OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

October 12, 1951

Oke Oil & Gas Company
Atlas Life Building
Tulsa, Oklahoma

Attention: Mr. T. F. Lawry

Gentlemen:

Enclosed herewith is the report of the analysis of the 3" Rotary core taken from the E. Ware Lease, Well No. C-5, Anderson County, Kansas, and submitted to our laboratory on September 29, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Clayton A. Nattier

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[illegible] OIL & GAS COMPANY

CORE ANALYSIS REPORT

E. WARE LEASE WELL NO. C-5

ANDERSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

OCTOBER 11, 1931

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Oko Oil & Gas Company Lease E. Hare Well No. C-8

Location NE¼

Section 13 Twp. 21S Rge. 20E ? County Anderson State Kansas

Name of Sand	Squirrel
Top of Core	796.00
Bottom of Core	825.30
Top of Sand	798.25
Bottom of Sand	816.85
Total Feet of Permeable Sand (Analyzed)	5.35
Total Feet of Floodable Sand (Analyzed)	4.00

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	3.15	3.15
10 - 30	0.30	3.45
30 - 50	1.35	4.80
50 - 70	0.30	5.10
70 - 90	0.10	5.20
90 & above	0.15	5.35

Average Permeability Millidarcys	22.59
Average Percent Porosity	16.63
Average Percent Oil Saturation	42.94
Average Percent Water Saturation	45.09
Average Oil Content, Bbls./A. Ft.	550.
Total Oil Content, Bbls./Acre	5,764.
Average Percent Oil Recovery by Laboratory Flooding Tests	8.70
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	110.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	689.
Total Calculated Oil Recovery, Bbls./Acre	600.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Salt water 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
795.00 - 796.75	Gray sandy shale.
796.75 - 797.35	Gray shale.
797.35 - 798.25	Gray sandy shale.
798.25 - 798.65	Brown fine grained laminated micaceous shaley sandstone, containing a sand streak.
798.65 - 800.35	Laminated sandstone and shale containing three sand streaks.
800.35 - 800.70	Brown fine grained laminated micaceous shaley sandstone.
800.70 - 801.00	Gray shale.
801.00 - 801.15	Brown fine grained finely laminated micaceous shaley sandstone.
801.15 - 801.38	Gray sandy shale.
801.38 - 801.70	Laminated shaley sandstone.
801.70 - 802.20	Brown fine grained finely laminated micaceous shaley sandstone.
802.20 - 802.40	Brown fine grained laminated shaley sandstone.
802.40 - 803.60	Finely laminated shaley sandstone containing a sand streak.
803.60 - 804.15	Brown fine grained laminated micaceous shaley sandstone.
804.15 - 808.80	Slightly laminated sandy shale containing two sand streaks.
808.80 - 809.10	Brown fine grained micaceous sandstone.
809.10 - 809.35	Brown fine grained laminated micaceous shaley sandstone.
809.35 - 810.80	Slightly laminated sandy shale.
810.80 - 811.10	Brown fine grained slightly laminated micaceous shaley sandstone.
811.10 - 811.55	Brown fine grained micaceous shaley sandstone.
811.55 - 811.70	Brown fine grained micaceous slightly shaley sandstone.

811.70 - 812.60 - Laminated shaley sandstone.

812.60 - 812.90 - Brown fine grained laminated micaceous carbonaceous sandstone.

812.90 - 813.00 - Brown fine grained micaceous sandstone.

813.00 - 813.35 - Brown fine grained laminated micaceous carbonaceous shaley sandstone.

813.35 - 814.45 - Brown fine grained laminated micaceous carbonaceous sandstone.

814.45 - 814.90 - Brown fine grained micaceous shaley sandstone.

814.90 - 816.85 - Brown fine grained laminated micaceous carbonaceous sandstone.

816.85 - 821.00 - Gray shale - bottom of core received.

821.00 - 825.30 - Black shale and limestone (Discarded at well).

Coring was started at a depth of 795.00 feet in gray sandy shale and completed at 825.30 feet in dark calcareous shale. This core shows a total of 10.45 feet of sandstone. For the most part, the pay is made up of fine grained micaceous to carbonaceous and shaley sandstone. The sand section is badly broken by layers of sandy shale.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 27.11 and 21.06 millidarcys respectively; the overall average being 22.89 (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, 42.94. The weighted average percent oil saturation of the upper and lower sections is 50.41 and 49.97 respectively. The weighted average percent water saturation of the upper and lower sections is 61.92 and 57.00 respectively; the

overall average being 45.09 (See Table IV). This gives an overall weighted average total fluid saturation of 88.03 percent.

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

The weighted average oil content of the upper and lower sections is 362 and 670 barrels per acre foot respectively; the overall average being 560. The total oil content, as shown by this core, is 5,764 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core did not respond very well to laboratory flooding tests, as a total recovery of only 889 barrels of oil per acre was obtained from 6.25 feet of sand. The weighted average percent oil saturation was reduced from 46.73 to 38.03, or represents an average recovery of 8.70 percent. The weighted average effective permeability of the samples is 2.19 millidarcys, while the average initial fluid production pressure is 22.8 pounds per squre inch (See Table VI). From the data given in Table VI, it is noticeable that the lower section or the carbonaceous sand showed a high percent residual oil saturation after flooding.

By observing the data given in Table V, you will note that of the 10 samples tested, 8 produced water and 9 oil. This indicates that most of the sand represented by these samples is floodable. The tests also show that the sand has a wide variation in effective permeability and part of same is very tight.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 500 barrels of oil per acre. In calculating this recovery, no allowance was made for oil lost

during coring, and it is assumed that the sand is not pressured up.

Inasmuch as the cored section is badly broken and does not contain very much clean sand, it is evident that this well was drilled near the edge of the trend or on a bone. We did not figure any shot for this well as we did not know whether you would consider it worth completing. Chances are, if it was shot rather heavy more permeable sand could be penetrated, thereby, increasing its possibility of making a better well.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Oke Oil & Gas Compa ny Lease E. Ware Well No. C-5

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	798.37	102.	0.05	0.05	5.10
2	799.05	31.	0.10	0.15	3.10
3	799.90	71	0.10	0.25	7.10
4	800.40	47.	0.35	0.60	16.45
5	801.05	27.	0.15	0.75	4.05
6	801.90	Imp.	0.50	1.25	0.00
7	802.70	12.	0.05	1.30	0.60
8	803.50	Imp.	0.40	1.70	0.00
9	803.75	0.37	0.55	2.25	0.20
10	807.80	12.	0.10	2.35	1.20
11	808.95	47.	0.30	2.65	14.10
12	810.95	54.	0.30	2.95	16.20
13	811.80	39.	0.15	3.10	5.85
14	812.95	147.	0.10	3.20	14.70
15	813.55	9.0	0.65	3.85	5.85
16	814.35	33.	0.45	4.30	14.85
17	814.95	9.4	0.40	4.70	3.76
18	815.70	6.6	0.60	5.30	3.36
19	816.15	4.6	0.95	6.25	4.37

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Oke Oil & Gas Company Lease E. Ware Well No. C-5

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
798.25 - 804.15	1.35	27.11	36.60
807.55 - 816.85	4.00	21.06	84.24
798.25 - 816.85	5.35	22.59	120.84

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RESULTS OF SATURATION TESTS

TABLE III

Company Oko Oil & Gas Company Lease E. Kare Well No. C-5

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-1	798.54	18.9	24.2	-	-	355	0.40	0.40	142
1	795.75	15.5	24.6	69.6	94.2	257	1.70	2.10	437
F-2	800.60	15.3	28.0	-	-	332	0.35	2.45	116
F-3	802.10	15.1	23.4	-	-	333	0.50	2.95	167
3	802.30	14.3	44.1	55.0	99.1	490	0.20	3.15	98
4	804.02	17.4	51.2	41.1	92.3	591	0.55	3.70	330
F-5	808.98	23.3	29.5	-	-	539	0.30	4.00	162
6	809.25	19.3	60.5	39.5	99.5	911	0.25	4.25	228
F-7	810.95	18.4	34.7	-	-	498	0.30	4.55	149
7	811.22	17.3	36.8	60.6	97.4	404	0.60	5.15	296
F-8	812.45	16.0	41.2	-	-	512	0.90	6.05	461
8	812.75	20.1	44.1	36.8	80.9	687	0.75	6.80	515
9	814.15	18.6	54.0	32.4	86.4	790	1.10	7.90	867
10	815.50	16.7	61.8	31.4	93.2	801	1.55	9.45	1,240
11	816.70	13.9	56.5	36.2	92.7	809	0.85	10.30	687
							Total - - - - - - - - -		5,764

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company Oko Oil & Gas Company Lease E. Ware Well No. C-5

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
798.25-804.15	3.70	15.16	30.41	61.92	362	1,340
808.80-816.85	6.60	17.45	48.97	37.00	670	4,424
798.25-816.85	10.30	16.63	42.94	45.09	560	5,764

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Oko Oil & Gas Company Lease E. Ware Well No. C-5

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	798.54	18.9	24.2	355	4.0	59	20.2	71.0	296	162	9.10	10
2	800.60	15.3	28.0	332	6.1	72	21.9	72.3	260	96	2.71	15
3	802.10	15.1	28.4	333	1.3	15	27.1	64.5	318	6	0.366	40
4	803.75	17.2	50.0	667	0.0	0	50.0	44.6	667	0	Imp.	50+
6	808.95	23.3	29.8	538	8.8	159	21.0	68.9	379	167	10.03	10
7	810.95	18.4	34.7	495	11.3	161	23.4	71.0	334	165	3.72	15
8	812.45	16.0	41.2	512	10.6	132	30.6	63.9	380	2	0.114	25
9	813.88	18.4	53.7	766	3.6	51	50.1	44.2	715	0	0.004	45
10	815.15	16.3	61.0	771	11.4	144	49.6	46.4	627	101	2.95	20
11	816.40	13.8	57.8	619	15.1	162	42.7	46.7	457	3	0.121	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 VI

Company Oka Oil & Gas Company Lease E. Ware Well No. C-5

Depth Interval, Feet	796.25 - 802.20	808.80 - 816.85	796.25 - 816.85
Feet of Core Analyzed	1.25	5.00	6.25
Average Percent Porosity	16.48	16.80	16.74
Average Percent Original Oil Saturation	27.04	51.86	46.75
Average Percent Oil Recovery	5.52	10.00	8.70
Average Percent Residual Oil Saturation	23.52	41.86	38.05
Average Percent Residual Water Saturation	68.80	51.96	55.35
Average Percent Total Residual Fluid Saturation	92.32	93.82	93.36
Average Original Oil Content, Bbls./A. Ft.	341.	867.	801.
Average Oil Recovery, Bbls./A. Ft.	46.	126.	110.
Average Residual Oil Content, Bbls./A. Ft.	295.	541.	491.
Total Original Oil Content, Bbls./Acre	426.	3,333.	5,759.
Total Oil Recovery, Bbls./Acre	57.	632.	689.
Total Residual Oil Content, Bbls./Acre	369.	2,701.	3,070.
Average Effective Permeability, Millidarcys	3.82	1.78	2.19
Average Initial Fluid Production Pressure, p.s.i.	21.7	23.3	22.8

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