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

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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April 17, 1959

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

Gentlemen:

Enclosed herewith is the report of the analysis of the 3" Rotary core taken from the Hultine Lease, Well No. 37-K, Wilson County, Kansas, and submitted to our laboratory on April 12, 1959.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. McElrea

Carl L. McElrea

CLM:cs

1 c. to Schermerhorn Oil Corporation
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Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Schermerhorn Oil Corporation Lease Hultine Well No. 37-K

Location W½, SE¼

Section 8 Twp. 28S Rge. 17E County Wilson State Kansas

Name of Sand	Bartlesville
Top of Core	975.0
Bottom of Core	1015.0
Top of Pay Sand	992.0
Bottom of Pay Sand	1011.6
Total Feet of Permeable Sand	29.9
Total Feet of Good Floodable Sand	17.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 40	5.8	5.8
40 - 60	5.0	10.8
60 - 80	3.5	14.3
80 - 100	4.0	18.3
100 - 120	3.8	22.1
120 - 140	3.3	25.4
140 & above	4.5	29.9

Average Permeability Millidarcys	86.2
Average Percent Porosity	21.2
Average Percent Oil Saturation	41.5
Average Percent Water Saturation	40.1
Average Oil Content, Bbls./A. Ft.	685.
Total Oil Content, Bbls./Acre	15,155.
Average Percent Oil Recovery by Laboratory Flooding Tests	17.9
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	298.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	5,664.
Total Calculated Oil Recovery, Bbls./Acre	4,600.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet (Above Datum)	968.5

Drilling mud was used as the circulating fluid during the coring of the sand.

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

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
975.0 - 977.5	Laminated sandy shale.
977.5 - 988.0	Light brown laminated shaley sandstone.
988.0 - 988.8	Gray limestone.
988.8 - 989.1	Laminated sandstone and shale.
989.1 - 989.5	Gray limestone.
989.5 - 991.0	Light brown slightly shaley sandstone.
991.0 - 992.0	Light brown laminated shaley sandstone.
992.0 - 996.5	Dark brown sandstone.
996.5 - 997.1	Dark brown conglomeratic sandstone.
997.1 - 998.2	Dark brown sandstone.
998.2 - 999.5	Dark brown conglomeratic sandstone.
999.5 - 1010.0	Dark brown sandstone.
1010.0 - 1010.2	Dark brown laminated shaley sandstone.
1010.2 - 1011.6	Dark brown sandstone.
1011.6 - 1015.0	Gray sandy shale.

Coring was started at a depth of 975.0 feet in laminated sandy shale and completed at 1015.0 feet in gray sandy shale. This core shows a total of 33.4 feet of sandstone. For the most part, the pay is made up of dark brown 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 59.2, 109.8 and 93.8 millidarcys respectively; the overall average being 86.2 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather irregular permeability profile. The permeability of the sand varies from 0.49 to a maximum of 236 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely 41.5. The weighted average percent oil saturation of the upper, middle and lower sections is 21.4, 40.8 and 46.6 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 61.0, 43.2 and 33.0 respectively; the overall average being 40.1 (See Table III). This gives an overall weighted average total fluid saturation of 81.6 percent. This total fluid saturation indicates some fluid was lost during coring, part of which probably was oil.

The weighted average oil content of the upper, middle and lower sections is 280, 658 and 798 barrels per acre foot respectively; the overall average being 685. The total oil content, as shown by this core, is 15,155 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The oil sand in this core responded very well to laboratory flooding tests, as a total recovery of 5,664 barrels of oil per acre was obtained from 19.0 feet of sand. The weighted average percent oil saturation was reduced from 44.4 to 26.5, or represents an average recovery

of 17.9 percent. The weighted average effective permeability of the samples is 5.45 millidarcys, while the average initial fluid production pressure is 20.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 22 samples tested, 21 produced water and 20 oil. This indicates that approximately 91 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a rather wide variation in effective permeability.

CONCLUSION

On the basis of the enclosed data, it is evident that an efficient water-flood within the vicinity of this well will recover approximately 4,600 barrels of oil per acre, or an average of 263 barrels of oil per acre foot from the 17.5 feet of good floodable pay sand analyzed. The following factors and assumptions were used in calculating this recovery:

Original formation volume factor	1.07
Present formation volume factor	1.03
True water saturation, percent	33.0
Primary oil recovery, percent	2.0
Calculated present oil saturation, percent	62.5
Porosity, percent	21.5
Oil saturation at abandonment, percent	30.0
Performance factor	0.50

This core shows a good section of floodable pay sand having good oil and normal water saturations, and good effective permeability. The analysis results indicate that the pay sand is in the interval extending from 992.0 to 1011.6 feet, and that the upper section of the core, above the depth of 992.0 feet, is gas sand.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Schermerhorn Oil Corporation Lease Hultine Well No. 37-K

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	978.5	43.	1.0	1.0	43.00
2	979.5	0.49	1.0	2.0	0.49
3	980.5	Imp.	1.0	3.0	0.00
4	982.5	113.	1.0	4.0	113.00
5	983.5	66.	1.0	5.0	66.00
6	984.5	93.	1.0	6.0	93.00
7	985.5	51.	1.0	7.0	51.00
8	986.5	147.	1.0	8.0	147.00
9	987.5	14.	1.0	9.0	14.00
10	988.5	Imp.	0.8	9.8	0.00
11	989.8	103.	0.5	10.3	51.50
12	990.3	19.	0.5	10.8	9.50
13	990.8	64.	0.5	11.3	32.00
14	991.3	0.59	0.5	11.8	0.30
15	991.8	1.7	0.5	12.3	0.85
16	992.3	152.	0.5	12.8	76.00
17	992.8	54.	0.5	13.3	27.00
18	993.3	173.	0.5	13.8	86.50
19	993.8	96.	0.5	14.3	48.00
20	994.3	229.	0.5	14.8	114.50
21	994.8	236.	0.5	15.3	118.00
22	995.3	199.	0.5	15.8	99.50
23	995.8	134.	0.5	16.3	67.00
24	996.3	108.	0.5	16.8	54.00
25	996.8	6.4	0.6	17.4	3.84
26	997.3	31.	0.4	17.8	12.40
27	997.8	126.	0.7	18.5	88.20
28	998.3	5.7	0.3	18.8	1.71
29	998.8	15.	0.5	19.3	7.50
30	999.3	21.	0.5	19.8	10.50
31	999.8	106.	0.5	20.3	53.00
32	1000.3	133.	0.5	20.8	66.50
33	1000.8	99.	0.5	21.3	49.50
34	1001.3	88.	0.5	21.8	44.00
35	1001.8	44.	0.5	22.3	22.00
36	1002.3	126.	0.5	22.8	63.00
37	1002.8	88.	0.5	23.3	44.00
38	1003.3	83.	0.5	23.8	41.50
39	1003.8	74.	0.5	24.3	37.00
40	1004.3	83.	0.5	24.8	41.50

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Schermerhorn Oil Corporation Lease Hultine Well No. 37-K

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	1004.8	53.	0.5	25.3	26.50
42	1005.3	43.	0.5	25.8	21.50
43	1005.8	133.	0.5	26.3	66.50
44	1006.3	53.	0.5	26.8	26.50
45	1006.8	66.	0.5	27.3	33.00
46	1007.3	116.	0.5	27.8	58.00
47	1007.8	44.	0.5	28.3	22.00
48	1008.3	118.	0.5	28.8	59.00
49	1008.8	76.	0.5	29.3	38.00
50	1009.3	193.	0.5	29.8	96.50
51	1009.8	65.	0.5	30.3	32.50
52	1010.3	118.	0.3	30.6	35.40
53	1010.8	173.	0.5	31.1	86.50
54	1011.3	131.	0.6	31.7	78.50

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RESULTS OF SATURATION TESTS

TABLE II

Company Schermerhorn Oil Corporation Lease Hultine Well No. 37-K

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.	
12	990.1	22.8	13	63	76	230	1.5	1.5	345
13	991.1	13.5	34	58	92	356	1.0	2.5	356
14	992.1	21.6	32	42	74	536	0.6	3.1	322
15	993.1	21.9	35	41	76	595	1.0	4.1	595
16	994.1	22.8	38	45	83	672	1.0	5.1	672
17	995.1	21.0	45	45	90	734	1.0	6.1	734
18	996.1	22.4	43	38	81	748	0.9	7.0	673
19	997.0	16.3	34	52	86	430	0.6	7.6	258
F-19	997.2	22.5	38	-	-	663	0.4	8.0	265
20	998.1	23.5	43	38	81	785	0.7	8.7	550
21	999.1	16.8	46	44	90	600	1.3	10.0	780
22	1000.1	21.2	45	45	90	740	1.1	11.1	814
23	1001.1	22.9	48	32	80	853	1.0	12.1	853
24	1002.1	21.6	47	34	81	788	1.0	13.1	788
25	1003.1	20.6	40	32	72	640	1.0	14.1	640
26	1004.1	21.1	49	28	77	803	1.0	15.1	803
27	1005.1	21.7	49	30	79	826	1.0	16.1	826
28	1006.1	21.9	50	26	76	850	1.0	17.1	850
29	1007.1	23.0	49	36	85	875	1.0	18.1	875
30	1008.1	22.2	47	30	77	810	1.0	19.1	810
31	1009.1	22.8	44	41	85	779	1.4	20.5	1,090
32	1010.1	19.4	42	42	84	632	0.2	20.7	126
33	1011.1	22.6	46	35	81	807	1.4	22.1	1,130
							Total-	- - - - -	15,155

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Schermerhorn Oil Corporation Lease Hultine Well No. 37-K

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
978.0 - 992.0	10.5	59.2	621.64
992.0 - 1000.6	8.6	109.8	944.05
1000.6 - 1011.6	10.8	93.8	1,013.00
978.0 - 1011.6	29.9	86.2	2,578.69

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
989.5 - 992.0	2.5	19.1	21.4	61.0	280	701
992.0 - 1000.6	8.6	20.9	40.8	43.2	658	5,663
1000.6 - 1011.6	11.0	22.1	46.6	33.0	798	8,791
989.5 - 1011.6	22.1	21.2	41.5	40.1	685	15,155

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Schermerhorn Oil Corporation Lease Hultine Well No. 37-K

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.			
12	990.1	22.6	15	263	0	0	15	76	263	143	5.00	25
13	991.1	13.2	34	348	0	0	34	61	348	0	Imp.	50+
14	992.1	21.1	32	524	2	33	30	65	491	134	4.12	25
15	993.1	21.8	35	592	11	186	24	67	406	80	2.73	35
16	994.1	22.4	38	660	12	208	26	64	452	140	7.18	25
17	995.1	21.0	45	734	13	212	32	63	522	181	13.52	15
18	996.1	22.5	43	751	13	227	30	65	524	220	14.61	15
19	997.2	22.5	38	664	10	175	28	67	489	120	7.00	25
20	998.1	23.2	43	775	15	270	28	67	505	155	6.48	25
21	999.1	16.7	46	596	20	259	26	65	337	6	0.205	25
22	1000.1	21.4	45	748	20	332	25	66	416	95	6.64	15
23	1001.1	22.8	48	850	25	443	23	67	407	110	7.50	5
24	1002.1	21.2	47	774	22	362	25	69	412	120	5.79	15
25	1003.1	20.0	40	621	15	233	25	66	388	19	0.600	15
26	1004.1	20.8	49	792	23	372	26	65	420	85	2.22	15
27	1005.1	21.6	49	821	25	419	24	68	402	81	2.56	15
28	1006.1	21.9	50	850	26	442	24	68	408	177	5.70	15
29	1007.1	22.6	49	859	20	351	29	65	508	168	6.50	15
30	1008.1	21.6	47	788	17	285	30	61	503	40	1.08	25
31	1009.1	22.5	44	770	18	315	26	63	455	89	2.63	25
32	1010.1	19.0	42	620	9	133	33	64	487	8	0.218	35
33	1011.1	22.9	46	818	20	356	26	60	462	165	9.94	15

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 Hultine Well No. 37-K

Depth Interval, Feet	992.0 - 1000.6	1000.6 - 1011.6	992.0 - 1011.6
Feet of Core Analyzed	8.0	11.0	19.0
Average Percent Porosity	21.1	21.8	21.5
Average Percent Original Oil Saturation	41.3	46.6	44.4
Average Percent Oil Recovery	13.9	20.7	17.9
Average Percent Residual Oil Saturation	27.4	25.9	26.5
Average Percent Residual Water Saturation	65.3	64.8	65.1
Average Percent Total Residual Fluid Saturation	92.7	90.7	91.6
Average Original Oil Content, Bbls./A. Ft.	672.	790.	741.
Average Oil Recovery, Bbls./A. Ft.	224.	352.	298.
Average Residual Oil Content, Bbls./A. Ft.	448.	438.	443.
Total Original Oil Content, Bbls./Acre	5,380.	8,701.	14,081.
Total Oil Recovery, Bbls./Acre	1,791.	3,873.	5,664.
Total Residual Oil Content, Bbls./Acre	3,589.	4,828.	8,417.
Average Effective Permeability, Millidarcys	6.74	4.51	5.45
Average Initial Fluid Production Pressure, p.s.i.	22.8	17.7	20.0

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