CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS
November 21, 1951

Lowry, et al.
Box 967
Farmington, New Mexico

Attention: Mr. Frank O. Grey

Subject: Core Analysis
Federal 4-13-132 Well
Wildcat
Rio Arriba County, New Mexico

Gentlemen:

Diamond conventional cores from the subject well in the Tocito formation have been sampled and quick-frozen by a representative of Lowry, et al. and analyzed in our Farmington, New Mexico laboratory. Results of analysis are presented in tabular and graphical form on the attached Coregraph. Water base mud was used as the drilling fluid.

Shale and sandy shale analyzed from 6649 to 6675 feet are interpreted to be nonproductive due to low permeability.

Sand analyzed from 6675 to 6692 feet is interpreted to be essentially oil productive. The productive capacity, average permeability times thickness, is 2346 millidarcy-feet and the average permeability is 138 millidarcys, sufficient for a satisfactory oil rate upon completion. The average residual oil saturation and calculated connate water saturation are 15.1 and 25 per cent of pore space, respectively, within the range of water-free, oil productive sands.

Sandy shale analyzed from 6692 to 6695 feet is interpreted to be essentially nonproductive due to low permeability; however, these three feet show an increase in per cent water saturation and when a pressure differential is applied across the formation they might possibly show

some water-cut. It is recommended that completion be limited to the sand from 6675 to 6692 feet.

The points indicated by an asterisk between the depths of 6699 and 6705 feet are interpreted to be essentially nonproductive due to low permeability.

Sand analyzed from 6706 to 6716 feet is interpreted to be very low capacity, oil productive; however, due to the low capacity, it is doubtful if any appreciable volumes of oil will be produced from this zone.

Recovery figures for the zone, 6675 to 6692 feet, are given on page one.

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:jr

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS

Page 1 of 1
File FDML-36 FC
Well FEDERAL 4-13-132

CORE SUMMARY AND CALCULATED RECOVERABLE OIL

CORE SUMMARY

FORMATION NAME	TOCITO			
DEPTH, FEET	6675.0-6692.0			
% CORE RECOVERY	100			
FEET OF PERMEABLE PRODUCTIVE FORMATION RECOVERED	17.0			
AVERAGE PERMEABILITY MILLIDARCYS	138			
CAPACITY — AVERAGE PERMEABILITY × FEET PRODUCTIVE FORMATION	2346			
AVERAGE POROSITY, PERCENT	15.1			
AVERAGE RESIDUAL OIL SATURATION, % PORE SPACE	15.1			
GRAVITY OF OIL, A P I	OVER 42			
AVERAGE TOTAL WATER SATURATION, % PORE SPACE	27.3			
AVERAGE CALCULATED CONNATE WATER SATURATION, % PORE SPACE	25			
SOLUTION GAS-OIL RATIO, CUBIC FEET PER BARREL (1)	800			
FORMATION VOLUME FACTOR--VOLUME THAT ONE BARREL OF STOCK TANK OIL OCCUPIES IN RESERVOIR (1)	1.46			
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)	148			
INCREASE DUE TO WATER DRIVE, BBLS PER ACRE FOOT	277			
TOTAL AFTER COMPLETE WATER DRIVE, BBLS PER ACRE FOOT (3)	425			

CORE LABORATORIES, INC.

J D Harris (PG)

J. D. Harris

NOTE:

(*) REFER TO ATTACHED LETTER

(1) REDUCTION IN PRESSURE FROM estimated 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 estimated ORIGINAL SATURATION PRESSURE.

(4) NO ESTIMATE FOR GAS PHASE RESERVOIRS

ROBERT MEAD
504 Employers Insurance Building
Dallas, Texas

May 18, 1953

Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Dear Sirs:

This is to advise you that I am in agreement with the field rules proposed by the Lowry Oil Company for the Pettigrew-Tocito Field, Rio Arriba County, New Mexico.

Sincerely,

Robert E. Mead

Robert E. Mead

mw

Case 537

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

August 5, 1952

Lowry, et al. Operating Account
616 East Central Avenue
Room 215
Albuquerque, New Mexico

Attention: Mr. Arthur Holland

Subject: Core Analysis
Federal 22-45-207 Well
Largo Canyon Field
Rio Arriba County, New Mexico

Gentlemen:

Diamond conventional cores from the subject well in the Tocito formation have been sampled and quick-frozen by a representative of Core Laboratories, Inc. and later analyzed in our Farmington, New Mexico laboratory. Results of analysis are presented in tabular and graphical form on the attached Coregraph. Oil emulsion mud was used as the drilling fluid.

Tocito formation analyzed from 6642 to 6644 feet is interpreted to be nonproductive due to low permeability.

Sand analyzed from 6644 to 6661 feet is interpreted to be oil productive where permeable.

Sand analyzed from 6661 to 6663.5 feet is interpreted to be nonproductive due to low permeability.

Recovery estimates for the zone, 6644 to 6661 feet, are given 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 (PS)
J. D. Harris,
District Engineer

JDH:ma

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

WESTERN UNION

1201

W. P. MARSHALL, PRESIDENT

SYMBOLS
DL=Day Letter
NL=Night Letter
LT=Int'l Letter Telegram
VLT=Int'l Victory Ltr.

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEX.
RECEIVED
MAY 19 1953

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

•LA13 SSA721

L•AYA835 NL PD=ALBUQUERQUE NMEX 18=

1953 MAY 18 PM 7 03

OIL AND GAS COMMISSION, ATTN R R SPURRIER=

SANTA FE NMEX=

Case 537

:PLEASE BE ADVISED THAT OUR COMPANY CONCURS WITH LOWRY ETAL OPERATING ACCOUNT GROUP IN THEIR APPLICATION AS TO 80 ACRE SPACING IN THE PETTIGREW TOCITO POOL AND STRONGLY URGE PASSING OF THIS APPLICATION FOR THE ECONOMIC AND COMMON RESERVOIR GOOD OF ALL PARTIES CONCERNED=

DAN W JOHNSTON JOHNSTON OIL AND GAS CO=••==

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

August 13, 1952

Lowry et al Operating Account
616 East Central Avenue
Albuquerque, New Mexico

Gentlemen:

Attached hereto are the results of tests made on the four 3¾" Rotary core samples taken from the Federal Lease, Well No. 4-13-132, Rio Arriba County, New Mexico, and submitted to our laboratory on August 4, 1952.

The reason why the samples have such a low total fluid saturation is the fact that they have been exposed to the weather for approximately a year and that the cans were not properly sealed.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

CLP:bl
9 c.c.

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

LOG

Sample No.	Description
1	Brown coarse grained micaceous slightly carbonaceous sandstone.
2	Brown coarse grained micaceous slightly carbonaceous calcareous sandstone.
3	Brown coarse grained micaceous slightly carbonaceous sandstone.
4	Brown coarse grained micaceous sandstone.

Oilfield Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1		87.			
2		5.6			
3		56.			
4		687.			

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1		17.8	14.1	2.3	16.4	195			
2		16.8	9.5	5.5	14.0	124			
3		16.3	12.9	2.8	15.7	163			
4		21.8	11.1	1.5	12.6	168			

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1		17.4	15.1	204	0.0	0	15.1	80.0	204	104	40.30	5
2		17.0	7.8	103	0.0	0	7.8	86.8	103	207	4.60	15
3		16.5	11.6	148	0.0	0	11.6	88.0	148	144	30.70	5
4		21.5	8.4	140	0.0	0	8.4	88.1	140	547	552.00	5

Notes: cc - cubic centimeter
*Volume of water recovered at the time of maximum oil recovery.
**Determined by passing water through sample which contains residual oil.

Oilfield Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1		52,500			
2		14,900			
3		24,400			
4		22,400			

Note: ppm - parts per million.

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

August 5, 1952

Lowry, et al. Operating Account
616 East Central Avenue
Room 215
Albuquerque, New Mexico

Attention: Mr. Arthur Holland

Subject: Core Analysis
Federal 22-45-207 Well
Largo Canyon Field
Rio Arriba County, New Mexico

Gentlemen:

Diamond conventional cores from the subject well in the Tocito formation have been sampled and quick-frozen by a representative of Core Laboratories, Inc. and later analyzed in our Farmington, New Mexico laboratory. Results of analysis are presented in tabular and graphical form on the attached Coregraph. Oil emulsion mud was used as the drilling fluid.

Tocito formation analyzed from 6642 to 6644 feet is interpreted to be nonproductive due to low permeability.

Sand analyzed from 6644 to 6661 feet is interpreted to be oil productive where permeable.

Sand analyzed from 6661 to 6663.5 feet is interpreted to be nonproductive due to low permeability.

Recovery estimates for the zone, 6644 to 6661 feet, are given 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 (PS)
J. D. Harris,
District Engineer

JDH:ma

August 30, 1952

Lowry et al Operating Account
616 East Central Avenue
Albuquerque, New Mexico

Gentlemen:

Attached hereto are the results of tests made on core samples taken from the Federal Lease, Well No. 4-13-132, and submitted to our laboratory on August 26, 1952.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:mm

9 c.c.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY AND POROSITY TESTS

TABLE I A

Company Lowry Oil Company Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.	Percent Porosity
			Ft.	Cum. Ft.		
1		182.				14.5
2		178.				17.8
3		202.				14.8
4		178.				15.7

Company Lowry Oil Company Lease Federal Well No. 4-13-132

Results Effective Permeability Tests

Sample No.	Effective Permeability Millidarcys
Salt Water	
1	39.00
2	69.30
3	51.20
4	65.30
5	Imp.
Fresh Water	
1	21.40
2	34.80
3	38.20
4	61.10
5	Imp.

August 30, 1952

Lowry et al Operating Account
616 East Central Avenue
Albuquerque, New Mexico

Gentlemen:

Attached hereto are the results of tests made on core samples taken from the Federal Lease, Well No. 22-45-207, and submitted to our laboratory on August 26, 1952.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

CLP:mm

9 c.c.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY AND POROSITY TESTS

TABLE I A

Company Lowry Oil Company Lease Federal Well No. 22-45-207

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.	Percent Porosity
			Ft.	Cum. Ft.		
1		0.75				10.7
2		Imp.				-
3		151.				17.3
4		Imp.				-
5		110.				14.4
6		12.				16.3
7		37.				16.3
8		Imp.				-

Company Lowry Oil Company Lease Federal Well No. 22-45-207

Results of Effective Permeability Tests

Sample No.	Effective Permeability Millidarcys
Salt Water	
1	Imp.
2	Imp.
3	46.80
4	Imp.
5	26.35
6	5.14
7	13.23
8	Imp.
Fresh Water	
1	Imp.
2	Imp.
3	61.0
4	Imp.
5	22.50
6	4.58
7	13.42
8	Imp.

August 13, 1952

Loury et al Operating Account
616 East Central Avenue
Albuquerque, New Mexico

Gentlemen:

Attached hereto are the results of tests made on the four 3" Rotary core samples taken from the Federal Lease, Well No. 4-13-13E, Rio Arriba County, New Mexico, and submitted to our laboratory on August 4, 1952.

The reason why the samples have such a low total fluid saturation is the fact that they have been exposed to the weather for approximately a year and that the cans were not properly sealed.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

CLP:bl
9 c.c.

Company Lowry et al Operating Account Lease Federal Well No. 4-17-132

LOG

Sample No.	Description
1	Brown coarse grained micaceous slightly carbonaceous sandstone.
2	Brown coarse grained micaceous slightly carbonaceous calcareous sandstone.
3	Brown coarse grained micaceous slightly carbonaceous sandstone.
4	Brown coarse grained micaceous sandstone.

Oilfield Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1		87.			
2		5.6			
3		56.			
4		687.			

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1		17.8	14.1	2.3	16.4	195			
2		16.8	9.5	5.4	14.0	124			
3		16.3	12.9	2.8	15.7	163			
4		21.8	11.1	1.5	12.6	168			

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1		17.4	15.1	204	0.0	0	15.1	50.0	204	104	40.30	5
2		17.0	7.6	103	0.0	0	7.6	56.5	103	207	4.60	15
3		16.5	11.0	148	0.0	0	11.0	53.0	148	144	30.70	5
4		21.5	8.4	140	0.0	0	8.4	58.1	140	547	552.00	5

Notes: cc - cubic centimeter
*Volume of water recovered at the time of maximum oil recovery.
**Determined by passing water through sample which contains residual oil.

Oilfield Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Lowry et al Operating Account Lease Federal Well No. 4-13-132

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1		52,500			
2		14,900			
3		24,400			
4		22,400			

Note: ppm - parts per million.

August 13, 1952

Lowry et al Operating Account
616 East Central Avenue
Albuquerque, New Mexico

Gentlemen:

Enclosed herewith is the report of the analysis of the 3¾" Rotary core samples taken from the Federal Lease, Well No. 22-45-207, Rio Arriba County, New Mexico, and submitted to our laboratory on August 4, 1952.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bl
9 c.c.

LOWRY et al OPERATING ACCOUNT

CORE ANALYSIS REPORT

FEDERAL LEASE WELL NO. 22-45-207

RIO ARRIBA COUNTY, NEW MEXICO

OILFIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

AUGUST 13, 1952

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Lowry et al Operating Account Lease Federal Well No. 22-45-207

Location SW¼, SE¼,

Section 10 Twp. 26N Rge. 6W County Rio Arriba State New Mexico

Name of Sand	Tocito
Top of Core	6643.00
Bottom of Core	6662.00
Top of Sand	6643.95
Bottom of Sand	6662.00
Total Feet of Permeable Sand	9.10
Total Feet of Floodable Sand	11.55

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	2.25	2.25
1 - 2	1.00	3.25
2 - 4	3.00	6.25
4 & above	2.85	9.10

Average Permeability Millidarcys	68.27
Average Percent Porosity	11.02
Average Percent Oil Saturation	35.66
Average Percent Water Saturation	22.83
Average Oil Content, Bbls./A. Ft.	305.
Total Oil Content, Bbls./Acre	5,792.
Average Percent Oil Recovery by Laboratory Flooding Tests	8.61
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	95.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,103.
Total Calculated Oil Recovery, Bbls./Acre	2,200.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

An oil base mud was used as a circulating fluid in the coring of the sand in this well. This well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
6643.00 - 6643.95	Sandy limestone.
6643.95 - 6647.75	Dark medium grained micaceous calcareous sandstone.
6647.75 - 6649.65	Dark fine grained micaceous calcareous sandstone.
6649.65 - 6650.60	Dark fine grained micaceous calcareous shaley sandstone.
6650.60 - 6653.45	Dark coarse grained micaceous calcareous sandstone containing a vertical fracture.
6653.45 - 6655.35	Hard calcareous shaley sandstone.
6655.35 - 6659.15	Brown medium grained micaceous calcareous sandstone.
6659.15 - 6662.00	Brown to dark medium grained micaceous calcareous sandstone.

Coring was started at a depth of 6643.00 feet in sandy limestone and completed at 6662.00 feet in medium grained micaceous calcareous sandstone. This core shows a total of 19.00 feet of formation containing oil. For the most part, the pay is made up of fine to medium grained micaceous calcareous sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into three sections. The weighted average permeability of the upper, middle and lower sections is 1.10, 214.74 and 1.92 millidarcys respectively; the overall average being 68.27 (See Table II). By observing the data given on the coregraph, it is noticeable that the cored section has a very irregular permeability profile and contains a very loose zone in the middle of the sand section.

The sand in this core shows a fair weighted average percent oil saturation, namely, 35.66. The weighted average percent oil saturation of the upper, middle and lower sections is 35.86, 37.40 and 34.90 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 24.75, 19.30 and 22.29 respectively; the overall average being 22.83 (See Table IV). This gives an overall weighted average total fluid saturation of 58.49 percent. This low total fluid saturation shows that considerable fluid was lost during coring which was no doubt oil.

For the sake of future information, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. From the data given in these tables and on the coregraph, it is noticeable that the sand has a very irregular chloride content.

The weighted average oil content of the upper, middle and lower sections is 266, 511 and 271 barrels per acre foot respectively; the overall average being 305. The total oil content, as shown by this core, is 5,792 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 1,103 barrels of oil per acre was obtained from 11.55 feet of sand. The weighted average percent oil saturation was reduced from 32.30 to 23.69, or represents an average recovery of 8.61 percent. The weighted average effective permeability of the samples is 4.65 millidarcys, while the average initial fluid production pressure is 31.3 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 20 samples tested, 12 produced oil and water. This indicates that approximately 60 percent of the sand represented by these samples is floodable. The tests also show that the sand has a very wide variation in effective permeability and that the middle part of the cored section is very loose. A synthetic brine of approximately 25,000 parts per million, calculated as common salt or sodium chloride, was used to flood out the sand samples.

CONCLUSION

On the basis of the above data, it is evident that a total recovery of 2,200 barrels of oil per acre, 1,800 barrels per acre by primary production and 400 barrels per acre by secondary recovery, can be obtained from the area represented by this core by efficient developing and operating practices. In calculating this recovery, an allowance was made for oil lost during coring.

The principle drawback of this core is the fact that it has a wide variation in permeability and a low percent porosity. The fact that the oil carries so much gas in solution is another factor that greatly reduces the volume of recoverable oil in place. Chances are, pressure maintenance, (the injection of the gas, produced along with the oil, back into the pay zone), will recover almost as much oil as would be expected by a combination of primary production and water-flooding. Furthermore, this method would be less expensive.

Oilfield Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Lowry et al Operating Acct. Lease Federal Well No. 22-45-207

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	6643.15	Imp.	0.95	0.95	0.00
2	6644.00	Imp.	0.55	1.50	0.00
3	6645.00	0.99	1.00	2.50	0.99
4	6646.00	1.75	1.00	3.50	1.75
5	6647.00	0.66	1.25	4.75	0.82
6	6648.00	Imp.	0.75	5.50	0.00
7	6649.00	Imp.	1.15	6.65	0.00
8	6650.00	Imp.	0.95	7.60	0.00
9	6651.00	229.	0.90	8.50	206.00
10	6652.00	126.	1.00	9.50	126.00
11	6653.00	295.	0.95	10.45	280.00
12	6654.00	Imp.	1.05	11.50	0.00
13	6655.00	Imp;	0.85	12.35	0.00
14	6656.00	Imp.	1.15	13.50	0.00
15	6657.00	2.9	1.00	14.50	2.90
16	6658.00	Imp.	1.00	15.50	0.00
17	6659.00	3.4	0.65	16.15	2.21
18	6660.00	0.49	1.35	17.50	0.66
19	6661.00	Imp.	1.00	18.50	0.00
20	6661.85	Imp.	0.50	19.00	0.00

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Lowry et al Operating Account Lease Federal Well No. 22-45-207

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content, Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1	6643.15	5.6	49.5	22.5	72.0	215	0.95	0.95	204
2	6644.00	8.9	34.4	19.4	53.8	238	0.55	1.50	131
3	6645.00	9.2	29.6	17.1	46.7	211	1.00	2.50	211
4	6646.00	9.3	41.8	28.6	70.4	388	1.00	3.50	388
5	6647.00	10.8	30.8	23.6	54.4	258	1.25	4.75	322
6	6648.00	12.4	47.8	21.3	69.1	461	0.75	5.50	346
7	6649.00	9.7	23.9	33.8	67.7	180	1.15	6.65	207
8	6650.00	8.1	35.2	27.4	62.6	221	0.95	7.60	210
9	6651.00	19.4	25.4	20.9	46.3	383	0.90	8.50	345
10	6652.00	12.9	39.4	17.4	56.8	394	1.00	9.50	394
11	6653.00	20.7	46.8	19.8	66.6	754	0.95	10.45	716
12	6654.00	6.8	51.2	23.2	74.4	271	1.05	11.50	285
13	6655.00	4.9	30.6	37.5	68.1	116	0.85	12.35	98
14	6656.00	13.9	35.0	23.7	58.7	378	1.15	13.50	435
15	6657.00	13.6	32.6	20.7	53.3	344	1.00	14.50	344
16	6658.00	9.8	33.9	22.3	56.2	258	1.00	15.50	258
17	6659.00	17.1	29.3	19.4	48.7	389	0.65	16.15	253
18	6660.00	11.6	31.7	16.9	48.6	286	1.35	17.50	386
19	6661.00	9.3	27.5	18.0	45.5	198	1.00	18.50	198
20	6661.85	3.5	45.0	21.4	66.4	122	0.50	19.00	61
							Total - - - - -		5,792

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company Lowry et al Operating Account Lease Federal Well No. 22-45-207

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
6643.00-6650.60	7.60	9.32	35.86	24.75	266	2,019
6650.60-6653.45	2.85	17.58	37.40	19.30	511	1,455
6653.45-6662.00	8.55	10.35	34.90	22.29	271	2,318
6643.00-6662.00	19.00	11.02	35.66	22.83	305	5,792

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Lowry et al Operating Account. Lease Federal Well No. 22-45-207

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	6643.15	5.8	47.7	215	0.0	0	47.7	27.3	215	0	Imp.	50+
2	6644.00	8.9	32.4	224	1.6	11	30.8	55.9	213	1	0.048	50
3	6645.00	9.6	28.4	212	7.0	52	21.4	50.8	160	1	0.039	50
4	6646.00	9.7	39.4	296	11.2	84	28.2	54.0	212	5	0.146	30
5	6647.00	10.7	28.7	238	0.0	0	28.7	45.9	238	0	Imp.	50+
6	6648.00	12.3	46.4	443	0.0	0	46.4	25.8	443	0	Imp.	50+
7	6649.00	9.3	26.4	191	0.0	0	26.4	45.4	191	0	Imp.	50+
8	6650.00	8.4	35.2	230	0.0	0	35.2	40.0	230	0	Imp.	50+
9	6651.00	19.1	26.8	397	10.0	148	16.8	66.5	249	99	24.50	5
10	6652.00	13.1	36.7	374	16.1	164	20.6	65.5	210	175	11.30	15
11	6653.00	20.7	44.4	714	20.2	325	24.2	63.4	389	72	17.90	5
12	6654.00	6.4	48.9	243	0.0	0	48.9	30.0	243	0	Imp.	50+
13	6655.00	5.2	29.1	118	0.0	0	29.1	68.2	118	0	Imp.	50+
14	6656.00	13.9	33.0	356	10.2	110	22.8	60.0	246	42	1.19	20
15	6657.00	13.5	34.0	356	6.5	68	27.5	57.2	288	3	0.202	50
16	6658.00	9.7	31.7	239	2.9	22	28.8	49.3	217	1	0.030	50
17	6659.00	17.4	27.2	367	5.2	70	22.0	59.4	297	83	1.75	20
18	6660.00	11.4	30.3	268	5.1	45	25.2	42.2	223	8	0.176	50
19	6661.00	9.0	26.0	182	4.7	33	21.3	41.5	149	5	0.202	50
20	6661.85	3.8	42.0	124	0.0	0	42.0	25.0	124	0	Imp.	50+

Notes: cc - cubic centimeter
* - Volume of water recovered at the time of maximum oil recovery.
** - Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Lowry et al Operating Account Lease Federal Well No. 22-45- 207

Depth Interval, Feet	6643.95 - 6646.50	6650.60 - 6653.45	6655.35 - 6661.50	6643.95 - 6661.50
Feet of Core Analyzed	2.55	2.85	6.15	11.55
Average Percent Porosity	9.49	17.51	12.18	12.90
Average Percent Original Oil Saturation	33.57	36.13	30.02	32.30
Average Percent Oil Recovery	7.49	15.54	5.87	8.61
Average Percent Residual Oil Saturation	26.08	20.59	24.15	23.69
Average Percent Residual Water Saturation	53.14	65.05	50.83	54.76
Average Percent Total Residual Fluid Saturation	79.22	85.64	74.98	78.45
Average Original Oil Content, Bbls./A. Ft.	248.	494.	291.	330.
Average Oil Recovery, Bbls./A. Ft.	56.	212.	58.	95.
Average Residual Oil Content, Bbls./A. Ft.	192.	282.	233.	235.
Total Original Oil Content, Bbls./Acre	631.	1,408.	1,787.	3,826.
Total Oil Recovery, Bbls./Acre	142.	605.	356.	1,103.
Total Residual Oil Content, Bbls./Acre	489.	803.	1,431.	2,723.
Average Effective Permeability, Millidarcys	0.083	17.68	0.517	4.65
Average Initial Fluid Production Pressure, p.s.i.	43.3	8.3	36.7	31.3

NOTE: Only those samples which recovered oil were used in calculating the above averages.

Oilfield Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Lowry et al Operating Acct. Lease Federal Well No. 22-45-207

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	6643.15	44,000			
2	6644.00	12,800			
3	6645.00	31,000			
4	6646.00	19,700			
5	6647.00	13,500			
6	6648.00	48,500			
7	6649.00	36,800			
8	6650.00	27,800			
9	6651.00	37,500			
10	6652.00	36,800			
11	6653.00	7,430			
12	6654.00	22,900			
13	6655.00	50,100			
14	6656.00	29,600			
15	6657.00	22,300			
16	6658.00	35,900			
17	6659.00	7,000			
18	6660.00	42,000			
19	6661.00	47,000			
20	6661.85	71,500			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Lowry et al Operating Acct. Lease Federal Well No 22-45-207

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
6643.00-6650.60	29,147		
6650.60-6653.45	27,231		
6653.45-6662.00	35,423		
6643.00-6662.00	31,684		

Note: ppm - parts per million.

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

September 9, 1952

RESERVOIR FLUID DIVISION
T. L. KENNERLY, *Manager*

Lowry, et al., Operating Account
616 East Central Avenue
Albuquerque, New Mexico

Attention: Mr. A. F. Holland

Subject: Reservoir Fluid Study
Federal Doswell No. 21-40-182 Well
Pettigrew Field
Rio Arriba County, New Mexico

Gentlemen:

This report presents the results of laboratory studies performed on subsurface samples collected from the subject well on August 19, 1952.

The fluid exhibited a saturation pressure of 2051 psig at the reservoir temperature of 175° F. The reservoir pressure at sampling depth, transmitted to us in a letter of August 25, 1952, was reported to be 2060 psig. Comparison of these two pressures indicates that a representative sample was obtained. Since the pressure at the top of the producing zone was calculated to be 2096 psig, there is sufficient agreement to indicate that the reservoir exists in a saturated condition. The reported produced gas-oil ratios are further substantiation of this fact since they are somewhat in excess of the solution gas-oil ratios determined in this study.

Differential vaporization of the reservoir fluid at reservoir temperature resulted in the evolution of 862 standard cubic feet of vapor, measured at 14.7 psia and 60° F., per barrel of residual liquid measured at 60° F. The corresponding formation volume factor was determined to be 1.512 barrels of saturated fluid per barrel of residual liquid. The viscosity of the liquid phase was determined at several pressure levels and varied from a value of 0.39 centipoise at saturation pressure to a maximum of 1.32 centipoises at zero pressure.

Samples of the fluid were vaporized through separators operating at various pressures in order to determine the effect of separator pressure upon the quantity and properties of the products. These studies indicate that maximum stock tank yield, per unit of reservoir withdrawal, will occur under an operating pressure of 130 psig. Maximum stock tank liquid gravity will also occur at approximately this pressure; however, the fluid should remain above 40° API under any normal operating conditions.

The composition of the fluid, as determined by low temperature fractional distillation, is presented on page six. A significant amount of the intermediate materials, plus a relatively low molecular weight residue, indicate the volatile nature of the fluid. These properties are responsible for the very pronounced effect which separator pressure has upon this fluid.

If we can serve you in any further manner please call upon us. We would be pleased to discuss this study further with you if you should so desire.

Very truly yours,

Core Laboratories, Inc.

F. O. Reudelhuber,
Division Engineer

FOR:ma

Form 69385-

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 85

Company Lowry, et al., Operating Account Date Sampled August 19, 1952

Well Federal Doswell No. 21-40-182 County Rio Arriba

Field Pettigrew State New Mexico

FORMATION CHARACTERISTICS

Formation Name	Tocito
Date First Well Completed	July, 1951
Original Reservoir Pressure	2197 PSI @ -100 ft.
Original Produced Gas-Oil Ratio	1400 cu. ft./bbl.
Production Rate	250 bbl./d.
Separator Pressure and Temperature	25 PSI, ° F.
Oil Gravity at 60° F.	42 ° API
Datum	100 ft. subsea
Original Gas Cap	

WELL CHARACTERISTICS

Elevation	6561 Feet K.B.
Total Depth	6761 ft.
Completion Depth	6705-25 ft.
Tubing Size and Depth	2.5 in. to 6720 ft.
Productivity Index	bbl./d./PSI @ bbl./d.
Last Reservoir Pressure	2060 PSI @ 6603 ft.
Date	August 19, 1952
Reservoir Temperature	175 ° F. @ 6603 ft.
Status of Well	Shut-In 90 Hours
Pressure Gauge	Amerada (Lowry)
Normal Production Rate	250 bbl./d.
Gas-Oil Ratio	1100 cu. ft./bbl.
Separator Pressure and Temperature	25 PSI, ° F.
Base Pressure	15.025 PSI Abs.
Well Making Water	None % Cut

SAMPLING CONDITIONS

Sampled at	6603 Feet K.B.*
Status of Well	Shut-In 90 Hours
Gas-Oil Ratio	cu. ft./bbl.
Separator Pressure and Temperature	PSI, ° F.
Tubing Pressure	1050 PSI
Casing Pressure	1590 PSI
Core Laboratories Engineer	WTL
Type Sampler	Perco

REMARKS:

* Necessary point of sampling due to presence of water

Form 54801

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 85

Well Federal Doswell
No. 21-40-182

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 2051 PSI @ 175 °F.

2. Thermal expansion of saturated oil @ 5000 PSI = $\frac{V \text{ @ } 175 \text{ °F.}}{V \text{ @ } 76 \text{ °F.}}$ = 1.05973

3. Compressibility of saturated oil @ reservoir temperature: Vol./Vol./PSI:

   From 5000 PSI to 4000 PSI = 11.65×10^{-6}

   From 4000 PSI to 3000 PSI = 13.34×10^{-6}

   From 3000 PSI to 2051 PSI = 16.20×10^{-6}

4. Specific volume at saturation pressure: cu. ft./# 0.02432 @ 175 °F.

Form 50870

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 85

Well Federal Doswell No. 21-40-182

Reservoir Fluid **SAMPLE TABULAR DATA**

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATIONS @ 175 °F., RELATIVE VOLUME OF OIL AND GAS, V/Vs	VISCOSITY OF OIL @ 175 °F., CENTIPOISES	DIFFERENTIAL VAPORIZATION @ 175 °F.		
			LIBERATED GAS SCF PER BARREL OF RESIDUAL OIL	SOLUTION GAS SCF PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/VR
5000	0.9602				1.452
4500	0.9656				1.460
4425		0.46			
4000	0.9715				1.469
3835		0.44			
3500	0.9780				1.479
3330		0.43			
3000	0.9846				1.489
2850		0.42			
2500	0.9920				1.500
2410		0.41			
2210		0.40			
2200	0.9973				1.508
2100	0.9989				1.511
2051	1.0000	0.39	0	862	1.512
2032	1.0041				
2002	1.0110				
1940		0.39			
1899	1.0360				
1815		0.40			
1805			100	762	1.462
1704	1.0958				
1570		0.43			
1569			187	675	1.421
1501	1.1798				
1305	1.2989				
1260		0.48			
1245			301	561	1.367
1085	1.4902				
970		0.52			
950			400	462	1.319
900	1.7464				
740		0.57			

V = Volume at given pressure.

V_s = Volume at saturation pressure at the specified temperature.

V_R = Residual oil volume at 14.7 PSI absolute and 60° F.

Form 50870

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 85

Well Federal Doswell No. 21-40-182

Reservoir Fluid SAMPLE TABULAR DATA

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATIONS @ 175 °F., RELATIVE VOLUME OF OIL AND GAS, V/Vs	VISCOSITY OF OIL @ 175 °F., CENTIPOISES	DIFFERENTIAL VAPORIZATION @ 175 °F.		
			LIBERATED GAS SCF PER BARREL OF RESIDUAL OIL	SOLUTION GAS SCF PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/VR
735	2.1032				
650			500	362	1.272
504	3.0194				
451		0.70			
405	3.7737				
352			606	256	1.221
291	5.3454				
155			698	164	1.170
82			749	113	1.142
0		1.32	862	0	1.061

@ 60° F. = 1.000

Gravity of Residual Oil =

41.8° API @ 60° F.

V = Volume at given pressure.
Vs = Volume at saturation pressure at the specified temperature.
VR = Residual oil volume at 14.7 PSI absolute and 60° F.

Form 54802

CORE LABORATORIES, Inc.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 85

Well Federal Doswell No. 21-40-182

SEPARATOR TESTS OF Reservoir Fluid SAMPLE

SEPARATOR PRESSURE, PSI GAUGE	SEPARATOR TEMPERATURE, °F.	SEPARATOR GAS/OIL RATIO *See Foot Note (1)*	STOCK TANK GAS/OIL RATIO *See Foot Note (1)*	STOCK TANK GRAVITY, °API @ 60° F.	SHRINKAGE FACTOR, V_R/V_S *See Foot Note (2)*	FORMATION VOLUME FACTOR, V_S/V_R *See Foot Note (3)*	SPECIFIC GRAVITY OF FLASHED GAS
0	76	876		41.8	0.6435	1.554	1.0269
25	75	782	23	42.9	0.6707	1.491	
50	74	724	45	44.2	0.6859	1.458	
150	73	600	135	44.4	0.6974	1.434	

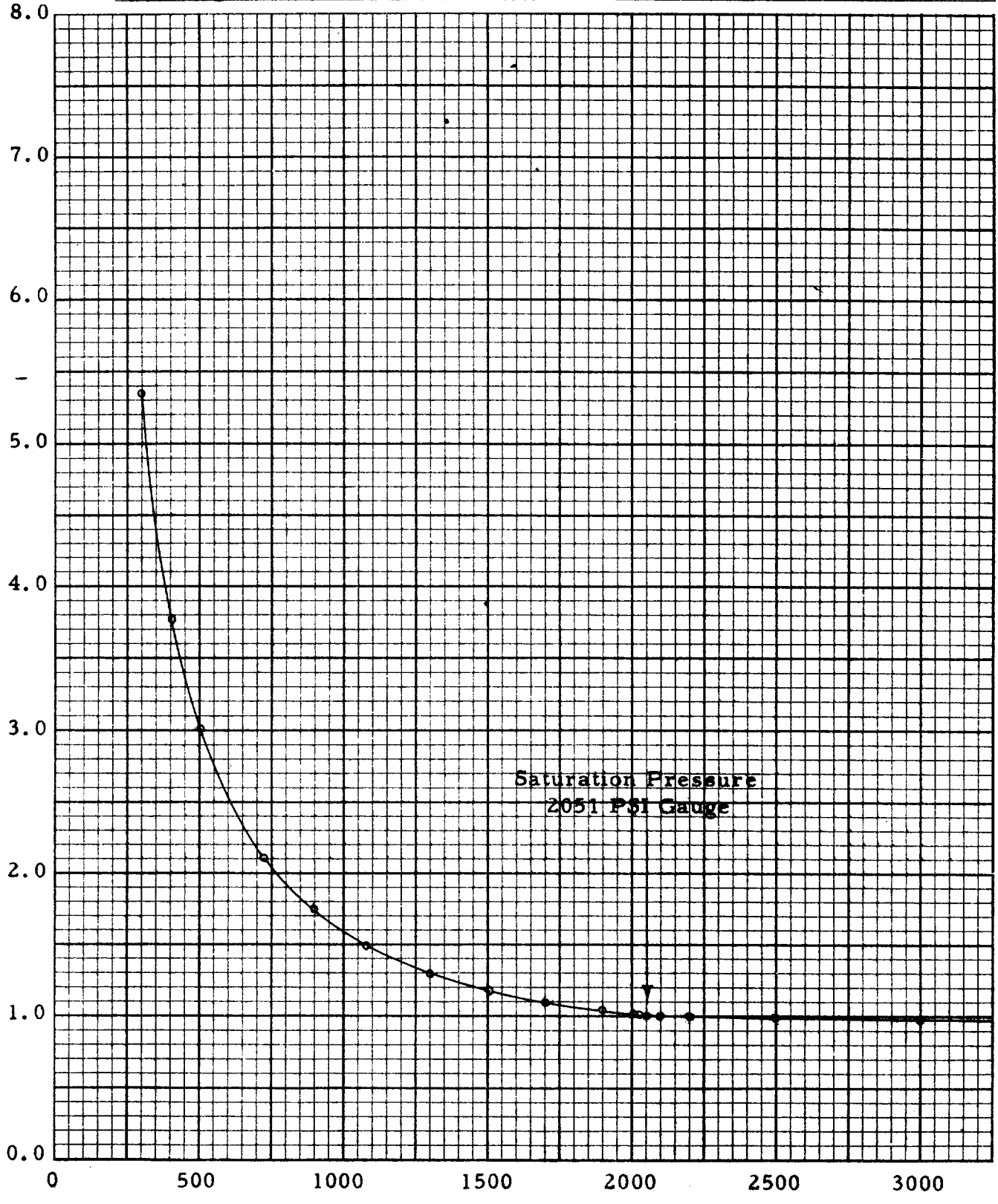
(1) Separator and stock tank gas/oil ratio in cubic feet of gas @ 60° F. and 14.7 PSI absolute per barrel of stock tank oil @ 60° F.

(2) Shrinkage Factor: V_R/V_S is barrels of stock tank oil @ 60° F. per barrel of saturated oil @ 2051 PSI gauge and 175 °F.

(3) Formation Volume Factor: V_S/V_R is barrels of saturated oil @ 2051 PSI gauge and 175 °F. per barrel of stock tank oil @ 60° F.

PRESSURE-VOLUME RELATIONS OF RESERVOIR FLUID

Company Lowry, et al., Operating Account Formation Tocito
Well Federal Doswell No. 21-40-182 County Rio Arriba
Field Pettigrew State New Mexico

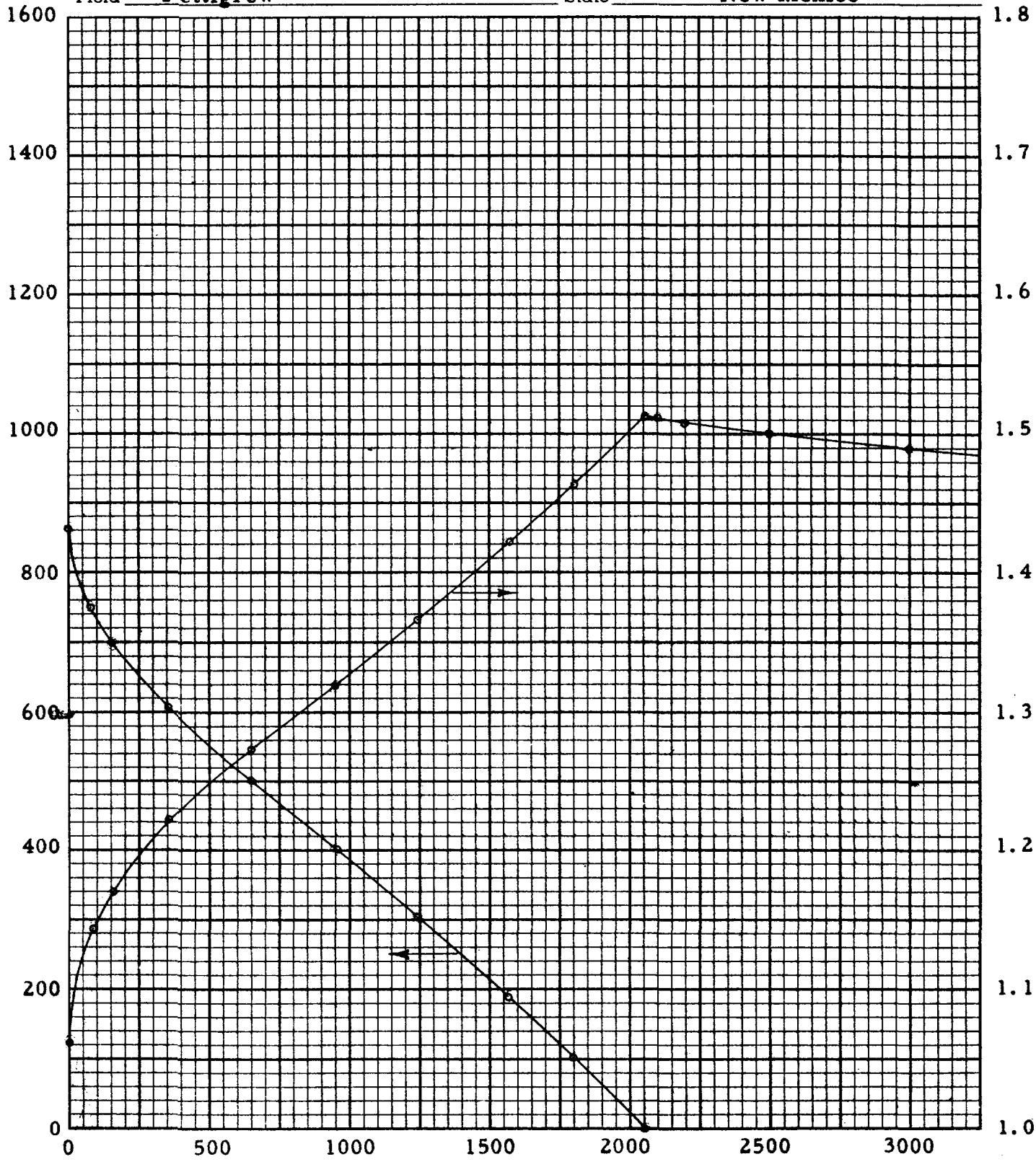


RELATIVE VOLUME: V/Vs

PRESSURE: POUNDS PER SQUARE INCH GAUGE

DIFFERENTIAL VAPORIZATION OF RESERVOIR FLUID

Company Lowry, et al., Operating Account Formation Tocito
Well Federal Doswell No. 21-40-182 County Rio Arriba
Field Pettigrew State New Mexico

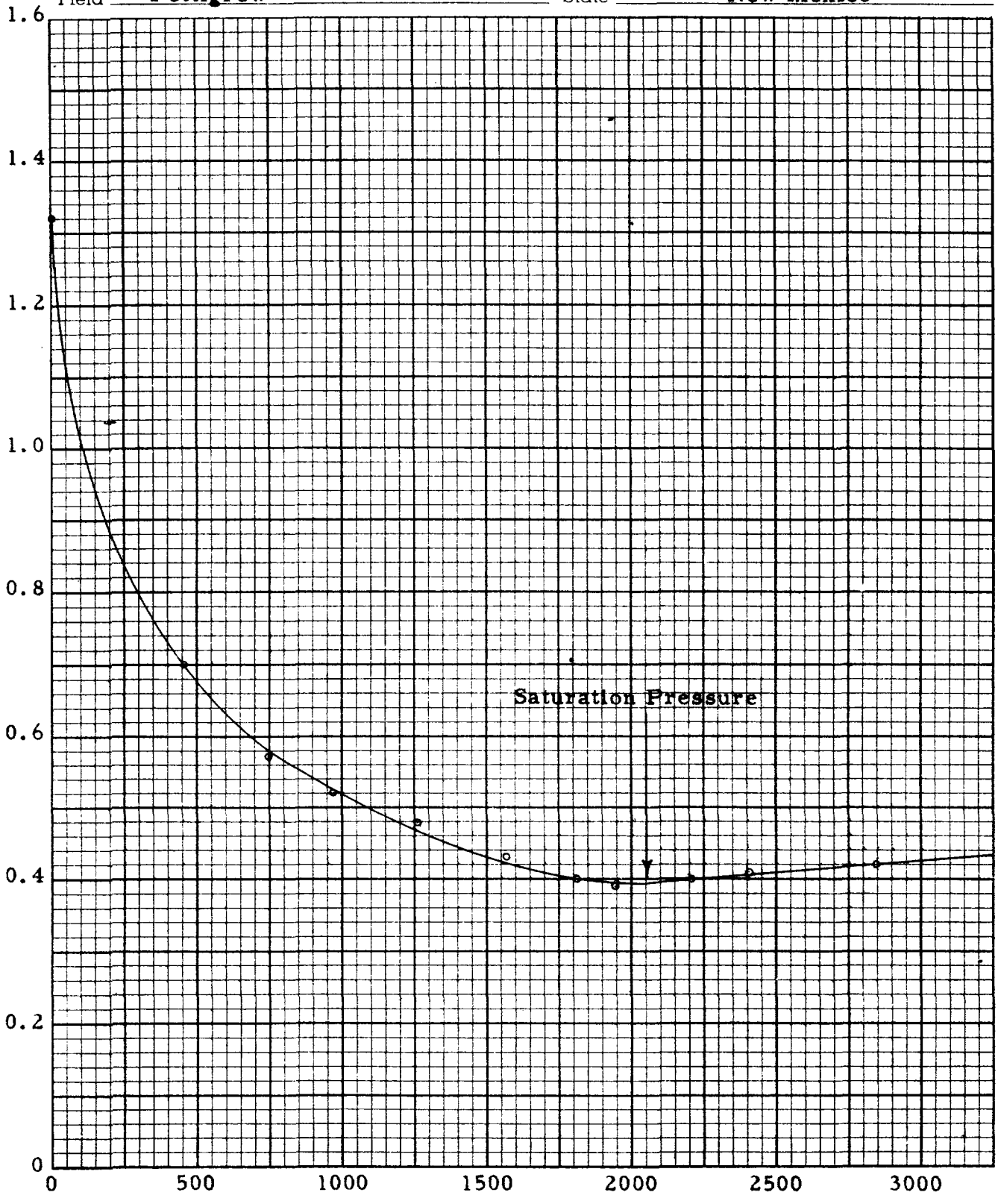


CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File RFL 85

VISCOSITY OF RESERVOIR FLUID

Company Lowry, et al., Operating Account Formation Tocito
Well Federal Doswell No. 21-40-182 County Rio Arriba
Field Pettigrew State New Mexico



Petroleum Production Laboratories, Inc.

TELEPHONE Victor-6971

Dallas, Texas

ADDRESS ALL CORRESPONDENCE TO P. O. BOX 2068

ADDRESS ALL SHIPMENTS TO 407 SOUTH HASKELL

October 7, 1952

File No. LO-790

Lowry Oil Company
616 East Central Avenue
Albuquerque, New Mexico

Attention: Mr. A. F. Holland

Subject: Porosity Determinations
Tocito Sandstone Reservoir
Federal 22-45-207
Federal 4-13-132
Pettigrew Tocito Field
Rio Arriba County, New Mexico

Gentlemen:

You will find enclosed the results of the porosity determinations on 39 samples of cores from the Tocito Sandstone Reservoir in the Federal 22-45-207 and the Federal 4-13-132 Wells in the Pettigrew Tocito Field. The samples used for the measurements were drilled samples of approximately 3/4 of an inch in diameter and of varying lengths.

The results are arranged on two tabular data sheets in the order of increasing depth. Table I lists the results for the 19 samples from the Federal 22-45-207 Well and Table II lists the results for the 20 samples from the Federal 4-13-132 Well. A discussion of the tabular data follows:

1. The first column of figures indicates the sample numbers.

2. The second column indicates the depths from which the samples were taken.

3. The last column lists the effective porosities (expressed as a percent of the bulk volume) as determined using an air expansion type porosimeter.

Arithmetic averages of the results of the analyses are shown below. An average is shown for the combined results of the samples from both wells and also for the separate results from each individual well.

Well	Number of Samples	Porosity (% bulk volume)
Federal 22-45-207	19	11.4
Federal 4-13-132	20	13.0
Combined	39	12.2

Petroleum Production Laboratories, Inc.

DALLAS, TEXAS

File No. LO-790

We sincerely appreciate this opportunity to be of service to you and hope that we may have the opportunity to serve you again in the future.

Yours very truly,

Harold S. Deyo
Laboratory Manager

HSDeyo:gad
Enclosures

Petroleum Production Laboratories, Inc.

DALLAS, TEXAS

POROSITY DETERMINATIONS

Company: Lowry Oil Company Date: October 7, 1952

Well: Federal 22-45-207 File No: 10-790

Reservoir: Tocito Sandstone County: Rio Arriba

Field: Pettigrew Tocito State: New Mexico

Sample Number	Depth (Ft.)	Porosity (%)
2	6643.5	6.1
3	6644.5	13.0
4	6645.5	6.4
5	6646.5	8.9
6	6647.5	9.9
7	6648.5	9.5
8	6649.5	10.9
9	6650.5	10.7
10	6651.5	18.1
11	6652.5	16.6
12	6653.5	18.3
13	6654.5	7.0
14	6655.5	5.5
15	6656.5	9.0
16	6657.5	15.8
17	6658.5	11.2
18	6659.5	19.0
19	6660.5	11.5
20	6661.5	9.1
Arithmetic Average		11.4

Table I

Petroleum Production Laboratories, Inc.

DALLAS, TEXAS

POROSITY DETERMINATIONS

Company: Lowry Oil Company Date: October 7, 1952

Well: Federal 4-13-13Z File No: LO-790

Reservoir: Tocito Sandstone County: Rio Arriba

Field: Petti:rew Tocito State: New Mexico

Sample Number	Depth (Ft.)	Porosity (%)
27	6675.5	7.0
28	6676.5	5.2
29	6677.5	7.9
30	6678.5	6.5
31	6679.5	13.2
32	6680.5	9.9
33	6681.5	18.4
34	6682.5	17.3
35	6683.5	15.5
36	6684.5	9.8
37	6685.5	15.7
38	6686.5	18.1
39	6687.5	8.9
40	6688.5	17.5
41	6689.5	21.3
42	6690.5	21.3
43	6691.5	16.6
44	6692.5	8.0
45	6693.5	13.4
46	6694.5	7.7
Arithmetic Average		13.0

Table II

Petroleum Production Engineering Co.

Reservoir and Engineering Analyses

P. O. BOX 4111
TULSA, OKLAHOMA

April 22, 1953

FILE NO.
LO-853

Lowry Oil Company
616 East Central Avenue
Albuquerque, New Mexico

Attention: Mr. A. F. Holland

Subject: Routine Permeability and
Porosity Determinations
Tocito Sandstone Reservoir
Federal 24-50-177
Pettigrew Tocito Field
Rio Arriba County, New Mexico

Gentlemen:

The following pages present the results of the routine permeability and porosity determinations made on samples of cores from the Tocito Sandstone Reservoir in the Federal 24-50-177 Well in the Pettigrew Tocito Field. Both tabular and graphical presentations of the data will be found.

The core was taken between the depths of 6604.2 feet and 6616.4 feet using rotary coring tools. Samples of the recovered core were selected in the field by a representative of the Lowry Oil Company, sealed in cans, and submitted for combination special and routine analysis.

As was requested, an analysis was performed on each section of core received. The following measurements were made:

1. Vertical permeability measurement on a full size section of core.

2. Porosity measurement on the full size section of core used in Test 1 above.

3. Horizontal permeability measurement on a $1\frac{1}{2}$ inch diameter plug drilled from the original full size section of core.

4. Porosity measurement on a plug drilled from the original full size section of core.

The results are arranged on the tabular data sheets in the order of increasing depth. A summary of the results follows:

1. The first column of figures lists the sample numbers.

2. The second column indicates the depths from which the samples were taken.

3. The next column gives the lithology of the samples.

4. The fourth column of figures lists the vertical permeabilities to air as measured on the full size core section. These values range from a minimum of 0.01 md. to a maximum of 418 md. and average 40 md.

5. The fifth column lists the porosities as measured on the full size core section. These values vary from 4.3% to 23.2% and average 11.7%.

6. Permeabilities to air as measured on the $1\frac{1}{2}$ inch diameter horizontal plug drilled from the full size core section appear in the next column. These values vary from a minimum of 0.06 md. to a maximum of 981 md. and average 146 md.

7. The last column lists the porosities as measured on a plug taken from the original full size core section. These values vary from 4.6% to 23.8% and average 12.6%.

The graphical presentations of the results will be found following the tabular data. The first graph depicts the results determined from the full size core analysis and the second graph depicts the results determined from the plug analysis.

We sincerely appreciate this opportunity to be of service to you and hope that we may have the opportunity to serve you again in the future.

Yours very truly,

Harold S. Deyo

HSDeyo:gad
Enclosures

Petroleum Production Laboratories, Inc.

TELEPHONE VIctor-0871

Dallas, Texas

ADDRESS ALL CORRESPONDENCE TO P. O. BOX 2856

ADDRESS ALL SHIPMENTS TO 407 SOUTH HASKELL

April 21, 1953

File No. LO-853

Petroleum Production Engineering Co.
P. O. Box 4111
Tulsa, Oklahoma

Gentlemen:

You will find enclosed the tabular data and graphs showing the results of the combination special and routine core analysis made on samples of cores from the Tocito Sandstone Reservoir in the Federal 24-50-177 Well, Pettigrew Tocito Field, Rio Arriba County, New Mexico.

Yours very truly,

Core Laboratories

Enclosures

Petroleum Production Laboratories, Inc.

DALLAS, TEXAS

ROUTINE PERMEABILITY AND POROSITY DETERMINATIONS

Company: Lowry Oil Company — Date: April 22, 1953

Well: Federal 24-50-17 — File No.: LO-853

Reservoir: Tocito Sandstone — County: Rio Arriba

Field: Pettigrew Tocito — State: New Mexico

Sample Number	Depth (Ft.)	Description of Formation	Full Size Core Analysis		Plug Analysis	
			Vertical Air Permeability (md.)	Porosity (%)	Horizontal Air Permeability (md.)	Porosity (%)
1	6604.2-04.7	vy fg cal ss	0.01	5.7	0.10	7.2
2	6604.7-05.2	shy ls - dense	0.04	4.3	0.25	4.7
3	6605.2-05.7	shy ls - dense	0.05	6.2	0.22	5.6
4	6605.7-06.2	shy ls - dense	0.05	8.7	0.26	7.3
5	6606.2-06.5	sdy shy ls - dense	0.03	5.4	0.11	7.8
6	6606.5-06.7	sdy shy ls - dense	*0.04	*6.1	***0.06	6.0
7	6606.7-07.2	shy ls - dense	0.03	8.0	0.10	6.5
8	6607.2-07.6	vy fg shy cal ss	0.04	9.8	0.43	12.0
9	6607.6-08.0	vy fg silty ss	0.22	10.3	0.78	11.3
10	6608.0-08.3	vy fg shy ss	*0.19	*11.1	***0.35	12.5
11	6608.3-08.5	vy fg shy ss	0.06	12.7	0.41	11.0
12	6608.5-09.0	fg shy ss	0.08	10.5	0.42	11.0
13	6609.0-09.5	vy fg shy ss	0.05	10.4	0.24	11.5
14	6609.5-10.5	vy fg shy ss-fractured	**8.1	11.9	0.38	13.5
15	6610.5-10.8	fy shy ss	0.07	10.2	0.20	13.0
16	6610.8-11.0	vy fg shy cal ss	*0.04	*6.3	***0.07	6.2
17	6611.0-11.5	vy fg shy cal ss	0.43	7.0	0.23	9.3
18	6611.5-11.9	fg shy ss	*0.12	*7.3	0.17	7.7

ROUTINE PERMEABILITY AND POROSITY DETERMINATIONS

Sample Number	Depth (Ft.)	Description of Formation	Full Size Core Analysis		Plug Analysis	
			Vertical Air Permeability (md.)	Porosity (%)	Horizontal Air Permeability (md.)	Porosity (%)
19	6611.9-12.2	fg shy ss	*0.09	*5.5	0.17	4.6
20	6612.2-12.7	fg ss	*14	*18.2	46	19.0
21	6612.7-13.0	fg ss	0.71	19.8	10	21.8
22	6613.0-13.3	fg ss	183	23.2	442	23.8
23	6613.3-13.9	fg ss	12	21.0	760	22.8
24	6613.9-14.2	fg ss	418	22.0	778	23.1
25	6614.2-14.5	fg ss	335	21.5	981	22.1
26	6614.5-15.0	fg sl shy ss	221	20.2	821	23.8
27	6615.0-15.4	fg ss	9.2	18.6	247	21.6
28	6615.4-15.8	fg ss	8.1	18.3	289	18.1
29	6615.8-16.1	shy ls - dense	0.04	6.9	0.24	8.4
30	6616.1-16.4	ls - dense	0.07	5.1	0.13	5.2
Arithmetic Averages			40	11.7	146	12.6

Note: In the two columns falling under the heading of "Full Size Analysis", several of the results are preceded by the symbol *. This indicates that it was not possible to perform an analysis on the full size core section and 1½ inch diameter vertical permeability plugs were drilled and analyzed. The sample preceded by the symbol ** had a vertical fracture extending through the entire length of the section which caused the permeability to be high in comparison with the other samples of similar structure.

In the "Air Permeability" column under "Plug Analysis" the symbol ***, indicates that 3/4 inch diameter horizontal permeability plugs were drilled and analyzed instead of 1½ inch diameter plugs.

Petroleum Production Laboratories, Inc.

LABORATORY AND RESERVOIR ENGINEERING ANALYSES

DALLAS, TEXAS

COREGRAPH

Company: Lowry Oil Company

Well: Federal 24-50-177

Field: Pettigrew Tocito

Reservoir: Tocito Sandstone

County: Rio Arriba

State: New Mexico

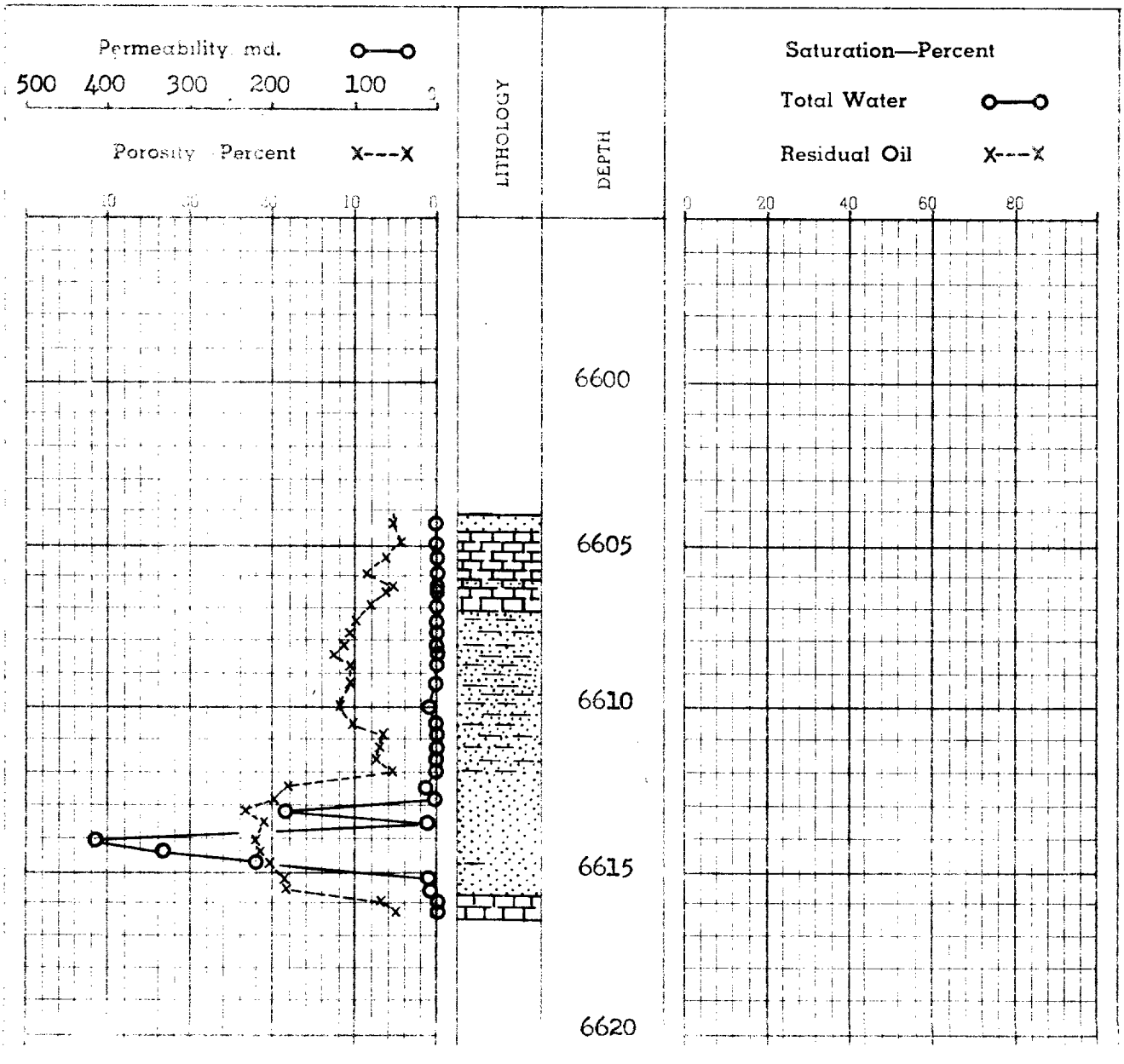
Elev:

File: LO-853

Date: April 21, 1953

Drilling Fluid:

Remarks: Results obtained from full size core analysis



Petroleum Production Laboratories, Inc.

LABORATORY AND RESERVOIR ENGINEERING ANALYSES

DALLAS, TEXAS

COREGRAPH

Company: Lowry Oil Company

Well: Federal 24-50-177

Field: Pettigrew Tocito

Reservoir: Tocito Sandstone

County: Rio Arriba

State: New Mexico

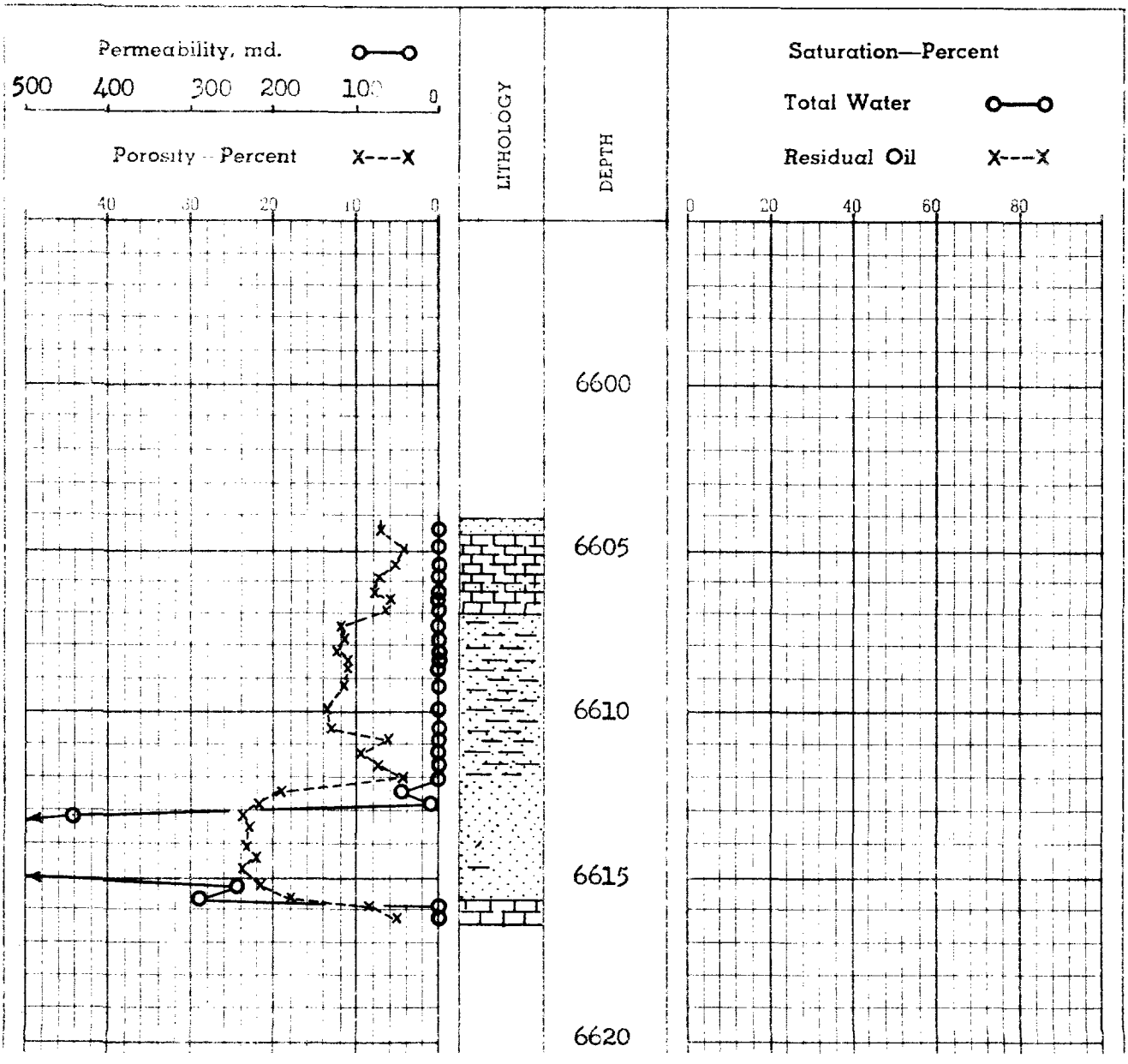
Elev:

File: 10-853

Date: April 21, 1953

Drilling Fluid:

Remarks: Results obtained from plug analysis



760
778
981
821

GASOLINE PLANT CONSTRUCTION CORPORATION

May 19, 1953

Lowry Oil Company
616 East Central Avenue
Albuquerque, New Mexico

Attention: Mr. A. F. Holland

Gentlemen:

In accordance with your request we herewith submit our report on the economics of a compressor plant in your Pettigrew-Tocito Field, Rio Arriba County, New Mexico, comprising the following described exhibits:

Exhibit "A" - Assumed gas analysis.
"B" - Assumed gas and oil flow schedule.
"C" - Annual revenue for three types of plants.
"D" - Plant cost estimates.
"E" - Average daily production.
"F" - Operating costs.
"G" - Income before depreciation, income tax, etc.
"H" - Casinghead gas gathering system layout.
"I" - Flow diagram for compressor plant with compression gasoline recovery.
"J" - Flow diagram for compressor plant with maximum 12# gasoline recovery.
"K" - Flow diagram for compressor plant with crude stabilization for maximum butane recovery.
"L" - Unit prices used.

We have analyzed the economics for three types of plants that could be installed. Plant I would be the minimum installation possible to compress the gas to the 500# El Paso Natural gathering system. This plant would also contain equipment to stabilize and recover 12# vapor pressure gasoline which would be produced by compression. This 12# gasoline could be added to the crude oil from the field.

Plant II would be the same as Plant I except that a refrigeration unit would be added to recover substantially all of the 12# gasoline that is in the casinghead gas. This process would strip the gas to such an extent that there would be no liquid production payments possible from El Paso Natural's plant. In the case of Plant I the residue gas would be rich enough that El Paso Natural would make payments for liquid production recoveries. The income realized from Plant II would be greater than from Plant I because of the fact that Lowry would retain all of the 12# gasoline instead of being paid only a portion of it by El Paso Natural.

We have shown in Exhibit "G" the total income for the life of the field that could be realized from the three described types of plants. This income is shown before depreciation, income tax, etc. In order to show the total income we have assumed a plant salvage value of 40%, which we believe conservative for this type of plant.

Our study indicates that a plant with the crude stabilization unit would produce the greatest income. This is, of course, due to the fact that stabilized crude can contain a large volume of light components and because these components can be recovered from the gas with only a slight additional cost when operating under the proposed conditions.

Exhibit "L" shows the various unit prices and other data used in this study.

If there is any further information which we can supply in this regard we will be happy to do so. We appreciate the opportunity of submitting this report and look forward with pleasure to serving you further.

Yours very truly,

GASOLINE PLANT CONSTRUCTION CORPORATION

John C Breaker

John C. Breaker, Vice-President

ASSUMED GAS ANALYSIS

Average Separator Vent Composition @ 20 psig, 48°F, on April 13, 1953

(Federal #22-45-207 & 19-34-157)

Component	Mol %	GPM
CO_2 & C_1	69.58	-
C_2	15.26	-
C_3	8.96	2.459
i C_4	1.29	0.421
C_4	2.71	0.854
i C_5	0.69	0.252
C_5	0.41	0.148
C_6+	1.10	0.466
	100.00	4.600

Estimated Separator Vent Composition in GPM @ 20 psig, 48°F

	1954	1955	1956	1957	1958	1959	1960
C_3	2.459	2.459	2.459	2.459	2.459	2.459	2.459
C_4	1.275	1.192	1.108	1.024	0.941	0.857	0.927
C_5+	0.866	0.809	0.753	0.697	0.640	0.584	0.629
	4.600	4.460	4.320	4.180	4.040	3.900	4.015

EXHIBIT "A"

ASSUMED GAS AND OIL FLOW SCHEDULE

Year	Gas MCF/D	Oil BBL/D	Gas/Oil MCF/BBL
1954	2,500	1,200	2.08
1955	3,750	1,130	3.32
1956	4,000	790	5.07
1957	4,000	620	6.45
1958	2,800	420	6.67
1959	1,300	240	5.42
1960	700	140	5.00

EXHIBIT "B"

GASOLINE PLANT CONSTRUCTION CORPORATION

ANNUAL REVENUE FOR THREE TYPES OF PLANTS

Plant I: Compression only.

Year	Sales Gas	El Paso Prods.	12# RVP	Total $/Year
1954	$ 89,790	$ 14,965	$ 25,550	$ 130,305
1955	134,685	21,535	35,405	191,625
1956	144,175	21,900	35,405	201,480
1957	144,175	20,440	32,850	197,465
1958	101,470	13,505	21,170	136,145
1959	51,465	5,840	8,760	66,065
1960	27,740	3,650	5,110	36,500
				$ 959,585

Plant II: Compression plus Refrigeration

1954	$ 94,535	$ 42,340	$ 136,875
1955	141,620	59,130	200,750
1956	151,475	58,765	210,240
1957	151,475	54,385	205,860
1958	105,850	35,040	140,890
1959	53,655	14,965	68,620
1960	28,835	8,760	37,595
			$ 1,000,830

Plant III: Compression plus Absorption-Crude Stabilization

1954	90,520	111,325	201,845
1955	139,065	126,655	265,720
1956	150,015	108,405	258,420
1957	150,380	94,535	244,915
1958	104,755	61,685	166,440
1959	52,195	29,200	81,395
1960	28,105	17,155	45,260
			$ 1,263,995

EXHIBIT "C"

GASOLINE PLANT CONSTRUCTION CORPORATION

PLANT COST ESTIMATES

Plant I - Compressor Plant with Compression Gasoline Recovery

Gathering System	$ 40,000
Compressor Plant, 1250 HP @ 230.00	287,000
Generator Units, 2 - 25 KW	10,000
Gasoline Recovery and Storage	25,000
Miscellaneous	10,000
	$ 392,000

Plant II - Compressor Plant with Refrigeration Unit for maximum 12# Gasoline Recovery

Gathering System	$ 40,000
Compressor and Refrigeration Plant, 1320 HP @ 230.00	303,000
Generator Units, 2 - 40 KW	14,000
Gasoline Recovery and Gas Dehydration Units	50,000
Miscellaneous	15,000
	$ 422,000

Plant III - Compressor Plant with Crude Stabilization

Gathering System	$ 40,000
Compressor Plant	287,000
Generator Units, 2 - 40 KW	14,000
Crude Stabilization	25,000
Gasoline Absorption Unit	75,000
Miscellaneous	20,000
	$ 461,000

EXHIBIT "D"

AVERAGE DAILY PRODUCTION

Plant	Year	Sales Gas MCF/D	* El Paso Products LPG-Gal/D	* El Paso Products 26#-Gal/D	Plant 12# Gaso. Gal/D
I	1954	2,235	634	440	1,165
	1955	3,350	934	620	1,615
	1956	3,590	967	620	1,615
	1957	3,590	934	560	1,500
	1958	2,530	634	360	967
	1959	1,175	267	160	400
	1960	634	167	100	233
II	1954	2,355			1,935
	1955	3,530			2,700
	1956	3,770			2,680
	1957	3,770			2,480
	1958	2,635			1,600
	1959	1,225			684
	1960	658			400
					12# Crude Vol. Increase
III	1954	2,255			5,080
	1955	3,470			5,780
	1956	3,740			4,950
	1957	3,745			4,320
	1958	2,610			2,815
	1959	1,190			1,333
	1960	642			783

* Portion of recovered products for which Lowry would receive payment.

EXHIBIT "E"

OPERATING COSTS

	Cost/Year
* Operator Salaries	$ 25,000
Lube Oil and Operating Supplies	12,000
Maintenance Materials @ 1%/year	4,000
Insurance and Taxes @ 1%/year	4,000
General Overhead @ 15% of above	7,000
	$ 52,000

* Includes General Foreman and one operator per shift.

Operating Costs of any one of the three types of plants described would be approximately the same.

EXHIBIT "F"

GASOLINE PLANT CONSTRUCTION CORPORATION

INCOME BEFORE DEPRECIATION, INCOME TAX, ETC.

Plant I:

Gross Income for Seven Year Period	$ 959,585	
Operating Expenses	364,000	
Income After Operating Expenses		$ 595,585
Cost of Plant	392,000	
Salvage Value of Plant @ 40%	157,000	
Cost of Plant After Salvage		235,000
Net Income Before Depreciation, Taxes		$ 360,585

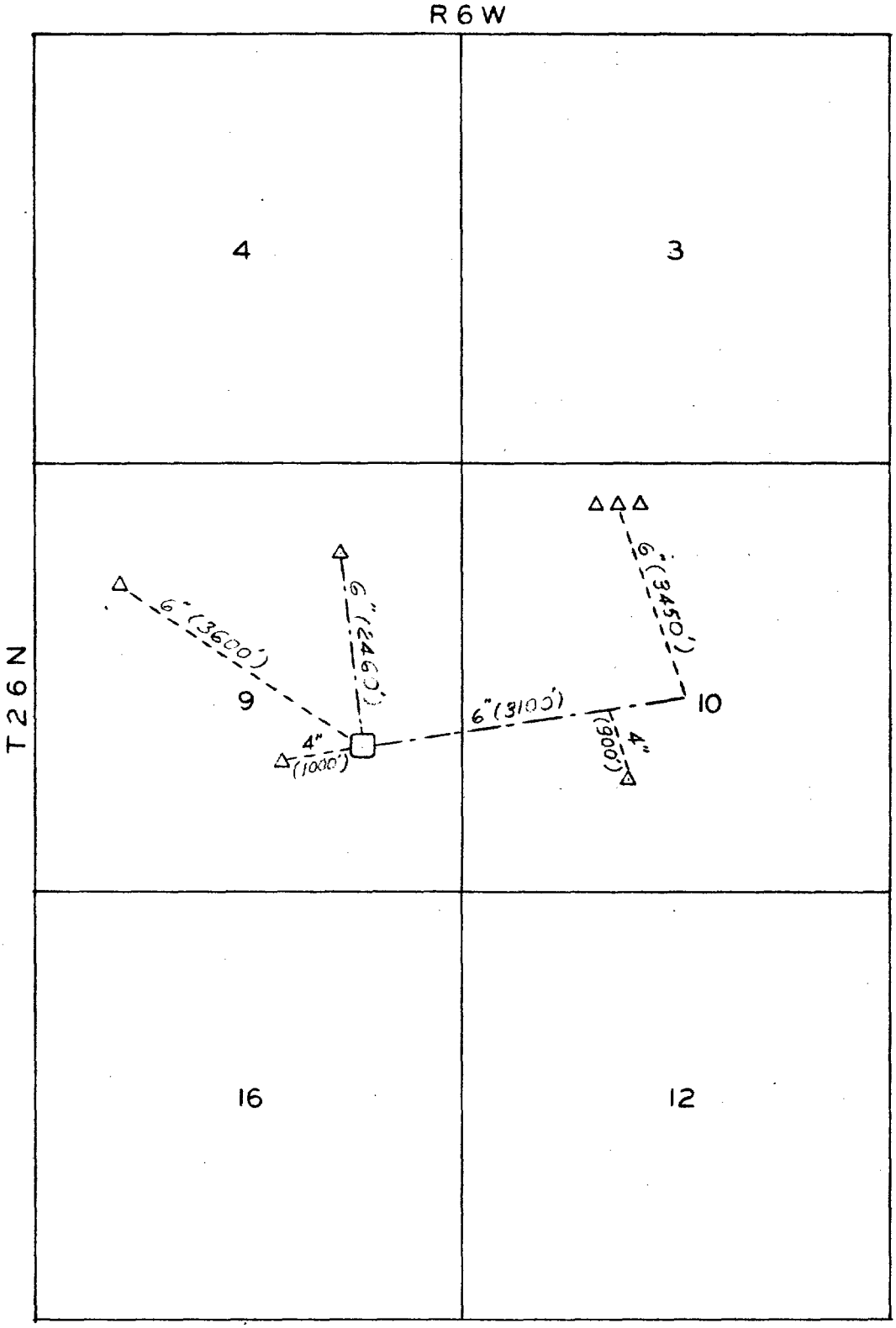
Plant II:

Gross Income for Seven Year Period	1,000,830	
Operating Expenses	364,000	
Income After Operating Expenses		$ 636,830
Cost of Plant	422,000	
Salvage Value of Plant @ 40%	169,000	
Cost of Plant After Salvage		253,000
Net Income Before Depreciation, Taxes		$ 383,830

Plant III:

Gross Income for Seven Year Period	1,263,995	
Operating Expenses	364,000	
Income After Operating Expenses		$ 899,995
Cost of Plant	461,000	
Salvage Value of Plant @ 40%	185,000	
Cost of Plant After Salvage		276,000
Net Income Before Depreciation, Taxes		$ 623,995

EXHIBIT "G"



LEGEND

△ TANK BATTERY

□ COMPRESSOR SITE

PROPOSED LINES

GASOLINE PLANT CONSTRUCTION CORP.

HOUSTON – CORPUS CHRISTI

CASINGHEAD GAS GATHERING SYSTEM

FOR

LOWRY OIL CO. — RIO ARRIBA COUNTY, N.M.

DR. TURER	DATE 5 - 18 - 53	
CK.	SCALE 1" = 2000'-0"	

EXHIBIT "H"

UNIT PRICES USED

* Sales Gas:	1954 - 58	11¢/MCF
	1959 - 60	12¢/MCF

** Product payment from El Paso Natural Gas Company used with Plant I only.

El Paso Recovery			x fraction	x price
C_3	25%	LPG	x 20.0%	x 3¢/gal.
C_4	70%	26#	x 33.3%	x 5¢/gal.
C_5	100%			

Price of Increased Crude: 6¢/gal.
(equivalent to 12# RVP natural gasoline)

* Volumes used in Plant I are after El Paso Natural Gas Company shrinkage. Volumes used in Plants II and III are before El Paso Natural Gas Company shrinkage.
Volume measurements are: MCF @ 15.025 psia.

** Sales gas contents of Plants II and III not sufficient in pentanes-plus to rate payment on products.

EXHIBIT "L"

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

May 21, 1953

COPY

Mr. Tim G. Lowry
616 Central Avenue, NE
Albuquerque, New Mexico

Dear Mr. Lowry:

On May 19th Mr. A. A. Hunt, Art Holland and Harry Birdseye with Counsel Jason Kellahin put on Case 537 before the New Mexico Oil Conservation Commission.

As you well know this case involves spacing of what is now called the South Blanco-Tocito Pool. Since I became a member of this Commission in October 1945 the Commission has heard about four hundred and seventy cases. Similar cases have been presented by the major oil companies such as Magnolia, Phillips, Amerada, Stanolind and Gulf but, never has a case been more thoroughly and competently presented in every detail than Case 537. Your organization is to be highly commended for the presentation and the efforts.

We would like permission to use your Case as an example for cases to be presented in the future.

Sincerely yours,

R. R. Spurrier
Secretary-Director

RRS/vc
BC: Mr. Kellahin
Mr. Hunt
Mr. Holland
Mr. Birdseye

RS
WBM

ABE R. PETERSON
TOM LEEMING
OWEN RALL
HENRY P. C. W. BARBER
WALTER W. ROSS, JR.
TIMOTHY G. LOWRY
JOHN R. PORTER
HAROLD W. HUFF
RICHARD V. HENRY, JR.
J. HAYDEN MACDONALD
WILLIAM A. CANNON
LEWIS E. BULKELEY, JR.
WALTER P. STEFFEN
GERHARD E. SEIDEL
HERBERT C. LOTH, JR.
ELROY C. SANDQUIST, JR.
IRVING G. SWENSON
ROBERT G. SCHLOERB
JOHN W. GILLIGAN

LAW OFFICES
ECKERT, PETERSON & LEEMING
FIELD BUILDING
135 SOUTH LA SALLE STREET
CHICAGO 3

WALTER H. ECKERT
1923-1944

TELEPHONE
ANDOVER 3-7300

May 25, 1953

Mr. R. R. Spurrier
Secretary-Director
New Mexico Oil Conservation Commission
P.O. Box 871
Santa Fe, New Mexico

Re: Case 537 - New Mexico Oil Conservation Commission

Dear Mr. Spurrier:

Thank you for your letter of May 21st. It is of course very gratifying to us when our people do an outstanding job and I appreciate your calling it to my attention.

You have our permission to use the case in such fashion as you believe will be useful.

Sincerely yours,

TGL/H

cc: Mr. A. A. Hunt
Mr. A. C. McLee
Mr. Gail F. Moulton

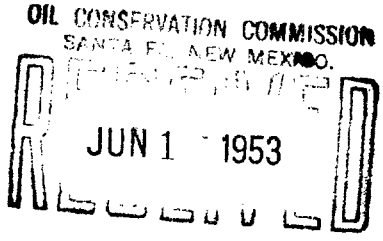
Case 537

Lowry et al Operating Account

616 East Central Avenue

Albuquerque, New Mexico

May 29, 1953



Mr. W. B. Macy
Post Office Box 871
Santa Fe, New Mexico

Re: South Blanco Tocito Pool

Dear Bill:

Attached is the report which I borrowed on the joint hearing of the Dollarhide Fields, Andrews County, Texas, and Lea County, New Mexico. This report helped immensely in the preparation of our data for the recent Field Rules hearing on the South Blanco Tocito Pool.

I wish to express my appreciation for the consideration and cooperation you gave to our request for Field Rules on the South Blanco Tocito Pool. Your interest in our problem relating to this Pool was greatly appreciated.

Thanks again for the use of the attached report.

Yours very truly,

A. F. Holland

AFH:eg
encl

Case 537

Lowry et al Operating Account

616 East Central Avenue

Albuquerque, New Mexico

May 29, 1953

Mr. R. R. Spurrier
Post Office Box 871
Santa Fe, New Mexico

Re: South Blanco Tocito Pool

Dear Mr. Spurrier:

At the recent hearing on May 19, 1953 for Field Rules pertaining to the South Blanco Tocito Pool, Rio Arriba County, New Mexico, the statement was made that Lowry et al Operating Account was having a study made to determine the proper procedure to be used for the conservation of the casing-head gas of subject Pool. Attached is a copy of the completed report, prepared by Gasoline Plant Construction Corporation of Houston, Texas, demonstrating that this Company is concerned about the conservation of this gas, and are conducting the necessary planning to arrive at the proper measures for conservation of this casing-head gas. It is believed that our decision as to whether we should construct the facilities or allow outsiders to do this, will soon be resolved, thereby allowing the sale of this gas and associated products.

I would like to express appreciation on behalf of Lowry Oil Company and myself for the consideration and the cooperation given by yourself and Mr. Macy to our Field Rule problems for the South Blanco Tocito Pool. Your interest and consideration of these problems were greatly appreciated.

Yours very truly,

A. F. Holland

AFH:eg

Case 537

JASON W. KELLAHIN
ATTORNEY AT LAW
100 CORDOVA LANE
P. O. BOX 361
SANTA FE, N. M.

June 4, 1953

New Mexico Oil Conservation Commission,
State Capitol,
Santa Fe, New Mexico

Gentlemen:

Attached is a copy of a report by Amstutz and Yates on the Pettigrew Tocito (now South Blanco Tocito) Pool, Rio Arriba County, New Mexico. Permission was granted by the Commission to file this report as a late-filed exhibit in Commission Case No. 537, heard by the Commission last month.

Your courtesy in hearing the somewhat lengthy presentation of this case, and your consideration of it, is greatly appreciated.

Yours very truly,

Jason W. Kellahin
Jason W. Kellahin