

January 23, 1950

Brandeberry Machine Company
Russell, Kansas

Attention: Mr. L. C. McLaughlin

Gentlemen:

Enclosed herewith is the report of the analysis of the Keystone barrel core taken from the Davidson Lease, Well No. 1, Wilson County, Kansas, and submitted to our laboratory on January 19, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

By Bonnie Ladd

CLP:bb
c.c.

L. C. McLAUGALIN

CORE ANALYSIS REPORT

DAVIDSON LEASE WELL NO. 1

WILSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

JANUARY 23, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company L. C. McLaughlin Lease Davidson Well No. 1

Location _____

Section 33 Twp. 28 Rge. 16 County Wilson State Kansas

Name of Sand	Bartlesville
Top of Core	894.00
Bottom of Core	904.10
Top of Sand (according to driller)	886.00
Bottom of Sand	901.23
Total Feet of Permeable Sand	6.00

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10	2.35	2.35
10 - 20	1.65	4.00
20 - 40	1.45	5.45
40 & above	0.55	6.00

Average Permeability, Millidarcys	20.08
Average Percent Porosity	17.71
Average Percent Oil Saturation	35.02
Average Percent Water Saturation	36.65
Average Oil Content, Bbls./A. Ft.	484.
Total Oil Content, Bbls./Acre	2,809.
Average Percent Oil Recovery by Laboratory Flooding Tests	10.21
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	145.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	812.
Total Calculated Oil Recovery, Bbls./Acre (for sand analyzed)	1,450.

Packer Setting, Feet

Note: The above averages are for that part of the sand section extending from the top of the core to the top of the cement plug.

Viscosity, Centipoises @ 83°F.

7.98

A. P. I. Gravity, degrees @ 60 °F

35.0

Fresh water was used as a circulating fluid in the coring of the sand in this well. According to the driller, eight feet of sand was drilled before coring was started.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
894.00 - 894.90	- Brown fine grained micaceous sandstone.
894.90 - 895.50	- Brown fine grained micaceous shaley sandstone.
895.50 - 895.80	- Brown fine grained micaceous sandstone.
895.80 - 896.50	- Light brown fine grained finely laminated micaceous sandstone.
896.50 - 898.15	- Brown fine grained micaceous sandstone.
898.15 - 899.85	- Dark brown fine grained micaceous sandstone.
899.85 - 900.30	- Brown fine grained micaceous slightly carbonaceous sandstone.
900.30 - 901.23	- Dark fine grained micaceous carbonaceous sandstone.
901.23 - 901.63	- Coal.
901.63 - 902.00	- Gray shale.
902.00 - 903.00	- Soft gray shale.
903.00 - 904.10	- Gray shale (according to log, discarded at well).

Coring was started at a depth of 894.00 feet in fine grained micaceous sandstone and completed at 904.10 feet in gray shale. This core shows a total of 6.30 feet of sandstone. For the most part, the sand body is made up of fine grained micaceous sandstone. Assuming that eight feet of sand was drilled before coring was started, then there would be a total of 14.30 feet of sandstone. Underlying the sand body is a coal layer extending from 901.23 to 901.63 feet.

PERMEABILITY

The sand in this core is fairly tight; having an overall weighted average permeability of 21.40 millidarcys (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has an irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 35.02. The weighted average percent water saturation is 36.65 (See Table IV). This gives an overall weighted average total fluid saturation of 71.67 percent. This low total fluid saturation indicates that an appreciable amount of fluid was lost during coring, which was probably oil.

In order to get some idea of the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. By observing the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur during coring. However, we are inclined to believe that most of the oil lost during coring was due to expansion of gas carried in solution by the oil.

The overall weighted average oil content of the sand in the core is 484 barrels per acre foot, while the total oil content is 2,809 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of oil bailed from the core hole is 7.98 centipoises at 83°F. The A.P.I. gravity of the oil is 35° at 60°F. With other factors being favorable, a sand containing an oil of this viscosity

should respond very satisfactorily to water repressuring.

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 812 barrels per acre was obtained from 5.60 feet of sand. The weighted average oil saturation was reduced from 37.23 to 27.02, or represents an average recovery of 10.21 percent. The weighted average effective permeability of the samples is 1.16 millidarcys, while the average initial fluid production pressure is 23.3 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that all of the samples took water and produced oil. This would indicate that all of the sand represented by these samples is floodable.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 1,450 barrels of oil per acre from that part of the sand section analyzed. In calculating this recovery, an allowance was made for oil lost during coring. It is unfortunate that the sand located in the upper part of the sand section was not cored, as the calculated recovery given above does not represent the entire sand section. Assuming that the recovery for that part of the sand section drilled with cable tools has the same average recovery as that part of the sand section cored, then the total recovery for the entire sand section would be approximately 3,522 barrels per acre. Of course, this value is based on a mere assumption and, naturally, is not reliable.

Inasmuch as this well was drilled on an old abandoned lease, it is doubtful whether very much oil can be recovered by natural production

unless there is a natural flood on the sand in this area brought about by water entering some of the old abandoned wells.

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SHOT RECOMMENDATION

Company L. C. McLaughlin Lease Davidson Well No. 1

<u>Depth Interval, Feet</u>	<u>Feet of Sand</u>	<u>Size of Shell Inches</u>	<u>Qts./Ft.</u>	<u>Total Quarts</u>
890.00 - 898.00	8.0	3.0	1.5	12.0

Note: Plug hole back to 900.50 feet.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company L. C. McLaughlin

Lease Davidson

Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	894.02	37.	0.15	0.15	4.55
2	894.20	33.	0.30	0.45	9.99
3	894.63	36.	0.30	0.75	10.80
4	894.85	0.64	0.15	0.90	0.10
5	895.12	1.8	0.60	1.50	1.08
6	895.85	Imp.	0.20	1.70	0.00
7	896.10	1.8	0.30	2.00	0.54
8	896.43	1.4	0.20	2.20	0.28
9	896.85	13.	0.50	2.70	6.50
10	897.30	14.	0.50	3.20	7.00
11	897.80	4.3	0.65	3.85	2.80
12	898.20	24.	0.30	4.15	7.20
13	898.70	121.	0.35	4.50	48.35
14	899.00	16.	0.40	4.90	6.40
15	899.45	33.	0.40	5.30	13.20
16	899.75	17.	0.25	5.55	4.25
17	899.95	2.5	0.45	6.00	1.13
18	900.45	51.	0.30	6.30	15.30
19	900.70	3.5	0.20	6.50	0.70
20	901.00	2.3	0.43	6.93	0.99

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company L. C. McLargalin Lease Davidson Well No. 1

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
894.00 - 900.50	6.00	21.40	128.37

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RESULTS OF SATURATION TESTS

TABLE III

Company L. C. McLaughlin Lease Davidson Well No. 1

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	894.52	16.0	36.0	47.3	83.3	448	0.90	0.90	404
2	895.57	16.2	31.4	46.4	77.8	396	0.90	1.80	356
3	896.72	18.0	34.5	37.1	71.6	483	0.90	2.70	435
4	898.08	19.5	36.4	35.5	71.9	552	0.75	3.45	414
5	899.32	18.7	36.8	26.4	63.2	535	1.70	5.15	910
F-6	900.15	17.0	34.8	-	-	458	0.45	5.60	206
6	900.32	18.1	29.7	34.3	64.0	418	0.93	6.53	388
							Total	- - - -	3,113

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SUMMARY OF SATURATION TESTS

TABLE IV

Company	L. C. McLaughlin		Lease		Davidson		Well No.	1
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre		
894.00-900.50	5.80	17.71	35.02	36.65	484	2,809		

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company L. C. McLaughlin

Lease Davidson

Well No. 1

Sample No.	Depth, Feet	Effective Porosity, Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered, cc*	Permeability, Millidarcys	Effective Permeability, Millidarcys	Initial Fluid Production Pressure, Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.				
1	894.35	17.5	88.8	526	8.4	114	30.4	65.0	412	26	0.930		25
2	895.72	18.5	32.6	468	7.0	101	25.6	67.0	367	16	0.816		25
3	896.55	17.4	34.9	471	10.7	144	24.2	67.0	327	9	0.457		25
4	897.95	18.2	39.9	563	14.8	209	25.1	64.6	354	47	1.28		15
5	899.15	19.0	39.3	579	12.9	190	26.4	60.0	389	43	2.01		20
6	900.15	17.0	24.8	458	1.2	16	23.6	52.0	442	11	0.324		30

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	<u>L. C. McLaughlin</u>	Lease	<u>Davidson</u>	Well No.	<u>1</u>
Depth Interval, Feet	<u>894.00 - 900.30</u>				
Feet of Core Analyzed	<u>5.60</u>				
Average Percent Porosity	<u>18.14</u>				
Average Percent Original Oil Saturation	<u>37.23</u>				
Average Percent Oil Recovery	<u>10.21</u>				
Average Percent Residual Oil Saturation	<u>27.02</u>				
Average Percent Residual Water Saturation	<u>63.04</u>				
Average Percent Total Residual Fluid Saturation	<u>90.06</u>				
Average Original Oil Content, Bbls./A. Ft.	<u>524.</u>				
Average Oil Recovery, Bbls./A. Ft.	<u>145.</u>				
Average Residual Oil Content, Bbls./A. Ft.	<u>379.</u>				
Total Original Oil Content, Bbls./Acre	<u>2,933.</u>				
Total Oil Recovery, Bbls./Acre	<u>812.</u>				
Total Residual Oil Content, Bbls./Acre	<u>2,121.</u>				
Average Effective Permeability, Millidarcys	<u>1.16</u>				
Average Initial Fluid Production Pressure, p.s.i.	<u>23.3</u>				

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

TABLE VII

Company L. C. McLaughlin Lease Davidson Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate	Percent Water Saturation Drilling & Foreign	Total
1	894.52	42,800			
2	895.57	34,000			
3	896.72	34,000			
4	898.08	26,600			
5	899.32	37,800			
6	900.32	27,300			
Note: ppm - parts per million.					

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company	<u>L. C. McLangalin</u>	Lease	<u>Davidson</u>	Well No.	<u>1</u>
Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water		
894.00 - 900.50	36,300				

Note: ppm - parts per million.