● CORE ANALYSIS ● WATER REPRESSURING ENGINEERING ● WATER ANALYSIS ● FLOODING WATER TREATMENT ● SURVEYING

OILFIELD RESEARCH LABORATORIES

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February 25, 1959

Schermerhorn Oil Corporation
P. O. Box 287
Tulsa, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the 2½" Rotary core taken from the Freidline "B" Lease, Well No. K-31, Wilson County, Kansas, and submitted to our laboratory on February 17, 1959.

This core was sampled and the samples sealed in plastic bags by a representative of our laboratory.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:cs

1 c. to Schermerhorn Oil Corporation
Route 1
Earlton, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

Location 320' E. of W. Line & 660' S. of N. Line, NE¼

Section 17 Twp. 28S Rge. 17E County Wilson State Kansas

Name of Sand	Bartlesville
Top of Core	971.0
Bottom of Core	1007.0
Top of Sand (Received)	971.0
Bottom of Pay Sand	997.9
Total Feet of Permeable Sand	26.7
Total Feet of Pay Floodable Sand	21.1

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	4.2	4.2
20 - 40	3.0	7.2
40 - 80	6.0	13.2
80 - 100	3.7	16.9
100 - 150	4.6	21.5
150 & above	5.2	26.7

Average Permeability Millidarcys	87.3
Average Percent Porosity	20.9
Average Percent Oil Saturation	42.1
Average Percent Water Saturation	37.2
Average Oil Content, Bbls./A. Ft.	684.
Total Oil Content, Bbls./Acre	19,165.
Average Percent Oil Recovery by Laboratory Flooding Tests	10.4
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	172.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	4,079.
Total Calculated Oil Recovery, Bbls./Acre	3,920.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet (Assumed Datum)	953.3

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

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
971.0 - 972.5	Light brown fine grained sandstone.
972.5 - 975.8	Brown fine grained micaceous sandstone.
975.8 - 977.0	Laminated sandstone and shale.
977.0 - 977.8	Brown fine grained sandstone.
977.8 - 978.1	Light brown shaley sandstone.
978.1 - 981.8	Brown fine grained sandstone.
981.8 - 983.1	Brown slightly shaley sandstone.
983.1 - 992.0	Brown fine grained sandstone.
992.0 - 994.0	Brown fine grained slightly shaley sandstone.
994.0 - 996.1	Brown fine grained sandstone.
996.1 - 996.4	Brown conglomeratic sandstone.
996.4 - 997.9	Brown fine grained sandstone.
997.9 - 998.2	Light brown conglomeratic sandstone.
998.2 - 998.4	Light brown fine grained sandstone.
998.4 - 1000.4	Dark fine grained micaceous carbonaceous sandstone.
1000.4 - 1007.0	Dark fine grained carbonaceous and conglomeratic sandstone.

Coring was started at a depth of 971.0 feet in light brown fine grained sandstone and completed at 1007.0 feet in dark fine grained carbonaceous and conglomeratic sandstone. This core shows a total of 34.7 feet of sandstone. For the most part, the pay is made up of brown fine grained 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 62.6, 120.0 and 36.3 millidarcys respectively; the overall average being 87.3 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from 0.5 to a maximum of 247 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 42.1. The weighted average percent oil saturation of the upper, middle and lower sections is 38.8, 44.1 and 47.5 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 38.1, 37.0 and 34.9 respectively; the overall average being 37.2 (See Table III). This gives an overall weighted average total fluid saturation of 79.3 percent. This fairly low total fluid saturation indicates some fluid was lost during coring which was probably oil.

The weighted average oil content of the upper, middle and lower sections is 620, 735 and 741 barrels per acre foot respectively; the overall average being 684. The total oil content, as shown by this core, is 19,165 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 4,079 barrels of oil per acre was obtained from 23.8 feet of sand. The weighted average percent oil saturation was reduced from 42.2 to 31.8, or represents an average recovery

of 10.4 percent. The weighted average effective permeability of the samples is 4.38 millidarcys, while the average initial fluid production pressure is 23.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 29 samples tested, 26 produced water and 25 oil. This indicates that approximately 86 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability.

CONCLUSION

On the basis of the above data, it is evident that an efficient water-flood, within the vicinity of this well, will recover approximately 3,920 barrels of oil per acre or an average of 186 barrels per acre foot from the 21.1 feet of floodable pay sand analyzed. In calculating this oil recovery value, the following factors and assumptions were employed:

Original formation volume factor	1.07
Present formation volume factor	1.02
Irreducible water saturation, percent	37.0
Primary oil recovery, percent	5.0
Present oil saturation, percent	55.0
Oil saturation at abandonment, percent	32.0
Percent porosity	21.3
Net feet of floodable pay sand	21.1
Performance factor (permeability distribution and sweep efficienty)	0.50

This core shows a fairly clean sand section having a good oil saturation, a fair water saturation and a wide variation in permeability. No difficulty should be encountered in forcing the sand to take an ample volume of water.

The analysis shows that the bottom of the pay sand is at a depth of 997.9 feet. It would be advisable to inject approximately 1000 gallons of solvent into the water-input wells prior to water injection.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	971.4	83.	0.6	0.6	49.80
2	971.9	52.	0.5	1.1	26.00
3	972.3	106.	0.4	1.5	42.40
4	972.8	110.	0.4	1.9	44.00
5	973.3	105.	0.6	2.5	63.00
6	973.9	121.	0.5	3.0	60.50
7	974.3	126.	0.5	3.5	63.00
8	974.9	77.	0.5	4.0	38.50
9	975.4	165.	0.7	4.7	115.50
10	975.9	0.68	0.4	5.1	0.27
11	976.4	Imp.	0.5	5.6	0.00
12	976.9	17.	0.3	5.9	5.10
13	977.3	49.	0.8	6.7	39.20
14	977.9	116.	0.3	7.0	34.80
15	978.3	21.	0.5	7.5	10.50
16	978.8	14.	0.5	8.0	7.00
17	979.3	28.	0.5	8.5	14.00
18	979.8	16.	0.5	9.0	8.00
19	980.4	32.	0.5	9.5	16.00
20	980.9	37.	0.5	10.0	18.50
21	981.4	56.	0.7	10.7	39.20
22	981.9	118.	0.4	11.1	47.20
23	982.4	2.4	0.5	11.6	1.20
24	982.9	1.7	0.4	12.0	0.68
25	983.3	16.	0.3	12.3	4.80
26	983.8	8.2	0.6	12.9	4.92
27	984.4	94.	0.6	13.5	56.40
28	984.9	40.	0.5	14.0	20.00
29	985.4	69.	0.5	14.5	34.50
30	985.9	193.	0.6	15.1	115.80
31	986.3	212.	0.4	15.5	84.80
32	986.8	200.	0.5	16.0	100.00
33	987.3	179.	0.5	16.5	89.50
34	987.9	169.	0.8	17.0	83.50
35	988.3	171.	0.5	17.5	85.50
36	988.8	111.	0.5	18.0	55.50
37	989.3	124.	0.5	18.5	62.00
38	989.8	90.	0.5	19.0	45.00
39	990.3	93.	0.5	19.5	46.50
40	990.9	154.	0.5	20.0	77.00

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	991.4	118.	0.5	20.5	59.00
42	991.9	66.	0.4	20.9	26.40
43	992.3	36.	0.6	21.5	21.60
44	992.8	72.	0.5	22.0	36.00
45	993.3	95.	0.5	22.5	47.50
46	993.9	84.	0.4	22.9	33.60
47	994.3	82.	0.6	23.5	49.20
48	994.9	174.	0.5	24.0	87.00
49	995.3	60.	0.5	24.5	30.00
50	995.8	238.	0.5	25.0	119.00
51	996.5	53.	0.3	25.3	15.90
52	996.9	39.	0.4	25.7	15.60
53	997.3	46.	0.5	26.2	23.00
54	997.8	72.	0.3	26.5	21.60
55	998.3	18.	0.2	26.7	3.60
56	999.8	0.50	0.5	27.2	0.25

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RESULTS OF SATURATION TESTS

TABLE II

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

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	971.1	21.9	35	31	66	595	0.6	0.6	357
2	972.1	19.4	35	35	70	527	0.9	1.5	475
3	973.1	22.9	39	36	75	693	1.0	2.5	693
4	974.1	22.0	37	41	78	632	1.0	3.5	632
5	975.1	22.9	40	35	75	711	1.2	4.7	854
6	976.1	16.0	37	50	87	459	1.2	5.9	551
7	977.1	22.0	35	41	76	598	0.8	6.7	479
F-8	978.0	17.2	32	-	-	427	0.3	7.0	128
8	978.2	20.6	39	41	80	624	0.5	7.5	312
9	979.1	20.6	41	34	75	655	1.0	8.5	655
10	980.1	19.4	45	39	84	678	1.0	9.5	678
11	981.1	22.4	43	39	82	748	1.2	10.7	898
12	982.1	18.8	41	35	76	598	0.8	11.5	479
F-13	983.0	15.9	32	-	-	395	0.5	12.0	197
13	983.2	21.4	45	31	76	748	0.5	12.5	374
14	984.1	20.2	46	43	89	721	1.0	13.5	721
15	985.1	19.9	39	47	86	602	1.0	14.5	602
16	986.1	21.5	38	52	90	634	0.6	15.1	380
17	987.1	18.1	54	38	92	758	1.4	16.5	1,062
18	988.1	22.4	44	39	83	764	1.0	17.5	764
19	989.1	23.9	42	32	74	778	1.0	18.5	778
20	990.1	22.4	45	29	74	782	1.0	19.5	782
21	991.1	24.6	39	33	72	742	1.4	20.9	1,040
22	992.1	23.1	47	31	78	842	0.6	21.5	505
23	993.1	22.6	43	31	74	751	1.4	22.9	1,051
24	994.1	21.1	40	33	73	655	0.6	23.5	393
25	995.1	19.6	47	42	89	715	1.0	24.5	715

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RESULTS OF SATURATION TESTS

TABLE II

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

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.	
F-26	996.0	22.8	44	-	-	779	0.5	25.0	389
26	996.2	16.5	47	39	86	602	0.3	25.3	181
27	997.1	19.7	47	38	85	718	1.5	26.8	1,078
28	998.1	19.2	28	45	73	417	0.3	27.1	125
29	1000.1	21.8	55	25	80	930	0.9	28.0	837
							Total-	- - - - -	19,165

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
971.0 - 983.6	12.0	62.6	750.79
983.6 - 996.1	12.5	120.0	1,500.58
996.4 - 1000.0	2.2	36.3	79.95
971.0 - 1000.0	26.7	87.3	2,331.32

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
971.0 - 983.6	12.5	20.4	38.8	38.1	620	7,762
983.6 - 996.1	12.5	21.7	44.1	37.0	735	9,182
996.1 - 1000.4	3.0	20.0	47.5	34.9	741	2,221
971.0 - 1000.4	28.0	20.9	42.1	37.2	684	19,165

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	971.1	21.5	35	584	7	117	28	68	467	150	4.67	15
2	972.1	18.9	35	514	6	88	29	62	426	7	0.193	35
3	973.1	22.5	39	681	10	175	29	63	506	168	5.70	15
4	974.1	21.7	37	624	9	152	28	64	472	164	5.50	25
5	975.1	23.1	40	717	11	197	29	65	520	103	11.41	15
6	976.1	15.4	35	418	0	0	35	64	418	0	Imp.	50+
7	977.1	21.5	35	585	8	134	27	69	451	63	1.68	30
8	978.2	17.2	32	427	6	80	26	66	347	99	2.47	25
9	979.1	20.7	41	659	13	209	28	63	450	6	0.192	30
10	980.1	19.8	45	692	16	246	29	62	446	12	0.277	25
11	981.1	22.9	43	765	14	249	29	65	516	101	11.81	15
12	982.1	18.2	41	579	15	212	26	68	367	4	0.197	25
13	983.2	15.9	32	395	0	0	32	60	395	0	Imp.	50+
14	984.1	20.4	46	729	13	206	33	61	523	89	2.45	25
15	985.1	20.3	39	614	7	110	32	63	504	68	2.00	25
16	986.1	22.0	38	649	6	103	32	61	546	149	14.87	15
17	987.1	17.8	54	746	20	276	34	61	470	81	2.68	30
18	988.1	22.2	44	759	12	207	32	61	552	193	9.21	25
19	989.1	24.2	42	788	11	206	31	62	582	116	12.55	15
20	990.1	21.8	45	762	18	305	27	67	457	43	1.30	15
21	991.1	24.3	39	736	7	132	32	60	604	181	7.24	15
22	992.1	23.4	47	854	11	200	36	58	654	59	1.68	25
23	993.1	22.1	43	738	6	103	37	55	635	61	1.61	25
24	994.1	21.6	40	671	5	84	35	62	587	80	2.45	25
25	995.1	20.1	47	733	10	156	37	60	577	72	1.87	25
26	996.2	22.8	44	779	12	212	32	62	567	173	4.79	25
27	997.1	20.0	47	731	3	47	44	54	684	11	0.333	35
28	998.1	18.7	31	450	0	0	31	56	450	6	0.209	40
29	1000.1	21.2	53	873	0	0	53	31	873	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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Schermerhorn Oil Corporation Lease Freidline "B" Well No. K-31

Depth Interval, Feet	971.0 - 982.6	983.6 - 997.9	971.0 - 997.9
Feet of Core Analyzed	9.8	14.0	23.8
Average Percent Porosity	21.1	21.5	21.3
Average Percent Original Oil Saturation	39.2	44.4	42.2
Average Percent Oil Recovery	11.0	10.1	10.4
Average Percent Residual Oil Saturation	28.2	34.3	31.8
Average Percent Residual Water Saturation	64.7	60.1	61.9
Average Percent Total Residual Fluid Saturation	92.9	94.4	93.7
Average Original Oil Content, Bbls./A. Ft.	644.	735.	698.
Average Oil Recovery, Bbls./A. Ft.	180.	165.	172.
Average Residual Oil Content, Bbls./A. Ft.	464.	570.	526.
Total Original Oil Content, Bbls./Acre	6,306.	10,284.	16,590.
Total Oil Recovery, Bbls./Acre	1,766.	2,313.	4,079.
Total Residual Oil Content, Bbls./Acre	4,540.	7,971.	12,511.
Average Effective Permeability, Millidarcys	4.57	4.27	4.38
Average Initial Fluid Production Pressure, p.s.i.	23.2	23.2	23.2

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