

May 16, 1952

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

Gentlemen:

Enclosed herewith is the report of the analysis of the Baker Barrel core taken from the Havener Lease, Well No. 22, Montgomery County, Kansas, and submitted to our laboratory May 8, 1952.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:eda
C.C.

33-33-14E

Havener 22

CONSOLIDATED GAS, OIL &

MANUFACTURING COMPANY

CORE ANALYSIS REPORT

HAVENER LEASE

WELL NO. 22

MONTGOMERY COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

MAY 16, 1952

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Consol. Gas, Oil & Mfg. Co. Lease Havener Well No. 22

Location _____

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

Name of Sand Wayside

Top of Core 685.00

Bottom of Core 707.40

Top of Sand 687.50

Bottom of Sand 702.50

Total Feet of Permeable Sand 18.75

Total Feet of Floodable ^{Pay} Sand 11.56

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10
10 - 20
20 - 40
40 - 80
80 & above

7.48
2.75
2.52
4.83
1.20

7.45
10.20
12.72
17.55
18.75

Average Permeability Millidarcys 32.25

Average Percent Porosity 17.60

Average Percent Oil Saturation 27.37

Average Percent Water Saturation 59.18

Average Oil Content, Bbls./A. Ft. 374.

Total Oil Content, Bbls./Acre 7,163.

Average Percent Oil Recovery by Laboratory Flooding Tests 4.56

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 54.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 607.

Total Calculated Oil Recovery, Bbls./Acre 3,100.

Packer Setting, Feet

Viscosity, Centipoises @

A. P. I. Gravity, degrees @ 60 °F

Elevation, Feet

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Fresh water was used as the circulating fluid in the coring of the sand in this well.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
685.00 - 687.10	- Hard gray calcareous shale.
687.10 - 687.50	- Gray sandy calcareous shale.
687.50 - 688.00	- Brown fine grained micaceous slightly shaley sandstone.
688.00 - 690.35	- Brown fine grained micaceous sandstone.
690.35 - 691.90	- Brown medium grained micaceous calcareous sandstone.
691.90 - 693.70	- Sandy limestone.
693.70 - 694.70	- Dark brown fine grained micaceous sandstone.
694.70 - 695.50	- Brown medium grained micaceous sandstone.
695.50 - 697.15	- Brown fine grained micaceous sandstone.
697.15 - 699.92	- Dark brown fine grained micaceous sandstone.
699.92 - 700.45	- Brown fine grained micaceous sandstone.
700.45 - 700.70	- Brown fine grained micaceous slightly shaley sandstone.
700.70 - 702.50	- Brown fine grained micaceous sandstone.
702.50 - 703.40	- Brown fine grained slightly laminated micaceous shaley sandstone.
703.40 - 703.90	- Laminated gray and brown fine grained micaceous sandstone.
703.90 - 705.70	- Brown fine grained micaceous slightly shaley sandstone.
705.70 - 706.05	- Gray fine grained micaceous sandstone.
706.05 - 707.40	- Brown fine grained micaceous slightly shaley sandstone.

Coring was started at a depth of 685.00 feet in hard gray calcareous shale and completed at 707.40 feet in fine grained micaceous slightly shaley sandstone. This core shows a total of 19.90 feet of formation containing oil. For the most part, the pay is made up of fine grained micaceous sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 44.67 and 8.54 millidarcys respectively; the overall average being 32.25 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a comparatively low percent oil saturation, namely, 27.37. The weighted average percent oil saturation of the upper and lower sections is 28.07 and 25.92 respectively. The weighted average percent water saturation of the upper and lower sections is 58.56 and 60.48 respectively; the overall average being 59.18. This gives an overall weighted average total fluid saturation of 86.55 percent.

In order to determine whether or not any flushing of the sand occurred 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 flushing of the sand did occur during coring, as for the most part, the zones of higher permeability have the lower chloride content.

The weighted average oil content of the upper and lower sections is 371 and 380 barrels per acre foot respectively; the overall average being 374. The total oil content, as shown by this core, is 7,163 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

Inasmuch as the sand has a comparatively low percent oil saturation, naturally, one would not expect a large volume of oil to be recovered by laboratory flooding tests. The total recovery of 607 barrels of oil per acre was obtained from 11.25 feet of sand. The weighted average percent oil saturation was reduced from 28.68 to 24.12, or represents an average recovery of 4.56 percent. The weighted average effective permeability of the samples is 1.89 millidarcys, while the average initial fluid production pressure is 15 pounds per square inch (See Table V I).

By observing the data given in Table V, you will note that of the 21 samples tested, 20 produced water and 13 oil. This indicates that approximately 62 percent of the sand represented by this core contains recoverable oil. The tests also show that the sand has a fairly uniform effective permeability.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approxi-

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CHANUTE, KANSAS

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mately 3,100 barrels of oil per acre, or an average of 268 barrels per acre foot from the 11.56 feet of floodable pay 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.

This core shows a comparatively clean sand section. The pay sand extends from 687.50 to 702.50 feet.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Consolidated Gas, Oil & Mfg. Lease Havener Well No. 22

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	687.83	44.	0.50	0.50	22.00
2	688.45	78.	0.70	1.20	54.60
3	688.93	64.	0.50	1.70	32.00
4	689.40	52.	0.40	2.10	20.80
5	689.80	105.	0.45	2.55	47.25
6	690.30	40.	0.30	2.85	12.00
7	691.30	9.5	0.90	3.75	8.55
8	692.05	1.97	0.30	4.05	0.59
9	692.35	1.92	0.80	4.85	1.54
10	693.03	1.41	0.70	5.55	0.99
11	693.83	1.13	0.25	5.80	0.28
12	694.10	165.	0.35	6.15	57.75
13	694.50	176.	0.40	6.55	70.40
14	694.86	9.5	0.40	6.95	3.80
15	695.34	16.	0.40	7.35	6.40
16	695.90	27.	0.70	8.05	18.90
17	696.43	38.	0.55	8.60	20.90
18	697.04	32.	0.40	9.00	12.80
19	697.50	50.	0.55	9.55	27.50
20	697.86	53.	0.50	10.05	26.50
21	698.40	32.	0.40	10.45	12.80
22	698.77	63.	0.40	10.85	25.20
23	699.23	61.	0.45	11.30	27.45
24	699.65	37.	0.47	11.77	17.39
25	699.95	40.	0.53	12.30	21.20
26	700.46	4.4	0.25	12.55	1.10
27	701.03	14.	0.55	13.10	7.70
28	701.45	10.	0.55	13.65	5.50
29	702.10	6.5	0.70	14.35	4.55
30	702.77	11.	0.45	14.80	4.95
31	703.05	7.6	0.45	15.25	3.42
32	704.05	8.7	0.40	15.65	3.48
33	704.55	19.	0.45	16.10	8.55
34	704.90	7.5	0.40	16.50	3.00
35	705.40	5.8	0.55	17.05	3.19
36	705.84	14.	0.35	17.40	4.90
37	706.25	5.6	0.35	17.75	1.96
38	706.56	4.2	0.45	18.20	1.89
39	707.15	1.58	0.55	18.75	0.87

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Consolidated Gas, Oil & Mfg. Co. Lease Havener Well No. 22

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
687.50 - 700.45	12.30	44.67	549.59
700.45 - 707.40	6.45	8.54	55.06
687.50 - 707.40	18.75	32.25	604.65

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RESULTS OF SATURATION TESTS

TABLE III

Company Consolidated Gas, Oil & Manufacturing Co. Lease Havener Well No. 22

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	687.66	15.6	29.7	58.6	88.3	360	0.50	0.50	180
2	688.65	21.5	25.6	62.8	88.4	427	1.15	1.65	491
3	689.60	19.6	25.3	62.9	88.2	384	1.20	2.85	461
4	690.65	16.2	25.8	69.1	94.9	324	0.85	3.70	275
5	691.75	10.5	25.1	61.5	86.6	204	0.70	4.40	143
6	692.60	8.6	25.2	74.0	99.2	168	1.10	5.50	185
7	693.55	10.5	31.3	49.4	80.7	255	0.70	6.20	179
8	694.65	21.0	32.0	59.7	91.7	510	1.00	7.20	510
F-8	694.75	13.7	22.9	-	-	243	0.80	8.00	194
9	695.65	17.9	29.5	56.0	85.5	410	0.70	8.70	287
10	696.80	19.2	26.1	50.7	76.8	389	0.95	9.65	370
11	697.70	17.9	31.9	46.0	77.9	443	1.00	10.65	443
12	698.60	18.5	33.8	48.2	82.0	485	0.85	11.50	413
13	699.46	19.9	28.0	60.6	88.6	432	0.92	12.42	397
14	700.30	20.7	33.0	50.0	83.0	530	0.53	12.95	281
15	701.25	20.6	28.7	48.1	76.8	458	1.10	14.05	504
16	702.35	19.0	31.0	65.7	96.7	457	0.70	14.75	320

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Consolidated Gas, Oil & Manufacturing Co. Lease Havener Well No. 22

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.	
17	703.26	18.2	32.8	64.4	97.2	448	0.90	15.65	403
18	704.36	19.0	26.3	59.7	86.0	388	0.85	16.50	330
19	705.15	19.3	17.3	64.4	81.7	260	0.95	17.45	247
F20	705.96	16.8	5.8	-	-	76	0.35	17.80	27
20	706.13	19.2	26.8	63.5	90.3	397	0.45	18.25	179
21	706.85	17.8	27.7	62.5	90.2	382	0.90	19.15	344
Total - - -							- - -	- - -	7,163

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Consolidated Gas, Oil & Mfg. Company Lease Havener Well No. 22

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
687.50-700.45	12.95	16.97	28.07	58.56	371	4,809
700.70-707.40	6.20	18.92	25.92	60.48	380	2,354
687.50-707.40	19.15	17.60	27.37	59.18	374	7,163

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Consolidated Gas, Oil & Manufacturing Co.

Lease Havener

Well No. 22

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	687.65	15.8	28.4	349	4.7	58	23.7	74.0	291	99	2.42	15
2	688.65	21.3	25.3	418	3.4	56	21.9	75.7	362	96	3.10	15
3	689.60	19.3	24.2	367	0.9	14	23.3	73.0	353	63	1.87	15
4	690.65	16.7	25.4	330	0.9	12	24.5	71.8	316	66	2.66	15
5	691.75	10.3	23.6	189	0.0	0	23.6	74.1	169	7	0.061	30
6	692.60	8.7	24.0	162	0.0	0	24.0	70.0	162	3	0.078	30
7	693.56	10.0	32.6	253	0.0	0	32.6	60.5	253	0	Imp.	50+
8	694.75	13.7	22.9	243	0.7	7	22.2	68.1	236	33	0.649	25
9	695.65	17.9	28.0	389	2.8	39	25.2	67.4	350	72	1.58	15
10	696.80	19.3	25.5	382	2.4	36	23.1	73.3	346	119	2.58	15
11	697.70	17.7	31.2	429	6.7	92	24.5	71.2	337	164	2.64	15
12	698.60	18.5	32.4	466	10.5	151	21.9	75.7	315	114	2.30	10
13	699.45	19.5	30.1	456	4.9	74	25.2	68.6	382	45	0.922	15
14	700.30	20.4	31.7	403	3.2	51	28.5	63.8	352	40	0.771	15
15	701.25	20.8	29.9	483	3.6	58	26.3	69.0	425	76	1.13	15
16	702.35	19.5	29.2	440	3.8	58	25.4	71.5	382	69	1.20	15
17	703.25	18.2	31.3	442	0.0	0	31.3	65.5	442	28	0.303	20
18	704.35	19.2	25.3	377	0.0	0	25.3	67.5	377	38	0.705	20
19	705.15	19.1	19.0	282	0.0	0	19.0	77.0	282	10	0.197	30
20	705.95	16.8	5.8	76	0.0	0	5.8	92.2	76	8	0.132	30
21	706.85	18.0	28.0	391	0.0	0	28.0	70.0	391	18	0.153	25

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 Consolidated Gas, Oil & Manufacturing Co. Lease Havener Well No. 22

Depth Interval, Feet	687.50 - 700.45	700.70 - 702.50	687.50 - 702.50
Feet of Core Analyzed	9.45	1.80	11.25
Average Percent Porosity	18.32	20.28	18.63
Average Percent Original Oil Saturation	28.49	29.72	28.68
Average Percent Oil Recovery	4.72	3.72	4.56
Average Percent Residual Oil Saturation	23.77	26.00	24.12
Average Percent Residual Water Saturation	71.54	70.06	71.31
Average Percent Total Residual Fluid Saturation	95.31	96.06	95.43
Average Original Oil Content, Bbls./A. Ft.	388.	467.	401.
Average Oil Recovery, Bbls./A. Ft.	53.	58.	54.
Average Residual Oil Content, Bbls./A. Ft.	335.	409.	347.
Total Original Oil Content, Bbls./Acre	3,665.	841.	4,506.
Total Oil Recovery, Bbls./Acre	502.	105.	607.
Total Residual Oil Content, Bbls./Acre	3,163.	736.	3,899.
Average Effective Permeability, Millidarcys	2.03	1.16	1.89
Average Initial Fluid Production Pressure, p.s.i.	15.0	15.0	15.0

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

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RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company Consolidated Gas, Oil & Mfg. Co. Lease Havener Well No. 22

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate	Percent Water Saturation Drilling & Foreign	Total
1	687.66	52,100			
2	688.65	12,400			
3	689.60	10,500			
4	690.65	5,660			
5	691.75	25,600			
6	692.60	29,000			
7	693.55	84,500			
8	694.65	12,800			
9	695.65	43,900			
10	696.80	36,400			
11	697.70	33,000			
12	698.60	40,200			
13	699.46	27,800			
14	700.30	43,200			
15	701.25	45,800			
16	702.35	24,300			
17	703.26	39,100			
18	704.36	44,900			
19	705.15	35,600			
20	706.13	46,500			
21	706.85	55,900			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Consol. Gas, Oil & Mfg. Co. Lease Havener Well No. 22

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
687.50 - 700.45	37,618		
700.70 - 707.40	42,188		
687.50 - 707.40	39,103		

Note: ppm - parts per million.