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

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

700 NORTH MISSION
OKMULGEE, OKLAHOMA
PHONE: 4444

Chanute, Kansas

536 N. HIGHLAND
CHANUTE, KANSAS
PHONE: HE 1-2650

August 23, 1961

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

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Wiggans Lease, Well No. H-20, Wilson County, Kansas, and submitted to our laboratory on August 15, 1961.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

BRP:rf

1 c. - Earlton, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Schermerhorn Oil Corp. Lease Wiggans "D" Well No. H-20

Location NE SE SW (Approximately 1000' N of S Line & 170' W of E Line SW¼)

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

Name of Sand	Bartlesville
Top of Core	962.0
Bottom of Core	999.0
Top of Sand (Analyzed)	962.0
Bottom of Sand (Analyzed)	994.2
Total Feet of Permeable Sand	27.3
Total Feet of Floodable Sand	19.7

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	9.2	9.2
10 - 20	5.9	15.1
20 - 30	7.3	22.4
30 - 40	1.8	24.2
40 & above	3.1	27.3

Average Permeability Millidarcys	17.3
Average Percent Porosity	19.0
Average Percent Oil Saturation	50.1
Average Percent Water Saturation	33.5
Average Oil Content, Bbls./A. Ft.	738.
Total Oil Content, Bbls./Acre	20,235.
Average Percent Oil Recovery by Laboratory Flooding Tests	22.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	331.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	6,523.
Total Calculated Oil Recovery, Bbls./Acre	5,720.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water mud was used in coring this well. The well was drilled in more or less virgin territory. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
962.0 - 963.8	Brown shaley sandstone.
963.8 - 965.4	Limestone.
965.4 - 965.8	Laminated shale and sandstone.
965.8 - 970.0	Brown slightly shaley sandstone.
970.0 - 970.8	Brown slightly calcareous sandstone.
970.8 - 971.1	Brown slightly conglomeratic sandstone.
971.1 - 972.2	Brown laminated shaley sandstone.
972.2 - 973.2	Brown slightly laminated slightly shaley sandstone.
973.2 - 977.8	Brown slightly shaley sandstone.
977.8 - 978.7	Laminated sandstone and shale.
978.7 - 986.7	Brown slightly shaley sandstone.
986.7 - 989.0	Dark carbonaceous shaley sandstone.
989.0 - 992.0	Dark carbonaceous laminated shaley sandstone.
992.0 - 994.2	Dark carbonaceous sandstone.
994.2 - 997.0	Alternate layers of shale and carbonaceous shaley sandstone.
997.0 - 999.0	Shale.

Coring was started at a depth of 962.0 feet in shaley sandstone and completed at 999.0 feet in shale. This core shows a total of 29.3 feet of sandstone. For the most part, the pay is made up of brown, slightly s haley 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 17.4, 24.8 and 6.2 millidarcys respectively; while that of the pay sand is 20.1; the overall average being 17.3 (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 0.59 to a maximum of 44. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a very good weighted average percent oil saturation, namely, 50.1. The weighted average percent oil saturation of the upper, middle and lower sections is 51.4, 44.6 and 54.5 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 33.2, 34.7 and 32.3 respectively; while that of the pay sand is 33.8, the overall average being 33.5 (See Table III). This gives an overall weighted average total fluid saturation of 83.6 percent.

The weighted average oil content of the upper, middle and lower sections is 719, 718 and 832 barrels per acre foot respectively; while that of the pay sand is 719, the overall average being 738. The total oil content, as shown by this core, is 20,235 barrels per acre of which 15,664 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 6,523 barrels of oil per acre was obtained from 19.7 feet of sand. The weighted average percent oil saturation was reduced from 49.0 to 26.4, or represents an average recovery of 22.6 percent. The weighted average effective permeability of the samples is 1.03 millidarcys, while the average initial fluid production pressure is 27.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 27 samples tested, 17 produced water and 20 oil. This indicates that approximately 74 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a more or less uniform effective permeability to water.

CONCLUSION

Based on the results of the laboratory tests, it appears that an efficient water-flood in the vicinity of this well should recover approximately 5,720 barrels of oil per acre. This represents an average recovery of 333 barrels per acre foot from the 17.2 feet of floodable pay sand analyzed in this core.

The following data and assumptions were used in calculating the above recovery values:

Original formation volume factor	1.07
Present formation volume factor	1.02
Reservoir water saturation, percent	25.0
Primary recovery, estimated, percent	3.0
Average porosity, percent	18.9
Abandonment oil saturation, percent	26.4
Performance factor, percent	55.0
Net floodable pay sand, feet	17.2

This core indicates a reservoir more or less shaley in nature having a good oil saturation, a moderate water saturation and fairly good effective permeability to water. No difficulty should be encountered in obtaining satisfactory injection rates.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Schermerhorn Oil Corp. Lease Wiggans Well No. H-20

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	962.1	15.0	37	54	91	433	10.	0.6	0.6	260	6.00
2	963.1	19.1	49	23	72	729	20.	1.2	1.8	874	24.00
3	966.1	17.3	52	35	87	700	20.	0.8	2.6	560	16.00
4	967.1	18.1	55	29	84	774	17.	1.0	3.6	774	17.00
5	968.1	20.2	61	25	86	960	21.	1.0	4.6	960	21.00
6	969.1	16.7	53	33	86	690	13.	1.4	6.0	965	18.20
7	970.1	16.3	59	32	91	746	31.	0.8	6.8	596	24.80
8	971.0	17.4	39	33	72	529	14.	0.3	7.1	159	4.20
9	972.1	16.6	48	45	93	620	6.0	1.1	8.2	681	6.60
10	973.1	17.9	49	35	84	680	43.	1.0	9.2	680	43.00
11	974.1	18.6	58	32	90	840	20.	1.4	10.6	1,175	28.00
12	975.1	17.1	61	32	93	813	28.	1.0	11.6	813	28.00
13	976.1	19.4	47	33	80	710	2.7	1.0	12.6	710	2.70
14	977.1	19.1	40	34	74	595	0.93	1.2	13.8	714	1.12
15	979.1	18.8	36	37	73	526	23.	0.9	14.7	474	20.70
16	980.1	21.3	43	30	73	712	33.	1.0	15.7	712	33.00
17	981.1	21.2	53	28	81	874	44.	1.0	16.7	874	44.00
18	982.1	19.8	38	47	85	586	19.	1.0	17.7	586	19.00
19	983.1	20.9	60	31	91	980	5.2	1.0	18.7	980	5.20
20	984.1	22.0	49	29	78	840	7.8	1.0	19.7	840	7.80
21	985.1	18.8	37	34	71	541	25.	1.0	20.7	541	25.00
22	986.1	21.5	40	41	81	670	40.	1.1	21.8	736	44.00
23	987.1	20.1	59	24	83	922	0.59	0.9	22.7	830	0.53
24	988.1	16.8	50	38	88	654	1.7	1.4	24.1	915	2.38
25	989.1	16.4	51	37	88	650	1.4	1.0	25.1	650	1.40
26	992.1	21.8	41	30	71	694	7.4	0.6	25.7	416	4.44
27	993.1	22.5	63	30	93	1,100	16.	1.6	27.3	1,760	25.60
								Total	------	20,235	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Schermerhorn Oil Corp. Lease Wiggans Well No. H-20

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
962.0 - 977.8	13.8	17.4	240.62
978.7 - 986.7	8.0	24.8	198.70
986.7 - 994.2	5.5	6.2	34.35
962.0 - 994.2	27.3	17.3	473.67

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
962.0 - 977.8	13.8	17.9	51.4	33.2	719	9,921
978.7 - 986.7	8.0	20.6	44.6	34.7	718	5,743
986.7 - 994.2	5.5	19.5	54.5	32.3	832	4,571
962.0 - 994.2	27.3	19.0	50.1	33.5	738	20,235

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Schermerhorn Oil Corp. Lease Wiggans Well No. H-20

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	962.1	15.6	37	448	15	182	22	69	266	4	0.160	30
2	963.1	18.8	49	714	22	321	27	67	393	4	0.160	30
3	966.1	17.2	52	695	29	388	23	68	307	43	1.20	25
4	967.1	17.9	55	765	28	389	27	62	376	5	0.400	35
5	968.1	20.0	61	947	31	481	30	63	466	166	6.25	15
6	969.1	16.6	53	682	24	309	29	63	373	7	0.240	30
7	970.1	16.0	59	732	32	397	27	64	335	74	2.24	15
8	971.0	17.3	39	524	9	121	30	62	403	0	0.004	45
9	972.1	16.4	46	585	0	0	46	48	585	0	Imp.	50+
10	973.1	16.2	45	565	0	0	45	40	565	0	Imp.	50+
11	974.1	18.5	58	832	31	445	27	65	387	104	3.76	15
12	975.1	17.4	61	824	30	405	31	64	419	8	0.266	25
13	976.1	19.2	47	701	16	238	31	57	463	0	0.014	35
14	977.1	18.9	40	586	14	205	26	64	381	0	0.018	35
15	979.1	18.6	36	520	14	202	22	60	318	10	0.356	25
16	980.1	21.0	43	701	21	342	22	68	359	28	0.640	25
17	981.1	21.0	53	864	26	424	27	65	440	17	0.400	15
18	982.1	20.0	38	590	8	124	30	58	466	8	0.480	45
19	983.1	20.5	60	955	32	509	28	67	446	5	0.240	25
20	984.1	21.7	49	825	27	455	22	70	370	35	0.960	15
21	985.1	19.2	37	551	14	208	23	70	343	56	1.44	15
22	986.1	21.2	40	658	17	280	23	72	378	2	0.160	50
23	987.1	20.0	56	870	0	0	56	28	870	0	Imp.	50+
24	988.1	17.0	51	673	0	0	51	39	673	0	Imp.	50+
25	989.1	16.4	50	636	0	0	50	38	636	0	Imp.	50+
26	992.1	21.6	43	721	0	0	43	29	721	0	Imp.	50+
27	993.1	22.6	62	1089	0	0	62	32	1089	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 Coproration Lease Wiggans Well No. H-20

Depth Interval, Feet	962.0 - 977.8	978.7 - 986.7	962.0 - 986.7
Feet of Core Analyzed	11.7	8.0	19.7
Average Percent Porosity	17.9	20.4	18.9
Average Percent Original Oil Saturation	52.0	44.5	49.0
Average Percent Oil Recovery	24.4	19.9	22.6
Average Percent Residual Oil Saturation	27.6	24.6	26.4
Average Percent Residual Water Saturation	63.8	66.4	64.8
Average Percent Total Residual Fluid Saturation	91.4	91.0	91.2
Average Original Oil Content, Bbls./A. Ft.	726.	709.	718.
Average Oil Recovery, Bbls./A. Ft.	340.	319.	331.
Average Residual Oil Content, Bbls./A. Ft.	386.	390.	387.
Total Original Oil Content, Bbls./Acre	8,481.	5,677.	14,158.
Total Oil Recovery, Bbls./Acre	3,971.	2,552.	6,523.
Total Residual Oil Content, Bbls./Acre	4,510.	3,125.	7,635.
Average Effective Permeability, Millidarcys	1.33	0.582	1.03
Average Initial Fluid Production Pressure, p.s.i.	27.9	26.9	27.5

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