17-16-24E

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

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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December 17, 1959

Hales & Hennigan
1008 Hales Building
Oklahoma City 2, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the Cable Tool core taken from the Barkis Lease, Well No. 2, Miami County, Kansas, and submitted to our laboratory on December 11, 1959.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. McElrea

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GENERAL INFORMATION & SUMMARY

Company Hales & Hennigan Lease Barkis Well No. 2

Location NW¼

Section 17 Twp. 16S Rge. 24E County Miami State Kansas

Name of Sand	Squirrel
Top of Core	674.0
Bottom of Core	699.8
Top of Pay Sand	688.0
Bottom of Pay Sand	695.0
Total Feet of Permeable Sand (Analyzed)	6.2
Total Feet of Floodable Sand	6.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 75	3.2	3.2
75 - 100	1.6	4.8
100 & above	1.4	6.2

Average Permeability Millidarcys	80.0
Average Percent Porosity	21.5
Average Percent Oil Saturation	31.0
Average Percent Water Saturation	52.4
Average Oil Content, Bbls./A. Ft.	525.
Total Oil Content, Bbls./Acre	6,046.
Average Percent Oil Recovery by Laboratory Flooding Tests	8.3
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	151.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	909.
Total Calculated Oil Recovery, Bbls./Acre	1,400.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

The core was preserved in water.

Samples were taken from the core and 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
674.0 - 682.0	Discarded gray sandy shale (According to field log).
682.0 - 683.5	Sandy shale.
683.5 - 688.0	Finely laminated sandstone and shale.
688.0 - 695.0	Brown slightly laminated slightly shaley sandstone.
695.0 - 699.8	Shale (Discarded at well).

Coring was started at a depth of 674.0 feet in gray sandy shale and completed at 699.8 feet in shale. This core shows a total of 7.0 feet of sandstone. For the most part, the pay is made up of brown slightly laminated slightly shaley 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 9.9 and 87.5 millidarcys respectively; the overall average being 80.0 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from 7.4 to a maximum of 145 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 31.0. The weighted average percent oil saturation of the upper and lower sections is 23.8 and 35.8 respectively. The

weighted average per cent water saturation of the upper and lower sections is 65.2 and 44.3 respectively; the overall average being 52.4 (See Table III). This gives an overall weighted average total fluid saturation of 83.4 percent.

The weighted average oil content of the upper and lower sections is 357 and 635 barrels per acre foot respectively; the overall average being 525. The total oil content, as shown by this core, is 6,046 barrels per acre of which 4,440 barrels are in the lower section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 909 barrels of oil per acre was obtained from 6.0 feet of sand. The weighted average percent oil saturation was reduced from 36.3 to 28.0, or represents an average recovery of 8.3 percent. The weighted average effective permeability of the samples is 4.65 millidarcys, while the average initial fluid production pressure is 18.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 8 samples tested, 6 produced water and oil. This indicates that approximately 75 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a comparatively uniform effective permeability.

CONCLUSION

It is evident from the enclosed data that an efficient water-flood will recover approximately 1,400 barrels of oil per acre from the area represented by this core. This represents an average recovery of 233 barrels of oil per acre foot from the 6.0 feet of floodable sand analyzed. The following factors and assumptions were used in calculating this recovery:

Original formation volume factor	1.06
Present formation volume factor	1.02
True water saturation, percent	35.0
Primary oil recovery, percent	8.0
Calculated present oil saturation, percent	54.6
Porosity, percent	23.0
Oil saturation at abandonment, percent	28.0
Performance factor, percent	50.0

This core shows a thin section of floodable sand which has good oil and normal water saturations. The floodable sand has good permeability, therefore, no difficulty should be encountered in forcing it to take the required volume of properly conditioned water.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Hales & Hennigan Lease Barkis Well No. 2

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	685.0	9.9	0.6	0.6	5.94
2	688.3	87.	0.5	1.1	43.50
3	688.7	126.	0.5	1.6	63.00
4	689.3	65.	0.5	2.1	32.50
5	689.7	68.	0.5	2.6	34.00
6	691.7	52.	0.6	3.2	31.20
7	692.3	58.	0.5	3.7	29.00
8	692.7	145.	0.5	4.2	72.50
9	693.1	125.	0.4	4.6	50.00
10	693.7	98.	0.6	5.2	58.80
11	694.3	79.	0.5	5.7	39.50
12	694.7	72.	0.5	6.2	36.00

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RESULTS OF SATURATION TESTS

TABLE II

Company Hales & Hennigan Lease Barkis Well No. 2

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	683.6	18.2	30	63	93	424	0.5	0.5	212
2	684.5	18.9	17	71	88	250	1.0	1.5	250
3	685.5	19.0	23	65	88	339	1.0	2.5	339
4	686.5	19.7	31	59	90	474	1.0	3.5	474
5	687.5	20.3	21	67	88	331	1.0	4.5	331
6	688.5	25.2	35	44	79	685	1.0	5.5	685
7	689.5	22.5	37	44	81	645	1.0	6.5	645
8	690.5	22.4	32	46	78	556	1.0	7.5	556
9	691.5	22.3	31	54	85	536	1.0	8.5	536
10	692.5	23.8	35	41	76	646	1.0	9.5	646
11	693.5	21.6	44	43	87	737	1.0	10.5	737
12	694.5	22.7	36	38	74	635	1.0	11.5	635
							Total-	- - - - - -	6,046

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hales & Hennigan Lease Barkis Well No. 2

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
684.7 - 685.3	0.6	9.9	5.94
688.0 - 695.0	5.6	87.5	490.00
684.7 - 695.0	6.2	80.0	495.94

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
683.5 - [illegible].0	4.5	19.3	23.8	65.2	357	1,606
688.0 - 695.0	7.0	22.9	35.8	44.3	639	4,440
683.5 - 695.0	11.5	21.5	31.0	52.4	525	6,046

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hales & Hennigan Lease Barkis Well No. 2

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.			
2	684.5	18.4	18	257	0	0	18	62	257	0	Imp.	50+
3	685.5	18.4	24	342	0	0	24	68	342	0	Imp.	50+
6	688.5	24.9	35	676	9	174	26	65	502	83	3.31	15
7	689.1	23.0	37	718	10	194	27	65	524	103	3.52	15
9	691.9	22.1	31	531	7	120	24	74	411	132	4.96	25
10	692.8	23.9	35	649	8	148	27	66	501	119	7.14	15
11	693.3	21.9	41	743	14	258	30	63	510	135	7.41	15
12	694.5	22.6	38	691	2	35	34	54	596	51	1.58	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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Hales & Hennigan Lease Barkis Well No. 2

Depth Interval, Feet	688.0 - 695.0
Feet of Core Analyzed	6.0
Average Percent Porosity	23.1
Average Percent Original Oil Saturation	36.3
Average Percent Oil Recovery	8.3
Average Percent Residual Oil Saturation	28.0
Average Percent Residual Water Saturation	64.5
Average Percent Total Residual Fluid Saturation	92.5
Average Original Oil Content, Bbls./A. Ft.	658.
Average Oil Recovery, Bbls./A. Ft.	151.
Average Residual Oil Content, Bbls./A. Ft.	507.
Total Original Oil Content, Bbls./Acre	3,953.
Total Oil Recovery, Bbls./Acre	909.
Total Residual Oil Content, Bbls./Acre	3,044.
Average Effective Permeability, Millidarcys	4.65
Average Initial Fluid Production Pressure, p.s.i.	18.3

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