EAST
Section 23: SE/4

(h) Extend the Grayburg-Keely Pool to include:

TOWNSHIP 17 SOUTH, RANGE 29 EAST
Section 23: NE/4

(i) Extend the Hume-Queen Pool to include:

TOWNSHIP 16 SOUTH, RANGE 34 EAST
Section 8: S/2 NE/4

(j) Extend the Jalmat Gas Pool to include:

TOWNSHIP 23 SOUTH, RANGE 36 EAST
Section 17: SW/4 & W/2 SE/4

(k) Extend the Lynch Pool to include:

TOWNSHIP 20 SOUTH, RANGE 34 EAST
Section 26: SW/4

(l) Extend the West Henshaw-Grayburg Pool to include:

TOWNSHIP 16 SOUTH, RANGE 30 EAST	
Section 4:	SE/4
Section 5:	SE/4
Section 8:	NE/4

(m) Extend the Millman Pool to include:

TOWNSHIP 19 SOUTH, RANGE 28 EAST	
Section 18:	S/2 NE/4

(n) Extend the Milnesand-Pennsylvanian Pool to include:

TOWNSHIP 8 SOUTH, RANGE 34 EAST	
Section 13:	SE/4

(o) Extend the Ranger Lake-Pennsylvanian Pool to include:

TOWNSHIP 12 SOUTH, RANGE 34 EAST	
Section 25:	NW/4 NW/4
Section 26:	N/2 NE/4

(p) Extend the Turkey Track Pool to include:

TOWNSHIP 18 SOUTH, RANGE 29 EAST	
Section 34:	NW/4

(q) Extend the Vacuum Pool to include:

TOWNSHIP 17 SOUTH, RANGE 34 EAST	
Section 2:	NW/4

(r) Extend the Terry-Blinebry Oil Pool to include:

TOWNSHIP 21 SOUTH, RANGE 37 EAST	
Section 3:	Lot 16
Section 4:	Lot 1

(s) Delete the following area from the Blinebry Gas Pool:

TOWNSHIP 21 SOUTH, RANGE 37 EAST	
Section 3:	Lot 16
Section 4:	Lot 1

(t) Delete the following area from the Blinebry Oil Pool:

TOWNSHIP 21 SOUTH, RANGE 37 EAST	
Section 3:	Lot 16
Section 4:	Lot 1

CASE 1298: Northwestern New Mexico Nomenclature case calling for an order extending existing pools in San Juan and Rio Arriba Counties, New Mexico.

(a) Extend the Blanco Mesaverde Pool to include:

TOWNSHIP 28 NORTH, RANGE 9 WEST	
Section 30:	E/2
Section 31:	E/2
Section 32:	All

(b) Extend the Ballard-Pictured Cliffs Pool to include:

TOWNSHIP 25 NORTH, RANGE 7 WEST	
Section 7:	W/2

(c) Extend the Blanco-Pictured Cliffs Pool to include:

TOWNSHIP 29 NORTH, RANGE 9 WEST	
Section 5:	All

(d) Extend the Otero-Pictured Cliffs Pool to include:

TOWNSHIP 23 NORTH, RANGE 5 WEST	
Section 3:	W/2
Section 4:	E/2
Section 5:	W/2
Section 6:	E/2
Section 7:	NE/4
Section 8:	NW/4
Section 10:	W/2

TOWNSHIP 24 NORTH, RANGE 5 WEST	
Section 32:	SW/4

(e) Extend the South Blanco-Pictured Cliffs Pool to include:

TOWNSHIP 24 NORTH, RANGE 2 WEST	
Section 5:	S/2
Section 6:	S/2
Section 7:	All

TOWNSHIP 24 NORTH, RANGE 3 WEST	
Section 12:	All
Section 13:	N/2

TOWNSHIP 24 NORTH, RANGE 4 WEST	
Section 6:	All

TOWNSHIP 25 NORTH, RANGE 6 WEST	
Section 23:	E/2
Section 24:	W/2

TOWNSHIP 26 NORTH, RANGE 5 WEST	
Section 19:	N/2

TOWNSHIP 27 NORTH, RANGE 8 WEST
Section 3: All

TOWNSHIP 28 NORTH, RANGE 9 WEST
Section 25: N/2
Section 33: W/2 & NE/4

(f) Extend the Tapacito-Pictured Cliffs Pool to include:

TOWNSHIP 25 NORTH, RANGE 3 WEST
Section 3: E/2

(g) Extend the Bisti-Lower Gallup Oil Pool to include:

TOWNSHIP 24 NORTH, RANGE 10 WEST
Section 4: N/2

TOWNSHIP 25 NORTH, RANGE 10 WEST
All of Sections 29 & 30
Section 31: N/2
All of Sections 32, 33 & 34

TOWNSHIP 25 NORTH, RANGE 11 WEST
Section 16: S/2
All of Sections 17 thru 23, incl.
All of Sections 25 & 26
Section 27: N/2 & SE/4

TOWNSHIP 25 NORTH, RANGE 12 WEST
Section 4: SE/4, N/2 SW/4, and SE/4 SW/4
All of Sections 13 & 14
Section 15: E/2 & E/2 NW/4
All of Sections 23 & 24
Section 25: N/2

CONTINUED CASES

CASE 1261: Application of Gulf Oil Corporation and Western Oil Fields, Inc., for an order force pooling certain acreage in the Blinebry and Tubb Gas Pools, Lea County, New Mexico. Applicants, in the above-styled cause, seek an order force pooling the interests of all persons having any right, title or interest in the Blinebry and Tubb formations underlying the SW/4 Section 30, Township 22 South, Range 38 East, Lea County, New Mexico.

CASE 1262: Application of Gulf Oil Corporation and Western Oil Fields, Inc., for an order force pooling certain acreage in the Blinebry and Tubb Gas Pools, Lea County, New Mexico. Applicants, in the above-styled cause, seek an order force pooling the interest of all persons having any right, title or interest in the Blinebry and Tubb formations underlying the SE/4 Section 30, Township 22 South, Range 38 East, Lea County, New Mexico.

CASE 1263: Application of Gulf Oil Corporation and Western Oil Fields, Inc., for an order force pooling certain acreage in the Blinebry and Tubb Gas Pools, Lea County, New Mexico. Applicants, in the above-styled cause, seek an order force pooling the interests of all persons having any right, title or interest in the Blinebry and Tubb formations underlying the NE/4 Section 25, Township 22 South, Range 37 East, Lea County, New Mexico.

CASE 1264: Application of Gulf Oil Corporation and Western Oil Fields, Inc., for an order force pooling certain acreage in the Blinebry and Tubb Gas Pools, Lea County, New Mexico. Applicants, in the above-styled cause, seek an order force pooling the interests of all persons having any right, title or interest in the Blinebry and Tubb formations underlying the SE/4 Section 25, Township 22 South, Range 37 East, Lea County, New Mexico.

ir/

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

August 1, 1957

COPY

Southern Union Gas Company
1104 Burt Building
Dallas 1, Texas

ATTENTION: A. M. Wiederkehr

Re: Case 977

Gentlemen:

Attached is a copy of a docket for the regular hearing before the Commission on August 15, 1957. You will note that Case 977 will be heard at this time, and the provisions of Order R-794-A expire on October 1, 1957.

Since your company will present testimony in Case 1295 and possibly 1296, we feel that you should appear in Case 977 and make any recommendation you deem necessary for the continuance of this case.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

ALP/WWM:bp

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 8-19-57

CASE 977 Hearing Date 8-15-57

My recommendations for an order in the above numbered cases are as follows:

1. That ~~additional~~ Dest data should be taken on the S. J. G. # 4-O Jicarilla on the offset interference wells. This data shall consist of the following:

(a) ~~At the Shut~~ At the conclusion of the test and before the Jicarilla 4-O is produced a bottom hole pressure shall be taken on the the Jicarilla 4-O and ~~the~~ bottom hole flowing pressures shall be taken on the offset interference wells.

(b) ~~At the time the~~ When the casing & tubing ~~periodic~~ monthly Shut-in pressures are taken on the Jicarilla 4-D, the flowing casing & tubing pressures shall ~~also~~ be taken on the offset interference wells.

(c) Southern Union shall ~~[redacted]~~ either run a gas analysis or allow any interested operator to run a gas analysis of the gas produced from the interference wells.

Staff Member

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 8-19-57

CASE 977 Hearing Date 8-15-57

My recommendations for an order in the above numbered cases are as follows:

Recommendations Attached.

Staff Member

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION OF THE STATE OF NEW MEXICO FOR THE PURPOSE OF CONSIDERING:

CASE NO. 977
Order No. R-794-~~A~~B

IN THE MATTER OF THE HEARING ORDERED TO BE HELD BY PARAGRAPH 10 OF ORDER R-794, CASE 977, TO PERMIT SOUTHERN UNION GAS COMPANY AND OTHER INTERESTED PARTIES TO SHOW CAUSE WHY 320-ACRE SPACING SHOULD BE CONTINUED IN THE TAPACITO-PICTURED CLIFFS GAS POOL.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on January 16, 1957 ~~and again on~~ + again on Aug. 15, 1957 March 14, 1957, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this ~~5th~~ day of ~~August~~, 1957, the Commission, a quorum being present, having considered the application and the evidence adduced, and being fully advised in the premises,

FINDS:

1. That due notice having been given as required by law, the Commission has jurisdiction of this case and the subject matter thereof.

2. That under the authority granted by Paragraph 8 of Order R-794, the Commission ordered an additional interference test to be conducted by the applicant, Southern Union Gas Company.

3. That the applicant began an additional interference test on December 17, 1956, on its Jicarilla No. 4-D Well located in the SE/4 NE/4 of Section 30, Township 26 North, Range 3 West, NMPM, Rio Arriba County, New Mexico.

4. That the applicable provisions of Order R-794 should be extended until ~~October 1~~ April 1, 1958, in order that the results of the additional test may be considered in the final determination of this matter.

5. That the case should be heard at the Commission monthly hearing ~~on August 15~~ in Oct., 1958 to show cause why the rules promulgated by Order R-794 should be continued in effect.

IT IS THEREFORE ORDERED:

1. That the provisions of Paragraphs 1 through 6 and paragraph 8 of Order R-794 be and the same are hereby continued in effect until ~~October 1, 1957~~ April 1, 1958.

2. That the completion data and the results of a one-point back pressure test, as prescribed in the Commission's Memorandum No. 1-56, on all wells completed within the area affected by this order will be reported to the Commission before any of the wells are put on production. All wells completed between April 1, 1956 and ~~October 1, 1957~~ April 1, 1958 shall be so reported.

3. That the case be heard at the Commission monthly hearing ~~on August 15~~ Jan., 1958, to show cause why the rules contained in Order R-794 should be continued.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

ir/

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF THE STATE OF NEW
MEXICO FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 977
Order No. R-794-B

IN THE MATTER OF THE HEARING
ORDERED TO BE HELD BY PARAGRAPH
3 OF ORDER R-794-A TO PERMIT
SOUTHERN UNION GAS COMPANY TO
SHOW CAUSE WHY 320-ACRE SPACING
SHOULD BE CONTINUED IN THE TAPACITO-
PICTURED CLIFFS GAS POOL.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m., on November 16, 1955, on March 14, 1957, and again on August 15, 1957, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 9th day of September, 1957, the Commission, a quorum being present, having considered the testimony and evidence adduced, and being fully advised in the premises,

FINDS:

(1) That due notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the interference test on the Southern Union Gas Company's Jicarilla No. 4-D Well located in the SE/4 NE/4 of Section 30, Township 26 North, Range 3 West, NMPM, Rio Arriba County, New Mexico, has not yet been completed.

(3) That the applicable provisions of Order R-794 should be extended until April 1, 1958, in order that the results of the aforementioned interference test may be considered in the final determination of this matter.

(4) That the applicant, Southern Union Gas Company, should be required to conduct a bottom hole pressure test on the said Jicarilla No. 4-D Well and bottom hole flowing pressure tests on the offset interference wells at the conclusion of the interference test and that the applicant should further be required to take flowing casing and tubing pressure tests on the offset interference wells at the same time that the monthly shut-in casing and tubing pressure test is taken on the said Jicarilla No. 4-D Well.

(5) That the applicant should be required to permit any interested operator to conduct a gas analysis of the gas produced from the aforementioned offset interference wells.

(6) That Southern Union Gas Company has agreed to furnish all operators within two miles of the Tapacito-Pictured Cliffs Gas Pool with the results of the aforementioned tests upon receipt of a request for the same from the said Operators.

(7) That this case should be called for hearing at the Commission monthly hearing in February of 1958 to permit Southern Union Gas Company and all other interested parties to show cause why the rules promulgated by Order R-794 should be continued in effect.

IT IS THEREFORE ORDERED:

1. That the provisions of paragraph 1 through 6 and paragraph 8 of Order R-794 be and the same are hereby continued in effect until April 1, 1958.

2. That the completion data and the results of a one-point pressure test, as prescribed in the Commission's Memorandum No. 1-56, on all wells completed within the area affected by this order will be reported to the Commission before any of the wells are put on production. All wells completed between April 1, 1956, and April 1, 1958, shall be so reported.

3. That Southern Union Gas Company shall conduct a bottom hole pressure test on its Jicarilla No. 4-D Well located in the SE/4 NE/4 of Section 30, Township 26 North, Range 3 West, NMPM, Rio Arriba County, New Mexico, and bottom hole flowing pressure tests on the offset interference wells at the conclusion of the interference test.

4. That Southern Union Gas Company shall take flowing casing and tubing pressure tests on the offset interference wells at the same time that the monthly shut-in casing and tubing pressure test is taken on the aforementioned Jicarilla No. 4-D Well.

5. That Southern Union Gas Company shall permit any interested operator to conduct a gas analysis of the gas produced from the aforementioned interference wells.

6. That Southern Union Gas Company shall furnish all operators within two miles of the Tapacito-Pictured Cliffs Gas Pool with the results of the tests which are herein ordered to be conducted upon receipt of a request for the same by said operators.

7. That this case be called for hearing at the Commission monthly hearing in February of 1958 to permit Southern Union Gas Company and all other interested parties to appear and show cause why the rules contained in Order R-794 should be continued beyond

April 1, 1958.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

A. L. PORTER, Jr., Member & Secretary

ir/

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

September 10, 1957

COPY

Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas 1, Texas

Dear Sir:

We enclose a copy of Order R-794-B issued by the Oil Conservation Commission on September 9, 1957, in Case 977.

Yours very truly,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

September 10, 1957

COPY

Mr. W. R. Johnston
Northwest Production Corp.
520 Simms Building
Albuquerque, New Mexico

Dear Sir:

We enclose a copy of Order R-794-B issued September 9, 1957, by the Oil Conservation Commission in Case 977.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 16, 1957

IN THE MATTER OF:

Case No. 977

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE - SANTE FE
3-6691 2-2211

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 16, 1957

IN THE MATTER OF: The Hearing ordered to be held by paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.	Case No. 977

BEFORE:
Honorable Edwin L. Mechem
Mr. A. L. Porter
Mr. Murray Morgan

TRANSCRIPT OF HEARING

MR. PORTER: The next case on the docket is Case 977.

MR. GURLEY: In the matter of the hearing ordered to be held by paragraph 10 of Order R-794, Case 977 to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

MR. UTZ: If the Commission please.

MR. PORTER: Mr. Utz?

MR. UTZ: Order R-794 is a temporary 320-acre spacing order for the Tapacito-Pictured Cliffs Gas Pool, of Rio Arriba County, New Mexico. The effective dates of the order are from April 1, 1956 to April 1, 1957. The order, however, calls for a hearing at the regular January, 1957 hearing. That, of course, necessitated

the call of the hearing today.

The Interference Test which was ordered in R-794 was concluded December 17, 1956. The shut-in test well of this test showed some 20 pounds per square inch drop. However, the Commission staff is desirous of observing the results of another interference test in this pool before making recommendations for a permanent order.

In conformance with the staff's request, Southern Union Gas Company began the second test on December 17, 1956. It shut in the Southern Union's Jicarilla 4-D, located in the SE NE Section 30 - 26 N, 3 W. The offset producing wells are Southern Union's Jicarilla 5-D, located in the NE SW Section 30, 26 N, 3 W; and the Jicarilla 2-D located in the NE SW Section 29, 26 N, 3 W. I give the locations as a matter of record.

It will take considerable time to determine the results of this test. I would, therefore, urge the Commission to continue this case until the March regular hearing, at which time we should have enough data to determine what course should be taken at that time.

MR. GURLEY: If the Commission please, going along with Mr. Utz recommendation, we have a letter from Southern Union Gas Company, dated December 31, 1956, a portion of which I would like to read into the record.

MR. PORTER: You may proceed.

MR. GURLEY: It is addressed to the New Mexico Oil Conservation Commission, and Mr. Grenier quotes in the letter, that it is the understanding that a continuance will be requested by a member of the staff until the regular February hearing date, and will in all

likelihood keep on requesting further month to month continuances until completion of the interference test now being conducted by our Company on its Jicarilla No. 4-D Well in the NE¼ of Section 30, Township 26 North, Range 3 West, Rio Arriba County, New Mexico.

This is to advise you that Southern Union Gas Copany will be agreeable to such continuance of the case from month to month, unless and until we advise you in writing to the contrary. Signed: Southern Union Gas Company, By: A. S. Grenier, Attorney."

MR. PORTER: Do we have any objection to the continuance of the case?

MR. SILVER: I have no objection, but I have an objection to continuance from month to month. I think a definite time should be set for the hearing.

MR. GURLEY: In connection with Mr. Silver's request, I doubt that anyone at this time could make a recommendation as to a definite time. The time would be contingent on the results of the test now being conducted. Whenever results are shown on that test, and we have no idea when they will be shown, would be the time to make recommendations for a permanent order.

MR. PORTER: It is the Commission's decision that Case 977 will be continued to the regular hearing date in March.

We will take a short recess.

(Recess.)

STATE OF NEW MEXICO)
:
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission in Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my notarial seal and hand this 18th day of January, 1957.

NOTARY PUBLIC, COURT REPORTER

My Commission Expires:
June 19, 1959

DEARNLEY-MEIER AND ASSOCIATES
COURT REPORTERS
605 SIMMS BUILDING
TELEPHONE 3-6691
ALBUQUERQUE, NEW MEXICO

No. 3-58

DOCKET: REGULAR HEARING FEBRUARY 13, 1958

Oil Conservation Commission 9 a.m., Mabry Hall, State Capitol, Santa Fe, NM

ALLOWABLE: (1) Consideration of the oil allowable for March, 1958.

(2) Consideration of the allowable production of gas for March, 1958, for six prorated pools in Lea County, New Mexico; also consideration of the allowable production of gas from six prorated pools in San Juan and Rio Arriba Counties, New Mexico, for March, 1958.

NEW CASES

CASE 977: In the matter of the hearing order to be held by Paragraph 7 of Order No. R-794-B to permit Southern Union Gas Company and all other interested parties to appear and show cause why the Special Pool Rules for the Tapacito-Pictured Cliffs Gas Pool, as set forth in Order No. R-794, should be continued in effect beyond April 1, 1958.

CASE 1376: Application of The Texas Company for approval of a unit agreement. Applicant, in the above-styled cause, seeks an order approving its Little Lucky Lake Unit Agreement embracing 11,715 acres, more or less, of Federal and State Lands in Township 15 South, Range 29 East; Township 15 South, Range 30 East, and Township 16 South, Range 30 East, in Chaves and Eddy Counties, New Mexico.

CASE 1377: In the matter of the hearing called by the Oil Conservation Commission of New Mexico on its own motion to consider the establishment of minimum allowables for gas wells in San Juan, Rio Arriba, Sandoval, and McKinley Counties, New Mexico.

CASE 1378: Application of El Paso Natural Gas Company for an order amending Order No. R-333-C & D. Applicant, in the above-styled cause, seeks an order revising, amending or deleting certain portions of Order No. R-333-C & D to extend the testing period and revise the test scheduling procedure applicable to gas wells in San Juan, Rio Arriba, Sandoval, and McKinley Counties, New Mexico.

CASE 1379: Southeastern New Mexico nomenclature case calling for an order for the creation of new pools and the extension of existing pools in Lea, Eddy and Chaves Counties, New Mexico.

(a) Create a new gas pool for Mississippian production, designated as the Austin-Mississippian Gas Pool, and described as:

Township 14 South, Range 36 East
Section 17: SW/4

(b) Create a new oil pool for Abo production, designated as the Empire-Abo Pool, and described as:

Township 18 South, Range 27 East
Section 11: NW/4

(c) Create a new gas pool for Pennsylvanian production, designated as the Grayburg-Atoka Gas Pool, and described as:

Township 17 South, Range 29 East
Section 22: NW/4

(d) Create a new oil pool for Drinkard production, designated as the Justis-Drinkard Pool, and described as:

Township 25 South, Range 37 East
Section 24: NE/4

(e) Create a new oil pool for Devonian production, designated as the Sand Springs-Devonian Pool, and described as:

Township 11 South, Range 34 East
Section 1: SW/4

(f) Create a new oil pool for Delaware production, designated as the Welch-Delaware Pool, and described as:

Township 26 South, Range 27 East
Section 21: NW/4

(g) Delete portions of the Arrowhead Pool described as:

Township 21 South, Range 36 East
Section 24: All
Section 25: E/2
Section 26: NE/4 NE/4

(h) Extend the Penrose Skelly Pool to include:

Township 21 South, Range 36 East
Section 24: SE/4
Section 25: SE/4 SE/4

Township 21 South, Range 37 East
Section 19: SW/4
Section 30: SW/4 SW/4

(i) Abolish the Anderson Pool described as:

Township 17 South, Range 29 East
Section 1: S/2
All of Sections 2, 3, 10, 11, & 12
Section 13: N/2
Section 14: N/2
Section 15: NE/4

Township 17 South, Range 30 East
Section 6: SW/4
Section 7: N/2

(j) Extend the Square Lake Pool to include:

Township 16 South, Range 29 East
Section 36: S/2 S/2

Township 16 South, Range 30 East
Section 31: S/2
Section 32: SW/4

Township 17 South, Range 29 East
All of Sections 1, 2, 3, 10, 11, & 12
Section 13: N/2
Section 14: N/2
Section 15: NE/4

Township 17 South, Range 30 East
Section 5: W/2
Section 6: All
Section 7: N/2

(k) Extend the Caprock-Queen Pool to include:

Township 14 South, Range 31 East
Section 17: W/2 SW/4

(l) Extend the Crosby-Devonian Gas Pool to include:

Township 25 South, Range 37 East
Section 20: SE/4

(m) Extend the Dos Hermanos-Yates-Seven Rivers Pool to include:

Township 20 South, Range 30 East
Section 28: S/2 SE/4

(n) Extend the South Eunice Pool to include:

Township 21 South, Range 36 East
Section 34: SW/4

(o) Extend the Four Lakes-Devonian Pool to include:

Township 11 South, Range 34 East
Section 35: SE/4

(p) Extend the West Lusk Pool to include:

Township 19 South, Range 31 East
Section 23: NW/4

(q) Extend the Reeves-Pennsylvanian Pool to include:

Township 18 South, Range 35 East
Section 14: SE/4
Section 23: N/2

(r) Extend the Townsend-Wolfcamp Pool to include:

Township 16 South, Range 36 East
Lots 9, 10, 11, 14, 15, 16

(s) Extend the Tubb Gas Pool to include:

Township 21 South, Range 37 East
Section 14: SE/4

CASE 1380: Northwestern New Mexico nomenclature case calling for an order for the extension of existing pools in San Juan and Rio Arriba Counties, New Mexico.

(a) Extend the Aztec-Pictured Cliffs Pool to include:

Township 29 North, Range 10 West
Section 29: S/2

(b) Extend the East Blanco-Pictured Cliffs Pool to include:

Township 30 North, Range 4 West
Section 10: SW/4
Section 15: NW/4

(c) Extend the Ballard-Pictured Cliffs Pool to include:

Township 26 North, Range 8 West
Section 14: SW/4

(d) Extend the Tapacito-Pictured Cliffs Pool to include:

Township 26 North, Range 3 West
All of Sections 8 & 17

(e) Extend the South Blanco-Pictured Cliffs Pool to include:

Township 25 North, Range 3 West
Section 18: W/2
Section 19: NW/4

Township 25 North, Range 4 West
Section 13: S/2
Section 24: N/2

Township 26 North, Range 5 West
All of Sections 17 & 18

Township 27 North, Range 7 West
All of Sections 9 & 10

Township 28 North, Range 8 West
All of Sections 30, 32 & 33
Section 34: W/2

(f) Extend the Bisti-Lower Gallup Oil Pool to include:

Township 25 North, Range 11 West
Section 7: SW/4

Township 25 North, Range 12 West
Section 11: S/2
Section 12: All

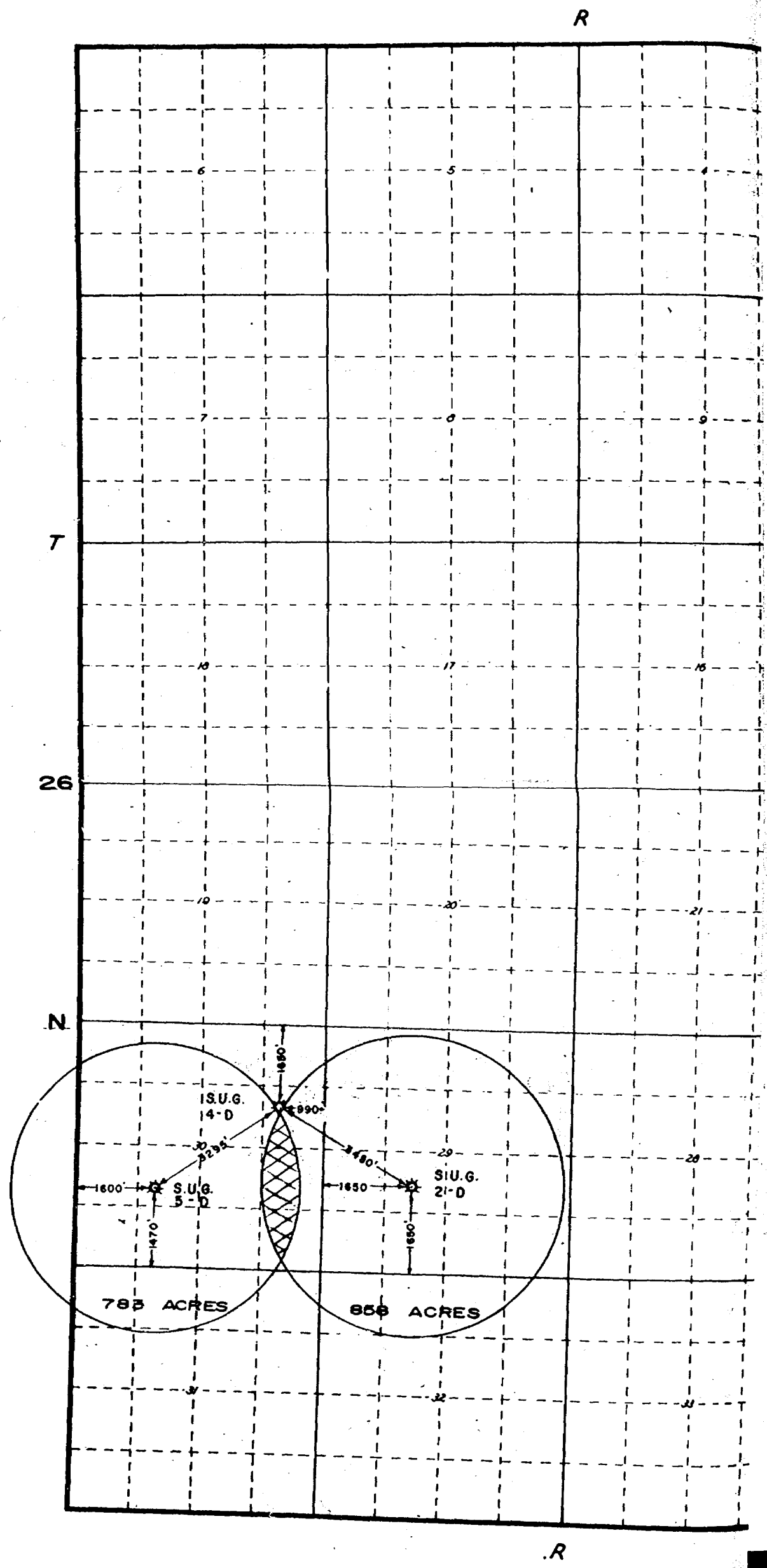
(g) Extend the Verde-Gallup Oil Pool to include:

Township 31 North, Range 15 West
Section 23: SE/4
Section 24: S/2
Section 25: NE/4

CONTINUED CASE

CASE 1369: In the matter of the hearing upon the motion of the Oil Conservation Commission of New Mexico at the request of The Atlantic Refining Company to amend Rule 107 of the Commission Rules and Regulations pertaining to casing, tubing, and cementing requirements.

ir/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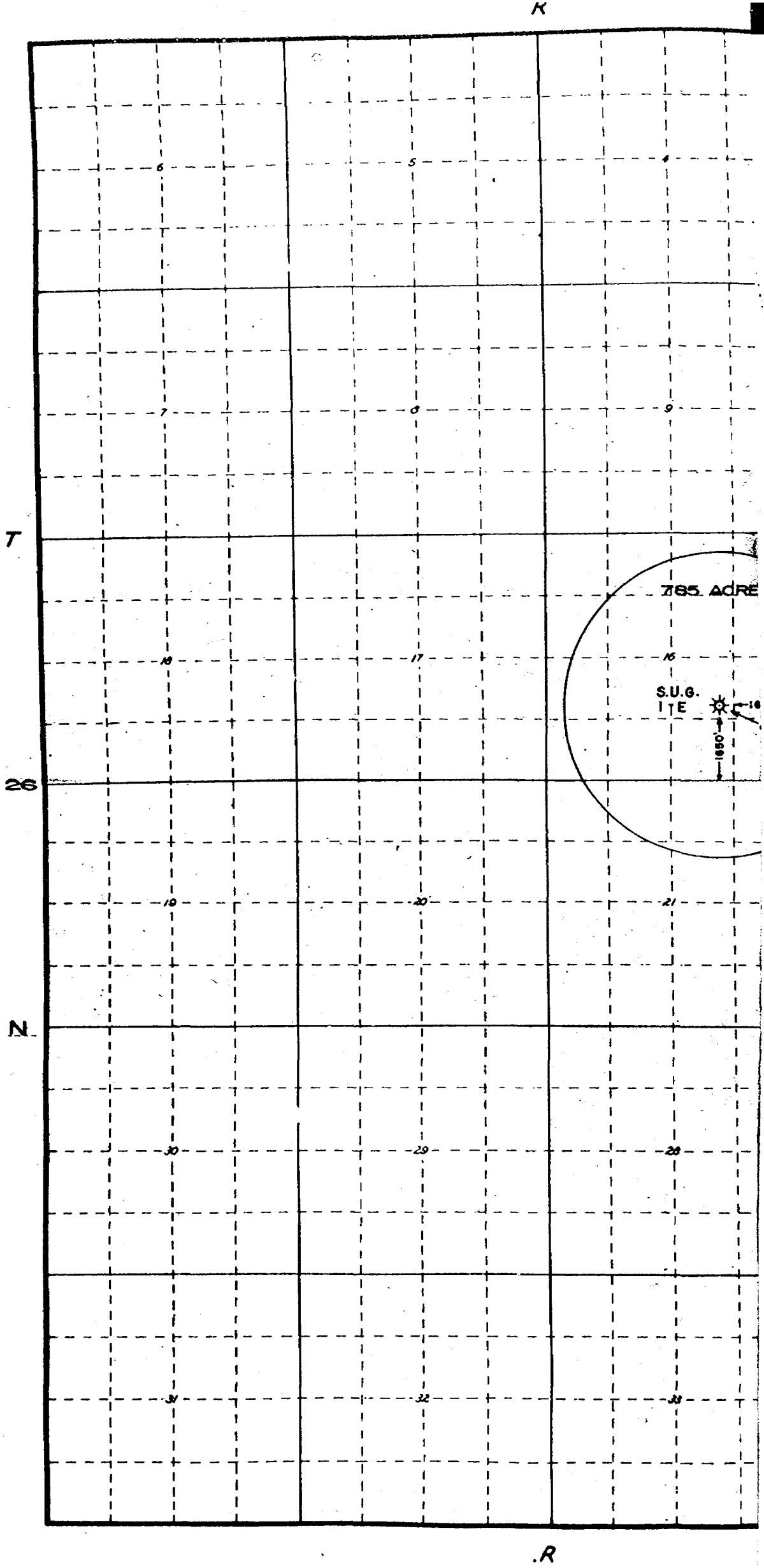
SOUTHERN UNION GAS

EXHIBIT 2

TOWNSHIP 26 N. RANGE 3 W.
RIO ARRIBA COUNTY, NEW MEXICO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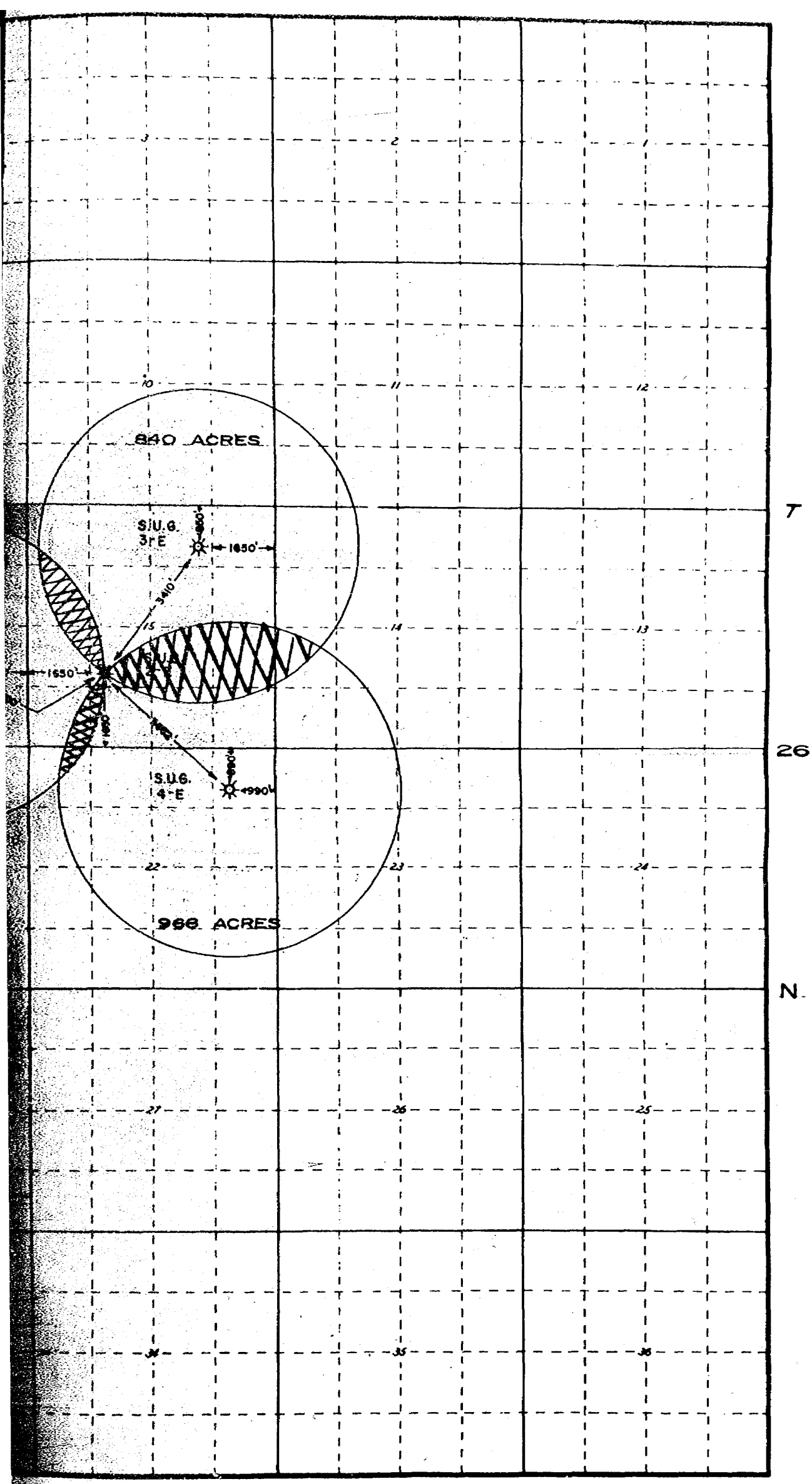


SOUTHERN UNION GAS

EXHIBIT 1

TOWNSHIP 26 N RANGE 4 W
RIO ARRIBA COUNTY, NEW-MEXICO
SHOWING DETAIL OF LEASES OWNED BY

Scale: 2" = 1 Mile

KEY
Active Union
Expired Leases

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
SVG EXHIBIT No. 3
CASE 1 977

TAPACITO FIELD

Interference Test #1.

Producing Wells:

Jicarilla 1-E	SW/4 16-26-4
Jicarilla 3-E	NE/4 15-26-4
Jicarilla 4-E	NE/4 22-26-4

Shut in:

Jicarilla 2-E	SW/4 15-26-4

Month	SICP	SITP	Monthly Production	Cumulative Production
January 1956	1090	1087.5	0	
February 1956	1088	1086	72,787	
March 1956	1089.5	1086.5	95,289	168,076
April 1956	1089.5	1087.5	140,648	308,724
May 1956	1089	1086	170,881	479,605
June 1956	1088.5	1085.5	145,098	624,703
July 1956	1086	1083	135,196	759,899
August 1956	1083	1080	145,782	905,681
September 1956	1079	1077	134,289	1,039,970
October 1956	1072.5	1074.5	121,394	1,161,364
November 1956	1070	1068	79,830	1,241,194
December 1956	1068	1066	99,256	1,340,450

TAPACITO FIELD

Interference Test #2

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
SUG EXHIBIT No. #4
CASE 977

Producing Wells:

Jicarilla 2-D — SW/4 29-26-3
Jicarilla 5-D — SW/4 30-26-3

Shut in:

Jicarilla 4-D — NE/4 30-26-3

Month	SICP	SITP	Monthly Production	Cumulative Production
November 1956				
December 1956	1065	1064	56,278	60,455*
January 1957	1065	1064	58,555	116,733
February 1957	1065	1064	47,744	175,288
March 1957	1065½	1064½	47,571	223,032
April 1957	1066	1064½	37,901	270,603
May 1957	1066	1064½	47,147	308,504
June 1957	1065½	1063½	37,819	355,651
				393,470

*Cumulative for 2-D well only, 4-D well on production in December 1956.

NEW MEXICO OIL CONSERVATION COMMISSION
CRUDE OIL PURCHASERS' NOMINATIONS, MARCH, 1958

SOUTHEAST NEW MEXICO

Continental	4,220			
Malco	11,000	-	70	
Famariss	10			
Atlantic	4,640	-	255	
Cactus	2,283	-	19	
Cities Service	13,086			
Gulf	21,000	-	3,500	
Magnolia	17,450	-	1,115	
Phillips	965			
Shell	34,700			
Indiana	35,000	-	3,000	
Sinclair	25,900			
Texas Co.	27,000	-	1,000	
Tidewater	3,500	-	200	
McWood	3,626	+	546	
Permian	1,546	+	191	
Ibex	373	+	28	
Total Southeast New Mexico				206,299 - 8,394

NORTHWEST NEW MEXICO

El Paso	5,200	+	200	
Shell	400	-	225	
Gulf	480			
Four States	50	-	135	
Oriental	67	+	2	
Vanadium	28	-	3	
Total Northwest New Mexico				6,225 - 161

TOTAL NEW MEXICO NOMINATIONS 212,524 - 8,555

Bureau of Mines estimate of demand for New Mexico crude, March, 1958: 280,000 barrels per day.

ir/

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
EXHIBIT No. 6
CASE 977

TAPACITO FIELD

Interference Test #2

Producing Wells:

Jicarilla 2-D	SW/4 29-26-3
Jicarilla 5-D	SW/4 30-26-3

Shut in:

Jicarilla 4-D	NE/4 30-26-3

Month	SICP	SITP	Monthly Production	Cumulative Production
November 1956				60,455*
December 1956	1065	1064	56,278	116,733
January 1957	1065	1064	58,555	175,288
February 1957	1065	1064	47,744	223,032
March 1957	1065½	1064½	47,571	270,603
April 1957	1066	1064½	37,901	308,504
May 1957	1066	1064½	47,147	355,651
June 1957	1065½	1063½	37,819	393,470
July 1957	1065	1063	37,819	431,289
August 1957	1064½	1062½	55,395	486,684
September 1957	1063½	1061½	62,571	549,255
October 1957	1061½	1060	40,876	590,131
November 1957			25,315	615,446
December 1957	1058½	1057	40,427	655,873
January 1958	1057½	1055	44,781	700,654
February 1958	1056	1054		

Bottom Hole Pressures

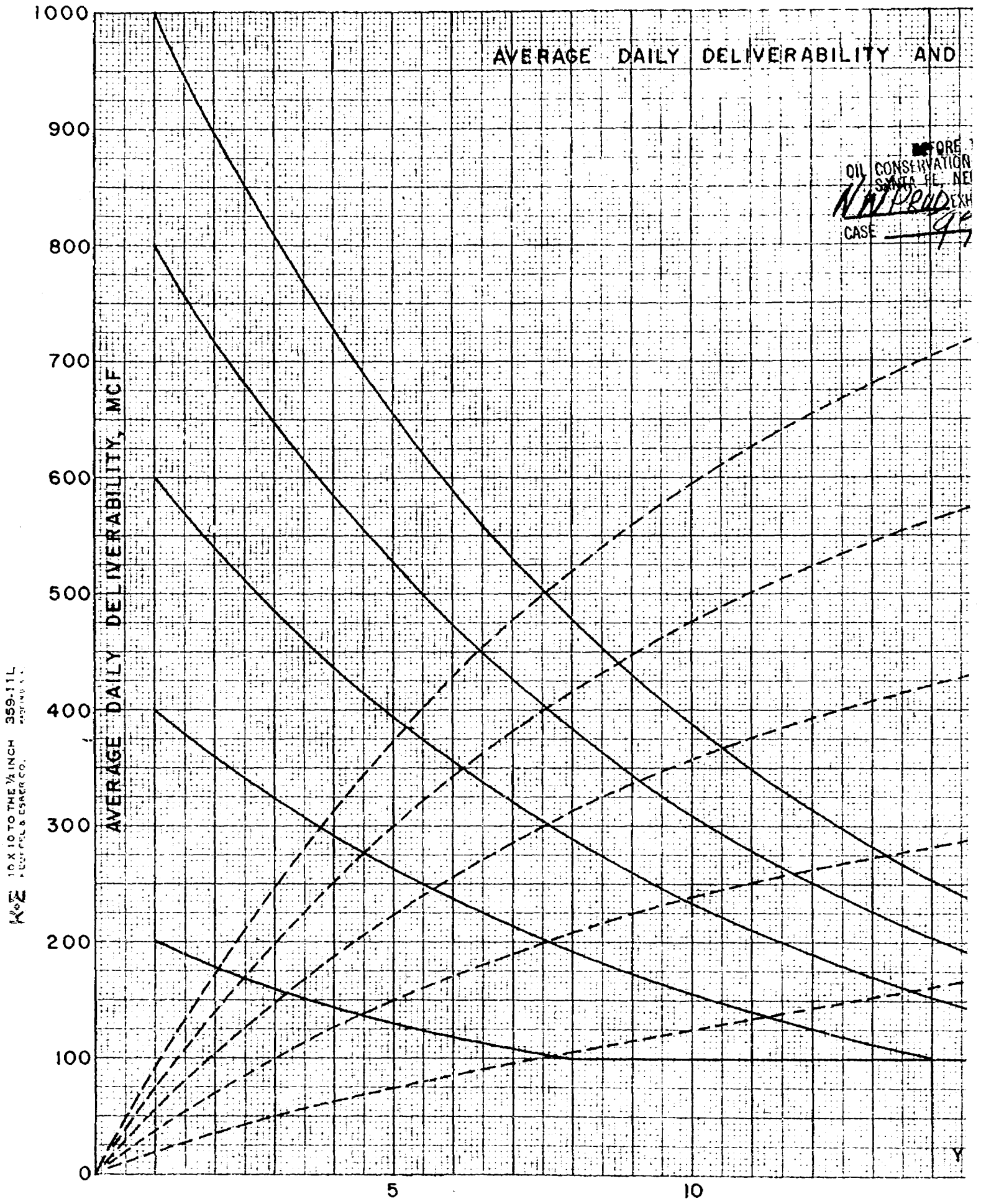
October 8, 1957

Jicarilla 2-D	- Flowing Bottom Hole Pressure	-	599
Jicarilla 4-D	- Shut in Bottom Hole Pressure	-	1199
Jicarilla 5-D	- Flowing Bottom Hole Pressure	-	610

January 30, 1958

Jicarilla 2-D	- Flowing Bottom Hole Pressure	-	753
Jicarilla 4-D	- Shut in Bottom Hole Pressure	-	1193
Jicarilla 5-D	- Flowing Bottom Hole Pressure	-	693

*Cumulative for 2-D well only, 5-D well on production in December 1956.


AVERAGE DAILY DELIVERABILITY AND
OIL CONSERVATION
SANTA FE, NE
CASE
AVERAGE DAILY DELIVERABILITY, MCF
1000
900
800
700
600
500
400
300
200
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5
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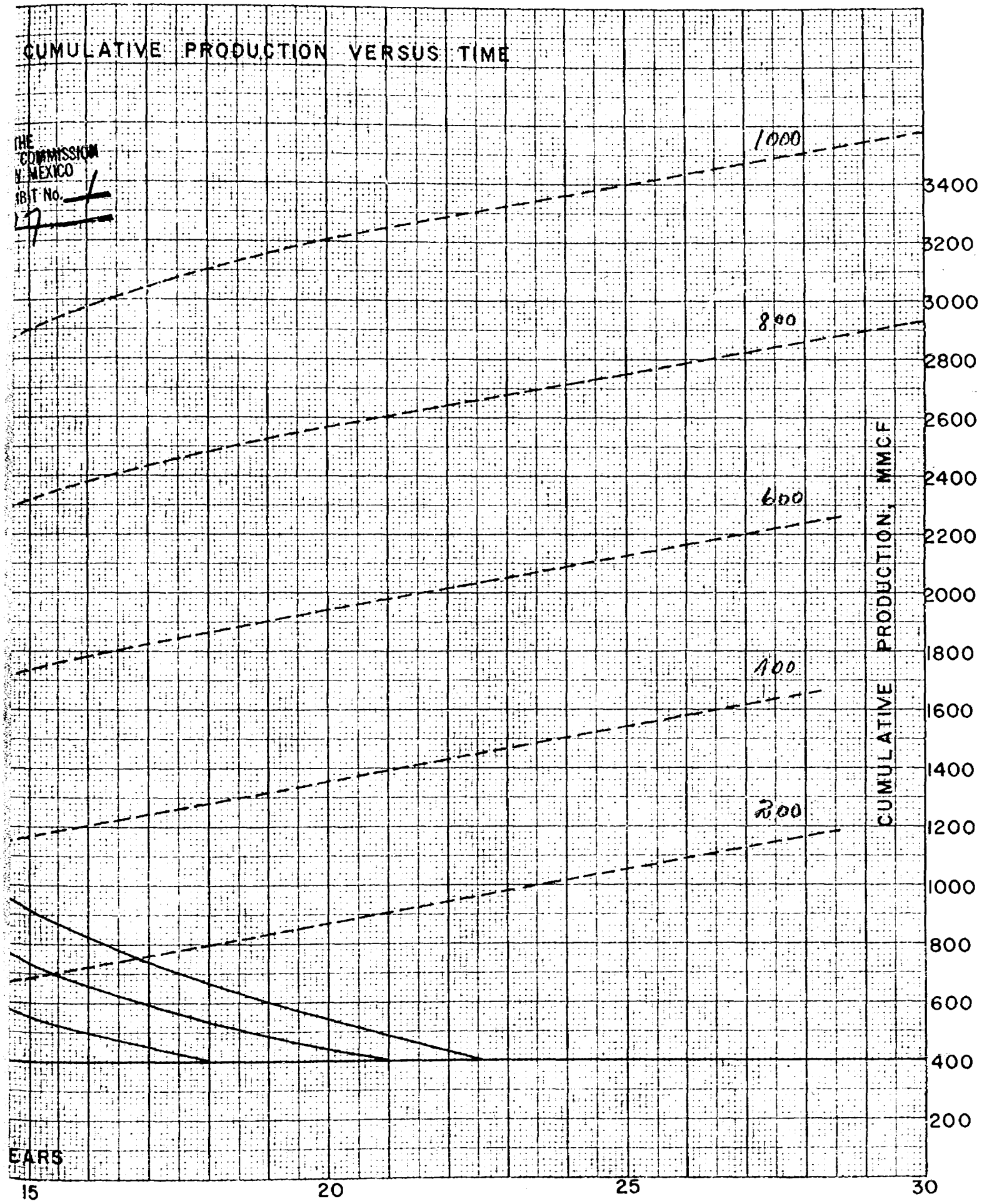
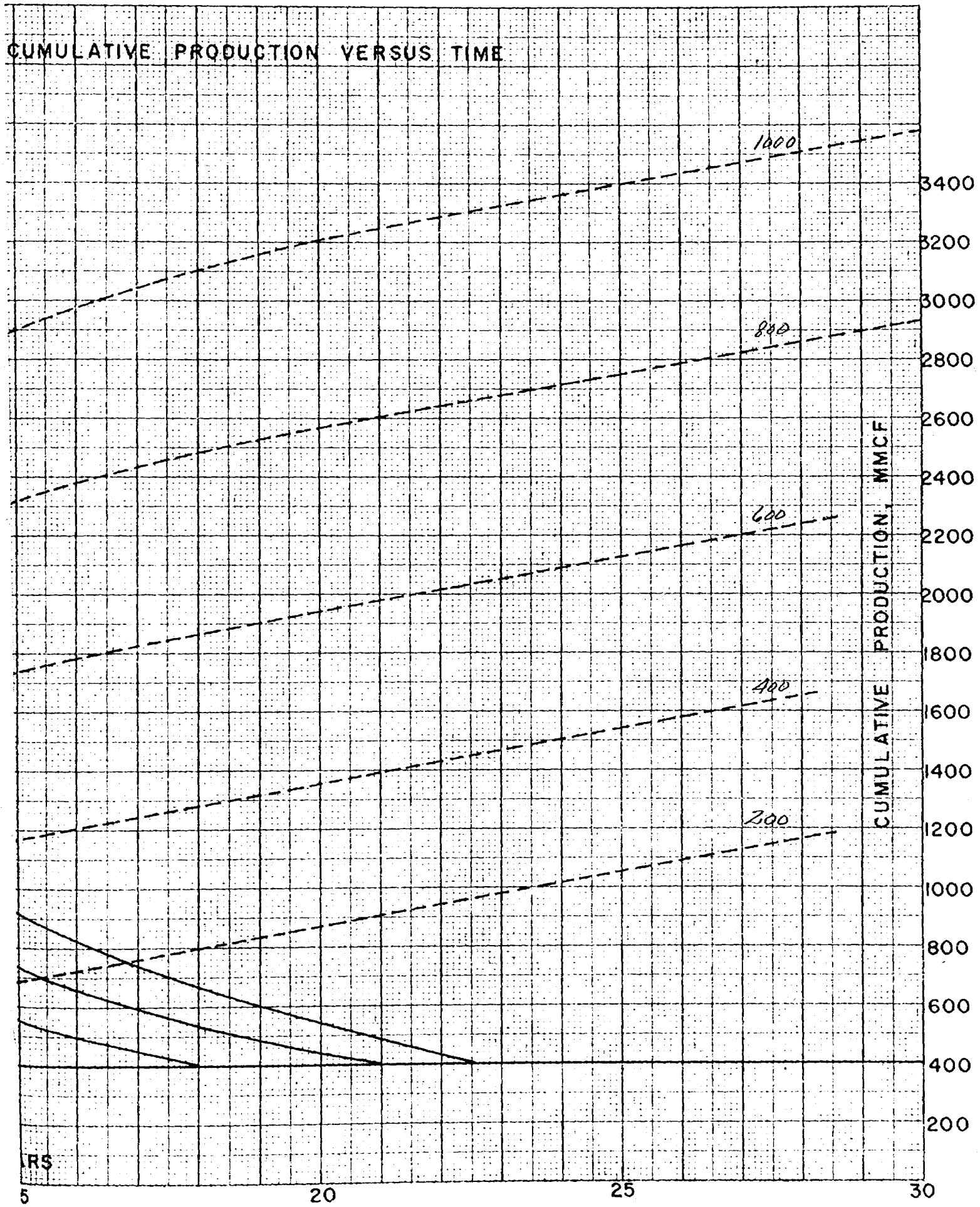
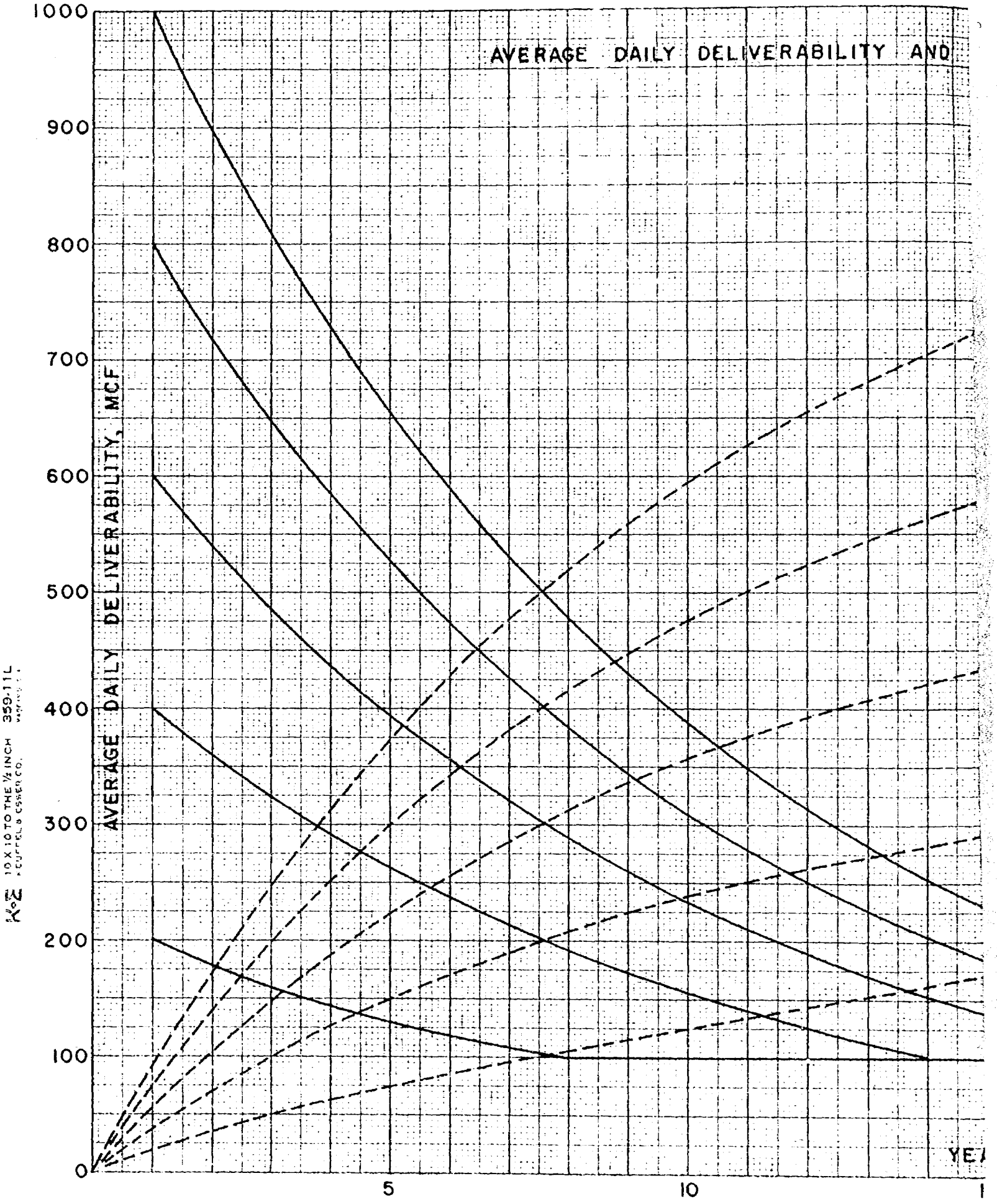
Y
K&E 10 X 10 TO THE ½ INCH 359-11L
KEUFFEL & ESSER CO.


CUMULATIVE PRODUCTION VERSUS TIME
THE COMMISSION
MEXICO
BIT No. 4
1000
800
600
400
200
CUMULATIVE PRODUCTION, MMCF
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
EARS
15
20
25
30

CUMULATIVE PRODUCTION VERSUS TIME




AVERAGE DAILY DELIVERABILITY AND
AVERAGE DAILY DELIVERABILITY, MCF
1000
900
800
700
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500
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5
10
YE
359-11L
10 X 10 TO THE ½ INCH
KEUFFEL & ESSER CO.

Calculation of Recoverable Gas

Tapacito Pictured Cliffs Field
Rio Arriba County, New Mexico

February, 1958

Acres within field	21,600	
Average depth of formation	3,800	Ft.
Net sand thickness	28.4	Ft.
Porosity of sand	15.3	%
Water saturation of sand	38.3	%
Oil saturation of sand	.4	%
Calculated bottom hole pressure	1,190	psig
Reservoir temperature	109	^{o}F
Compressibility factor	.865	
Gas per acre-foot originally in place	352	MCF
Gas per acre-foot remaining at 100 psia abandonment	26	MCF
Recoverable gas per acre-foot	326	MCF
Recoverable gas per acre	9,258	MCF
Total recoverable gas	199,972,800	MCF

$$43,560 \times .153 \times .613 \times \frac{1190 \neq 12}{14.73} \times \frac{520}{109 \neq 460} \times \frac{1}{.865} = 352,266 \text{ cu. ft. or } 352 \text{ MCF}$$

$$43,560 \times .153 \times .613 \times \frac{100}{14.73} \times \frac{520}{569} \times \frac{1}{.987} = 25,685 \text{ cu. ft. or } 26 \text{ MCF}$$

Gunsite Butte Exhibit No. 2
Docket No. 477

(3)

TABULATION OF RESERVES ON PRODUCING WELLS
TAPACITO PICTURED CLIFFS FIELD
RIO ARRIBA COUNTY, NEW MEXICO
FEBRUARY, 1958

Well	Location		Comp. Date	TD	IP	Del.	Sand thick.	Cum. Prod.	Reserves/ Ac.	Reserves/ 320 Ac.	% Reserves Produced
El Paso Natural Gas											
6	SW/4	31-27- 4	9- 7-56	4249 4180PB	4,957		33	22,298	10,758	3,442,560	.65
8	SW/4	32-27- 4	9- 4-56	4007 3966PB	1,787		35	3,427	11,410	3,651,200	.09
9	SW/4	33-27- 4	9- 4-56	4095 4075PB	2,621		41	---	13,366	4,277,120	0
18	SW/4	36-27- 5	11- 1-56	5860 5820PB	23,258		41	162,235	13,366	4,277,120	3.79
20	NE/4	35-27- 5	6- 1-57	5807 5745PB	8,719		40	133,681	13,040	4,172,800	3.20
Gunsite Butte Uranium											
1	NW/4	4-25- 3	10-17-55	3926	10,154		30	292,288	9,780	3,129,600	9.34
2	NE/4	5-25- 3	11- 6-55	3879	7,179		39	142,309	12,714	4,068,480	3.50
Honolulu Oil Corp.											
1	SW/4	10-26- 4	9- 1-55	3589	19,300	1033	30	351,603	9,780	3,129,600	11.23
2	NE/4	9-26- 4	1- 7-56	3933	3,800	687	31	249,074	10,106	3,233,920	7.70
3	SW/4	9-26- 4	7-17-56	3911 3890PB	40,102		26	586,930	8,476	2,712,320	21.64
4	SW/4	4-26- 4	10-15-56	4045 4020PB	1,356		30	57,038	9,780	3,129,600	1.82
6	SW/4	3-26- 4	9-21-56	3729	2,145		27	33,694	8,802	2,816,640	1.20
Magnolia Petroleum Co.											
1	SW/4	19-26- 3	9-21-55	3930	4,501		25	90,070	8,150	2,608,000	3.45
1	SW/4	7-26- 3	11- 6-55	3635	834		24	15,780	7,824	2,503,680	.63

Gunsite Butte Unit No. 1 Exhibit No. 3

TABULATION OF RESERVES ON PRODUCING WELLS (contd.)

Well		Location	Comp. Date	TD	IP	Del.	Sand thick.	Cum. Prod.	Reserves/ Ac.	Reserves/ 320 Ac.	% Reserves Produced
Northwest Production											
1	SW/4	33-26- 3	8-10-56	4107	3,873		28	209,522	9,128	2,920,960	7.17
2	NE/4	33-26- 3	3-13-57	6448	2,612		26	77,134	8,476	2,712,320	2.84
3	SW/4	34-26- 3	9-27-57	6260 6252PB	1,261		25	25,231	8,150	2,608,000	.97
5	SW/4	28-26- 3	7-10-57	6219	1,990		24	8,439	7,824	2,503,680	.34
Northwest Production Jic. N											
1	SW/4	8-26- 4	8- 9-56	3672	36,257		26	350,122	8,476	2,712,320	12.91
3	SW/4	5-26- 4	5-21-57	4111 4109PB	37,388		43	104,400	14,018	4,485,760	2.33
5	SW/4	6-26- 4	6- 4-57	6152	12,717		30	249,807	9,780	3,129,600	7.98
6	NE/4	7-26- 4	5- 3-57	3924	8,637		20	295,336	6,520	2,086,400	14.16
7	NE/4	8-26- 4	8-23-56	6216 6200PB	5,516		40	339,618	13,040	4,172,800	8.14
9	NE/4	6-26- 4	4-29-57	4045	4,420		37	164,428	12,062	3,859,840	4.26
Southern Union Gas Jic. A											
1	SW/4	23-26- 4			3,989	1517	32	464,741	10,432	3,338,240	13.92
2	SW/4	14-26- 4	5- 5-54	3619	4,955	1568	33	304,430	10,758	3,442,560	8.84
4	SW/4	13-26- 4	7-28-55	3915	4,892	483	26	66,430	8,476	2,712,320	2.45
5	NE/4	23-26- 4	7-28-55	3870	7,298	1497	33	258,450	10,758	3,442,560	7.51
Southern Union Gas Jic. B											
1	SW/4	4-25- 3	10- 4-57	3860 3820PB	10,154		33	16,097	10,758	3,442,560	.47
2	NE/4	25-26- 4	12-12-56	6050 6010PB	150		26	4,416	8,476	2,712,320	.16

Gonzales Basin Exhibit No. 3
Docket No. 6717

TABULATION OF RESERVES ON PRODUCING WELLS (contd.)

Well	Location		Comp. Date	TD	IP	Del.	Sand thick.	Cum. Prod.	Reserves/ Ac.	Reserves/ 320 Ac.	% Reserves Produced
Southern Union Gas Jic. C											
2	SW/4	11-26- 4			4,768		30	76,235	9,780	3,129,600	2.44
Southern Union Gas Jic. E											
1	SE/4	16-26- 4	7- 8-54	3465	3,134	2537	20	801,826	6,520	2,086,400	38.43
2	SW/4	15-26- 4	6-21-55	3478	7,712		26	166,996	8,476	2,712,320	6.16
3	NE/4	15-26- 4			6,793	1490	32	335,277	10,432	3,338,240	10.04
4	NE/4	22-26- 4	7- 5-55	3504	5,546	2576	26	59,281	8,476	2,712,320	2.19
5	NE/4	16-26- 4	8-14-56	3541 3510PB	36,660		29	402,681	9,454	3,025,280	13.31
Southern Union Gas Jic. D											
1	NW/4	32-26- 3	6-21-55	3884	326	253	24	73,535	7,824	2,503,680	2.94
2	SW/4	29-26- 3	6- 7-55	3821	6,754	585	22(16/)	133,101	7,172	2,295,040	5.80
3	SE/4	32-26- 3	9-10-56	4080	19,191		28	145,731	9,128	2,920,960	4.99
5	SW/4	30-26- 3	8- 6-56	3934 3920PB	18,158		32	509,604	10,432	3,338,240	15.27
Southern Union Gas Jic. H											
2	NE/4	17-26- 4	8- 6-56	3480 3470PB	935		17	22,483	5,542	1,773,440	1.27
Southern Union Gas McCroden Fed.											
1	SW/4	3-25- 3	8-14-56	3848 3830PB	4,280		29	40,510	9,454	3,025,280	1.34
1-A	NE/4	9-25- 3	7-18-56	3760 3740PB	8,872		27	47,082	8,802	2,816,640	1.67
					Total			7,893,370		133,112,320	
					Average				9,674		5.93

Note: Cumulative production is to 12-1-57 as taken from the New Mexico Oil & Gas Engineering Committee Annual Report and USGS.
The reserves per acre are calculated using 326 Mcf as the average recoverable gas per acre-foot and the net pay sand thickness as shown on the isopachous map (Map #1)

Weighted Average 12.6775¢ / MCF

Used 12.7¢ / MCF thereby taking into consideration probability of slight additional drop in production in early years and production continuing after the 20th year.

Price 10.9¢ / MCF until Jan 1959 when it increases 1¢ / MCF and 1¢ each 5 yrs. thereafter.

Used Gunsite av. percent decline based on drainage of less than 320 Ac. and slightly in excess of 160 Ac.

Gunsite Exhibit No. 4

PRODUCTION DECLINE CURVE

Tapacito Pictured Cliffs Field

Val R. Reese and Associates, Inc. February 1958

Percent Reserves Produced

Years

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 977
Order No. R-794

THE APPLICATION OF SOUTHERN UNION
GAS COMPANY FOR AN ORDER CREATING
THE TAPACITO-PICTURED CLIFFS GAS
POOL IN RIO ARRIBA COUNTY, NEW
MEXICO AND FOR THE TEMPORARY
ESTABLISHMENT OF 320 ACRE DRILLING
UNITS WITHIN SAID POOL.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on November 16, 1955 at Santa Fe, New Mexico, before the Oil Conservation Commission hereinafter referred to as the "Commission".

NOW, on this 18th day of April 1956, the Commission, a quorum being present, having considered the testimony presented and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That the subject acreage of paragraph (e) of application for creation of new pool in Rio Arriba County as set forth in Case 964, was consolidated with Case 977 by paragraph (2) of Order No. R-709. Subject acreage is described as follows:

TOWNSHIP 26 NORTH, RANGE 4 WEST, NMPM
NE/4 Section 9
W/2 Section 10
SW/4 Section 13
S/2 Section 14
All Section 15
SE/4 Section 16
NE/4 Section 22
W/2 & NE/4 Section 23

(2) That there is sufficient evidence to justify creation of a new gas pool, said pool to be designated as the Tapacito-Pictured Cliffs Gas Pool.

(3) That the delineation of said Tapacito-Pictured Cliffs Gas Pool should conform to the area presently outlined by development.

(4) That there is sufficient evidence to justify establishment of 320 acre drilling units within said gas pool.

IT IS THEREFORE ORDERED:

(1) That the Tapacito-Pictured Cliffs Gas Pool be and the same is hereby created. Said pool to consist of the following described acreage in Rio Arriba County, New Mexico:

TOWNSHIP 25 NORTH, RANGE 3 WEST, NMPM
N/2 Section 4
N/2 Section 5

TOWNSHIP 26 NORTH, RANGE 3 WEST, NMPM
S/2 Section 7
All Section 18
All Section 19
All Section 29
All Section 30
All Section 32

TOWNSHIP 26 NORTH, RANGE 4 WEST, NMPM
E/2 Section 9
S/2 Section 10
All Section 13
All Section 14
All Section 15
E/2 Section 16
E/2 Section 22
All Section 23
All Section 24

(2) That applicant's request for an order granting temporary establishment of 320 acre drilling units in the Tapacito-Pictured Cliffs Gas Pool, be and the same is hereby approved.

(3) Any well drilled a distance of two miles or more from the outer boundary of the Tapacito-Pictured Cliffs Gas Pool shall be classified as a wildcat. Any well drilled less than two miles from the outer boundary of said pool shall be spaced, drilled and operated in accordance with the temporary rules of the Tapacito-Pictured Cliffs Gas Pool.

(4) That all wells shall be drilled in the NE/4 or the SW/4 of the governmental sections of all units in said Tapacito-Pictured Cliffs Gas Pool.

(5) That all wells shall be located at least 990 feet from the outer boundary of the quarter section in which the well is drilled, provided however, that a tolerance of plus or minus 200 feet will be permissible. Provided further that the wells shall not be drilled closer than 130 feet to any quarter quarter section, or subdivision, inner boundary.

(6) That the following wells having been drilled prior to the effective date of this order shall be exceptions to the spacing rules provided in Paragraph 4 above:

1. Southern Union Gas Company, Jicarilla Well No. 1-E, located in the NW/4 SE/4 Section 16, Township 26 North, Range 4 West.

2. Southern Union Gas Company's Jicarilla No. 1-D located in NW/4 NW/4 Section 32, Township 26 North, Range 3 West.

3. Gunsite Butte Uranium Corporation's Florence Well No. 1 located in NE/4 NW/4 Section 4, Township 25 North, Range 3 West.

(7) That the applicant, Southern Union Gas Company, shall perform an interference test involving four wells. Said test shall be for a period of one year or until definite proof of communication among the wells has been established in a lesser period. The applicant's Jicarilla Well No. 2-E located in the NE/4 SW/4 Section 15, Township 26 North, Range 4 West shall be shut-in for the duration of the test. Shut-in pressure tests on this well shall be taken each month beginning April 1, 1956. The valves on said well shall be sealed in the interim between pressure tests. All tests shall be witnessed by a Commission representative or other personnel authorized by the Commission. The other three wells involved in this interference test were producing as of April 1, 1956 and shall continue to be produced unrestrictedly into the pipeline for the duration of the test. Said wells are the applicant's, Jicarilla Well 3-E located in the NW/4 NE/4 Section 15, Township 26 North, Range 4 West, Jicarilla Well No. 1-E located in NW/4 SW/4 Section 16, Township 26 North, Range 4 West, and the Jicarilla Well No. 4-E located in the NE/4 NE/4 Section 22, Township 26 North, Range 4 West.

(8) That the Commission, at its discretion may order additional interference tests on any of applicants wells.

(9) That the completion data and the results of a one point back pressure test, as prescribed in the Commission's Memorandum NO. 1-56, on all wells completed within the area effected by this order will be reported to the Commission before any of the wells are put on production. All wells completed between April 1, 1956 and rehearing date of this temporary order shall be so reported.

(10) That a rehearing will be held on the date of the regular January 1957 monthly hearing of the Commission, at which time applicant will make an appearance to show cause why rules herein adopted should be continued.

(11) The effective date of this order shall be April 1, 1956 and unless otherwise adduced shall remain in full force and effect until April 1, 1957.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

JOHN F. SIMMS, Chairman

E. S. WALKER, Member

A. L. PORTER, Jr., Member & Secretary

BEFORE THE OIL CONSERVATION COMMISSION

OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF SOUTHERN UNION GAS COMPANY FOR AN ORDER DESIGNATING CERTAIN LANDS IN TOWNSHIP 26 NORTH, RANGES 3 AND 4 WEST, N.M.P.M., RIO ARRIBA COUNTY, NEW MEXICO, AS THE TAPICITO-PICTURED CLIFFS GAS POOL AND ESTABLISHING 320-ACRE DRILLING UNITS FOR SAID POOL.

CASE NO. 977

APPLICATION

Southern Union Gas Company (herein referred to as "Applicant"), a Delaware corporation with its principal place of business in the Burt Building, Dallas 1, Texas, hereby makes application to the Commission for an order designating certain lands in Rio Arriba County, New Mexico, more fully hereinafter described, as the Tapicito-Pictured Cliffs Gas Pool and establishing 320-acre drilling units for said pool. In support of such application Applicant respectfully states and shows the following:

(1) The lands, all located in Rio Arriba County, New Mexico, herein requested by Applicant to be designated as the Tapicito-Pictured Cliffs Gas Pool are as follows:

Township 26 North, Range 3 West, N.M.P.M.

Section 19: All
Section 29: All
Section 30: All
Section 32: N/2

Township 26 North, Range 4 West, N.M.P.M.

Section 3: S/2
Section 4: S/2
Section 9: All
Section 10: All
Section 11: S/2
Section 13: All
Section 14: All
Section 15: All
Section 16: All
Section 21: E/2
Section 22: All
Section 23: All
Section 24: All
Section 25: E/2

(2) As of the date of this application, approximately 12 wells have been completed by Applicant and others in the Pictured Cliffs formation within the requested pool boundaries set forth above. By reason of the completion of said wells, and in the light of the geological and well log data available to Applicant, Applicant is of the opinion that all of the lands within the requested pool boundaries may reasonably be expected to be productive of natural gas in commercial quantities from the Pictured Cliffs formation. Such geological and well log data also indicate that the Pictured Cliffs Gas Pool underlying the lands referred to hereinabove is and should be regarded as a different pool from any of those heretofore formally designated by the Commission as such in northwestern New Mexico.

(3) In the light of the geological and well log data available to it, Applicant is of the opinion that a well drilled and properly completed in the Pictured Cliffs formation within the requested pool limits referred to above may reasonably be expected to drain in an efficient and economic manner not less than 320 acres of land, and that it is appropriate for the Commission, for the purposes of preventing waste and protecting correlative rights, to establish 320-acre drilling units for the Tapicito-Pictured Cliffs Gas Pool, each such unit to consist of either the N/2, S/2, E/2 or W/2 of a standard section according to the United States Land Surveys, and to order that no well within said pool be drilled (in the absence of special topographical conditions justifying some other location) closer than 990 feet to any boundary of the quarter section upon which it is located.

(4) At the hearing regarding this matter Applicant will be prepared to present further evidence relating to (a) the propriety of designation of the proposed area as a new and separate Pictured Cliffs Gas Pool and (b) the propriety of the well-spacing provisions proposed in paragraph (3) above.

WHEREFORE, premises considered, Applicant prays that the Commission, after such hearing and upon such notice as the Commission may direct, issue its order designating the lands described in paragraph (1) hereof as the Tapicito-Pictured Cliffs Gas Pool, and establishing drilling units and providing for the location of wells within said pool in the manner outlined in paragraph (3) hereof.

Respectfully submitted,

SOUTHERN UNION GAS COMPANY

By _____
Vice President

THE STATE OF TEXAS)
)
COUNTY OF DALLAS)

J. C. Reid, being first duly sworn, hereby states that he is the Vice President of Southern Union Gas Company, the Applicant in the foregoing application, that as such officer he has executed said application on behalf of Southern Union Gas Company; that he has read said application and, to the best of his knowledge, information and belief, all statements of fact therein contained are true and correct.

_____

SWORN TO AND SUBSCRIBED before me, the undersigned authority, this 12th day of October, 1955.

_____
Notary Public in and for
Dallas County, Texas

My Commission Expires:

June 1, 1957

BEFORE THE OIL CONSERVATION COMMISSION

OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF)
SOUTHERN UNION GAS COMPANY FOR AN)
ORDER DESIGNATING CERTAIN LANDS IN)
TOWNSHIP 25 NORTH, RANGE 3 WEST, AND)
TOWNSHIP 26 NORTH, RANGES 3 AND 4 WEST) CASE NO. 977
N.MPM., RIO ARRIBA COUNTY, NEW MEXICO,)
AS THE TAPICITO-PICTURED CLIFFS GAS)
POOL AND TEMPORARILY ESTABLISHING)
320-ACRE DRILLING UNITS FOR SAID POOL)

AMENDED APPLICATION

Comes now Southern Union Gas Company (herein referred to as "Applicant"), a Delaware corporation with its principal place of business in the Burt Building, Dallas 1, Texas, and in substitution for its original application in this matter, filed with the Commission on October 13, 1955, files this amended application requesting an order of the Commission designating certain lands in Rio Arriba County, New Mexico, more fully hereinafter described, as the Tapicito-Pictured Cliffs Gas Pool and temporarily establishing 320-acre drilling units for said pool; and in support thereof Applicant respectfully states and shows the following:

(1) The lands, all located in Rio Arriba County, New Mexico, herein requested by Applicant to be designated as the Tapicito-Pictured Cliffs Gas Pool are as follows:

Township 25 North, Range 3 West, N.M.P.M.

Section 4: All
Section 5: All

Township 26 North, Range 3 West, N.M.P.M.

Section 19: All
Section 29: All
Section 30: All
Section 32: All

Township 26 North, Range 4 West, N.M.P.M.

Section 3: S/2
Section 4: S/2
Section 9: All
Section 10: All
Section 11: S/2
Section 13: All
Section 14: All
Section 15: All
Section 16: All
Section 21: E/2
Section 22: All
Section 23: All
Section 24: All
Section 25: E/2

(2) As of the date of this application, approximately 14 wells have been completed by Applicant and others in the Pictured Cliffs formation within the requested pool boundaries set forth above. By reason of the completion of said wells, and in the light of the geological and well log data currently available to Applicant, Applicant is of the opinion that all of the lands within the requested pool boundaries may reasonably be expected to be productive of natural gas in commercial quantities from the Pictured Cliffs formation. Such geological and well log data also indicate that the Pictured Cliffs Gas Pool underlying the lands referred to hereinabove is and should be regarded as a different pool from any of those heretofore formally designated by the Commission as such in northwestern New Mexico.

(3) In the light of the geological and well log data currently available to it, Applicant is of the opinion that a well drilled and properly completed in the Pictured Cliffs formation within the requested pool limits referred to above may reasonably be expected to drain in an efficient and economic manner not less than 320 acres of land, and that pending further development of and production from such area it is appropriate for the Commission, for the purposes of preventing waste and protecting correlative rights, temporarily to establish 320-acre drilling units for the Tapicito-Pictured Cliffs Gas Pool and adjacent areas within two miles of same, each such unit to consist of either the N/2, S/2, E/2 or W/2 of a standard section according to the United States Land Surveys, and to order that no well within said pool and adjacent areas be drilled (in the absence of special topographical conditions justifying some other location) closer than 990 feet to any boundary of the quarter section upon which it is located.

(4) At the hearing regarding this matter Applicant will be prepared to present further evidence relating to (a) the propriety of designation of the proposed area as a new and separate Pictured Cliffs Gas Pool and (b) the propriety of the temporary well-spacing provisions proposed in paragraph (3) above.

WHEREFORE, premises considered, Applicant prays that the Commission, after such hearing and upon such notice as the Commission may direct, issue its order designating the lands described in paragraph (1) hereof as the Tapicito-Pictured Cliffs Gas Pool, and temporarily establishing drilling units and providing for the location of wells within said pool in the manner outlined in paragraph (3) hereof.

Respectfully submitted,

SOUTHERN UNION GAS COMPANY

By _____
Vice President

STATE OF TEXAS)
)
COUNTY OF DALLAS)

J. C. Reid, being first duly sworn, hereby states that he is the Vice President of Southern Union Gas Company, the Applicant in the foregoing application, that as such officer he has executed said application on behalf of Southern Union Gas Company; that he has read said application and, to the best of his knowledge, information and belief, all statements of fact therein contained are true and correct.

_____

SWORN TO AND SUBSCRIBED before me, the undersigned authority, this 24th day of October, 1955.

_____
Notary Public in and for
Dallas County, Texas

My Commission Expires:

June 1, 1957

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
August 15, 1957

TRANSCRIPT OF HEARING

Case 977

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
August 15, 1957

IN THE MATTER: The hearing ordered to be held by Paragraph 3 of Order R-794-A, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.	Case 977

BEFORE:

Mr. A. L. Porter
Mr. Murray Morgan
Honorable Edwin L. Mechem

TRANSCRIPT OF HEARING

MR. PORTER: The case to be considered next is Case 977.

MR. COOLEY: In the matter of the hearing ordered to be held by Paragraph 3 of Order R-794-A, Case 977, to permit Southern Union Gas Company and other interested parties to show cause why 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool.

MR. GRENIER: We will have one witness in this case. I am A. S. Grenier, Counsel for Southern Union Gas Company. Mr. Wiedlehr, if he may be sworn.

(Witness sworn.)

MR. GRENIER: If it please the Commission, this case originally came on for hearing in November 16, 1955 and was called

upon the application of Southern Union Gas Company for an order establishing 320-acre drilling units within the Tapacito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico. At that time the Commission, in its Order No. R-794, ordered that an interference test be conducted involving the Southern Union Gas Company Jicarilla Well No. 2-E, located in the Northeast Quarter of the Southwest Quarter of Section 14, Township 36 North, Range

The case, at that time, was continued until April 1, 1957, at which time it was anticipated that the results of that test might be indicative as to whether or not the relief requested was appropriate. Subsequently, by order dated April 15 of 1957, which followed a hearing in March of that year, the Commission decided that an additional test was appropriate involving the Southern Union Jicarilla No. 4-D Well, and that test has been in progress since that time. It was further ordered in that case, that a hearing should be had on August 15, 1957 to show cause why the rules promulgated by this original order R-794 should be continued in February.

A. M. WIEDIKEHR

called as a witness, having first been duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. GRENIER:

Q Will you please state your name?

A A. M. Wiedikehr.

Q What is your employment, Mr. Wiedikehr?

A Manager of Exploration, Southern Union Gas Company.

Q Have you testified previously in this and other cases before the Commission? A Yes, I have.

MR. GRENIER: Are the witness's qualifications acceptable to the Commission?

MR. PORTER: They are.

Q Now, Mr. Wiedikehr, is it your thought that this is an appropriate time to give final consideration to this matter so as to determine definitely 320-acre spacing is appropriate?

A No, it isn't.

Q Why do you say that, Mr. Wiedikehr?

A If the Commission please, the first interference test run on the run on the 2-E Well, we had three additional wells offsetting this well producing.

Q You are pointing now to an exhibit?

(Marked Southern Union's Exhibit No. 1, for identification.)

A To an exhibit marked Exhibit 1, showing the location of the four wells which were involved in this particular test. The drainage area of these four wells, assuming a radial drainage pattern, would have been a minimum of 785 acres to a maximum of 960 acres to show interference on the shutin well.

From a tabulation of the pressures versus production, we find that no definite break in pressure in the shutin well was observed until such time as approximately 625,000,000 feet of gas had been produced from the three offset wells. The initial pressure was in the order of 187½ pounds, in June of '56 after production of 625,000,000 feet of gas the pressure was 185½ pounds. Then in July, the pressure took an abrupt drop down to 183 pounds and continued dropping at the rate of about three pounds per month until the test was discontinued in December, 1956. This test showed that the tubing pressure dropped 21½ pounds on the shutin well during the time the test was run, and during that time, 1,340,000 feet of gas was produced from the three offset wells.

I feel that this conclusively proves that the area in which we are talking, that a well cannot only drain 320 acres, but as is indicated on Exhibit 1, a minimum of 785 acres, because that is the minimum drainage that would have had to occur for a pressure drop to have occurred in our test well.

Q Just a minute, Mr. Wiedikehr, you were speaking there of 185 pounds, was that not 1,085? A 1,085.

Q In each instance it was intended to be a thousand plus pounds? A Yes.

Q Thank you.

A Now, the second interference test shown by Exhibit 2, was actually begun back in November, 1956. Pressures were taken in

December '56 on the shutin well, the Jicarilla 4-D, showing casing pressure of 1,065, a tubing pressure of 1,064. Production through June of '57 was 393,000,000 feet of gas, and the pressure had dropped one-half pound.

I would like to point out that the pressure did rise from 1,064 to 1,064½ and then dropped to 1,063½, or one pound pressure drop, which we do not feel is conclusive, but if you will look at figures on Exhibit 2, you will notice that there are only two wells which affect the drainage of the shutin well, and the minimum acreage to be drained before interference would be determined is 783 acres, the maximum 858 acres. The producing capacity of the two wells involved in this interference test is approximately forty-five to fifty million feet per month. The capacity of the three wells in Test No. 1, ran one hundred forty to one hundred fifty million a month. Consequently, we do not feel that this second test has had a fair chance.

I'm sorry that we were not able to present pressures during the month of July. We have had a man in the field the last week trying to get down there, but because of the rain and the bad roads, he wasn't able to get us any information. At least it hadn't reached my office when I left. I feel definitely with only two wells producing, we would have to have a minimum of six to seven hundred feet of cumulative production from the two wells involved before definite drainage would be shown.

(Marked Southern Union's Exhibit No. 2, for identification.)

Q How long do you anticipate it will be, Mr. Wiedikehr, before additional production in the range you have indicated, is likely to have been obtained?

A Well, we need an additional 300,000,000 feet of gas, and we are producing at the rate of 40,000,000 a month. That would be somewhere in the vicinity of eight months to give us a definite break. It is conceivable that within the next few months we'll get a break in our shutin well that would indicate that interference has been proved, but I don't think we can discount our test until our 700,000,000 production figure has been arrived at.

Q Have you prepared tabulations indicating the pressures and monthly production and cumulative production with respect to these two interference tests that you have been talking about?

A Yes, I have.

(Marked Southern Union's Exhibits No. 3 and 4, for identification.)

Q Those are the sheets which have been marked respectively as Exhibits 3 and 4 for interference test 1 and interference test 2?

A That's correct.

Q Were Exhibits 1, 2, 3 and 4 prepared either by you or under your personal supervision? A They were.

MR. GRENIER: We request that such exhibits be introduced in evidence in this case.

MR. PORTER: Let's be sure that those are properly identified since they appear on the same sheet.

MR. GRENIER: Now, at the top of Exhibit 3 it indicates that refers to interference test1, and Exhibit 4 relates to interference test No. 2.

MR. PORTER: I see. Yes, sir. Without objection, the exhibits will be admitted.

Q Do I gather then from the testimony that you have given, that you think a further continuance is appropriate in this case?

A I certainly do.

Q How long a continuance then would you feel to be appropriate under the circumstances?

A I would like to request that the case be continued for a period of six months.

Q If, during that six-month period, it were to develop that a break, as you say, in these pressures had been obtained, would it be your thought that Southern Union Gas Company should have the privilege of coming in and accelerating the next hearing date on this matter? A Yes, sir, I do.

Q Would it be Southern Union's intention to do that?

A Yes, we would like to get it off the docket as soon as possible.

MR. GRENIER: That concludes our testimony at this time, and we do move for a six-months' further continuance in this case.

That is to say until the regular February hearing in the absence of the request on our part, or any other interest operator or the Commission staff, for the further earlier hearing on the matter.

MR. PORTER: Before we act on the motion, is there anyone that has any questions of the witness? Mr. Utz.

CROSS EXAMINATION

By MR. UTZ:

Q Mr. Wiedikehr, referring to your interference tests in the Tapacito Pool, did you take any pressure information on your first test or the one in which the 2-E was included, to show what the pressure differential was between the producing wells and the shutin well?

A The wells were producing at approximately 500 pounds flowing pressure.

Q Five hundred pounds flowing pressure?

A Yes.

Q Did you take working pressures?

A Well, the wells were producing wide open into a 500 pound system. So, in other words, the wells working pressure would have been five hundred, five hundred fifty pounds.

Q That would be the difference between the working pressure and your friction loss? A That's right.

Q You do have that information available?

A I don't have that with me. It can be taken from the

charts, we have weekly charts on all the production, and we know that the wells were wide open in the line. We can take the line pressure off the chart.

Q You didn't actually take working pressure of the wells?

A No, we did not.

Q In that connection, on this second test that you ran on 4-D, I wonder if you would be willing to take your flowing tubing and working pressures on the offset wells at the same time that you take the shutin pressure?

A I would be very happy to.

MR. UTZ: I would like to have that information if I could.

A If I may ask a question, why --

Q (Interrupting) I would like to know the different pressures between the two wells.

MR. PORTER: You have agreed to furnish that information?

A Yes, sir, we will be very happy to furnish it. No problem.

MR. PORTER: Mr. Cooley.

MR. COOLEY:

I understood your motion to be for a continuance. It would more properly have to be an extension, this Order R794-A expires on its own terms on October 1st, this year. It would be necessary for another Order 794-B to be written extending the provisions of 794 for an additional six-months' period?

MR. GRENIER: Yes, I think that is the mechanical procedure we had in mind then, Mr. Cooley, thank you.

MR. PORTER: Then you revise your motion to request an extension of the rules presently in effect?

MR. GRENIER: Yes, that the provisions of Paragraphs 1 through 6 and Paragraph 8 of the original order in this case, Order No. R-794-A, be continued in effect for an additional period of six months, that is to say, until April 1, 1958. They currently expire on October 1, with the contemplation that there be a further hearing on this matter at the regular February meeting in 1958.

MR. PORTER: Does anyone have any objection to the motion? Does anyone have anything further in this case?

MR. JOHNSON: W. R. Johnson, Northwest Production Corporation. I have a request to make of the Commission concerning this case. The Northwest Production Corporation is an operator at the Tapacito-Pictured Cliffs, and requests that the New Mexico Oil Conservation Commission give consideration to the following: One, that Southern Union Gas Company should furnish all data concerning the two test areas to all operators in and within two miles of the Tapacito Pool so that an engineering evaluation of the tests can be made, both as to possible communication and effective drainage.

The data should include gas volumes, liquid production,

casing pressures on all wells, bottomhole pressures on all wells, gas analysis and gas gravity.

Two, that any extension granted in this case be subject to any operator being able to reopen the case with the usual notice to the Oil and Gas Commission.

MR. PORTER: You mean to reopen the case during the six-month' period?

MR. JOHNSON: That's correct.

MR. MORGAN: Southern Union Gave that right on their motion.

MR. GRENIER: We had that contemplation that if anyone wanted to get in sooner, they would be able to do so. We felt that the information was definitive enough to let us proceed on a final basis.

MR. PORTER: Is Southern Union willing to furnish the information?

A Certainly a portion of the information. A lot of, it involves a lot of expense, the information wouldn't justify the expense to obtain it. As far as the pressure and the production, certainly.

Let me continue, there are some twenty or thirty wells in the field and we would have one man doing nothing but running around and taking pressures, if we did it on all the wells. We would be more than happy to submit it on the wells on which the tests that are being conducted.

MR. JOHNSON: I referred specifically to only the test areas.

A He is talking about only the test wells.

MR. PORTER: Only the test wells, are you agreeable to furnishing that information?

MR. GRENIER: How about the gas gravity and the other information he requested at the last?

A All are readily available except the bottomhole pressure, and the gas analysis. Bottomhole pressure might have value, I seriously doubt if the gas analysis would have any value at all in this case. Consequently, I don't see that that should be required.

By MR. UTZ:

Q You say you don't believe the bottomhole pressure would have any value?

A No, I didn't say that, I said the gas analysis. I said the bottomhole pressure we object, but we will do it.

Q Would it be very expensive?

A We are talking now about three wells. It will only cost three or four hundred dollars, we won't argue about that.

Q Do you feel a calculation of the bottomhole would be as effective? A I'm afraid not.

MR. UTZ: I agree with you.

MR. PORTER: Any further questions? Mr. Morgan.

By MR. MORGAN:

Q Why do you say that the gas analysis would not be of value?

A The gas analysis has no bearing whatsoever as far as I can see on whether producing one well will draw the pressure down on another well. That's what we are trying to prove is that a well shut in will be drained by offset wells, and if the pressure declines, then certainly it has been drained.

Q I think the petitioner is asking for the analysis so that they can determine at any time the source of the gas. Would you agree to that?

A I don't think there is any doubt where the gas is coming from. There is only one completed horizon in any of these wells.

MR. JOHNSON: My contention on the gas analysis is that in my opinion the gas analysis is necessary to calculate an effective drainage from a reservoir engineering standpoint.

A We're not trying to calculate it, if I may say so, we are trying to prove it by pressures. They will hold up more conclusively since we don't know anything about the permeability or porosity. We are trying to show it by pressure decline, and gas gravity would have nothing to do with that, nor analysis either.

MR. PORTER: Anyone else have a question of Mr. Wiedikehr?

RE-DIRECT EXAMINATION

By MR. GRENIER:

Q On those items, we of course, would be willing to make

available to them and any information we do have. We would not want to be under an obligation to be incurring expense in the last ones, particularly of gas gravity and gas analysis, of making periodic tests, merely for that purpose.

A We are willing to have them come and take samples any time they want and have them analyzed.

MR. PORTER: The witness may be excused.

(Witness excused.)

The Commission would like to call Mr. Johnson to the stand, please. (Witness sworn.)

W. R. JOHNSON

called as a witness, having first been duly sworn, testified as follows:

DIRECT EXAMINATION

By MR. COOLEY:

Q State your name and position please.

A W. R. Johnson, Manager of Production Operations, Northwest Production Corporation.

Q Have you previously testified before the Oil Conservation Commission as an expert witness in the field of gas engineering?

A Not in the field of gas engineering.

Q What field?

A Well, completion and petroleum engineer.

Q Would you please state to the Commission why you feel that

gas gravities and gas analysis would lend any evidence in this case to the drainage area of a well in the Tapacito-Pictured Cliffs Pool?

A Well, I feel that any proof of drainage in this case must be proven by some calculation of gas movement, and for any reservoir engineering calculation, it is necessary that you have more data than I asked for, but it is necessary that you have gas analysis, gas gravity and preferably water saturation in the cores permeability, porosity and so forth. Some of it can be estimated, but in my opinion, to prove or disprove this case, it is necessary that those calculations be made and that it cannot be made on pressure information alone.

Q You do feel that drainage area cannot be established by means of pressure interference test?

A Communication can be established, drainage area, in my opinion, cannot be.

MR. COOLEY: That is all.

MR. PORTER: Anyone else have a question?

MR. GRENIER: Yes.

CROSS EXAMINATION

By MR. GRENIER:

Q What is his distinction between communication and drainage. Are they not substantially the same thing?

A No, sir. I might tell you a little parable on that.

You can take water out of the Atlantic side of the ocean, or the New York side of the Atlantic ocean, and you will communicate with the English side, but you are not going to take any fish out of it, and it's the same principle, you can communicate, but you may not drain that particular area.

Q And it is your feeling then that pressure decline can only show communication but cannot show that there is any drainage between wells?

A It can prove it, in my opinion.

By MR. WIEDIKEHR:

Q What causes the pressure to drop?

A Movement of gas, Mr. Wiedikehr.

Q That is all I wanted to know, thank you.

A But the question of effective drainage, for instance, you and I both know that the well drilled every 40 acres in a 320 , 8 times those wells would produce more gas than one on 320, but somewhere in between there is an effective drainage pattern. I don't think you can prove it by pressures alone.

Q Let me ask you, with a distance of 3200 feet, or 3300 feet between wells, and with a pressure drawdown on a shutin well of say 20 plus pounds, you don't think that shows any drainage between two wells?

A It shows communication between the two wells providing you had bottom hole pressure data to substantiate it.

Q No drainage?

A I don't know. I would have to calculate it.

Q Can you calculate without permeability and other factors that you don't know about this field?

A No, but I can estimate them, but I would have assumed that you would have attempted to prove the case on that point, or at least to back it up.

Q When you have insufficient information, isn't this a better means than trying to calculate something from a lot of unknowns since all of these factors are known?

A Not from an engineering standpoint.

MR. WIEDIKEHR: That is all.

MR. PORTER: Anyone else have a question? Mr. Utz.

By MR. UTZ:

Q Mr. Johnson, is the thing that you are concerned about more than anything not whether or not we have communication on 320, but as to how efficient that drainage is?

A Or that communication is, that's right.

Q That is the thing you would like to check with the calculations?

A That is correct.

Q In other words, the pressure between the producing well and the shutin well, the pressure drop through the formation?

A That is very correct. At this time I do not know in my own mind if I have any objection to 320 acre spacing in the field.

but I think we should have the information to try to take an engineering look at the whole case.

By MR. GRENIER:

Q Would you be willing, Mr. Johnson, to make these tests in which you are interested, at your company's expense?

A Yes. However, you do take them periodically. We have some of the gas analysis from your Tapacito Field, and you do by your gas contracts, take specific gravities at least every three months, so it is readily available.

Q Do I understand that you are merely asking for the information we have on hand and are not requesting us to make any additional tests out of the ordinary?

A I do not know if you have taken bottomhole pressure. I would think you would have wanted to.

Q That, I believe that Mr. Wiedikehr stated that we were willing to do.

A The rest of the information is available.

Q So youare not asking for anything of particular or unusual on our part other than what we would obtain in the way of data in any event, is that correct? A Not to my knowledge.

MR. PORTER: Anyone else have a question?

By MR. WIEDIKEHR:

Q How often would you like bottomhole pressures?

A The ones I would like to have had would be the initials.

I think one static and one good flowing bottomhole pressure at the end of the test would be adequate from your wells primarily to determine fluid level. We do know, and I would like to add for the Commissions' information, we do know in the field that liquids are produced. We are gathering them from the Pictured Cliff formation in that field, and we do know that the bottomhole pressures can be different and not easily calculated from surface pressures.

Q On a flowing well, but not on a shutin well, that has never been produced? A That all depends.

MR. PORTER: Are there any more questions? The witness may be excused.

(Witness excused.)

MR. COOLEY: Mr. Greiner, the requests by Mr. Johnson have been clarified, is Southern Union willing to furnish the information requested?

MR. GREINER: What we would like to suggest is that if Mr. Johnson would advise us in writing just exactly what it is that he wants of us, that we will either supply it or notify the Commission of anything that might cause us any difficulty along those lines. We don't wish to be difficult in this case, and we are, of course, very glad to furnish readily obtainable information to anyone, but we don't want to be put into a position of thinking that we are satisfying Mr. Johnson and then not actually doing so. So we would like to have it definite and in writing. We do not

want to be in a position of undertaking to do something that is inappropriately costly. You may have some suggestion on procedure that may accomplish that same result.

MR. COOLEY: I believe Mr. Wiedikehr stated that he was willing to furnish the bottomhole pressure test, that the expense would not be out of line.

MR. WIEDIKEHR: Yes, sir.

MR. COOLEY: And the more specific tests was one static test and one flowing test at the end of the communication test, is that correct?

MR. WIEDIKEHR: That is my understanding, which well does he want the static on, the shutin, the flowing bottomhole, that is the reason I wanted it put in writing so I would know what he definitely requested.

MR. COOLEY: I think we could clarify it here.

MR. JOHNSON: You have it exactly correct.

MR. COOLEY: And you have sufficient information as is readily available without having to run other tests?

MR. WIEDIKEHR: Yes. We are in full accord and are willing to submit to the operators within the pool within a two mile radius.

MR. JOHNSON: I stated that because that is the way the field rules are written.

MR. GRENIER: Is that operators of wells that are completed

now or are completed in the future, that is not all the lease owners is it?

MR. JOHNSON: I presumed operators of wells, lease owners to this extent, there are only about six that might drill wells within the field rules of that Tapacito.

MR. GRENIER: I'm wondering about the possibility of a record check. We will be glad to do it on the basis of what the records indicate, when we might not have up-to-date information.

MR. JOHNSON: They are all Jicarilla 4 section leases and involve ours, El Paso, Magnolia, Humble, Honolulu and I think that's all.

MR. COOLEY: Would it not be agreeable to supply this information upon request to the offset operators?

MR. GRENIER: We would be very pleased to put it on that basis.

MR. JOHNSON: That would be fine. I so request.

MR. PORTER: Anything further in this case? Mr. Grenier, the Commission will not rule on your motion immediately for an extension of this order for six months, but will take the case under advisement and give you an early decision.

MR. GRENIER: Thank you very much, Mr. Porter.

MR. PORTER: We will take the case under advisement.

DEARNLEY, MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

C E R T I F I C A T E

STATE OF NEW MEXICO)
: SS
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this day of August, 1957.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1959.

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

June 4, 1958

COPY

Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas 1, Texas

Dear Mr. Grenier:

We enclose one copy of Order R-794-E issued June 4, 1958, by the Oil Conservation Commission in Case 977, which was last heard on May 14, 1958.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

June 4, 1958

Mr. Clarence Hinkle
Hervey, Dow & Hinkle
P.O. Box 547
Roswell, New Mexico

Dear Mr. Hinkle:

On behalf of your client, Humble Oil & Refining Company, we enclose two copies of Order R-794-E issued June 4, 1958, by the Oil Conservation Commission in Case 977, which was last heard on May 14, 1958.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encls.

MAIN OFFICE OCC
APR 4 PM 4:27

HONOLULU OIL CORPORATION
P. O. DRAWER 1391
MIDLAND, TEXAS

April 3, 1958

The Oil Conservation Commission
The State of New Mexico
Box 871
Santa Fe, New Mexico

Re: In the matter of the application of Southern Union Gas Company for an order creating the Tapacito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico, and for the establishment of 320-acre drilling units within said pool.

Gentlemen:

Honolulu Oil Corporation is one of the producing operators in the Tapacito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico. Honolulu has recently received a copy of the application for re-hearing filed by Southern Union Gas Company, and classified as Case No. 977.

Honolulu is in complete accord with this application, and wishes to go on record as supporting the application.

Very truly yours,

HONOLULU OIL CORPORATION

A. S. Donnelly
Vice President

ASD:led

AIRMAIL

Mr. A. S. Grenier
cc: Southern Union Gas Company
Burt Building
Dallas 1, Texas

Mr. J. W. House
Humble Oil & Refining Company
P. O. Box 1600
Midland, Texas

Mr. Ross Madole
Magnolia Petroleum Company
P. O. Box 900
Dallas, Texas

Mr. F. Norman Woodruff
El Paso Natural Gas Company
P. O. Box 1492
El Paso, Texas

Mr. Quilman B. Davis
Aztec Oil & Gas Company
920 Mercantile Securities Bldg.
Dallas, Texas

Mr. R. F. Rood
Phillips Petroleum Company
Bartlesville, Oklahoma

Mr. R. N. Richey
Pacific Northwest Pipe Line Corporation
10th Floor Simms Building
Albuquerque, New Mexico

J. M. HERVEY 1874-1953
HIRAM M. DOW
CLARENCE E. HINKLE
W. E. BONDURANT, JR.
GEORGE H. HUNKER, JR.
HOWARD C. BRATTON
S. B. CHRISTY IV
LEWIS C. COX, JR.
PAUL W. EATON, JR.
ROBERT C. BLEDSOE

LAW OFFICES
HERVEY, DOW & HINKLE
HINKLE BUILDING
ROSWELL, NEW MEXICO

TELEPHONE MAIN 2-6510
POST OFFICE BOX 547

April 4, 1958

Mr. A. L. Porter
Executive Director
New Mexico Oil Conservation Commission
Capitol Building
Santa Fe, New Mexico

Re: Case No. 977
Order No. R-974-C
Tapacito-Pictured Cliffs Pool
Rio Arriba County, New Mexico

Dear Mr. Porter:

We enclose herewith in triplicate application of the Humble Oil & Refining Company for rehearing of the above case under Order No. R-974-C.

It is our understanding that the Southern Union Gas Company has also filed an application for rehearing.

We would appreciate your giving this matter prompt favorable consideration.

Yours very truly,

HERVEY, DOW & HINKLE

By

CEH/bp
Encl.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF THE STATE OF NEW
MEXICO FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 977
Order No. R-794-C

APPLICATION OF SOUTHERN UNION GAS
COMPANY FOR AN ORDER CREATING THE
TAPACITO-PICTURED CLIFFS POOL IN
RIO ARRIBA COUNTY, NEW MEXICO, AND
FOR THE TEMPORARY ESTABLISHMENT OF
320-ACRE DRILLING UNITS WITHIN SAID
POOL.

APPLICATION FOR REHEARING

Comes the Humble Oil & Refining Company and hereby makes application for a rehearing of the above captioned case with respect to the matters hereinafter referred to which were determined by Order No. R-794-C of the New Mexico Oil Conservation Commission and in support thereof respectfully shows:

I.

That applicant is the owner, with Southern Union Gas Company, of a number of producing gas wells located within the limits of the Tapacito-Pictured Cliffs Gas Pool.

II.

That findings Nos. 4, 5 and 6, contained in Order No. R-794-C, are erroneous in that they are not supported by the evidence introduced at the hearing held before the Commission on February 13, 1958, which showed beyond a reasonable doubt that the Tapacito-Pictured Cliffs Gas Pool can be efficiently and economically drained on a 320-acre spacing pattern and that it would not be in the interest of conservation or the prevention of waste to require said pool to be developed by the drilling and spacing of wells in accordance with Rule 104 of the Commission Rules and Regulations.

III.

That upon rehearing additional evidence will be presented by interested parties further showing that the Tapacito-Pictured Cliffs Gas Pool can be efficiently and economically developed on a 320-acre spacing pattern and that such spacing will prevent economic waste caused by the drilling of unnecessary wells.

WHEREFORE, applicant respectfully requests that the Commission grant a rehearing of the above styled case and that upon such rehearing the Commission make permanent the special field rules for the Tapacito-Pictured Cliffs Gas Pool as originally provided in Order No. R-794 entered on April 18, 1956, so that said pool may be continued to be developed upon 320-acre drilling or spacing units.

HUMBLE OIL & REFINING COMPANY

By _____

Hervey, Dow & Hinkle
P. O. Box 547
Roswell, New Mexico

SOUTHERN UNION GAS COMPANY
BURT BUILDING
DALLAS 1, TEXAS

LEGAL DEPARTMENT
WILLIS L. LEA, JR
GENERAL ATTORNEY

A. S. GRENIER
MILLARD F. CARR
JACK HERTZ
WM. S. JAMESON
JAS. R. WETHERBEE

April 2, 1958

Mr. A. L. Porter, Jr, Secretary
New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Dear Sir:

Enclosed herewith for filing with the Commission are four copies of an application for rehearing of Southern Union Gas Company with respect to Order No. R-794-C, entered by the Commission in Case No. 977, on March 19, 1958.

Very truly yours,

A. S. Grenier

ASG:fg

Enc.

BEFORE THE OIL CONSERVATION COMMISSION

OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF SOUTHERN UNION GAS COMPANY FOR AN ORDER CREATING THE TAPACITO-PICTURED CLIFFS GAS POOL IN RIO ARRIBA COUNTY, NEW MEXICO, AND FOR THE ESTABLISHMENT OF 320-ACRE DRILLING UNITS WITHIN SAID POOL.	)	CASE NO. 977

APPLICATION FOR REHEARING

Comes now Southern Union Gas Company, Applicant in the above-mentioned case, and respectfully applies for a rehearing therein. In support of such request for rehearing Applicant states that the Commission erred in entering its Order No. R-794-C dated March 19, 1958, in the following respects:

1. That said order is contrary to the evidence in that the finding is made therein that the Tapacito-Pictured Cliffs Gas Pool cannot be efficiently drained on a 320-acre spacing pattern, whereas the evidence adduced clearly shows that a well in said pool will efficiently drain an area of substantially more than 320 acres.

2. That said order is unreasonable, arbitrary and contrary to law in that, in violation of the principles of conservation established by Section 65-3-14(b) of the New Mexico Statutes, 1953, Annotated, and in violation of the duties imposed upon the Commission by Section 65-3-10 of said Statutes, said order fails to give consideration to the waste and economic loss which will be caused by the drilling of unnecessary wells, the protection of correlative rights, and the augmentation of risks arising from the drilling of an excessive number of wells; and said order is also contrary to law in other respects.

WHEREFORE, Applicant prays that this Application for Rehearing be granted for the purpose of reconsidering Order No. R-794-C, and that, after notice and hearing as required by law, the Commission modify such order

so as to continue in effect the 320-acre spacing pattern for the Tapacito-Pictured Cliffs Gas Pool originally established by the Commission in Order No. R-794.

Respectfully submitted,

SOUTHERN UNION GAS COMPANY

By A. S. Grenier
A. S. Grenier, Attorney

April 2, 1958

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF THE STATE OF NEW
MEXICO FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 977
Order No. R-794-C

APPLICATION OF SOUTHERN UNION GAS
COMPANY FOR AN ORDER CREATING THE
TAPACITO-PICTURED CLIFFS POOL IN
RIO ARRIBA COUNTY, NEW MEXICO, AND
FOR THE TEMPORARY ESTABLISHMENT OF
320-ACRE DRILLING UNITS WITHIN SAID
POOL.

APPLICATION FOR REHEARING

Comes the Humble Oil & Refining Company and hereby makes application for a rehearing of the above captioned case with respect to the matters hereinafter referred to which were determined by Order No. R-794-C of the New Mexico Oil Conservation Commission and in support thereof respectfully shows:

I.

That applicant is the owner, with Southern Union Gas Company, of a number of producing gas wells located within the limits of the Tapacito-Pictured Cliffs Gas Pool.

II.

That findings Nos. 4, 5 and 6, contained in Order No. R-794-C, are erroneous in that they are not supported by the evidence introduced at the hearing held before the Commission on February 13, 1958, which showed beyond a reasonable doubt that the Tapacito-Pictured Cliffs Gas Pool can be efficiently and economically drained on a 320-acre spacing pattern and that it would not be in the interest of conservation or the prevention of waste to require said pool to be developed by the drilling and spacing of wells in accordance with Rule 104 of the Commission Rules and Regulations.

III.

That upon rehearing additional evidence will be presented by interested parties further showing that the Tapacito-Pictured Cliffs Gas Pool can be efficiently and economically developed on a 320-acre spacing pattern and that such spacing will prevent economic waste caused by the drilling of unnecessary wells.

WHEREFORE, applicant respectfully requests that the Commission grant a rehearing of the above styled case and that upon such rehearing the Commission make permanent the special field rules for the Tapacito-Pictured Cliffs Gas Pool as originally provided in Order No. R-794 entered on April 18, 1956, so that said pool may be continued to be developed upon 320-acre drilling or spacing units.

HUMBLE OIL & REFINING COMPANY

By _____

Hervey, Dow & Hinkle
P. O. Box 547
Roswell, New Mexico

Exh. No. 9

TABULATION OF RESERVES ON PRODUCING WELLS CONNECTED TO SOUTHERN UNION GAS COMPANY'S SYSTEM
TAPACITO PICTURED CLIFFS FIELD, RIO ARRIBA COUNTY, NEW MEXICO

Operator & Well	Reserve/320 Acre*	Cumm. Prod. 2-28-58	% Reserve Produced	Days Produced	% Reserve Produced/365 Days
Honolulu Oil Corporation					
Jicarilla 1	2,033,920	387,632	19.06	451	15.42
Jicarilla 2	1,016,960	270,204	26.57	390	24.87
Jicarilla 3	1,307,520	741,432	56.71	267	77.52
Jicarilla 4	1,162,240	67,973	5.85	245	8.41
Jicarilla 6	---	37,011	---	230	---
Southern Union Gas Company					
Jicarilla 1-A	3,050,880	536,845	17.60	444	14.47
Jicarilla 2-A	4,503,680	361,271	8.02	354	8.27
Jicarilla 4-A	1,162,240	81,391	7.00	279	9.16
Jicarilla 5-A	3,632,000	264,029	7.27	312	8.51
Jicarilla 2-C	1,162,240	109,753	9.44	193	17.85
Jicarilla 1-D	1,743,360	89,475	5.13	402	4.66
Jicarilla 2-D	2,324,480	151,672	6.53	476	5.01
Jicarilla 3-D	2,615,040	260,762	9.97	184	19.76
Jicarilla 5-D	3,196,160	601,514	18.82	435	15.79
Jicarilla 1-E	2,033,920	883,488	43.44	546	29.04
Jicarilla 2-E	3,341,440	212,308	6.35	250	9.27
Jicarilla 3-E	3,050,880	353,715	11.59	448	9.44
Jicarilla 4-E	2,905,600	827,174	28.47	559	18.59
Jicarilla 5-E	2,469,760	568,902	23.03	229	36.71
Jicarilla 2-H	290,560	40,867	1.41	165	3.12
McCroden 1	3,777,280	119,338	3.16	143	8.06
McCroden 1-A	2,324,480	113,367	4.88	165	10.79
McCrodan 1-B	2,615,040	88,676	3.39	89	13.90

*Based on 454 MCF/AF

Ex. U. 8.

TABULATION OF RESERVES ON PRODUCING WELLS
CONNECTED TO SOUTHERN UNION GAS COMPANY'S SYSTEM
TAPACITO PICTURED CLIFFS FIELD
RIO ARRIBA COUNTY, NEW MEXICO

Operator & Wells	Location	Connection Date	Sand Thickness	Micro Log Sand Thickness	Reserve/ 320 Acre Gross	Reserve/ 320 Acre Net M.L.	Cumm. Prod. 2-28-58	% Reserve Produced Gross	% Reserve Produced M.L.	Days Produced	% Gross 320 Acre Reserve Produced/ 365 Days	% M.L. 320 Acre Reserve Produced/ 365 Days
Honolulu Oil Corporation												
Jicarilla 1	SW/4 10-26-4	1-23-56	30	14	3,129,600	1,460,480	387,632	12.39	26.54	451	10.03	21.48
Jicarilla 2	NE/4 9-26-4	3-5-56	31	7	3,233,920	730,240	270,204	8.36	37.00	390	7.82	34.62
Jicarilla 3	SW/4 9-26-4	11-6-56	26	9	2,712,320	938,880	741,432	27.34	78.97	267	37.37	107.96
Jicarilla 4	SW/4 4-26-4	1-22-57	30	8	3,129,600	834,560	67,973	2.17	8.14	254	3.12	11.70
Jicarilla 6	SW/4 3-26-4	1-23-57	27	0	2,816,640	0	37,011	1.31	---	230	2.08	---
Southern Union Gas Company												
Jicarilla 1-A	SW/4 23-26-4	1-25-56	32	21	3,338,240	2,190,720	536,845	16.08	24.51	444	13.22	20.15
Jicarilla 2-A	SW/4 14-26-4	2-16-56	33	31	3,442,560	3,233,920	361,271	10.49	11.17	354	10.82	11.52
Jicarilla 4-A	SW/4 13-26-4	3-10-56	26	8	2,712,320	834,560	81,391	3.00	9.75	279	3.92	12.76
Jicarilla 5-A	NE/4 23-26-4	3-30-56	33	25	3,442,560	2,608,000	264,029	7.67	10.12	312	8.97	11.84
Jicarilla 2-C	SW/4 11-26-4	5-21-57	30	8	3,129,600	834,560	109,753	3.51	13.15	193	6.64	24.87
Jicarilla 1-D	NW/4 32-26-3	1-12-56	24	12	2,503,680	1,251,840	89,475	3.57	35.53	402	3.24	32.26
Jicarilla 2-D	SW/4 29-26-3	3-30-56	22	16	2,295,040	1,669,120	151,672	6.61	9.09	476	5.07	6.97
Jicarilla 3-D	SE/4 32-26-3	2-5-57	28	18	2,920,960	1,877,760	260,762	8.93	13.89	184	17.71	27.55
Jicarilla 5-D	SW/4 30-26-3	12-11-56	32	22	3,338,240	2,295,040	601,514	18.02	26.21	435	15.12	21.99
Jicarilla 1-E	SE/4 16-26-4	2-16-56	20	14	2,086,400	1,460,480	883,488	42.34	60.49	546	28.30	40.44
Jicarilla 2-E	SW/4 15-26-4	12-11-56	26	23	2,712,320	2,399,360	212,308	7.83	8.85	250	11.43	12.92
Jicarilla 3-E	NE/4 15-26-4	3-29-56	32	21	3,338,240	2,190,720	353,715	10.60	16.15	448	8.64	13.16
Jicarilla 4-E	NE/4 22-26-4	2-16-56	26	20	2,712,320	2,086,400	827,174	30.50	39.65	559	19.91	25.89
Jicarilla 5-E	NW NE/4 16-26-4	2-15-57	29	17	3,025,280	1,773,440	568,902	18.80	32.08	229	29.97	51.13
Jicarilla 2-H	NE/4 17-26-4	4-30-57	17	2	1,773,440	208,640	40,867	2.3	19.59	165	5.09	43.34
McCroden 1	SW/4 3-25-3	2-6-57	29	26	3,025,280	2,712,320	119,338	3.94	4.40	143	10.06	11.23
McCroden 1-A	NE/4 9-25-3	2-5-57	27	16	2,816,640	1,669,120	113,367	4.02	6.80	165	8.89	15.04
McCroden 1-B	SW/4 4-25-3	11-21-57	33	18	3,442,560	1,877,760	88,676	2.58	4.72	89	10.58	19.36

Reserve figures are based on MCF/AF supplied by Gunsite Butte, Witness Val R. Reese.

TABULATION OF RESERVES ON PRODUCING WELLS
CONNECTED TO SOUTHERN UNION GAS COMPANY'S SYSTEM
TAPACITO PICTURED CLIFFS FIELD
RIO ARRIBA COUNTY, NEW MEXICO

Operator & Wells	Location	Connection Date	Sand Thickness	Micro Log Sand Thickness	Reserve/ 320 Acre Gross	Reserve/ 320 Acre Net M.L.	Cumm. Prod. 2-28-58	% Reserve Produced Gross	% Reserve Produced M.L.	Days Produced	% Gross 320 Acre Reserve Produced/ 365 Days	% M.L. 320 Acre Reserve Produced/ 365 Days
Honolulu Oil Corporation												
Jicarilla 1	SW/4 10-26-4	1-23-56	30	14	3,129,600	1,460,480	387,632	12.39	26.54	451	10.03	21.48
Jicarilla 2	NE/4 9-26-4	3-5-56	31	7	3,233,920	730,240	270,204	8.36	37.00	390	7.82	34.62
Jicarilla 3	SW/4 9-26-4	11-6-56	26	9	2,712,320	938,880	741,432	27.34	78.97	267	37.37	107.96
Jicarilla 4	SW/4 4-26-4	1-22-57	30	8	3,129,600	834,560	67,973	2.17	8.14	254	3.12	11.70
Jicarilla 6	SW/4 3-26-4	1-23-57	27	0	2,816,640	0	37,011	1.31	---	230	2.08	---
Southern Union Gas Company												
Jicarilla 1-A	SW/4 23-26-4	1-25-56	32	21	3,338,240	2,190,720	536,845	16.08	24.51	444	13.22	20.15
Jicarilla 2-A	SW/4 14-26-4	2-16-56	33	31	3,442,560	3,233,920	361,271	10.49	11.17	354	10.82	11.52
Jicarilla 4-A	SW/4 13-26-4	3-10-56	26	8	2,712,320	834,560	81,391	3.00	9.75	279	3.92	12.76
Jicarilla 5-A	NE/4 23-26-4	3-30-56	33	25	3,442,560	2,608,000	264,029	7.67	10.12	312	8.97	11.84
Jicarilla 2-C	SW/4 11-26-4	5-21-57	30	8	3,129,600	834,560	109,753	3.51	13.15	193	6.64	24.87
Jicarilla 1-D	NW/4 32-26-3	1-12-56	24	12	2,503,680	1,251,840	89,475	3.57	35.53	402	3.24	32.26
Jicarilla 2-D	SW/4 29-26-3	3-30-56	22	16	2,295,040	1,669,120	151,672	6.61	9.09	476	5.07	6.97
Jicarilla 3-D	SE/4 32-26-3	2-5-57	28	18	2,920,960	1,877,760	260,762	8.93	13.89	184	17.71	27.55
Jicarilla 5-D	SW/4 30-26-3	12-11-56	32	22	3,338,240	2,295,040	601,514	18.02	26.21	435	15.12	21.99
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McCroden 1-A	NE/4 9-25-3	2-5-57	27	16	2,816,640	1,669,120	113,367	4.02	6.80	165	8.89	15.04
McCroden 1-B	SW/4 4-25-3	11-21-57	33	18	3,442,560	1,877,760	88,676	2.58	4.72	89	10.58	19.36

Reserve figures are based on MCF/AF supplied by Gunsite Butte, Witness Val R. Reese.

SUGAR

TABULATION OF RESERVES ON PRODUCING WELLS CONNECTED TO SOUTHERN UNION GAS COMPANY'S SYSTEM
TAPACITO PICTURED CLIFFS FIELD, RIO ARRIBA COUNTY, NEW MEXICO

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Jicarilla 1-D	1,743,360	89,475	5.13	402	4.66
Jicarilla 2-D	2,324,480	151,672	6.53	476	5.01
Jicarilla 3-D	2,615,040	260,762	9.97	184	19.76
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Jicarilla 1-E	2,033,920	883,488	43.44	546	29.04
Jicarilla 2-E	3,341,440	212,308	6.35	250	9.27
Jicarilla 3-E	3,050,880	353,715	11.59	448	9.44
Jicarilla 4-E	2,905,600	827,174	28.47	559	18.59
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Jicarilla 2-H	290,560	40,867	1.41	165	3.12
McCroden 1	3,777,280	119,338	3.16	143	8.06
McCroden 1-A	2,324,480	113,367	4.88	165	10.79
McCroden 1-B	2,615,040	88,676	3.39	89	13.90

*Based on 454 MCF/AF

EQUATION OF DARCY'S LAW FOR RADIAL, HORIZONTAL GAS FLOW

$$q_{gw} = \frac{0.0447\pi\, K_g\, H\, 144\, (P_d^2 - P_w^2)}{1000\mu_g\, P_w \ln \frac{r_d}{r_w}}$$

OR

$$\ln \frac{r_d}{r_w} = \frac{0.0447\pi\, K_g\, H\, 144\, (P_d^2 - P_w^2)}{1000\mu_g\, P_w\, q_{gw}}$$

WHERE

q_{gw} = Rate of gas flow into well bore, cubic feet/day at bottom hole flowing conditions

K_g = Permeability to gas, millidarcys

H = Net pay thickness, feet

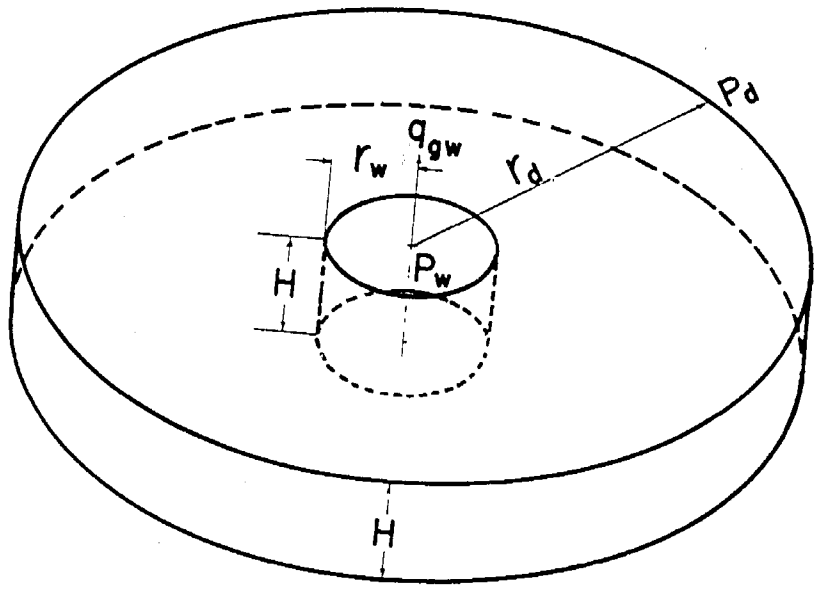
P_d = Pressure in reservoir at distance r_d from well bore, psia

P_w Pressure in well bore, psia

μ_g Viscosify of gas, centipoises

r_d = Drainage radius, feet

r_w = Effective well bore radius, feet

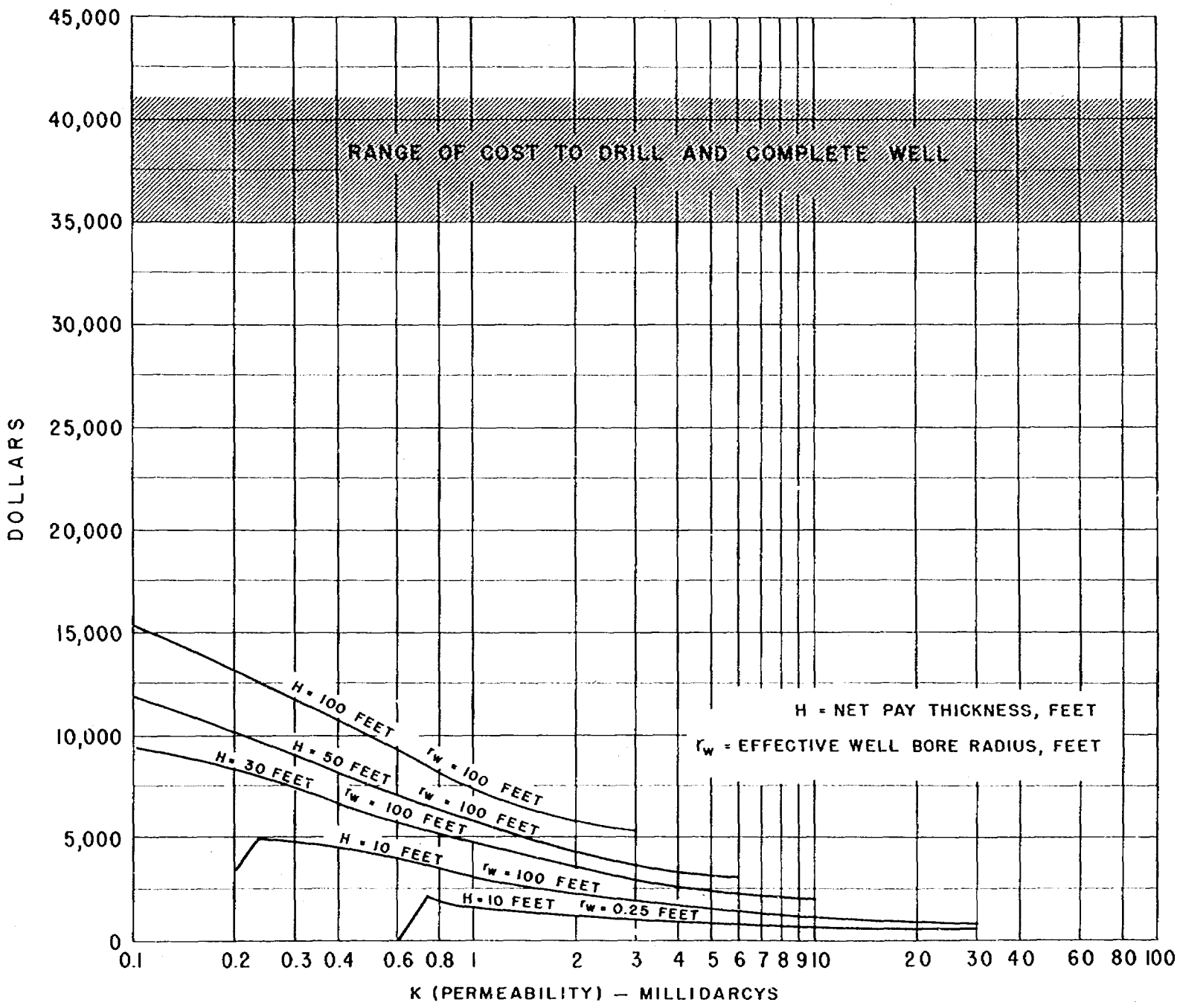


HUMBLE EXHIBIT NO. 1

INDICATED NET VALUE OF ADDITIONAL GAS RECOVERABLE UNDER 160 ACRE SPACING AS COMPARED TO 320 ACRE SPACING

TAPACITO PICTURED CLIFFS GAS POOL
RIO ARRIBA COUNTY, NEW MEXICO

BASED ON NET GAS PRICE OF 10.4 ¢/Mcf AFTER ROYALTY AND SEVERANCE TAXES

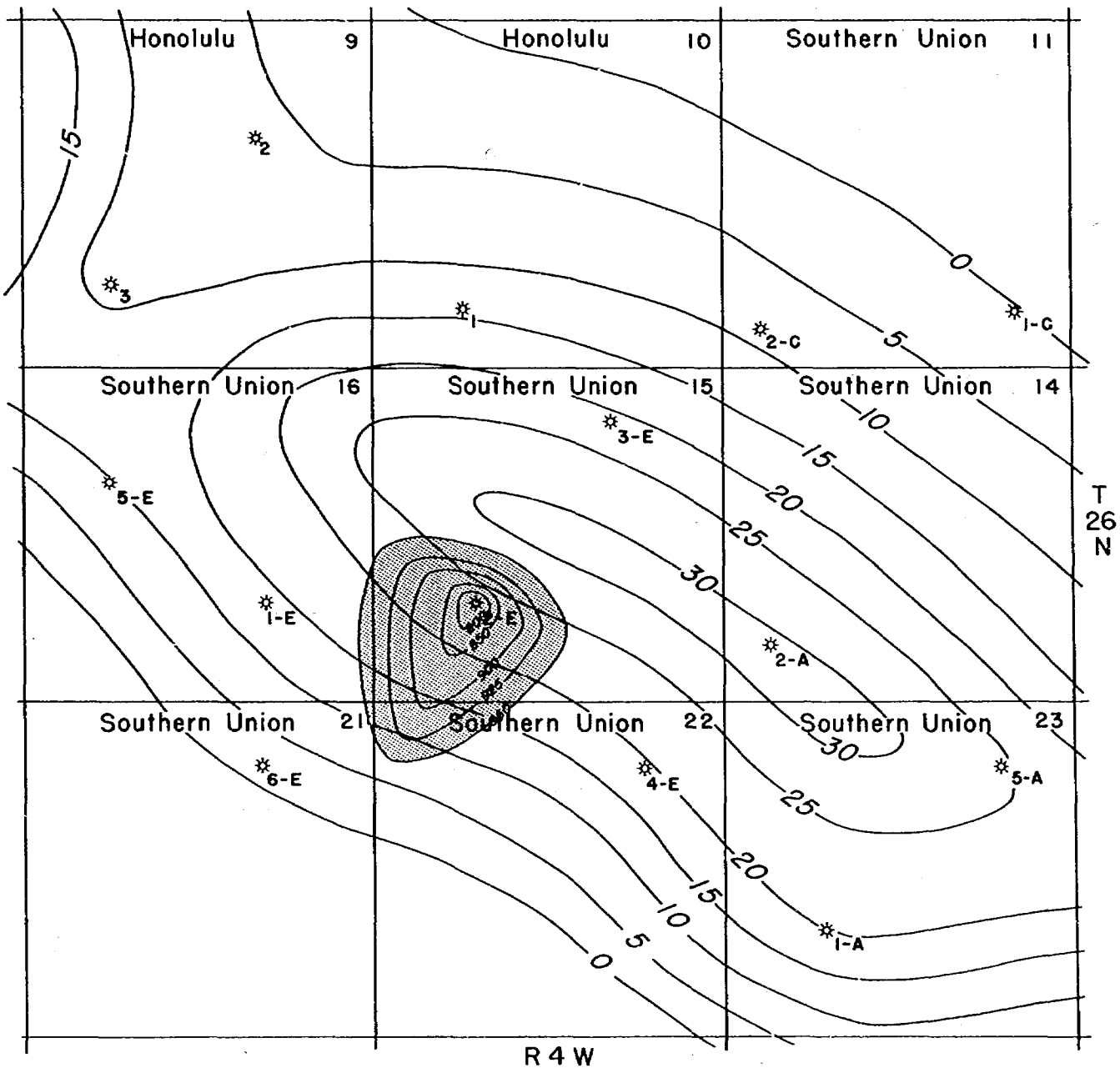


HUMBLE EXHIBIT NO. 2

ISOPACHOUS MAP OF MICROLOG POROSITY

TAPACITO PICTURED CLIFFS GAS POOL
SOUTHERN UNION JICARILLA "E" AREA

RIO ARRIBA CO., NEW MEXICO



CALCULATED PRESSURE DISTRIBUTION
IN VICINITY OF SOUTHERN UNION JICARILLA NO. 2-E

ASSUMING UNIFORM PERMEABILITY

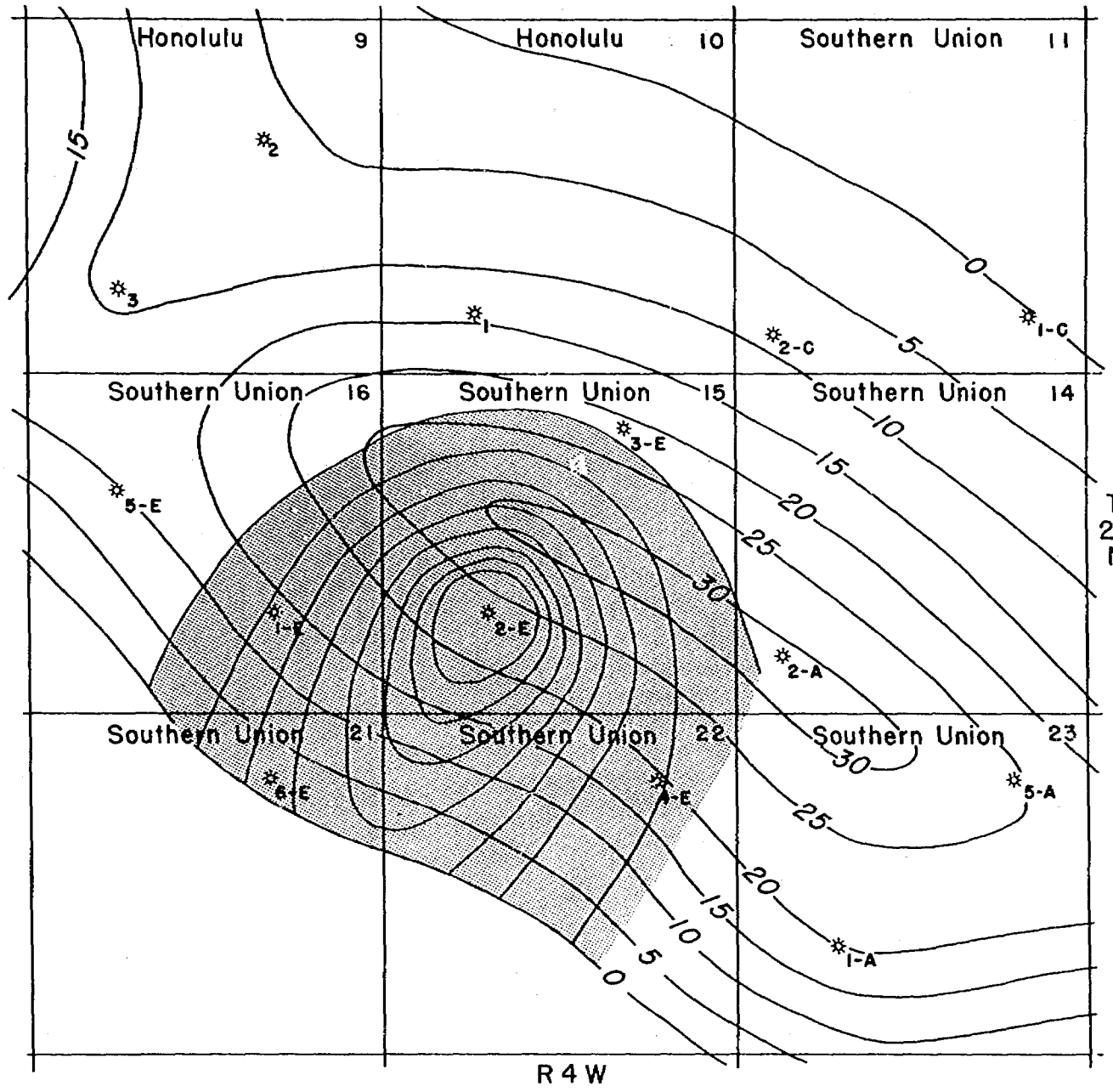
BASED ON EQUATION OF DARCY'S LAW FOR RADIAL, HORIZONTAL GAS FLOW

HUMBLE EXHIBIT NO. 3

ISOPACHOUS MAP OF MICROLOG POROSITY

TAPACITO PICTURED CLIFFS GAS POOL
SOUTHERN UNION JICARILLA "E" AREA

RIO ARRIBA CO., NEW MEXICO



CALCULATED PRESSURE DISTRIBUTION
IN VICINITY OF SOUTHERN UNION JICARILLA NO. 2-E

ASSUMING VARYING PERMEABILITY

BASED ON COMPUTER SOLUTION OF UNSTEADY STATE EQUATION FLUID FLOW

HUMBLE EXHIBIT NO. 4

-SUG-19-R-

DERIVATION OF FORMULA TO CALCULATE THE RELATIVE UNRECOVERABLE RESERVES AT DEPLETION FOR 160 AND 320 ACRE SPACING

The pressure distribution in a radial flow system will be given by the following for isothermal conditions

$$P^2 = \frac{(Pe^2 - Pw^2)\log r/rw}{\log re/rw} + Pw^2$$

or

$$P = \left[\frac{(Pe^2 - Pw^2)\log r/rw}{\log re/rw} + Pw^2\right]^{1/2}$$

Since the system is considered to be radial flow to the well, the pressure at any point on a concentric circle to the well bore would be described by inserting the radius of that circle in the above equation.

To evaluate the reserves under the area drained by the well, the reserves at each point in the reservoir can be described by the equation

$$\Delta R = Ph\phi\, \Delta A$$

$$\Delta A = 2\pi r \Delta r$$

Therefore by reducing this equation to its differential form and intergrating over the limits of the radius of drainage, the reserves in the area drained by the well can be described as a function of the pressure at the edge of drainage (Pe) and at the well (Pw). The integral is as follows

$$\int_0^R dR = \int_{rw}^{re} 2\pi h\phi r p\, dr$$

Since p is a function of r as stated in the equation from Muskat for steady state pressure distribution, the complete equation is as follows

$$\int_0^R dR = 2\pi h\phi \int_{rw}^{re} r\left[\frac{(Pe^2 - Pw^2)}{\log re/rw}\log r/rw + Pw^2\right]^{1/2} dr$$

The problem proposed was the two methods of draining the reservoir, the first by drilling wells on 160 acre spacing and the second by drilling wells on 320 acre spacing. The answer to this problem is what is the increase in recoverable reserves by use of the 160 acre spacing as opposed to the 320 acre spacing. Disregarding the assumption that the closer spacing might decrease the total time required to deplete the reservoir, we have made this study to show that at some time in the future, the reservoir pressures will be reduced by depletion to the point where the remaining reserves will be uneconomical to produce. This reservoir pressure will be approximately the same for both types of spacing as would be proved by the equation of deliverability given by Muskat as Equation (3), Section 11.3.

$$Q = \frac{\pi h k}{\mu} \frac{(P_e^2 - P_w^2)}{\log r_e/r_w}$$

$$\frac{Q160}{Q320} = 1 + \frac{\log \sqrt{2}}{\log r_e/r_w} = 1.0434 \qquad \left(\frac{r_e}{r_w}\right)_{160} = 2980$$

Therefore, the ratio of reserves remaining in the reservoir under each type of spacing could be calculated by the following equation

$$\frac{R_{160}}{R_{320}} = \frac{\int_{r_w}^{r_e} r \left[\frac{(P_e^2 - P_w^2)}{\log r_e/r_w} \log r/r_w + P_w^2\right]^{1/2} dr}{\int_{r_w}^{r_e\sqrt{2}} r \left[\frac{(P_e^2 - P_w^2)}{\log r_e\sqrt{2}/r_w} \log r/r_w + P_w^2\right]^{1/2} dr}$$

Solving this equation the solution is as follows

$$\frac{R_{160}}{R_{320}} = \left[\frac{\log \sqrt{2}\, r_e/r_w}{\log r_e/r_w}\right]^{1/2} e^{\frac{2P_w^2 \log\sqrt{2}}{P_e^2 - P_w^2}} \frac{\sum_0^\infty \frac{2^n \left[1 - \left(\frac{P_w}{P_e}\right)^{2n+3}\right]}{n!(2n+3)} \left[\frac{\log r_e/r_w}{1 - P_w^2/P_e^2}\right]^{n+3/2}}{\sum_0^\infty \frac{j^M \left[1 - \left(\frac{P_w}{P_e}\right)^{2n+3}\right]}{n!(2n+3)} \left[\frac{\log \sqrt{2}\, r_e/r_w}{1 - P_w^2/P_e^2}\right]^{n+3/2}}$$

NOMENCLATURE

P - pressure at a distance or from the well

Pe - pressure at the edge of drainage

Pw - pressure at the well bore

r - distance from the center of the well bore

re - radius of the area of drainage

rw - radius of the well bore

h - thickness of the producing zone

f - porosity of the producing zone

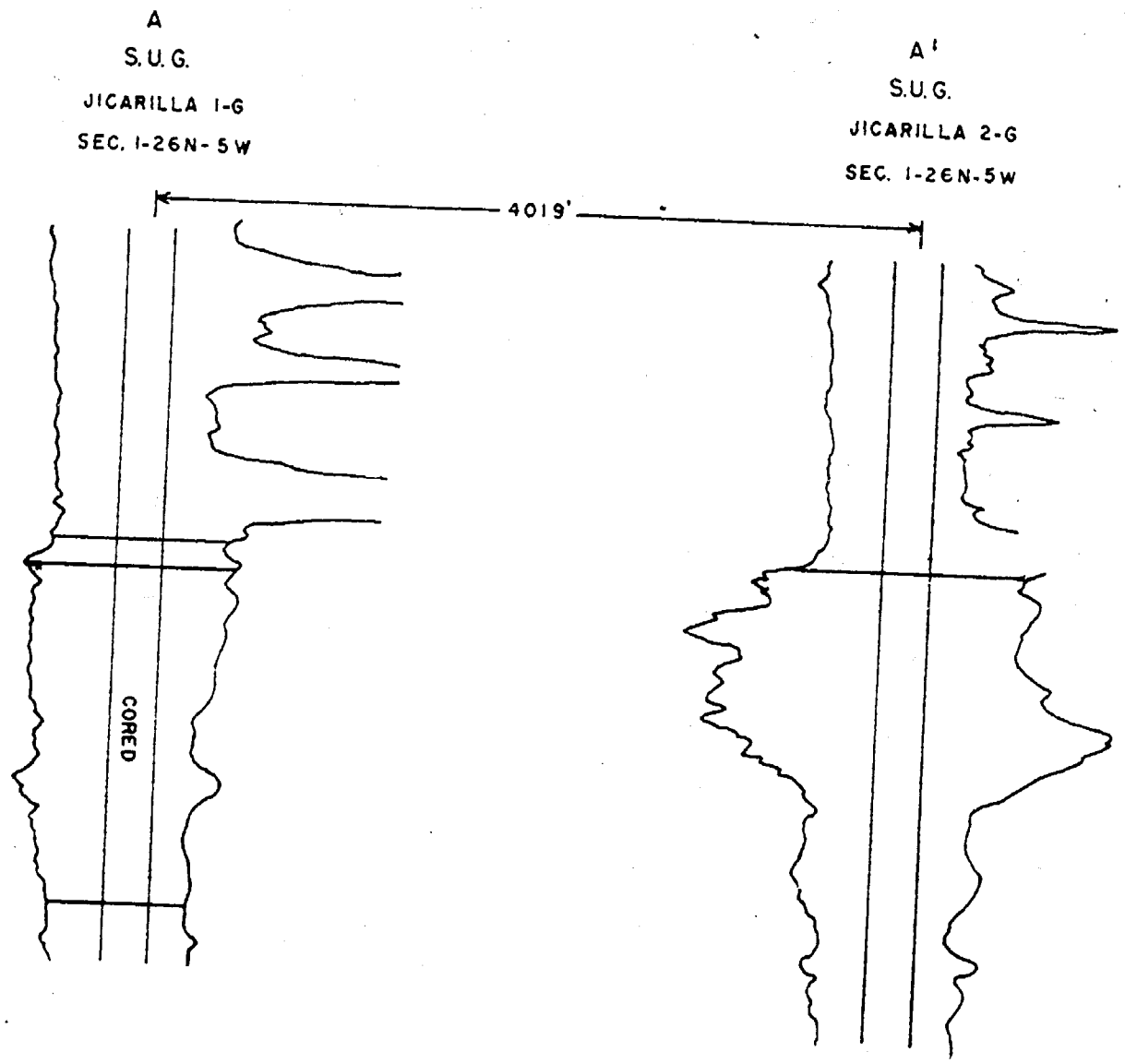
k - permeability

μ - viscosity

Subscript

160 - with reference to 160 acre spacing

320 - with reference to 320 acre spacing


A
S.U.G.
JICARILLA 1-G
SEC. 1-26N-5W
A'
S.U.G.
JICARILLA 2-G
SEC. 1-26N-5W
4019'
CORED
IP 20,005 MCF

SOG 4 R

B

S.U.G.

JICARILLA 2-H

SEC. 17-26N-4W

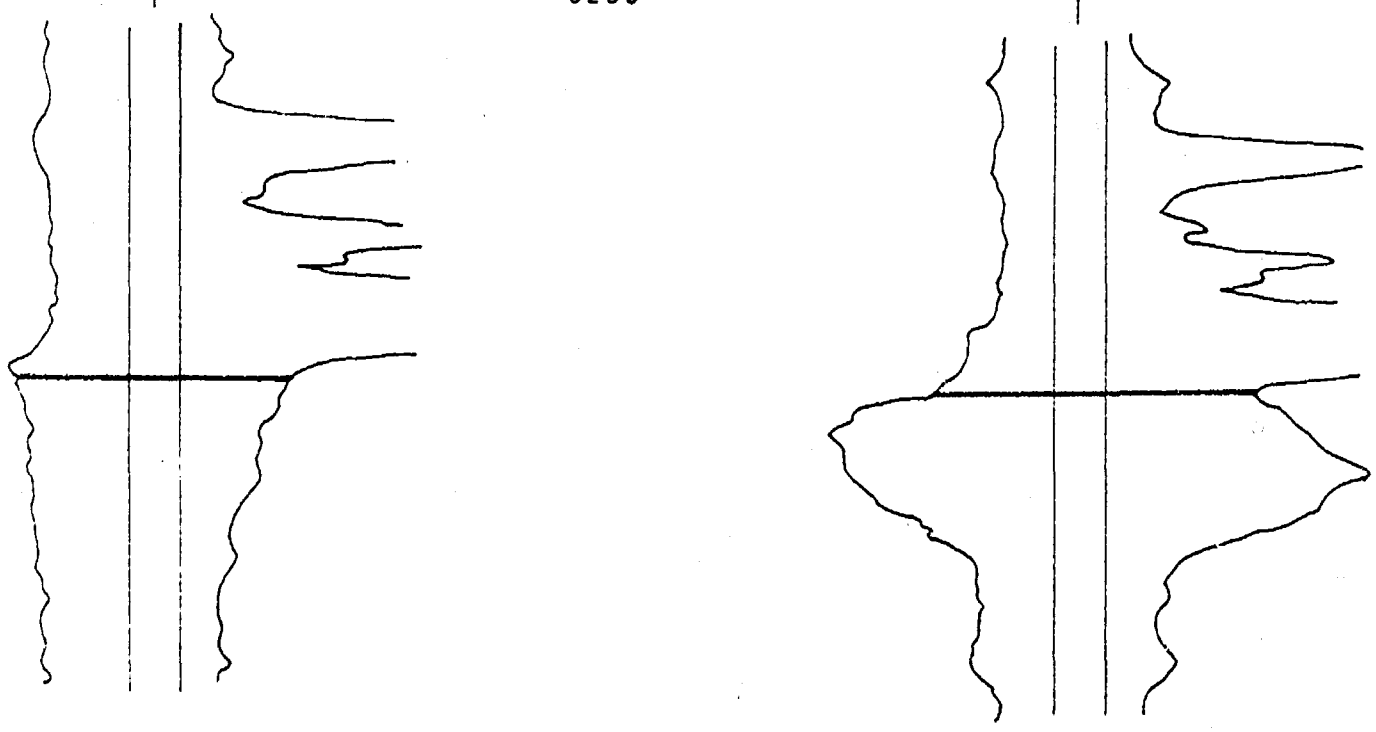
3235'

B'

S.U.G.

JICARILLA 5-E

SEC. 16-26N-4W



IP 943 MCF

IP 36,600 MCF

SUG 5 R

C

S.U.G.

JICARILLA 1-A

SEC. 23-26N-4W

S.U.G.

JICARILLA 1-B

SEC. 26-26N-4W

C'

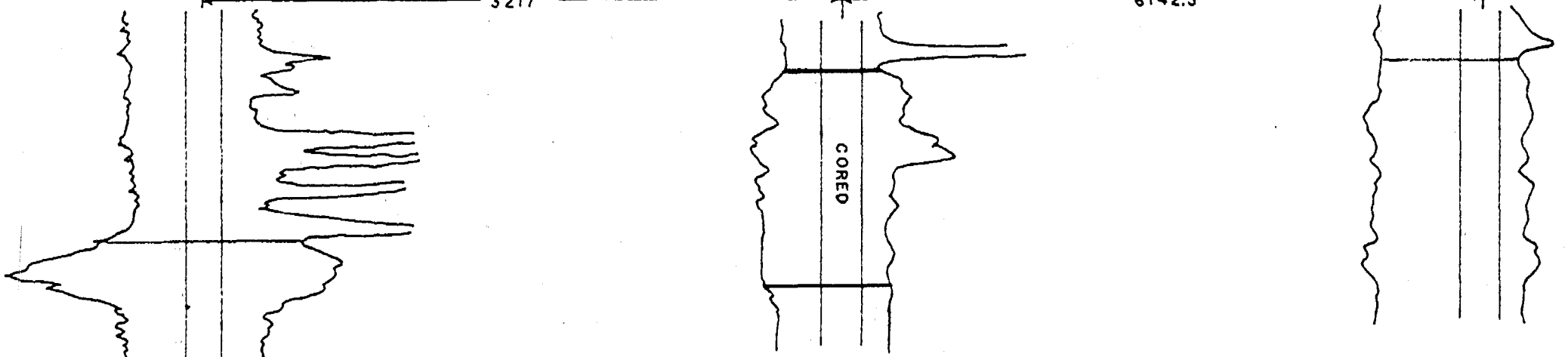
S.U.G.

JICARILLA 2-B

SEC. 25-26N-4W

3217'

6142.5'



IP 3989 MCF

IP T.S.T.M.

SUG 6R

D

S. U. G.

JICARILLA 1-E

SEC. 16-26N-4W

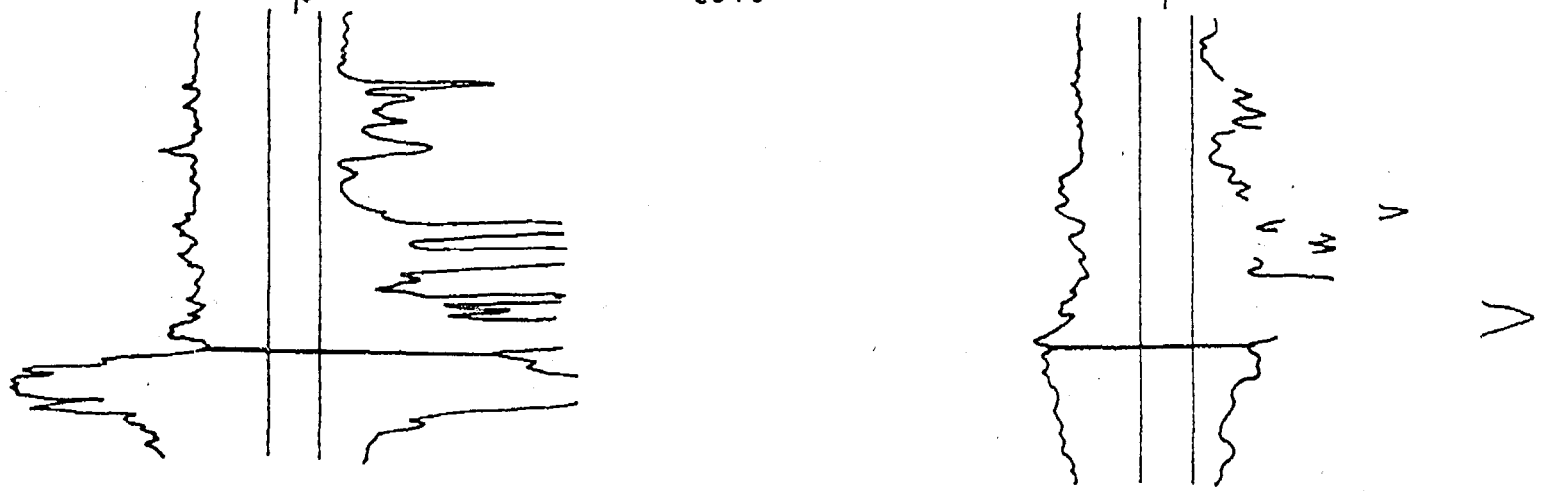
D'

S. U. G.

JICARILLA 6-E

SEC. 21-26N-4W

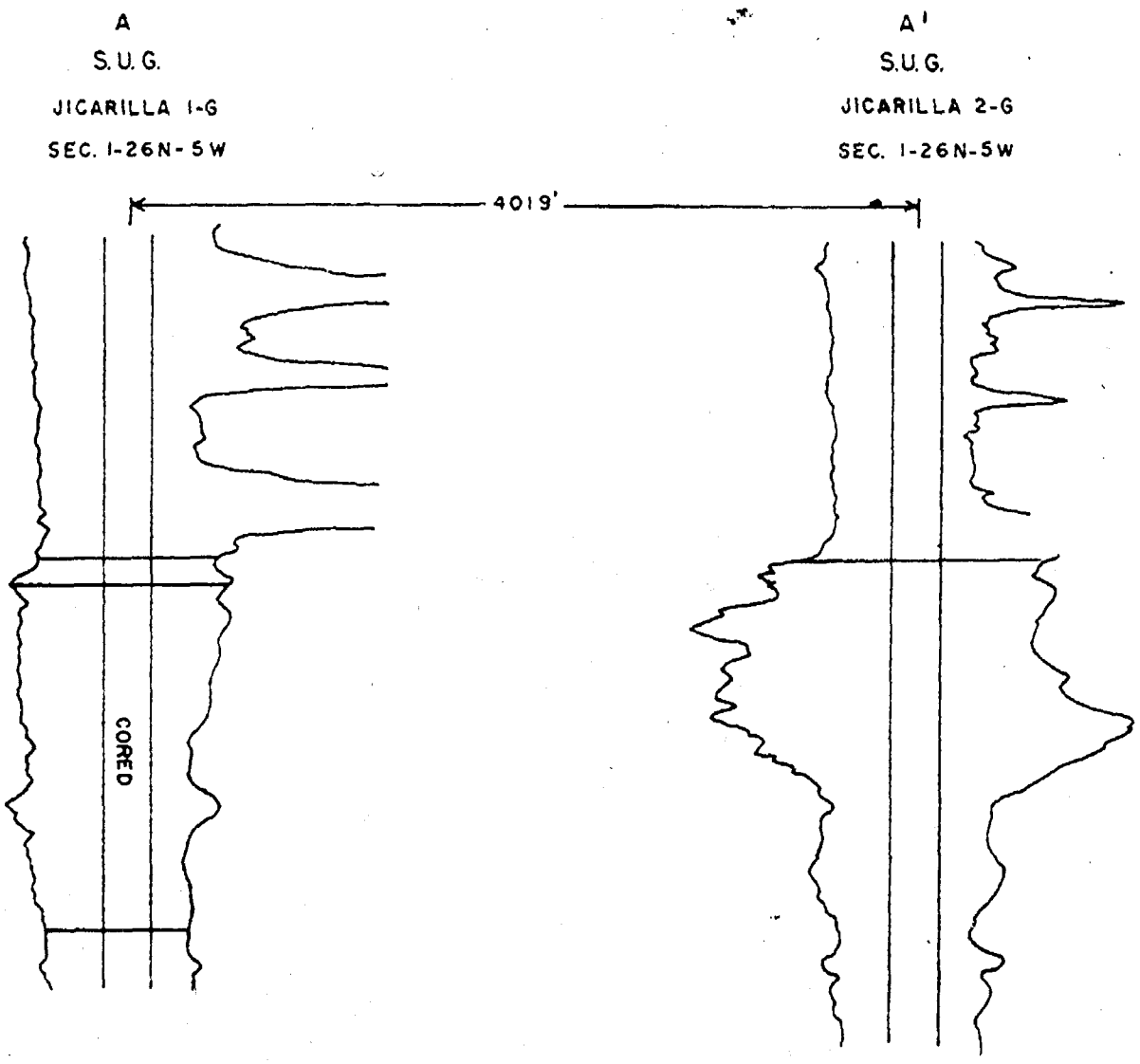
2540'



IP 3087 MCF

SUG 7 R

SO. U. EX 4


A
S. U. G.
JICARILLA 1-G
SEC. 1-26N-5W
A'
S.U.G.
JICARILLA 2-G
SEC. 1-26N-5W
4019'
CORED
IP 20,005 MCF

So. U. Ex 5.

B

S.U.G.

JICARILLA 2-H

SEC. 17-26N-4W

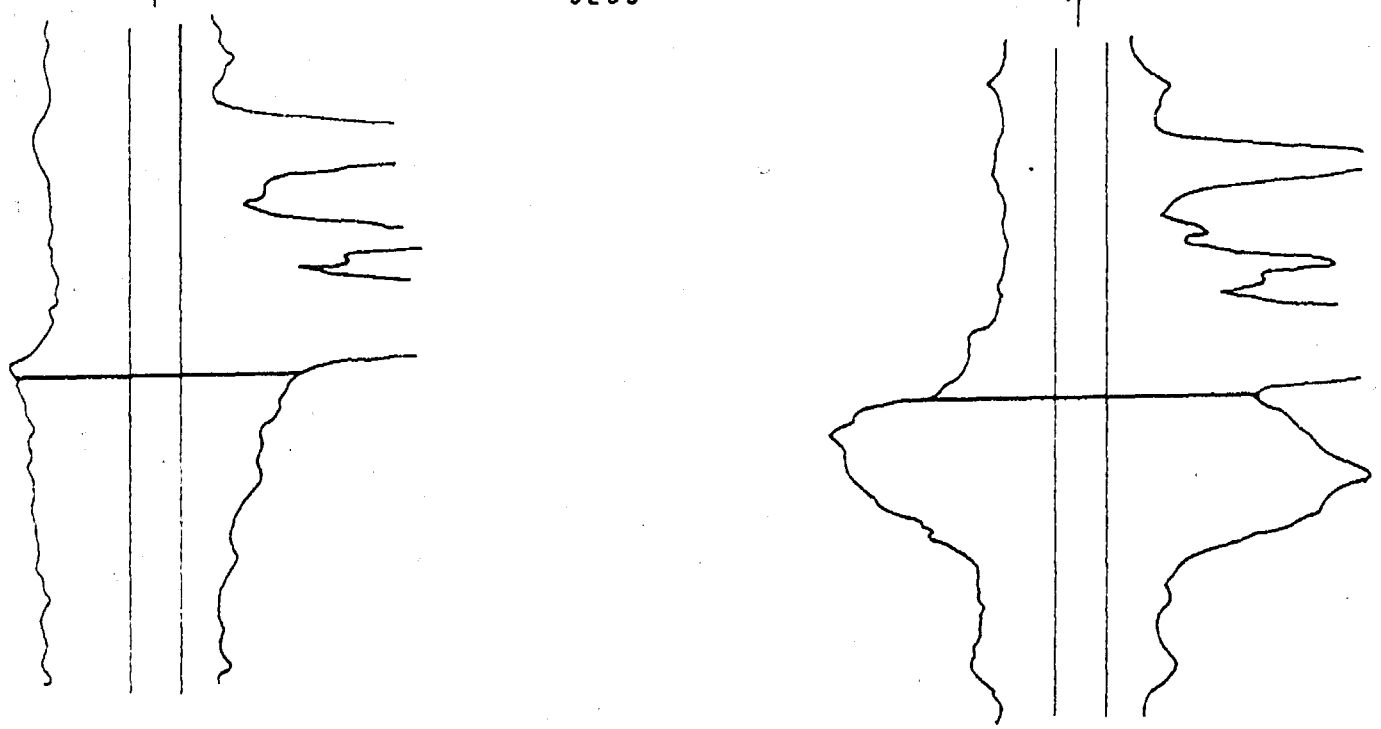
3235'

B'

S.U.G.

JICARILLA 5-E

SEC. 16-26N-4W



IP 943 MCF

IP 36,600 MCF

2

So. U. E. 6

C

S.U.G.

JICARILLA 1-A

SEC. 23-26N-4W

S.U.G.

JICARILLA 1-B

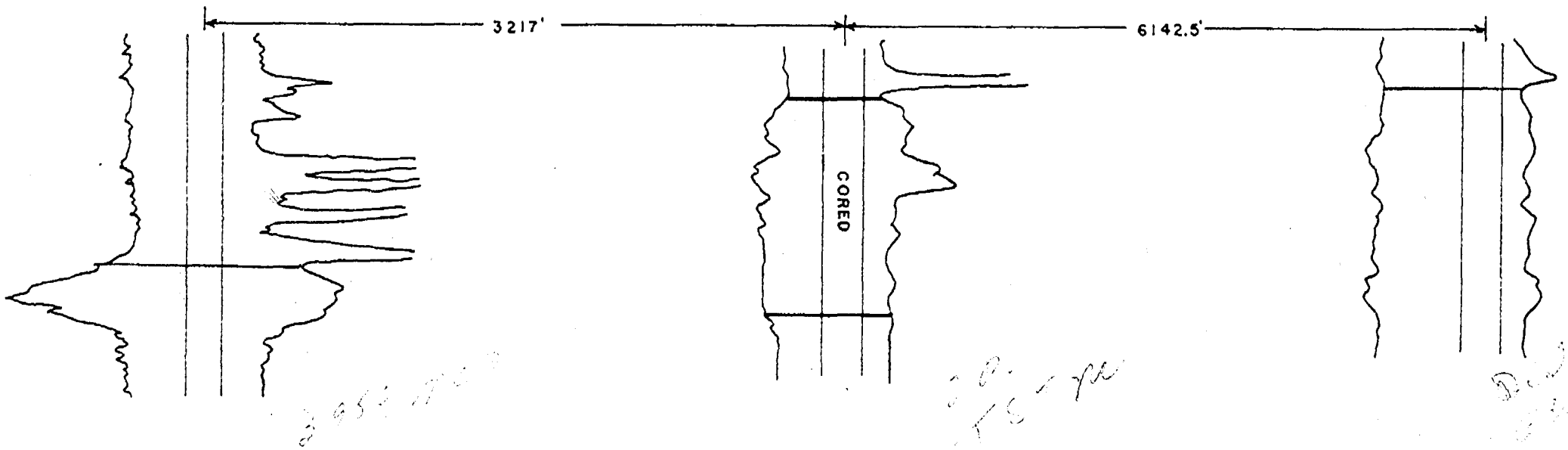
SEC. 26-26N-4W

C'

S.U.G.

JICARILLA 2-B

SEC. 25-26N-4W



IP 3989 MCF

IP T.S.T.M.

3

D

S. U. G.

JICARILLA 1-E

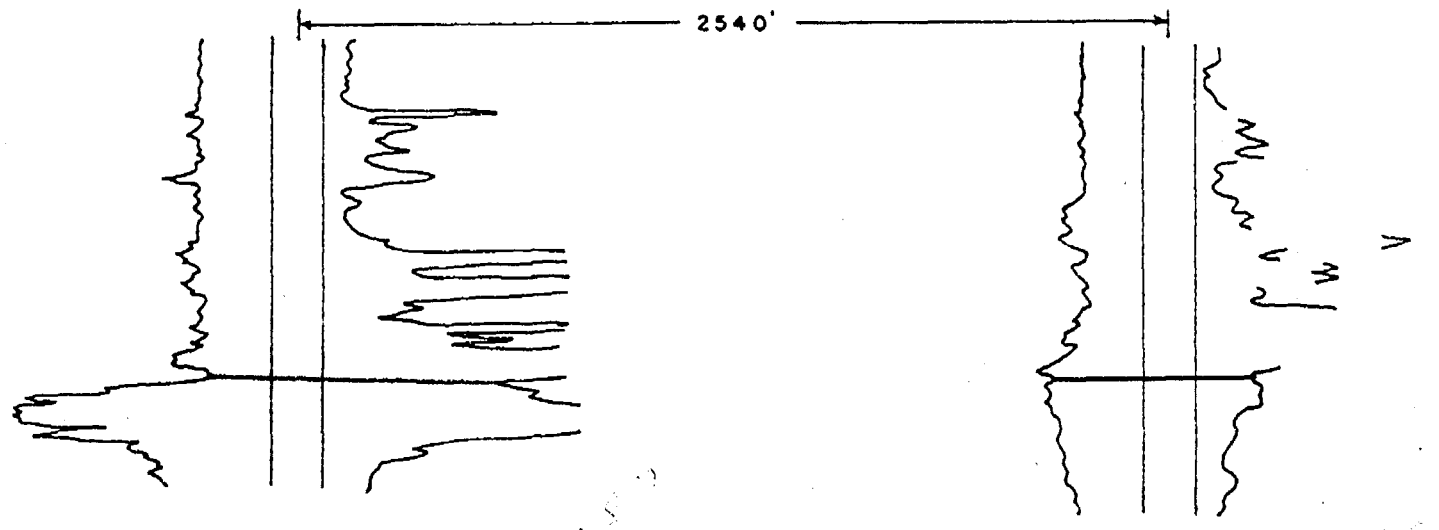
SEC. 16-26N-4W

D'

S. U. G.

JICARILLA 6-E

SEC. 21-26N-4W



IP 3087. MCF

FORM F-9

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 1 of 2
Well [illegible] Cores [illegible] File [illegible]
Field [illegible] Formation [illegible] Analysts [illegible]
County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]
Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION			PROBABLE PRODUCTION	REMARKS
				OIL		TOTAL WATER		
				% VOLUME	% PORE	% PORE		
1	3[illegible]4.5	0.0	8.1	0.0		70.4		
2	65.5	0.0	9.3	0.0		53.0		
3	66.5	0.0	[illegible].7	0.0		[illegible].0		
4	67.5	0.0	7.2	0.0		70.9		
5	68.5	0.00	7.3	0.0		75.2		
6	69.5	0.0	13.9	0.0		50.0		
7	70.5	0.0	[illegible].6	0.0		64.3		
8	71.5	0.0	[illegible].6	0.0		60.1		
9	72.5	0.0	[illegible].8	0.0		[illegible].2		
10	73.5	0.0	7.1	0.0		[illegible].5		
11	74.5	0.0	9.7	0.0		[illegible].9		
12	75.5	0.0	7.0	0.0		[illegible].4		
13	76.5	0.0	[illegible].5	0.0		[illegible].2		
14	77.5	0.0	7.1	0.0		71.8		
15	78.5	0.0	7.7	0.0		75.6		
16	79.5	0.0	7.0	0.0		[illegible].4		
17	80.5	0.0	[illegible].5	0.0		[illegible].2		
18	81.5	0.0	7.1	0.0		69.1		
19	82.5	0.0	6.3	0.0		[illegible].7		
20	83.5	0.0	7.1	0.0		[illegible].3		
21	84.5	0.0	7.3	0.0		67.5		
22	85.5	0.0	7.1	0.0		71.8		
23	86.5	0.0	7.6	0.0		73.8		
24	87.5	0.0	7.4	0.0		77.0		
25	88.5	0.0	8.2	0.0		58.7		
26	89.5	0.0	10.3	0.0		74.0		
27	90.5	0.0	7.5	0.0		77.4		
28	91.5	0.0	9.5	0.0		86.4		
29	92.5	0.0	8.5	0.0		76.5		
30	93.5	0.0	8.3	0.0		68.9		
31	94.5	0.0	9.3	0.0		79.6		
32	3[illegible]5.5	0.0	[illegible].1	[illegible].0		84.2		

NOTE:
(*) REFER TO ATTACHED LETTER.
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.
(2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representation, as to the productivity, proper operation, or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

ILLEGIBLE

FORM 1-C

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 2 of 2
Well [illegible] Cores File
Field Formation Analysts
County State Elevation Coregraph
Location Remarks

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION		PROBABLE PRODUCTION	REMARKS
				OIL		TOTAL WATER	
				% VOLUME	% PORE	% PORE	
33	3496.5	0.0	10.8	0.0		87.1	
34	97.5	0.0	9.8	0.0		81.6	
35	98.5	0.0	9.3	0.0		86.0	
36	99.5	0.0	9.1	0.0		85.8	
37	3500.5	0.0	10.5	0.0		83.9	
38	01.5	0.0	11.3	0.0		77.9	
39	02.5	0.0	10.5	0.0		85.6	
40	3502.5	0.0	20.3	0.0		22.2	

This section is essentially non-productive.

NOTE:
(*) REFER TO ATTACHED LETTER. (2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.

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ILLEGIBLE

FORM F-6

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 2 of 2
Well [illegible] Cores [illegible] File [illegible]
Field [illegible] Formation [illegible] Analysts [illegible]
County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]
Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION OIL % VOLUME	RESIDUAL SATURATION OIL % PORE	RESIDUAL SATURATION TOTAL WATER % PORE	PROBABLE PRODUCTION	REMARKS
41	3504.5	0.0	9.7	0.0		75.2		
42	05.5	0.0	6.4	0.0		82.0		
43	06.5	0.0	9.2	0.0		63.5		
44	07.5	0.0	9.0	0.0		74.5		
45	08.5	0.0	10.7	0.0		68.3		
46	09.5	0.0	8.8	0.0		78.0		
47	10.5	0.0	9.7	0.0		73.2		
48	11.5	0.0	9.6	0.0		78.0		
49	12.5	0.0	8.1	0.0		71.7		
50	13.5	0.0	10.5	0.0		74.2		
51	14.5	0.0	4.8	0.0		82.9		
52	15.5	0.0	7.9	0.0		81.0		
53	16.5	0.0	9.9	0.0		65.6		
54	17.5	0.0	10.5	0.0		74.4		
55	18.5	0.0	9.2	0.0		78.3		
56	19.5	0.0	10.2	0.0		74.5		
57	20.5	0.0	9.9	0.0		75.8		
58	21.5	0.0	12.5	0.0		67.3		
59	22.5	0.0	11.3	0.0		76.1		
60	23.5	0.0	10.1	0.0		78.3		
61	24.5	0.0	9.1	0.0		72.4		
62	25.5	0.0	8.2	0.0		79.2		
63	26.5	0.0	9.4	0.0		76.5		
64	27.5	0.0	8.1	0.0		73.5		
65	28.5	0.0	10.3	0.0		79.5		
66	29.5	0.0	6.9	0.0		74.0		
67	30.5	0.0	10.1	0.0		77.2		
68	31.5	0.0	9.0	0.0		74.5		
69	32.5	0.0	10.2	0.0		78.4		
70	33.5	0.0	7.9	12.7		64.6		
71	34.5	0.0	9.3	0.0		72.0		
72	3535.5	0.0	9.7	0.0		85.6		

NOTE:
(*) REFER TO ATTACHED LETTER.
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.
(2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.

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ILLEGIBLE

FORM P-3

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Company [illegible] Date Report [illegible] Page 2 of 2
Well [illegible] Cores [illegible] File [illegible]
Field [illegible] Formation [illegible] Analysts [illegible]
County [illegible] State [illegible] Elevation [illegible] Coregraph [illegible]
Location [illegible] Remarks [illegible]

CORE ANALYSIS RESULTS

(Figures in parentheses refer to footnote remarks)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION			PROBABLE PRODUCTION	REMARKS
				OIL		TOTAL WATER		
				% VOLUME	% PORE	% PORE		
73	3526.5	0.0	7.5	[illegible]	[illegible]	[illegible]		
74	37.5	0.0	12.0	5.0	[illegible]	[illegible]		
75	38.5	0.0	10.3	0.0	[illegible]	[illegible]		
76	39.5	0.0	6.6	12.6	[illegible]	[illegible]		
77	40.5	0.0	2.7	2.0	[illegible]	[illegible]		
78	3541.5	0.0	2.4	0.0	[illegible]	[illegible]		

The oil saturations noted are from a thinly coated [illegible].

This section is essentially non-productive.

NOTE:
(*) REFER TO ATTACHED LETTER. (2) OFF LOCATION ANALYSES—NO INTERPRETATION OF RESULTS.
(1) INCOMPLETE CORE RECOVERY—INTERPRETATION RESERVED.

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ILLEGIBLE

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

July 3, 1958

COPY

Southern Union Gas Company
Burt Building
Dallas 1, Texas

ATTENTION: A. S. Grenier

Re: Case No. 977 Rehearing

Gentlemen:

Reference is made to my letter of June 26th, 1958, wherein I advised your company that the Oil Conservation Commission of New Mexico took the position that a second rehearing by the same party in the same case was not contemplated nor authorized by Section 65-3-22, NMSA, 1953 Comp. This office is still of the same opinion as of this date.

However, even if it be assumed that a second rehearing is authorized, you may consider that the application has been refused inasmuch as ten days have elapsed since the date of filing of the application.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

ALP/WJC:bp

CC-Commissioner Morgan
Governor Mechem

ILLEGIBLE

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

June 26, 1958

COPY

Southern Union Gas Company
Burt Building
Dallas 1, Texas

ATTENTION: A. S. Grenier

Re: Case No. 977

Gentlemen:

This office is in receipt of a second application by your company for rehearing in Case No. 977.

One rehearing has already been granted and held in this case at your request. After considering all the evidence presented at the rehearing, the Commission entered Order No. R-794-E reaffirming its prior decision in Order No. R-794-C.

It is our position that the statute authorizing appeals from decisions of the Oil Conservation Commission of New Mexico (Section 65-3-22, NMSA, 1953 Comp.) does not contemplate nor authorize a second application for rehearing by the same party. The statute seems quite clear on this point when it provides that any party to a rehearing who is dissatisfied with the disposition of the case by the Commission may appeal to the District Court. Order No. R-794-E is a final and appealable order of this Commission and any further litigation of this order must be had in the District Court as provided by statute.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

ALP/WJC:bp

CC-Commissioner Morgan
Governor Mechem

ILLEGIBLE

AZTEC OIL & GAS COMPANY
920 MERCANTILE SECURITIES BUILDING
DALLAS 1, TEXAS

QUILMAN B. DAVIS
SECRETARY AND GENERAL ATTORNEY

June 24, 1958

AIR MAIL

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Re: Case No. 977
Order No. R-794-E

Gentlemen:

Southern Union Gas Company has delivered to us a copy of its application dated June 21, 1958 for a re-hearing in the subject case.

Aztec Oil & Gas Company concurs generally in the application and urges the Commission to grant applicant's request.

Yours very truly,

AZTEC OIL & GAS COMPANY

Q. B. Davis

General Attorney

QBD:NL

LEGAL DEPARTMENT

WILLIS L. LEA, JR.
GENERAL ATTORNEY

SOUTHERN UNION GAS COMPANY
BURT BUILDING
DALLAS 1, TEXAS

A. S. GRENIER
MILLARD F. CARR
JACK HERTZ
WM. S. JAMESON
JAS. R. WETHERBEE

June 21, 1958

Mr. A. L. Porter, Jr., Secretary
New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Dear Sir:

Enclosed herewith for filing with the Commission are four copies of an application of Southern Union Gas Company for a rehearing with respect to Order No. R-794-E, entered by the Commission in Case No. 977 on June 4, 1958.

Very truly yours,

A. S. Grenier

ASG:fg

Enc.

cc: Mr. Jason W. Kellahin
Kellahin & Fox
P. O. Box 1713
Santa Fe, New Mexico

BEFORE THE OIL CONSERVATION COMMISSION

OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF SOUTHERN UNION GAS COMPANY FOR AN ORDER CREATING THE TAPACITO-PICTURED CLIFFS GAS POOL IN RIO ARRIBA COUNTY, NEW MEXICO, AND FOR THE ESTABLISHMENT OF 320-ACRE DRILLING UNITS WITHIN SAID POOL	CASE NO. 977 Order No. R-794-E

APPLICATION FOR REHEARING

Comes now Southern Union Gas Company, Applicant in the above entitled and numbered case, and hereby applies for a rehearing therein. In support of such request for rehearing Applicant respectfully states that the New Mexico Oil Conservation Commission, in entering its Order No. R-794-E dated June 4, 1958, erred in the various respects hereinafter set forth.

1.

Said order is erroneous and contrary to the evidence in that the finding is made therein that the Tapacito-Pictured Cliffs Gas Pool cannot be efficiently drained and developed on a 320-acre spacing pattern, whereas the evidence introduced in this proceeding clearly indicates that throughout the great majority of the area of said pool, as presently defined by the Commission's orders, a well will efficiently drain a tract of substantially more than 320 acres.

The only portion of the pool in which it was indicated by the evidence that a well might not be able to drain efficiently at least as much as 320 acres consisted of a relatively minor area along the pool's outer fringes. It thus is apparent that the Commission, in making its finding that a well in the Tapacito Pool cannot efficiently drain a 320-acre tract, has failed to give consideration to conditions as they exist on the average in the pool as a whole and has given consideration instead only to conditions prevailing in the fringe areas just mentioned. The evidence introduced indicates that these fringe areas, besides representing only a small fraction of the pool's total acreage, contain an even smaller fraction of its total recoverable gas reserves. Indeed, the testimony is uncontradicted that hardly any of the wells drilled in the fringe area to date are capable of producing gas in sufficient quantities to pay for the cost of their drilling within a reasonable period of time. Plainly, such areas as these

cannot provide a valid criterion for an order covering and affecting the pool's entire area.

The statutes of New Mexico nowhere require or even intimate that the Commission, in establishing drilling units for a gas pool, may validly give consideration only to the least productive portions thereof. In no gas pool will all of the wells ever be wholly identical either with respect to their productive capacities or the areas which they can efficiently and economically drain. The characteristics of an average well in a pool plainly are entitled to greater consideration than those of the few wells with the very poorest productive capacity. It is respectfully submitted that Order No. R-794-E, insofar as it disregards the drainage capabilities of the wells constituting the overwhelming preponderance of the commercially productive wells in the pool, is arbitrary, capricious, unsupported by the evidence and, therefore, invalid and void.

2.

Said order is contrary to the evidence and invalid in that the finding is made therein that establishment of a 320-acre spacing pattern in the Tapacito-Pictured Cliffs Gas Pool would appreciably reduce the ultimate recovery from the pool as a result of the drilling of too few wells, thereby causing underground waste. The evidence introduced clearly indicates that, even though the Commission's finding might possibly be correct if applied only to the minor fringe areas where productive and drainage conditions are the poorest, 160-acre spacing will not produce materially more gas than 320-acre spacing in the case of the great majority of the pool's total area. In this connection, the evidence indicates that in the central and most representative portion of the pool, the additional volumes of gas which could be produced from the drilling of two wells instead of one on a 320-acre tract would be substantially less in value than the probable cost of drilling the second well.

As indicated by Section 65-3-14(b) of the New Mexico Statutes Annotated, 1953, prevention of reduced recoveries which might result from the drilling of too few wells is merely one of numerous factors which the Commission is required to consider in determining the proper spacing pattern for any particular pool. Also to be considered under the provisions of Section 65-3-14(b) are economic losses caused by the drilling of unnecessary wells,

the proper protection of correlative rights, and the avoidance of the augmentation of risks arising from the drilling of an excessive number of wells.

If 160-acre spacing is left in effect in the Tapacito-Pictured Cliffs Gas Pool, it is clear that tremendous economic loss will result since, as indicated by the testimony, at least 50 additional wells at a cost of $40,000 each, or a total cost of approximately $2,000,000, will be needed in order for the pool to be fully developed on a 160-acre spacing pattern. It is no answer to say that no operator is required to drill more than one well per 320 acres unless he so desires. If any of the operators offsetting him drills on a 160-acre basis, he is presented with but two choices: either he can refrain from drilling the extra well or wells needed to prevent his acreage from being drained, or he can stave off further injury to his correlative rights by drilling a well or wells which in most portions of the pool will not add sufficiently to his total ultimate recovery of gas to pay for the cost of their drilling. Plainly, also, if in self-protection the operator elects to follow the essentially wasteful course of doubling the number of wells on his land, a substantial augmentation of risks of the type contemplated by Section 65-3-14(b) will be unavoidable.

For the reasons stated above, it is respectfully submitted that, in addition to there being no proper foundation in the evidence for the Commission's finding that establishment of 320-acre spacing pattern would appreciably reduce the ultimate recovery of gas from the pool and thereby cause underground waste, the Commission's order establishing 160-acre spacing in the pool is invalid and void because it fails to give proper recognition to principles of conservation which the Commission by law is required to consider and observe.

3.

Said order is unsupported by the evidence in that the finding is made therein that the Tapacito-Pictured Cliffs Gas Pool can be efficiently and economically drained on a 160-acre spacing pattern and that such a pattern should be established for said pool. No evidence was adduced at the hearing tending to indicate that any significant portion of the pool could be efficiently and economically drained and developed on a 160-acre spacing pattern which could not also be so drained and developed on a 320-acre

basis. In the absence of such evidence, it is clear that the Commission's establishment of a 160-acre spacing pattern for the pool is arbitrary, invalid and void.

WHEREFORE, Applicant prays that this application for rehearing be granted for the purpose of reconsidering Order No. R-794-E, and that after notice as required by law and upon rehearing, the Commission modify such order so as to continue in effect the 320-acre spacing pattern for the Tapacito-Pictured Cliffs Gas Pool originally established by the Commission in Order No. R-794.

Respectfully submitted,

SOUTHERN UNION GAS COMPANY

By A. S. Grenier
A. S. Grenier, Attorney

June 21, 1958

AZTEC OIL & GAS COMPANY
920 MERCANTILE SECURITIES BUILDING
DALLAS 1, TEXAS

QUILMAN B. DAVIS
SECRETARY AND GENERAL ATTORNEY

April 4, 1958

Oil Conservation Commission
of the State of New Mexico
P. O. Box 871
Santa Fe, New Mexico

Re: Southern Union Gas Company's
Application for Re-Hearing
Tapacito-Pictured Cliffs Gas
Pool, Rio Arriba County, N.M.

Gentlemen:

Southern Union Gas Company has delivered to us a copy of its application to you for a re-hearing with respect to Order No. R-794-C which denied its application for a 320-acre spacing in the Tapacito-Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico.

We concur with the statements made in Southern Union's application and urge the Commission to grant the re-hearing as requested.

Yours very truly,

AZTEC OIL & GAS COMPANY

By Q. B. Davis
General Attorney

QBD:NL

cc - Southern Union Gas Company
Honolulu Oil Corporation
Humble Oil & Refining Company
Magnolia Petroleum Company
El Paso Natural Gas Company
Phillips Petroleum Company
Pacific Northwest Pipeline Corp.

El Paso Natural Gas Company

El Paso, Texas

April 7, 1958

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Jr.

Gentlemen:

El Paso Natural Gas Company is in receipt of a copy of an application filed by Southern Union Gas Company for rehearing with respect to the findings in Order R-794-C concerning spacing in the Tapacito Pictured Cliffs Gas Pool, Rio Arriba County, New Mexico.

In view of the short producing history and greater cost of Pictured Cliffs wells in this area, it seems that prudent operations would be best served by 320 acre spacing until additional production history and data indicates the necessity of closer spacing. This Company urges the Commission to grant the rehearing and reconsider the case.

Yours very truly,

Ben R. Howell

BEN R. HOWELL, Attorney

BRH:mgs

CC: Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas 1, Texas

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

April 11, 1958

COPY

Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas 1, Texas

Dear Mr. Grenier:

We enclose a copy of Order R-794-D, Order of the Commission for Rehearing, issued April 11, 1958, in Case 977.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

Duplicated Copies
Mailed 4-21-58 BP

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

April 11, 1958

COPY

Mr. Clarence Hinkle
Hervey, Dow & Hinkle
P.O. Box 547
Roswell, New Mexico

Dear Mr. Hinkle:

On behalf of your client, Humble Oil & Refining Company, we enclose two copies of Order R-794-D, Order of the Commission for Rehearing, issued April 11, 1958, in Case 977.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encls.

R-794-C Mailed to:

Jason Kellahin.
Leo. Hoy. Honolulu, Box 1391, Midland
Warren Mankin, Aztec Oil & Gas.
W. R. Johnston, Northwest Prod.
Guy Buell, Pan American
John Anderson, USGS
Norman Woodruff, El Paso
Clarence Hinkle,

3-21-58
EP

ION COMMISSION
OX 871
IEW MEXICO

1958

94-C issued March 19, 1958, by
Case 977, which was last heard

ruly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

March 20, 1958

COPY

Mr. A. S. Grenier
Southern Union Gas Company
Burt Building
Dallas 1, Texas

Dear Mr. Grenier:

We enclose a copy of Order R-794-C issued March 19, 1958, by the Oil Conservation Commission in Case 977, which was last heard on February 13, 1958.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp
Encl.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF THE STATE OF NEW
MEXICO FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 977
Order No. R-794-C

APPLICATION OF SOUTHERN UNION GAS
COMPANY FOR AN ORDER CREATING THE
TAPACITO-PICTURED CLIFFS POOL IN
RIO ARRIBA COUNTY, NEW MEXICO, AND
FOR THE TEMPORARY ESTABLISHMENT OF
320-ACRE DRILLING UNITS WITHIN SAID
POOL.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on November 16, 1955, January 16, 1957, March 14, 1957, August 15, 1957, and again on February 13, 1958, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission."

NOW, on this 19th day of March, 1958, the Commission, a quorum being present, having considered the testimony and the evidence adduced at said hearings and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the Tapacito-Pictured Cliffs Pool in Rio Arriba County, New Mexico, was created by Order No. R-794 dated April 18, 1956, and that, upon application of Southern Union Gas Company, temporary 320-acre spacing was established in said pool.

(3) That paragraph (10) of Order No. R-794 ordered Southern Union Gas Company to appear and show cause why temporary 320-acre spacing should be continued in the Tapacito-Pictured Cliffs Gas Pool beyond April 1, 1957, and that the Commission by Order No. 794-A dated April 5, 1957, and R-794-B dated September 9, 1957, extended the duration of Order No. R-794 until April 1, 1958, in order to allow Southern Union Gas Company more time in which to compile additional information concerning the Tapacito-Pictured Cliffs Gas Pool.

(4) That Southern Union Gas Company has failed to prove that the Tapacito-Pictured Cliffs Gas Pool can be efficiently drained on a 320-acre spacing pattern.

(5) That the Tapacito-Pictured Cliffs Gas Pool can be efficiently and economically drained on a 160-acre spacing pattern.

(6) That the drilling and spacing of wells in the Tapacito-Pictured Cliffs Gas Pool should be governed by Rule 104 of the Commission Rules and Regulations.

IT IS THEREFORE ORDERED:

1. That paragraph (1) of Order No. R-794 which created the Tapacito-Pictured Cliffs Gas Pool shall remain in full force and effect and that paragraphs (2) through (11) inclusive be and the same are hereby superseded.

2. That all wells hereafter projected to or completed in the Tapacito-Pictured Cliffs Gas Pool shall be drilled, spaced, and operated in conformance with Rule 104 of the Commission Rules and Regulations.

3. That this order shall become effective on April 1, 1958.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

A. L. PORTER, Jr., Member & Secretary

ir/

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF THE STATE OF NEW
MEXICO FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 977
Order No. R-794-D

APPLICATION OF SOUTHERN UNION GAS
COMPANY FOR AN ORDER CREATING THE
TAPACITO-PICTURED CLIFFS POOL IN
RIO ARRIBA COUNTY, NEW MEXICO, AND
FOR THE TEMPORARY ESTABLISHMENT OF
320-ACRE DRILLING UNITS WITHIN SAID
POOL.

ORDER OF THE COMMISSION FOR REHEARING

BY THE COMMISSION:

This cause came on for reconsideration upon the petition of Southern Union Gas Company and Humble Oil & Refining Company for a rehearing in Case No. 977, Order No. R-794-C, heretofore entered by the Commission on March 19, 1958.

NOW, on this 11th day of April, 1958, the Commission, a quorum being present, having considered the petitions for rehearing,

HEREBY ORDERS:

That the above-styled cause be reopened and that a rehearing be held at 9 o'clock a.m. on May 14, 1958, at Mabry Hall, State Capitol, Santa Fe, New Mexico.

IT IS FURTHER ORDERED:

That the testimony on rehearing shall be limited to new evidence upon the issues raised in the petitions for rehearing.

IT IS FURTHER ORDERED:

That Order No. R-794-C shall remain in full force and effect pending the issuance of any further order by the Commission in the above-styled cause; provided however, that all operators in the Tapacito-Pictured Cliffs Pool are hereby notified that inasmuch as this cause has been set for rehearing, the issues involved have not yet been finally determined by the Commission.

DONE at Santa Fe, New Mexico, on the day and year herein-above designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

A. L. PORTER, Jr., Member & Secretary

ir/

No. 14-58

DOCKET: REGULAR HEARING MAY 14, 1958

Oil Conservation Commission 9 a.m., Mabry Hall, State Capitol, Santa Fe, New Mexico

ALLOWABLE: (1) Consideration of the oil allowable for June, 1958.

(2) Consideration of the allowable production of gas for June, 1958, for six prorated pools in Lea County, New Mexico, and also presentation of purchasers' nominations for the six-month period beginning July 1, 1958; consideration of the allowable production of gas from six prorated pools in San Juan and Rio Arriba Counties, New Mexico, for June, 1958.

NEW CASES

CASE 977: In the matter of the rehearing in Case 977, Order No. R-794-D upon the petition of Southern Union Gas Company, et al., to reconsider its application for the establishment of 320-acre drilling units in the Tapacito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico.

CASE 1439: In the matter of the hearing called by the Oil Conservation Commission of New Mexico on its own motion to consider the institution of gas prorationing in the Tapacito-Pictured Cliffs Gas Pool in Rio Arriba County, New Mexico.

CASE 1440: Application of Skelly Oil Company for an order promulgating temporary special rules and regulations for the Otero-Gallup Oil Pool in Rio Arriba County, New Mexico. Applicant, in the above-styled cause, seeks an order promulgating temporary special rules and regulations for the Otero-Gallup Oil Pool in Rio Arriba County, New Mexico, to provide for 80-acre proration units, well spacing, and such other provisions as the Commission may deem necessary and proper.

CASE 1441: Application of Pubco Petroleum Corporation for an order promulgating temporary special rules and regulations for the Verde-Gallup Oil Pool in San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an order promulgating temporary special rules and regulations for the Verde-Gallup Oil Pool in San Juan County, New Mexico, to provide for 80-acre proration units, well spacing, and such other rules and regulations as the Commission may deem necessary and proper.

CASE 1442: Application of Pure Oil Company for the extension of the South Vacuum (Devonian) Pool and for the promulgation of special rules and regulations for said pool. Applicant, in the above-styled cause, seeks an order extending the horizontal limits of the South Vacuum (Devonian) Pool to include certain acreage in Township 18 South, Ranges 35 and 36 East; Township 19 South, Ranges 35 and 36 East, in Lea County, New Mexico. The applicant further proposes that

special rules and regulations for the South Vacuum (Devonian) Pool be promulgated incorporating, among other provisions, the establishment of 80-acre proration units in the South Vacuum (Devonian) Pool.

CASE 1443: In the matter of the hearing called by the Oil Conservation Commission of New Mexico on its own motion to revise Rule 112 (a) to permit administrative approval of oil over gas and oil-oil dual completions under certain circumstances.

CASE 1444: Southeastern New Mexico Nomenclature case calling for an order for the creation of new pools and the extension of existing pools in Lea, Eddy, Chaves and Roosevelt Counties, New Mexico.

(a) Create a new oil pool for San Andres production, designated as the West Crossroads-San Andres Pool, and described as:

TOWNSHIP 9 SOUTH, RANGE 35 EAST, NMPM
Section 21: SW/4

(b) Create a new gas pool for Pennsylvanian production, designated as the Halfway-Pennsylvanian Gas Pool, and described as:

TOWNSHIP 20 SOUTH, RANGE 32 EAST, NMPM
Section 25: SE/4

(c) Create a new gas pool in Eddy County, New Mexico, classified as a gas pool for Pennsylvanian production, designated as the Shugart-Pennsylvanian Gas Pool, and described as:

TOWNSHIP 18 SOUTH, RANGE 31 EAST, NMPM
Section 34: NE/4

(d) Extend the Atoka-Grayburg Pool to include:

TOWNSHIP 18 SOUTH, RANGE 26 EAST, NMPM
Section 13: SW/4 NE/4

(e) Extend the Caprock-Queen Pool to include:

TOWNSHIP 13 SOUTH, RANGE 32 EAST, NMPM
Section 29: W/2 NW/4

TOWNSHIP 14 SOUTH, RANGE 31 EAST, NMPM
Section 20: E/2 SE/4

(f) Extend the Jalmat Gas Pool to include:

TOWNSHIP 22 SOUTH, RANGE 35 EAST, NMPM
Section 11: SW/4

TOWNSHIP 24 SOUTH, RANGE 36 EAST, NMPM
Section 10: SW/4

(g) Extend the Justis-Drinkard Pool to include:

TOWNSHIP 25 SOUTH, RANGE 37 EAST, NMPM
Section 24: NW/4

(h) Extend the Justis-McKee Pool to include:

TOWNSHIP 25 SOUTH, RANGE 37 EAST, NMPM
Section 13: S/2 SE/4

(i) Extend the Pearl-Queen Pool to include:

TOWNSHIP 19 SOUTH, RANGE 35 EAST, NMPM
Section 28: S/2 & NE/4
Section 29: S/2
Section 30: SE/4
Section 31: NE/4

(j) Extend the Roberts Pool to include:

TOWNSHIP 17 SOUTH, RANGE 33 EAST, NMPM
Section 9: W/2 SW/4

(k) Extend the North Shugart-Grayburg Pool to include:

TOWNSHIP 18 SOUTH, RANGE 31 EAST, NMPM
Section 9: SE/4
Section 10: SW/4
Section 15: N/2 NW/4

(l) Contract the Forrest Pool by the deletion of the following described area:

TOWNSHIP 16 SOUTH, RANGE 29 EAST, NMPM
Section 35: NE/4, N/2 SE/4, and SE/4 SE/4

(m) Contract the Square Lake Pool by the deletion of the following described area:

TOWNSHIP 16 SOUTH, RANGE 29 EAST, NMPM
Section 35: SW/4 SE/4

(n) Extend the Square Lake Pool to include:

TOWNSHIP 16 SOUTH, RANGE 29 EAST, NMPM
Section 35: NE/4

(o) Extend the Townsend-Wolfcamp Pool to include:

TOWNSHIP 16 SOUTH, RANGE 36 EAST, NMPM
Section 6: Lots 1, 2, 7 & 8

(p) Extend the Warren-McKee Pool to include:

TOWNSHIP 20 SOUTH, RANGE 38 EAST, NMPM
Section 19: SW/4 NE/4

(q) Extend the Milnesand-Pennsylvanian Pool to include therein:

TOWNSHIP 8 SOUTH, RANGE 35 EAST, NMPM
Section 18: SE/4 & N/2 NW/4

CASE 1445: Northwestern New Mexico nomenclature case calling for an order for the extension of existing pools in San Juan and Rio Arriba Counties, New Mexico.

(a) Extend the Aztec-Pictured Cliffs Pool to include:

TOWNSHIP 29 NORTH, RANGE 9 WEST, NMPM
Section 35: All

TOWNSHIP 29 NORTH, RANGE 10 WEST, NMPM
Section 32: N/2
Section 33: NW/4

TOWNSHIP 30 NORTH, RANGE 10 WEST, NMPM
Section 7: S/2

(b) Extend the Blanco-Pictured Cliffs Pool to include:

TOWNSHIP 29 NORTH, RANGE 9 WEST, NMPM
Section 4: S/2
Section 9: All
Section 10: NW/4
Section 15: NW/4
Section 16: N/2
Section 17: All

TOWNSHIP 30 NORTH, RANGE 9 WEST, NMPM
Section 31: SE/4

(c) Extend the Gavilan-Pictured Cliffs Pool to include:

TOWNSHIP 24 NORTH, RANGE 1 WEST, NMPM
Section 6: NW/4

TOWNSHIP 24 NORTH, RANGE 2 WEST, NMPM
Section 1: E/2

TOWNSHIP 25 NORTH, RANGE 1 WEST, NMPM
Section 19: W/2

TOWNSHIP 25 NORTH, RANGE 2 WEST, NMPM
Section 3: SW/4
Section 4: SE/4
Section 10: W/2 & NE/4
Section 13: S/2
Section 36: E/2

(d) Extend the South Blanco-Pictured Cliffs Pool to Include:

TOWNSHIP 24 NORTH, RANGE 2 WEST, NMPM
Section 8: N/2
Section 9: All
Section 14: SE/4
Section 22: S/2
Section 23: All
Section 24: SW/4
Section 25: N/2
Section 27: NW/4

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Section 3: W/2

TOWNSHIP 25 NORTH, RANGE 3 WEST, NMPM
Section 21: S/2
Section 22: W/2

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 34: S/2

TOWNSHIP 25 NORTH, RANGE 6 WEST, NMPM
Section 4: All
Section 9: NW/4

TOWNSHIP 26 NORTH, RANGE 6 WEST, NMPM
Section 31: S/2

TOWNSHIP 27 NORTH, RANGE 8 WEST, NMPM
Section 32: N/2

TOWNSHIP 28 NORTH, RANGE 8 WEST, NMPM
Section 23: S/2
Section 26: N/2

(e) Extend the Tapacito-Pictured Cliffs Pool to include:

TOWNSHIP 25 NORTH, RANGE 3 WEST, NMPM
Section 1: SW/4
Section 2: S/2

(f) Extend the West Kutz-Pictured Cliffs Pool to include:

TOWNSHIP 27 NORTH, RANGE 12 WEST, NMPM
Section 5: SE/4
Section 8: NE/4

(g) Extend the Otero Graneros-Dakota Pool to include:

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 10: SW/4
Section 15: NW/4

(h) Extend the Bisti-Lower Gallup Oil Pool to include:

TOWNSHIP 24 NORTH, RANGE 9 WEST, NMPM
Section 9: SW/4
Section 17: N/2

TOWNSHIP 24 NORTH, RANGE 10 WEST, NMPM
Section 4: S/2
Section 9: NE/4
Section 12: S/2
Section 13: NE/4

TOWNSHIP 25 NORTH, RANGE 12 WEST, NMPM
Section 10: NE/4

TOWNSHIP 26 NORTH, RANGE 13 WEST, NMPM
Section 20: SW/4

(i) Extend the Verde Gallup Oil Pool to include:

TOWNSHIP 31 NORTH, RANGE 15 WEST, NMPM

Section 20: SW/4
Section 31: NW/4

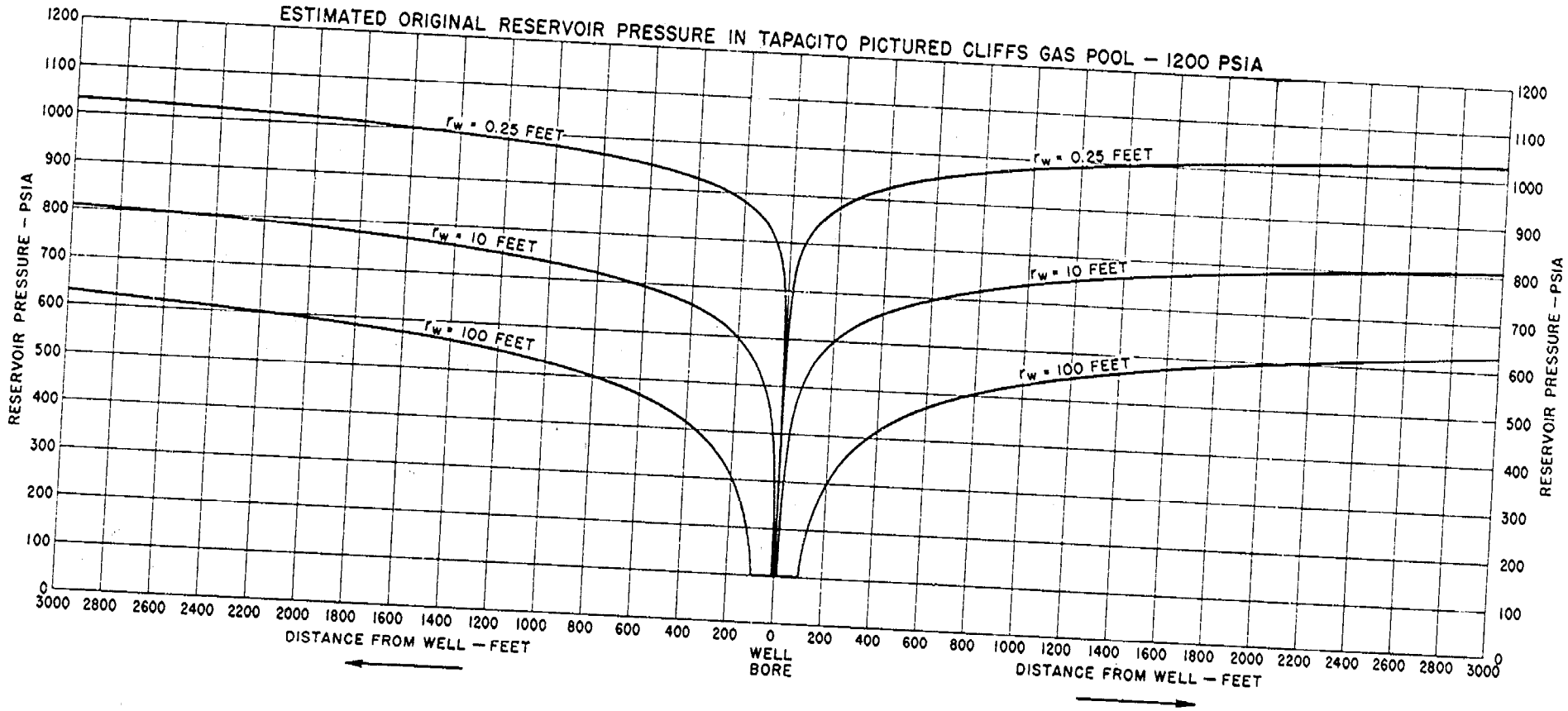
ga

For Information only
Not an Exhibit.

PRESSURE – DRAINAGE RADIUS PROFILE FOR EXAMPLE WELL AT ECONOMIC LIMIT

CONDITIONS:

ECONOMIC LIMIT ON GAS PRODUCTION	= 100 SMCF/D AT 100 PSIA BOTTOM HOLE FLOWING PRESSURE
NET PAY THICKNESS	= 10 FEET
PERMEABILITY TO GAS	= 1 MILLIDARCY
GAS VISCOSITY	= 0.014 CENTIPOISES
EFFECTIVE WELL BORE RADIUS	= r_w, FEET



HUMBLE EXHIBIT NO. ____

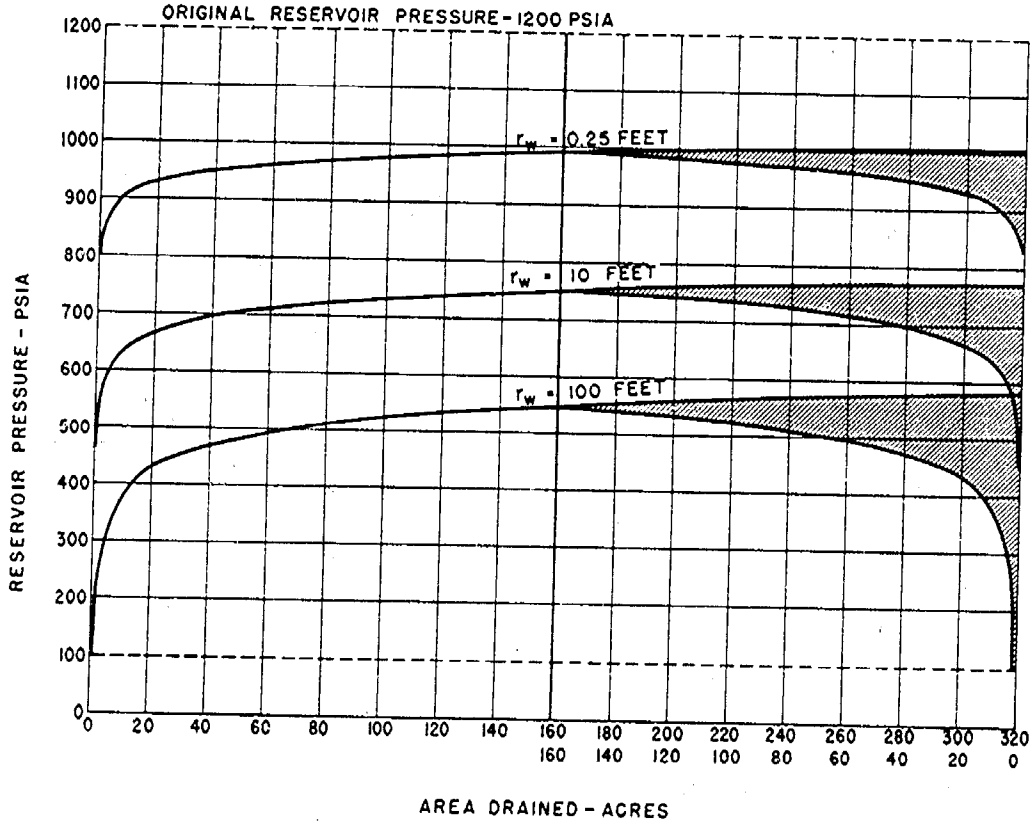
From Hearing - Humble

PRESSURE – DRAINAGE AREA PROFILE FOR EXAMPLE WELL AT ECONOMIC LIMIT

TO ILLUSTRATE QUANTITY OF GAS RECOVERABLE WITH 160 AND 320 ACRE SPACING

CONDITIONS:

ECONOMIC LIMIT ON GAS PRODUCTION	= 100 SMCF/D AT 100 PSIA BOTTOM HOLE FLOWING PRESSURE
NET PAY THICKNESS	= 10 FEET
PERMEABILITY TO GAS	= 1 MILLIDARCY
GAS VISCOSITY	= 0.014 CENTIPOISES
EFFECTIVE WELL BORE RADIUS	= r_w, FEET



RECOVERY FACTOR - FRACTION OF GAS IN PLACE	160 ACRES	320 ACRES	DIFFERENCE
r_w = 0.25	0.2361	0.2182	0.0179
r_w = 100	0.6745	0.6398	0.0347

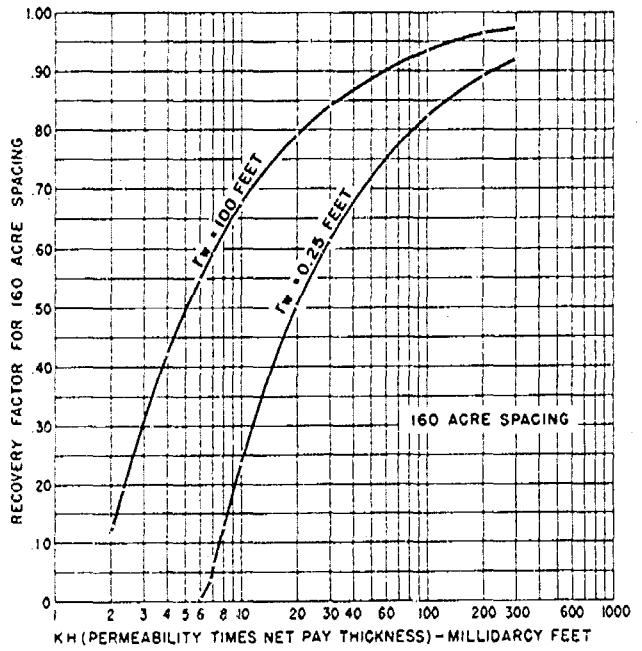
LEGEND

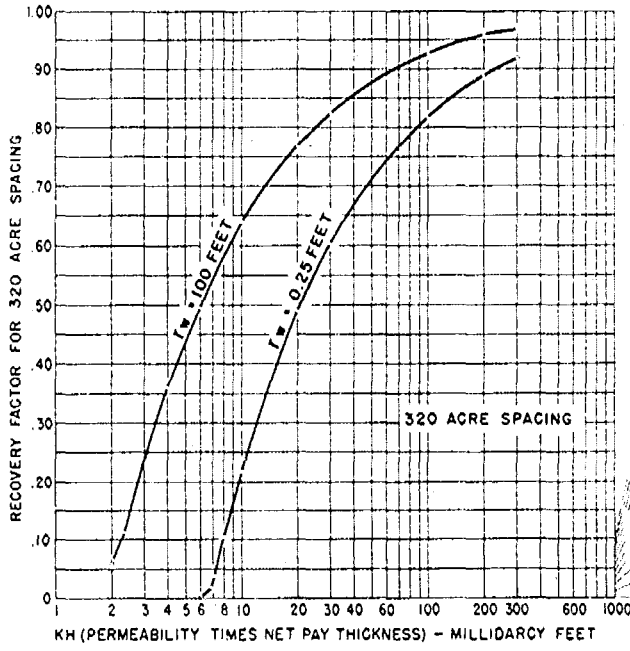
▨ INDICATION OF ADDITIONAL QUANTITY OF GAS RECOVERABLE WITH 160 ACRE SPACING AS COMPARED TO 320 ACRE SPACING.

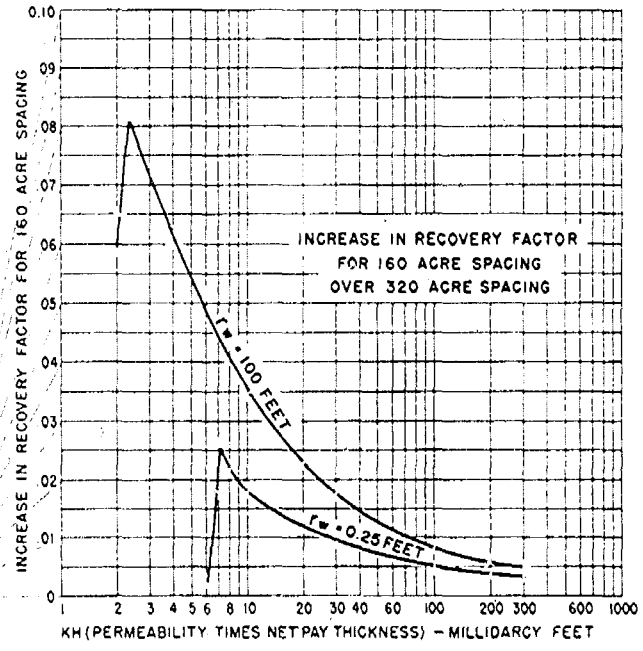
HUMBLE EXHIBIT NO. ____

RELATIONSHIP OF RECOVERY FACTOR TO FUNCTION OF PERMEABILITY TIMES NET PAY THICKNESS

r_w = EFFECTIVE WELL BORE RADIUS, FEET







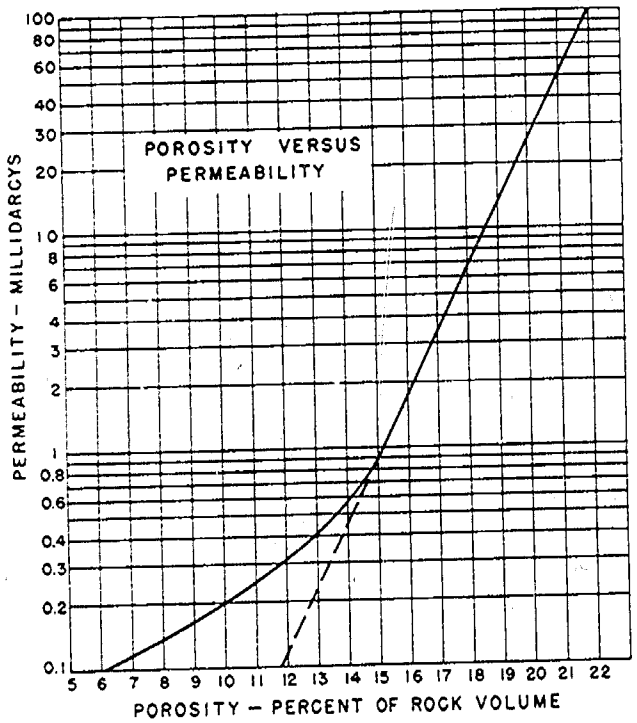
HUMBLE EXHIBIT NO. ____

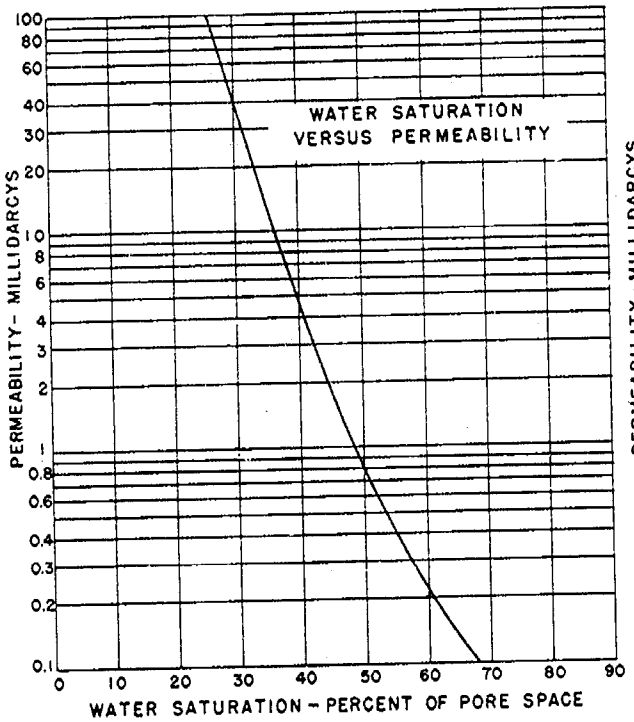
Dawn Hocking - Humble

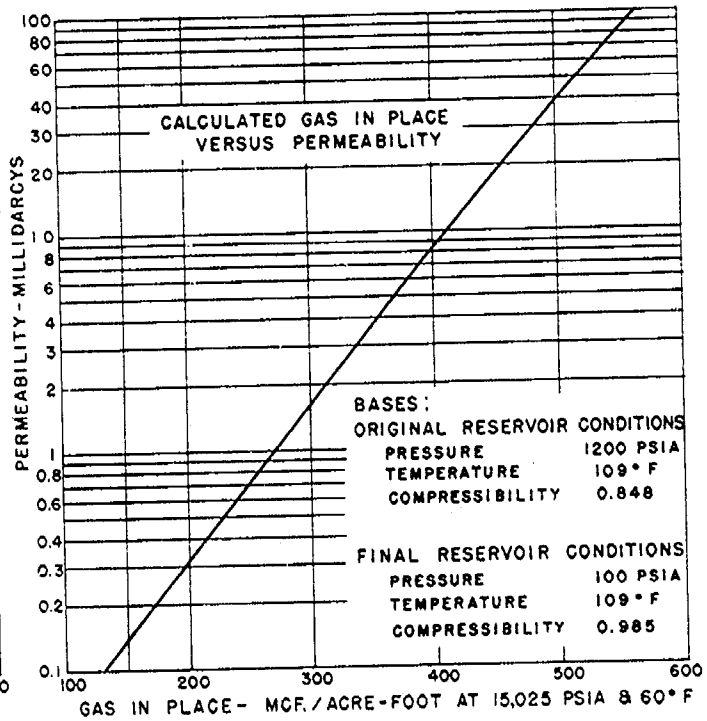
RELATIONSHIP OF POROSITY, WATER SATURATION AND GAS IN PLACE TO FORMATION PERMEABILITY

TAPACITO PICTURED CLIFFS GAS POOL

RIO ARRIBA COUNTY, NEW MEXICO







HUMBLE EXHIBIT NO. ____

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May 22, 1958

Dear Bobbie:

Would you please send us the old case 977 as soon as you can.

Thanks

ADA

5-23-58.
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from 2-13-58
hearing.
BP

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R-791-E

6-8-58
BP

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF THE STATE OF NEW
MEXICO FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 977
Order No. R-794-E

APPLICATION OF SOUTHERN UNION GAS
COMPANY FOR AN ORDER CREATING THE
TAPACITO-PICTURED CLIFFS POOL IN
RIO ARRIBA COUNTY, NEW MEXICO, AND
FOR THE ESTABLISHMENT OF 320-ACRE
DRILLING UNITS WITHIN SAID POOL.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on November 16, 1955, January 16, 1957, March 14, 1957, August 15, 1957, and again on February 13, 1958, at Santa Fe, New Mexico, before the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission," and this cause came on for rehearing before the Commission at Santa Fe, New Mexico, on May 14, 1958, upon the petition of Southern Union Gas Company and Humble Oil and Refining Company.

NOW, on this 4th day of June, 1958, the Commission, a quorum being present, having considered the testimony and evidence adduced at all of said hearings, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the petitioners, Southern Union Gas Company and Humble Oil and Refining Company, seek the establishment of 320-acre spacing in the Tapacito-Pictured Cliffs Pool in Rio Arriba County, New Mexico.

(3) That the Tapacito-Pictured Cliffs Pool cannot be efficiently drained and developed on a 320-acre spacing pattern, and that the establishment of a 320-acre spacing pattern in said pool would appreciably reduce the ultimate recovery from the pool as a result of the drilling of too few wells thereby causing underground waste.

(4) That the Tapacito-Pictured Cliffs Pool can be efficiently and economically drained and developed on a 160-acre spacing pattern, and that such a pattern should be established for said pool.

(5) That the drilling and spacing of wells in the Tapacito-Pictured Cliffs Pool should be governed by Rule 104 of the Commission Rules and Regulations.

(6) That paragraph (1) of Order No. R-794 which created the Tapacito-Pictured Cliffs Pool should remain in full force and effect but that paragraphs (2) through (11) inclusive of Order No. R-794 should be superseded hereby, and further that Order No. R-794-A, Order No. R-794-B, and Order No. R-794-C should also be superseded hereby.

IT IS THEREFORE ORDERED:

(1) That a 160-acre spacing pattern be and the same is hereby established for the Tapacito-Pictured Cliffs Pool in Rio Arriba County, New Mexico.

(2) That the drilling and spacing of wells in the Tapacito-Pictured Cliffs Pool shall be governed by Rule 104 of the Rules and Regulations of the Oil Conservation Commission of New Mexico.

(3) That Order No. R-794, Order No. R-794-A, Order No. R-794-B, and Order No. R-794-C be and the same are hereby superseded with the exception that paragraph (1) of Order No. R-794 shall remain in full force and effect.

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

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

EDWIN L. MECHEM, Chairman

MURRAY E. MORGAN, Member

A. L. PORTER, Jr., Member & Secretary

ir/