OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

April 3, 1952

33-33-14E

Consol. Gas, Oil & Mfg. Company
Professional Building
Independence, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis made on the Baker Barrel core taken from the Havener Lease, Well No. 18, Montgomery County, Kansas, and submitted to our laboratory March 26, 1952.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:eda
c.c.

HAVENER 18

CONSOLIDATED GAS, OIL & MANUFACTURING COMPANY

CORE ANALYSIS REPORT

HAVENER LEASE WELL NO. 18

MONTGOMERY COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

APRIL 3, 1952

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Consol. Gas, Oil & Mfg. Co. Lease Havener Well No. 18

Location

Section 33 Twp. 33 S Rge. 14 E County Montgomery State Kansas

Name of Sand	Wayside
Top of Core	686.60
Bottom of Core	707.10
Top of Sand (According to Driller)	681.00
Bottom of Pay Sand	700.00
Total Feet of Permeable Sand	19.95
Total Feet of Floodable Sand	8.45

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 2	4.00	4.00
2 - 4	4.25	8.25
4 - 12	4.00	12.25
12 - 24	3.10	15.35
24 - 48	2.05	17.40
48 & above	2.55	19.95

Average Permeability Millidarcys	16.85
Average Percent Porosity	17.90
Average Percent Oil Saturation	19.88
Average Percent Water Saturation	64.64
Average Oil Content, Bbls./A. Ft.	283.
Total Oil Content, Bbls./Acre	5,622.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.14
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	79.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	619.
Total Calculated Oil Recovery, Bbls./Acre	2,100.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water was used as the circulating fluid in the coring of the sand in this well. The trimmer shoe came off the inner barrel during the first run, thereby, resulting in a fishing and drilling job. As a result, 5.60 feet of sand was drilled before coring was started.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
686.60 - 689.05	Brown fine grained micaceous sandstone.
689.05 - 689.45	Brown fine grained micaceous calcareous sandstone.
689.45 - 690.75	Brown fine grained micaceous sandstone.
690.75 - 691.00	Brown fine grained laminated micaceous shaley sandstone.
691.00 - 692.70	Brown fine grained micaceous sandstone.
692.70 - 694.60	Light brown fine grained laminated micaceous shaley sandstone.
694.60 - 695.00	Gray fine grained micaceous sandstone containing thin layers of oil sand.
695.00 - 696.50	Brown fine grained micaceous shaley sandstone.
696.50 - 697.70	Brown fine grained laminated micaceous shaley sandstone.
697.70 - 700.70	Laminated gray and brown fine grained micaceous shaley sandstone.
700.70 - 704.40	Gray fine grained micaceous shaley sandstone containing a few thin layers of oil sand.
704.40 - 707.10	Gray fine grained micaceous shaley sandstone.

Coring was started at a depth of 686.60 feet in fine grained micaceous sandstone and completed at 707.10 feet in gray fine grained

micaceous shaley sandstone. This core shows a total of 20.50 feet of sandstone. For the most part, the pay is made up of fine grained micaceous to shaley 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 41.95, 8.62 and 2.68 millidarcys respectively; the overall average being 16.85 (See Table II). By observing the data given on the coregraph, it is noticeable that the cored section has a wide variation in permeability and that the permeability of the upper part of the core is much higher.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low overall weighted average percent oil saturation, namely, 19.88. The weighted average percent oil saturation of the upper, middle and lower sections is 30.29, 21.70 and 9.54 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 47.87, 62.91 and 79.18 respectively; the overall average being 64.64 (See Table IV). This gives an overall weighted average total fluid saturation of 84.52 percent.

In an effort to determine the degree of flushing of the sand during coring, 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 evident that considerable flushing of the sand did

occur in the more permeable zone at the top of the core, as for the most part, the zones of higher permeability have the lower chloride content.

The weighted average oil content of the upper, middle and lower sections is 446, 307 and 126 barrels per acre foot respectively; the overall average being 283. The total oil content, as shown by this core, is 5,622 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The pay sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 619 barrels of oil per acre was obtained from 7.80 feet of sand. The weighted average percent oil saturation was reduced from 28.61 to 23.47, or represents an average recovery of 5.14 percent. The weighted average effective permeability of the samples is 1.78 millidarcys, while the average initial fluid production pressure is 19.4 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 20 samples tested, 18 produced water and 8 oil. This indicates that approximately 40 percent of the sand represented by these samples contained recoverable oil.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 2,100 barrels of oil per acre, or an average of 249 barrels of oil per acre foot from the 8.45 feet of floodable sand analyzed.

In calculating this recovery, an allowance was made for oil lost during coring, and it was assumed that the primary production and the true water saturation of the sand are 10 and 38 percent respectively. It is very unfortunate that we were unable to get a core from the top of the sand section, as it is evident that at least part of this sand was pay sand. In case this well is to be used as a water injection well, it would be advisable to plug the hole back to a depth of 694.00 feet, as the sand below this depth contains very little recoverable oil and is apt to take some water.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Consolidated Gas, Oil & Mfg. Co. Lease Havener Well No. 18

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	686.85	46.	0.50	0.50	23.00
2	687.35	31.	0.40	0.90	12.40
3	687.73	39.	0.50	1.40	19.50
4	688.24	16.	0.40	1.80	6.40
5	688.65	28.	0.65	2.45	18.20
6	689.31	2.1	0.40	2.85	0.84
7	689.80	71.	0.55	3.40	39.05
8	690.22	59.	0.75	4.15	44.25
9	690.80	3.6	0.25	4.40	0.90
10	691.45	56.	0.70	5.10	39.20
11	691.92	85.	0.55	5.65	46.75
12	692.60	12.	0.45	6.10	5.40
13	693.25	13.	0.95	7.05	12.35
14	694.05	10.	0.95	8.00	9.50
15	694.70	3.6	0.40	8.40	1.44
16	695.15	6.0	0.40	8.80	2.40
17	695.60	3.0	0.40	9.20	1.20
18	696.10	16.	0.70	9.90	11.20
19	696.55	5.2	0.30	10.20	1.56
20	697.05	9.1	0.60	10.80	5.46
21	697.65	17.	0.30	11.10	5.10
22	698.25	6.8	0.85	11.95	5.78
23	698.82	1.2	0.50	12.45	0.60
24	699.35	7.8	0.50	12.95	3.90
25	699.82	5.1	0.40	13.35	2.04
26	700.20	2.6	0.70	14.05	1.82
27	700.75	16.	0.30	14.35	4.80
28	701.35	1.9	0.65	15.00	1.24
29	701.90	2.1	0.45	15.45	0.95
30	702.25	1.7	0.40	15.85	0.68
31	702.80	3.7	0.55	16.40	2.04
32	703.35	2.0	0.55	16.95	1.10
33	703.85	1.6	0.55	17.50	0.88
34	704.30	1.8	0.25	17.75	0.45
35	704.80	1.7	0.60	18.35	1.02
36	705.25	1.7	0.50	18.85	0.85
37	705.75	2.2	0.55	19.40	1.21
38	706.35	1.2	0.55	19.95	0.66
39	706.80	Imp.	0.50	20.45	0.00

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Consolidated Gas, Oil & Mfg. Co. Lease Havener Well No. 18

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
686.60 - 692.70	6.10	41.95	255.89
692.70 - 700.00	7.25	8.62	62.53
700.00 - 707.10	6.60	2.68	17.70
686.60 - 707.10	19.95	16.85	336.12

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RESULTS OF SATURATION TESTS

TABLE III

Company Consolidated Gas, Oil & Manufacturing Co. Lease Havener Well No. 18

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	686.98	17.1	28.6	54.2	82.8	380	0.80	0.80	304
2	687.85	16.9	27.5	53.5	81.0	362	1.00	1.80	362
3	688.95	16.6	29.8	51.7	81.5	384	0.65	2.45	250
F3	689.15	12.5	23.9	-	-	232	0.40	2.85	93
4	689.95	19.9	35.2	39.0	74.2	545	1.30	4.15	710
5	691.17	21.3	27.5	52.9	80.4	456	0.65	4.80	296
6	692.18	22.4	32.5	43.2	75.7	565	1.05	5.85	594
7	693.35	18.1	29.4	52.4	81.8	413	1.20	7.05	495
8	694.36	17.1	25.9	56.7	82.6	344	0.70	7.75	241
9	695.35	19.6	25.0	65.0	90.0	381	0.80	8.55	304
10	696.25	18.9	19.8	61.6	81.4	290	0.70	9.25	203
11	697.25	17.8	18.1	63.0	82.1	250	1.20	10.45	300
12	698.43	17.4	11.2	78.0	89.2	151	1.30	11.75	196
13	699.47	18.5	26.2	59.7	85.9	377	1.00	12.75	377
14	700.45	17.6	13.9	70.2	84.1	190	0.70	13.45	133
15	701.55	18.2	8.9	78.8	87.7	126	1.30	14.75	164
16	702.53	16.6	14.6	77.2	91.8	188	1.00	15.75	188
17	703.55	16.5	8.1	78.1	86.2	104	1.40	17.15	146
18	704.48	16.9	2.4	88.4	90.8	32	0.60	17.75	19
19	705.45	16.6	7.9	78.8	86.7	102	1.00	18.75	102
20	706.52	16.7	10.2	84.0	94.2	132	1.10	19.85	145
							Total	- - - -	-5,622

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Consolidated Gas, Oil & Mfg. Company Lease Havener Well No. 18

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
686.60-692.70	5.85	18.72	30.29	47.87	446	2,609
692.70-700.00	6.90	18.14	21.70	62.91	307	2,116
700.00-707.10	7.10	17.00	9.54	79.18	126	897
686.60-707.10	19.85	17.90	19.88	64.64	283	5,622

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Consolidated Gas, Oil & Manufacturing Co. Lease Havener Well No. 10

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	686.98	17.6	26.6	383	3.3	45	23.3	75.2	318	134	2.97	15
2	687.85	17.0	28.3	373	5.7	75	22.6	75.7	298	103	2.70	20
3	689.15	12.3	23.9	232	0.0	0	23.9	63.6	232	5	0.268	50
4	689.95	20.1	34.2	534	10.4	162	23.8	70.6	372	148	2.92	15
5	691.17	21.3	28.8	476	4.6	76	24.2	66.0	400	94	1.65	15
6	692.18	22.4	31.9	555	9.5	165	22.4	71.7	390	197	5.14	15
7	693.35	18.0	27.8	369	1.8	25	26.0	61.5	364	9	0.157	30
8	694.36	17.5	23.0	312	0.0	0	23.0	65.0	312	1	0.093	30
9	695.25	19.7	25.7	362	1.3	20	22.4	69.9	342	17	0.172	25
10	696.25	18.6	19.3	278	0.0	0	19.3	68.0	278	3	0.041	50
11	697.25	17.9	17.9	249	0.0	0	17.9	68.7	249	0	Imp.	50≠
12	698.43	17.0	12.1	160	0.0	0	12.1	78.6	160	0	Imp.	50≠
13	699.47	18.2	24.6	348	2.1	30	22.5	70.9	318	24	0.296	20
14	700.45	17.8	13.6	188	0.0	0	13.6	73.1	188	3	0.068	50
15	701.55	18.1	8.8	121	0.0	0	8.8	78.1	121	1	0.065	50
16	702.83	17.1	16.2	215	0.0	0	16.2	76.7	215	3	0.053	50
17	703.58	17.0	6.4	85	0.0	0	6.4	83.4	85	9	0.114	40
18	704.48	16.7	3.6	47	0.0	0	3.6	80.8	47	5	0.073	50
19	705.45	16.4	11.8	150	0.0	0	11.8	78.8	150	2	0.062	50
20	706.52	16.9	8.5	112	0.0	0	8.5	87.0	112	6	0.160	40

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.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Consolidated Gas, Oil & Manufacturing Co. Lease Havener Well No. 18

Depth Interval Feet	686.60 - 692.70	692.70 - 700.00	686.60 - 700.00
Feet of Core Analyzed	4.80	3.00	7.80
Average Percent Porosity	19.75	18.53	19.28
Average Percent Original Oil Saturation	30.49	25.64	28.61
Average Percent Oil Recovery	7.25	1.77	5.14
Average Percent Residual Oil Saturation	23.24	23.87	23.47
Average Percent Residual Water Saturation	71.67	66.90	69.83
Average Percent Total Residual Fluid Saturation	94.91	90.77	93.30
Average Original Oil Content, Bbls./A. Ft.	468.	368.	430.
Average Oil Recovery, Bbls./A. Ft.	113.	25.	79.
Average Residual Oil Content, Bbls./A. Ft.	355.	343.	351.
Total Original Oil Content, Bbls./Acre	2,249.	1,105.	3,354.
Total Oil Recovery, Bbls./Acre	543.	76.	619.
Total Residual Oil Content, Bbls./Acre	1,706.	1,029.	2,735.
Average Effective Permeability, Millidarcys	2.76	0.200	1.78
Average Initial Fluid Production Pressure, p.s.i.	16.0	25.0	19.4

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

Oil Field Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Consol. Gas, Oil & Mfg. Co. Lease Havener Well No. 18

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation Connate	Drilling & Foreign	Total
1	686.98	29,800			
2	687.85	37,600			
3	688.95	33,300			
4	689.95	23,500			
5	691.17	27,000			
6	692.18	29,600			
7	693.35	63,700			
8	694.36	68,300			
9	695.25	32,400			
10	696.25	35,300			
11	697.25	38,400			
12	698.43	41,000			
13	699.47	48,800			
14	700.45	47,200			
15	701.55	51,200			
16	702.53	54,100			
17	703.55	48,500			
18	704.48	44,600			
19	705.45	45,300			
20	706.52	53,100			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTATION TESTS

TABLE VIII

Company Consol. Gas, Oil & Mfg. Co. Lease Havener Well No. 18

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
686.60 - 692.70	29,670		
692.70 - 700.00	46,870		
700.00 - 707.10	49,620		
686.60 - 707.10	43,057		

Note: ppm - parts per million.