

21-25-18
November 7, 1950

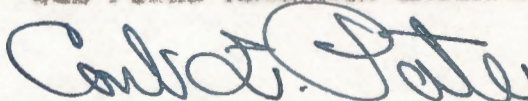
Doty 4
G. L. McMahon, Inc.
1605 Nat'l Bank of Tulsa Bldg.
Tulsa, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the Cable Tool core taken from R.E.P. Oil Company's Doty Lease, Well No. 4, Allen County, Kansas, and submitted to our laboratory on October 23, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES



Carl L. Pate

CLP:bb
3 c.c.

R. E. F. OIL COMPANY

CORE ANALYSIS REPORT

DOTY LEASE

WELL NO. 4

ALLEN COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANDLER, KANSAS

NOVEMBER 7, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company R. E. P. Oil Company Lease Doty Well No. 4
 Location 850' South and 450' West of Northeast corner. W $\frac{1}{2}$ of the SE $\frac{1}{4}$
 Section 21 Twp. 25S Rge. 18E County Allen State Kansas

Name of Sand Bartlesville
 Top of Core 830.00
 Bottom of Core 856.15
 Top of Sand ?
 Bottom of ~~Sand~~ Pay 849.40
 Total Feet of Permeable Sand 14.63

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 50	1.50	1.50
50 - 75	3.09	4.59
75 - 100	4.63	9.22
100 - 150	2.47	11.69
150 - 200	2.14	13.83
200 & above	0.80	14.63

Average Permeability, Millidarcys 104.84
 Average Percent Porosity 21.10
 Average Percent Oil Saturation 39.28
 Average Percent Water Saturation 40.03
 Average Oil Content, Bbls./A. Ft. 646.
 Total Oil Content, Bbls./Acre 11,538.
 Average Percent Oil Recovery by Laboratory Flooding Tests 7.30
 Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 124.
 Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 1,413.
 Total Calculated Oil Recovery, Bbls./Acre 3,750.
 Packer Setting, Feet 830.

Viscosity, Centipoises @ Note: The above averages are for that part of
the sand section extending from the packer setting
 A. P. I. Gravity, degrees @ 60 °F to the bottom of the sand.

Fresh 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:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
830.00 - 831.15	- Dark brown fine grained micaceous sandstone.
831.15 - 831.30	- Dark brown fine grained micaceous slightly shaley sandstone.
831.30 - 831.45	- Dark brown fine grained micaceous sandstone.
831.45 - 831.95	- Laminated sandy shale.
831.95 - 832.19	- Dark brown fine grained micaceous sandstone.
832.19 - 832.60	- Laminated sandy shale.
832.60 - 832.98	- Dark brown fine grained micaceous sandstone.
832.98 - 833.50	- Finely laminated shaley sandstone.
833.50 - 833.85	- Dark brown fine grained laminated micaceous shaley sandstone.
833.85 - 834.00	- Laminated sandy shale.
834.00 - 834.25	- Dark brown fine grained micaceous sandstone.
834.25 - 834.40	- Finely laminated shaley sandstone.
834.40 - 834.65	- Dark brown fine grained slightly laminated micaceous shaley sandstone.
834.65 - 835.60	- Dark brown fine grained micaceous sandstone.
835.60 - 836.40	- Laminated sandy shale.
836.40 - 836.55	- Dark brown fine grained micaceous sandstone.
836.55 - 836.70	- Dark brown fine grained laminated micaceous shaley sandstone.
836.70 - 836.85	- Laminated sandy shale.
836.85 - 839.05	- Dark brown fine grained micaceous sandstone.
839.05 - 839.35	- Gray sandy shale.

839.35 - 839.55 - Dark brown fine grained micaceous sandstone.
839.55 - 839.75 - Brown fine grained laminated micaceous shaley sandstone.
839.75 - 840.00 - Finely laminated shaley sandstone.
840.00 - 840.30 - Finely laminated sandy shale.
840.30 - 843.50 - Dark brown fine grained micaceous sandstone.
843.50 - 843.63 - Dark brown fine grained micaceous slightly shaley sandstone.
843.63 - 845.07 - Dark brown fine grained micaceous sandstone.
845.07 - 845.25 - Laminated shaley sandstone.
845.25 - 845.40 - Dark brown fine grained micaceous sandstone.
845.40 - 845.55 - Finely laminated shaley sandstone.
845.55 - 845.75 - Finely laminated sandy shale.
845.75 - 846.00 - Dark brown fine grained micaceous sandstone.
846.00 - 846.13 - Gray sandy shale.
846.13 - 846.80 - Dark brown fine grained micaceous sandstone.
846.80 - 847.35 - Gray shale.
847.35 - 847.50 - Dark brown fine grained micaceous slightly shaley sandstone.
847.50 - 847.75 - Laminated shaley sandstone.
847.75 - 848.25 - Finely laminated sandy shale.
848.25 - 849.40 - Dark brown fine grained micaceous sandstone.
849.40 - 849.75 - Dark brown fine grained micaceous slightly shaley sandstone.
849.75 - 854.10 - Soft dark fine grained micaceous carbonaceous sandstone.
854.10 - 854.40 - Dark fine grained micaceous carbonaceous sandstone.
854.40 - 856.15 - Gray shale.

Coring was started at a depth of 830.00 feet in fine grained micaceous sandstone and completed at 856.15 feet in gray shale. This core shows a total of 19.04 feet of sandstone. For the most part, the pay

sand is made up of fine grained micaceous sandstone. The lower part of the cored section is composed of soft fine grained micaceous 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 are 113.33 and 75.67 millidarcys respectively; the overall average being 104.84 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a fairly uniform permeability profile. By comparing the permeability of the sand in this core with that taken from the Harold Baker Well No. 4, you will note that it is considerable tighter.

PERCENT SATURATION & OIL CONTENT

The sand in this core has a fairly good weighted average percent oil saturation, namely, 39.28. The weighted average percent oil saturation of the upper and lower sections are 40.01 and 37.58 respectively. The weighted average percent water saturation of the upper and lower sections are 41.49 and 36.92 respectively; the overall average being 40.03, (See Table IV). This gives an overall weighted average total fluid saturation of 79.31 percent. This comparatively low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil. Chances are most of this loss was due to the expansion of gas carried in solution by the 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 as some parts of the sand section had a very low chloride content.

The weighted average oil content of the upper and lower sections are 666 and 598 barrels per acre foot respectively; the overall average being 646. The total oil content, as shown by this core, is 11,538 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests as a total recovery of 1,413 barrels of oil per acre was obtained from 11.37 feet of sand. The weighted average percent oil saturation was reduced from 40.95 to 33.65, or represents an average recovery of 7.30 percent. The weighted average effective permeability of the samples is 9.22 millidarcys while the average initial fluid production pressure is 13.8 pounds per square inch (See Table VI). The sand in this core flooded down to a somewhat lower residual oil saturation than that taken from the Harold Baker Well No. 4.

By observing the data given in Table V, you will note that of the 20 samples tested, 17 produced water and 16 oil. This indicates that most of the sand represented by these samples is floodable. The tests show that the so-called dark carbonaceous sand located at the bottom of the cored section is not floodable, and that the sand has a fairly wide variation in effective permeability.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 3,750 barrels of oil per acre. 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. This core shows approximately 12 feet of good floodable sand which is considerable more than that contained in the core taken from the Harold Baker Well No. 4.

Oil Field Research Laboratories

SHOT RECOMMENDATION

Company R. E. P. Oil Company Lease Doty Well No. 4

Depth Interval, Feet	Feet of Sand	Size of Shell Inches	Qts./Ft.	Total Quarts
<u>834.0 - 848.5</u>	<u>14.5</u>	<u>3½</u>	<u>2.0</u>	<u>29.0</u>

Recommended Packer Setting 830.0 feet

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS
TABLE I

Company R. E. P. Oil Company

Lease Doty

Well No. 4

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	830.03	73.	0.15	0.15	10.95
2	830.21	170.	0.35	0.50	59.50
3	830.75	99.	0.40	0.90	39.60
4	831.12	101.	0.25	1.15	25.25
5	832.10	56.	0.24	1.39	13.45
6	832.65	87.	0.20	1.59	17.40
7	832.95	84.	0.18	1.77	15.12
8	834.15	41.	0.25	2.02	10.25
9	834.90	63.	0.45	2.47	28.40
10	835.30	85.	0.50	2.97	42.50
11	836.91	58.	0.25	3.22	14.50
12	837.25	89.	0.40	3.62	35.60
13	837.83	151.	0.40	4.02	60.40
14	838.08	139.	0.40	4.42	55.60
15	838.42	254.	0.40	4.82	101.60
16	838.79	81.	0.35	5.17	28.35
17	839.45	186.	0.20	5.37	37.20
18	840.65	336.	0.40	5.77	134.40
19	841.05	132.	0.50	6.27	66.00
20	841.70	105.	0.55	6.82	57.75
21	841.95	39.	0.25	7.07	9.75
22	842.22	28.	0.40	7.47	11.20
23	842.60	47.	0.30	7.77	14.10
24	842.92	58.	0.30	8.07	17.40
25	843.15	84.	0.50	8.57	42.00
26	843.65	154.	0.17	8.74	26.20
27	843.94	76.	0.30	9.04	22.80
28	844.37	61.	0.50	9.54	30.50
29	844.75	115.	0.47	10.01	54.10
30	845.30	68.	0.15	10.16	10.20
31	846.50	191.	0.67	10.83	128.00
32	847.45	56.	0.15	10.98	8.40
33	848.42	159.	0.35	11.33	55.60
34	848.80	65.	0.40	11.73	26.00
35	849.33	77.	0.40	12.13	30.80
36	849.55	82.	0.35	12.48	28.70
37	849.80	84.	0.45	12.93	37.80
38	853.05	65.	0.50	13.43	32.50
39	853.32	132.	0.30	13.73	39.60
40	853.68	76.	0.60	14.33	45.60
41	854.25	29.	0.30	14.63	8.70

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company	<u>R. E. P. Oil Company</u>	Lease	<u>Doty</u>	Well No.	<u>4</u>
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.		
830.00 - 848.70	11.33	113.33	1,284.07		
848.70 - 854.10	3.30	75.67	249.70		
830.00 - 854.40	14.63	104.84	1,533.77		

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company H. K. P. Oil Company Lease Doty Well No. 4

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	830.33	22.0	43.0	30.1	73.1	734	1.15	1.15	844
2	831.23	17.4	37.0	36.0	73.0	501	0.15	1.30	75
F2	831.36	22.9	39.1	-	-	695	0.15	1.45	104
F3A	832.82	20.9	41.6	-	-	675	0.38	1.83	256
4	833.56	15.4	33.6	59.4	93.0	403	0.35	2.18	141
F4A	834.05	21.2	34.1	-	-	562	0.25	2.43	141
5	834.56	17.2	31.8	60.6	92.4	424	0.25	2.68	106
6	835.53	20.7	42.6	39.2	81.8	685	0.95	3.63	650
F6	836.45	22.9	39.5	-	-	701	0.15	3.78	105
7	836.63	16.4	34.5	53.3	87.8	440	0.15	3.93	66
8	837.73	21.5	43.9	46.5	90.4	731	1.15	5.08	840
9	838.66	23.6	42.2	50.4	92.6	773	1.05	6.13	811
10	839.65	16.4	31.9	65.6	97.5	406	0.20	6.33	81
11	840.55	22.0	44.0	36.3	80.3	752	0.80	7.13	603
12	841.45	22.9	40.5	38.9	79.4	720	0.90	8.03	649
13	842.45	19.4	38.9	44.2	83.1	586	0.80	8.83	468
14	843.42	22.2	36.2	43.0	79.2	624	0.70	9.53	437
15	844.63	21.4	36.0	37.8	73.8	597	1.44	10.97	860
F14	845.82	21.4	41.1	-	-	683	0.38	11.35	260
16	846.25	23.7	39.2	29.6	68.8	720	0.67	12.02	483
F15	848.32	21.6	43.4	-	-	728	0.45	12.47	328
18	849.06	21.2	42.6	32.6	75.2	700	0.70	13.17	490

RESULTS OF SATURATION TESTS

Company R. E. F. Oil Company Lease 1st Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content, Bbbls./A. Ft.	Feet of Core		Total Oil Content Bbbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
F17	849.65	21.8	40.0	-	-	677	0.35	13.52	237
19	850.65	20.4	36.0	36.5	72.5	570	1.25	14.77	712
20	851.92	20.5	33.4	40.7	74.1	533	1.50	16.27	799
21	853.56	20.0	40.0	35.6	75.6	620	1.60	17.87	992
							Total	- - - -	11,538
Note: "A" samples were drilled from the core after it was received in the laboratory.									

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company R. E. P. Oil Company Lease Doty Well No. 4

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
830.00 - 848.70	12.47	21.36	40.01	41.49	666	8,308
848.70 - 854.10	5.40	20.50	37.58	36.92	598	3,230
830.00 - 854.10	17.87	21.10	39.28	40.03	646	11,538

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company R. E. P. Oil Company

Lease Doty

Well No. 4

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	Bbbls./A. Ft.	Percent	Bbbls./A. Ft.	% Oil	% Water	Bbbls./A. Ft.			
1	830.46	22.4	42.9	747	13.7	238	29.2	65.0	509	131.5	5.95	15
2	831.36	22.9	39.1	695	11.0	195	28.1	61.5	500	128	6.12	15
3A	832.82	20.9	41.6	675	8.9	145	32.7	61.2	530	32.5	7.26	15
4A	834.05	21.2	34.1	562	2.3	36	31.6	54.5	524	39	4.18	20
5	834.72	21.0	44.1	719	9.2	150	34.9	61.2	569	80	2.71	15
6	836.45	22.9	39.5	701	9.9	175	29.6	63.7	526	160.5	11.35	10
7	837.55	21.4	45.7	756	9.5	186	36.2	56.3	600	155	9.48	10
8A	838.35	24.0	42.5	791	5.3	99	37.2	42.8	692	122	19.16	10
9	840.35	22.2	43.2	744	9.8	169	33.4	60.5	575	95.5	6.23	15
10	841.32	22.0	42.3	721	3.9	66	38.4	51.7	655	114	14.27	10
11	842.33	19.2	38.0	567	4.6	69	33.4	49.0	498	17	1.08	20
12	843.26	22.5	36.5	672	6.5	113	32.0	60.0	559	131.5	7.00	15
13	844.46	21.7	34.4	579	6.0	101	28.4	61.3	478	108	6.97	15
14	845.62	21.4	41.1	665	4.5	75	36.6	38.4	608	115.5	7.75	15
16A	846.41	23.1	40.5	726	4.8	86	35.7	59.5	640	184	12.43	10
15	848.32	21.6	43.4	728	6.6	114	36.6	38.4	614	149.5	10.64	10
17	849.65	21.8	40.0	677	0.0	0	40.0	50.0	677	106	2.69	15
18	850.53	16.9	35.7	470	0.0	0	35.7	55.6	470	0	Imp.	50+
19A	851.65	20.0	33.3	517	0.0	0	33.3	29.2	517	0	Imp.	30+
20	853.42	19.5	42.8	647	0.0	0	42.8	44.0	647	0	Imp.	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.

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

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company	<u>R. E. P. Oil Company</u>	Lease	<u>Doty</u>	Well No.	<u>4</u>
Depth Interval, Feet	<u>830.00 - 848.70</u>				
Feet of Core Analyzed	<u>11.37</u>				
Average Percent Porosity	<u>21.87</u>				
Average Percent Original Oil Saturation	<u>40.95</u>				
Average Percent Oil Recovery	<u>7.30</u>				
Average Percent Residual Oil Saturation	<u>33.65</u>				
Average Percent Residual Water Saturation	<u>57.22</u>				
Average Percent Total Residual Fluid Saturation	<u>89.90</u>				
Average Original Oil Content, Bbls./A. Ft.	<u>696.</u>				
Average Oil Recovery, Bbls./A. Ft.	<u>124.</u>				
Average Residual Oil Content, Bbls./A. Ft.	<u>572.</u>				
Total Original Oil Content, Bbls./Acre	<u>7,918.</u>				
Total Oil Recovery, Bbls./Acre	<u>1,413.</u>				
Total Residual Oil Content, Bbls./Acre	<u>6,505.</u>				
Average Effective Permeability, Millidarcys	<u>9.22</u>				
Average Initial Fluid Production Pressure, p.s.i.	<u>13.8</u>				

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

Oil Field Research Laboratories
RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company R. E. P. Oil Company Lease Doty Well No. 4

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate	Percent Water Saturation Drilling & Foreign	Total
1	830.33	11,300			
2	831.23	19,600			
4	833.56	24,000			
5	834.56	9,900			
6	835.53	10,100			
7	836.63	17,500			
8	837.73	11,800			
9	838.76	5,400			
10	839.65	14,100			
11	840.55	15,500			
12	841.45	9,000			
13	842.43	9,000			
14	843.42	6,200			
15	844.73	12,000			
16	846.25	12,300			
18	849.06	12,500			
19	850.65	11,100			
20	851.92	15,300			
21	853.56	17,600			

Note: ppm - parts per million

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company	<u>R. E. P. Oil Company</u>	Lease	<u>Doty</u>	Well No.	<u>4</u>
Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water		Average Percent Drilling & Foreign Water	
830.00 - 846.80	11,072				
848.70 - 854.10	14,612				
830.00 - 854.10	12,206				

Note: ppm - parts per million