OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

30-26-17E

February 19, 1952

Mr. J. A. Aylward
First National Bank Building
Wichita, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the Cable Tool core taken from the Jake Hegwald Lease, Well No. 9, ~~Wilson~~ Woodson County, Kansas, and submitted to our laboratory on February 11, 1952.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate
By: Benn White

CLP:mm

c.c.

Jake Hegwald 9

J. A. AYLWARD

CORE ANALYSIS REPORT

JAKE HEGWALD LEASE WELL NO. 9

Woodson
~~WILSON~~ COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

FEBRUARY 19, 1952

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company J. A. Aylward Lease Jake Hegwald Well No. 9

Location

Section 30 Twp. 26S Rge. 17E County ~~Wilson~~ Woodson State Kansas

Name of Sand	Squirrel
Top of Core	835.00
Bottom of Core	855.00
Top of Pay Sand	840.10
Bottom of Sand	853.90
Total Feet of Permeable Sand	11.50
Total Feet of Floodable Sand	6.25

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	3.05	3.05
20 - 40	4.45	7.50
40 - 80	1.85	9.35
80 & above	2.15	11.50

Average Permeability Millidarcys	37.12
Average Percent Porosity	17.98
Average Percent Oil Saturation	45.69
Average Percent Water Saturation	29.86
Average Oil Content, Bbls./A. Ft.	647.
Total Oil Content, Bbls./Acre	9,125.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.52
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	88.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	546.
Total Calculated Oil Recovery, Bbls./Acre	2,100.
Packer Setting, Feet	-
Viscosity, Centipoises @ 81° F	37.4
A. P. I. Gravity, degrees @ 60 °F	28.3
Elevation, Feet	

Salt water was used as the circulating fluid in the coring of the sand in this well. This well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
835.00 - 836.30	Gray sandy shale.
836.30 - 837.20	Hard brown fine grained micaceous calcareous sandstone.
837.20 - 839.80	Gray sandy shale.
839.80 - 840.10	Laminated shaley sandstone.
840.10 - 844.00	Brown fine grained micaceous sandstone.
844.00 - 847.15	Dark fine grained micaceous carbonaceous sandstone.
847.15 - 853.50	Dark finely laminated micaceous shaley sandstone.
853.50 - 853.90	Dark fine grained micaceous sandstone.
853.90 - 855.00	Gray sandy shale.

Coring was started at a depth of 835.00 feet in gray sandy shale and completed at 855.00 feet in gray sandy shale. This core shows a total of 15.00 feet of sandstone. For the most part, the pay is made up of fine grained micaceous to carbonaceous 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 45.46 and 23.92 respectively; the overall average being 37.12 (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 good weighted average percent oil saturation, namely, 45.69. The weighted average percent oil saturation of the upper and lower sections is 48.70 and 42.06 respectively. The weighted average percent water saturation of the upper and lower sections is 27.60 and 31.82 respectively; the overall average being 29.86 (See Table IV). This gives an overall weighted average total fluid saturation of 75.55 percent. This comparatively low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil.

Inasmuch as salt water was used as the circulating fluid in the coring of the sand in this well, no chloride determinations were run as the results would not be representative.

The weighted average oil content of the upper and lower sections is 709 and 526 barrels per acre foot respectively; the overall average being 647. The total oil content, as shown by this core, is 9,125 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of oil taken from the bleeder at a nearby producing well is 37.4 centipoises at 81° F. The A.P.I. gravity of the oil is 28.3° at 60° F. With other factors being favorable, a sand containing an oil with this viscosity should respond very satisfactorily to water repressuring.

LABORATORY FLOODING TESTS

This core responded only fairly well to laboratory flooding tests, as a total recovery of 546 barrels of oil per acre was obtained from 6.25 feet of sand. The weighted average percent oil saturation was reduced from 46.42 to 40.90, or represents an average recovery of 5.52 percent. The weighted average effective permeability of the samples is 3.50 millidarcys, while the average initial fluid production pressure is 18.1 pounds per square inch (See Table VI). From the above data it is noticeable that the sand samples after flooding had a high percent residual oil saturation.

By observing the data given in Table V, you will note that of the 14 samples tested, 9 produced water and 7 oil. This indicates that only approximately one-half of the sand represented by these samples is floodable. The tests also show that the sand has a rather wide variation in effective permeability and that six of the samples were impermeable to water.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 2,100 barrels of oil per acre, or an average of 336 barrels per acre foot from the 6.25 feet of floodable sand analyzed. In calculating this recovery, an allowance was made for oil lost during coring, and it was assumed that the well was drilled in virgin territory and that the true water saturation of the sand is 27 percent.

The principle drawback of this core is the fact that it contained

only 6.25 feet of floodable sand and that the sand samples after flooding had a high percent residual oil saturation. One would expect a sand containing an oil with a viscosity of 37.4 to flood down to a somewhat lower residual oil saturation than was actually obtained in the laboratory.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company J. A. Aylward Lease Jake Hegwald Well No. 9

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	840.15	19.	0.20	0.20	3.80
2	840.45	32.	0.35	0.55	11.20
3	840.85	47.	0.45	1.00	21.15
4	841.25	47.	0.35	1.35	16.45
5	841.61	31.	0.30	1.65	9.30
6	841.85	84.	0.45	2.10	37.80
7	842.40	54.	0.55	2.65	29.70
8	843.10	95.	0.55	3.20	52.25
9	843.53	112.	0.40	3.60	44.80
10	843.90	26.	0.30	3.90	7.80
11	844.50	33.	0.70	4.60	23.10
12	844.95	26.	0.40	5.00	10.40
13	845.30	19.	0.40	5.40	7.60
14	845.75	35.	0.50	5.90	17.50
15	846.23	12.	0.50	6.40	6.00
16	846.83	22.	0.50	6.90	11.00
17	847.12	71.	0.15	7.05	10.65
18	847.75	47.	0.75	7.80	35.25
19	848.05	22.	0.50	8.30	11.00
20	848.75	Fractured	0.60	8.90	-
21	849.22	33.	0.45	9.35	14.85
22	849.68	12.	0.45	9.80	5.40
23	850.13	24.	0.45	10.25	10.80
24	850.55	63.	0.35	10.60	22.05
25	850.90	14.	0.40	11.00	5.60
26	851.33	Imp.	0.60	11.60	0.00
27	852.10	1.6	0.55	12.15	0.88
28	852.46	1.1	0.55	12.70	0.61
29	853.10	Imp.	0.70	13.40	0.00
30	853.55	Imp.	0.40	13.80	0.00

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company J. A. Aylward Lease Jake Hegwald Well No. 9

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
840.10 - 847.15	7.05	45.46	320.50
847.15 - 853.90	4.45	23.92	106.44
840.10 - 853.90	11.50	37.12	426.94

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company J. A. Aylward Lease Jake Hegwald Well No. 9

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	837.05	8.6	46.2	25.0	71.2	308	0.90	0.90	277
3	839.95	13.2	21.9	64.8	86.7	224	0.30	1.20	67
4	841.05	19.1	46.5	35.4	81.9	690	1.40	2.60	966
5	842.05	21.1	43.1	31.3	74.4	706	1.20	3.80	847
6	843.35	21.2	54.2	28.2	82.4	891	1.30	5.10	1,158
7	844.25	20.0	53.2	19.2	72.4	826	0.80	5.90	661
8	845.50	20.1	54.6	16.7	71.3	852	1.20	7.10	1,012
9	846.55	19.2	50.5	20.0	72.5	753	0.70	7.80	527
F-10A	846.90	18.6	51.4	-	-	742	0.45	8.25	334
10	847.45	15.2	39.1	38.2	77.3	465	0.75	9.00	349
11	848.40	15.8	35.6	43.3	78.9	437	1.00	10.00	437
12	849.45	16.3	50.3	30.3	80.6	637	1.00	11.00	637
13	850.35	17.9	51.0	19.7	70.7	709	1.00	12.00	709
14	851.55	14.7	26.6	33.3	59.9	304	1.20	13.20	365
15	852.65	15.4	50.4	26.0	76.4	603	1.40	14.60	844
16	853.75	17.9	38.1	41.4	79.5	529	0.40	15.00	212
							Total	- - - - -	9,402

Note: "A" sample was taken from the core after it was received in the laboratory.

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SUMMARY OF SATURATION TESTS

TABLE IV

Company J. A. Aylward Lease Jake Hegwald Well No. 9

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
836.30 - 847.15	8.25	18.59	48.70	27.60	709	5,849
847.15 - 853.90	6.75	15.97	42.06	31.82	526	3,553
839.80 - 853.90	14.10	17.98	45.69	29.86	647	9,125

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company J. A. Aylward Lease Jake Hegwald Well No. 9

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	837.05	8.5	43.4	287	0.0	0	43.4	35.7	287	0	Imp.	50+
3	839.95	13.5	19.8	208	0.0	0	19.8	74.7	208	36	Fractured	20
4	841.05	19.3	44.1	662	3.8	57	40.3	58.0	605	78	1.95	15
5A	841.70	21.6	41.4	694	3.0	50	38.4	54.7	644	108	9.30	15
6	843.35	21.2	51.3	844	12.2	201	39.1	51.2	643	113	3.56	15
7	844.25	20.4	50.1	794	2.3	36	47.8	42.5	758	136	3.02	15
8	845.50	20.0	52.3	813	0.0	0	52.3	35.7	813	6	0.208	40
9	846.55	19.5	48.4	733	5.8	88	42.6	46.7	645	40	0.578	20
10A	846.90	18.6	51.4	743	3.5	51	47.9	39.0	692	9	0.174	30
11	848.40	16.0	36.0	447	0.0	0	36.0	45.0	447	0	Imp.	50+
12	849.45	16.2	50.2	631	0.0	0	50.2	38.9	631	0	Imp.	50+
13	850.35	18.2	53.3	753	0.0	0	53.3	22.2	753	0	Imp.	50+
14	851.55	14.5	24.2	272	0.0	0	24.2	50.0	272	0	Imp.	50+
16	853.75	18.2	36.9	522	5.4	76	31.5	60.0	446	47	1.04	20

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.
"A" samples were taken from the core after it was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company J. A. Aylward Lease Jake Hegwald Well No. 9

Depth, Interval, Feet	840.10 - 853.90
Feet of Core Analyzed	6.25
Average Percent Porosity	20.18
Average Percent Original Oil Saturation	46.42
Average Percent Oil Recovery	5.52
Average Percent Residual Oil Saturation	40.90
Average Percent Residual Water Saturation	51.41
Average Percent Total Residual Fluid Saturation	92.31
Average Original Oil Content, Bbls./A. Ft.	729.
Average Oil Recovery, Bbls./A. Ft.	88.
Average Residual Oil Content, Bbls./A. Ft.	641.
Total Original Oil Content, Bbls./Acre	4,553.
Total Oil Recovery, Bbls./Acre	546.
Total Residual Oil Content, Bbls./Acre	4,007.
Average Effective Permeability, Millidarcys	3.50
Average Initial Fluid Production Pressure, p.s.i.	18.1

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