

21-25-18E
Doty Co

June 22, 1951

R. E. P. Oil Company
Box 188
Isola, Kansas

Gentlemen:

Enclosed herewith is the report of
the analysis of the Cable tool core taken
from the Doty Lease, Well No. 6, Allen
County, Kansas, and submitted to our lab-
oratory on June 9, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:pm
4 c.c.

B. E. P. Oil Company

Core Analysis Report

Daly Lease

Well No. 6

Allen County, Kansas

OIL FIELD RESEARCH LABORATORIES

CHANDLER, KANSAS

JUNE 22, 1951

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company N. E. P. Oil Company Lease Doty Well No. 6

Location _____

Section 21 Twp. 25 S Rge. 10 E County Allen State Kansas

Name of Sand Bartlesville

Top of Core 809.30

Bottom of Core 837.80

Top of Sand 811.65

Bottom of Sand 833.55

Total Feet of Permeable Sand (Analyzed) 18.50

Total Feet of Floodable Sand (Analyzed) 14.38

Distribution of Permeable Sand:

Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10
10 - 30
30 - 60
60 - 90
90 - 120
120 - 150
150 & above

1.07
0.55
5.83
3.10
4.45
2.20
1.30

1.07
1.62
7.45
10.55
15.00
17.20
18.50

Average Permeability Millidarcys 81.64

Average Percent Porosity 20.76

Average Percent Oil Saturation 42.84

Average Percent Water Saturation 38.67

Average Oil Content, Bbls./A. Ft. 700.

Total Oil Content, Bbls./Acre 12,828.

Average Percent Oil Recovery by Laboratory Flooding Tests 12.34

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 210.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 3,010.

Total Calculated Oil Recovery, Bbls./Acre 8,850.

Packer Setting, Feet 810.00

Viscosity, Centipoises @ 810° 53.4

A. P. I. Gravity, degrees @ 60 °F 86.2

Elevation, Feet

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The above averages are for that part of the sand section extending from the packer setting to the top of the cement plug.

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:

Depth Interval, <u>Feet</u>	Description
809.30 - 810.00	Laminated sandy shale.
810.00 - 810.85	Brown fine grained laminated micaceous shaley sandstone.
810.85 - 811.23	Finely laminated sandy shale.
811.23 - 811.45	Brown fine grained slightly laminated micaceous shaley sandstone.
811.45 - 811.65	Finely laminated sandy shale.
811.65 - 811.80	Brown fine grained micaceous sandstone.
811.80 - 811.95	Finely laminated shaley sandstone.
811.95 - 813.55	Brown fine grained slightly laminated micaceous shaley sandstone.
813.55 - 813.85	Laminated sandy shale.
813.85 - 814.25	Brown fine grained slightly laminated micaceous shaley sandstone.
814.25 - 814.40	Finely laminated shaley sandstone.
814.40 - 814.90	Brown fine grained micaceous sandstone.
814.90 - 815.25	Gray sandy shale.
815.25 - 815.40	Gray shale.
815.40 - 815.65	Laminated sandy shale.
815.65 - 816.25	Brown fine grained slightly laminated micaceous shaley sandstone.
816.25 - 816.40	Brown fine grained laminated micaceous shaley sandstone.

- 816.40 - 817.05 - Finely laminated sandy shale.
817.05 - 817.40 - Brown fine grained micaceous sandstone.
817.40 - 817.90 - Gray shale.
817.90 - 817.95 - Brown fine grained micaceous sandstone.
817.95 - 818.40 - Gray shale.
818.40 - 818.70 - Brown fine grained micaceous sandstone.
818.70 - 819.45 - Laminated sandy shale.
819.45 - 821.60 - Brown fine grained micaceous sandstone containing a gray sandy shale break.
821.60 - 833.35 - Dark brown fine grained micaceous sandstone.
833.35 - 833.55 - Dark brown fine grained micaceous calcareous sandstone.
833.55 - 835.45 - Hard dark calcareous sandstone.
835.45 - 836.30 - Gray shale.
836.30 - 837.80 - According to log, shale (Discarded at well).

Coring was started at a depth of 809.30 feet in laminated sandy shale and completed at 837.80 feet in shale. This core shows a total of 19.64 feet of sandstone. For the most part, the pay sand is made up of fine grained micaceous 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 31.21 and 97.70 millidarcys respectively; the overall average being 81.64 (See Table II). By observing the data given on the coregraph, it is noticeable that the clean sand section has a fairly uniform permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 42.84. The weighted average percent oil saturation

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of the upper and lower sections are 28.07 and 47.66 respectively; The weighted average percent water saturation of the upper and lower sections are 50.68 and 35.78 respectively; the overall average being 38.67 (See Table IV). This gives an overall weighted average total fluid saturation of 81.51 percent. This comparatively low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil.

In an effort to determine whether or not any flushing of the sand occurred during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. From the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur in the more permeable sand section. However, we are inclined to believe that most of the oil lost during coring was due to the expansion of gas carried in solution by the oil.

The weighted average oil content of the upper and lower sections are 404 and 796 barrels per acre foot respectively; the overall average being 700. The total oil content, as shown by this core, is 12,822 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of crude oil taken from the bleeder at a nearby producing well is 53.4 centipoises at 81° F. The A.P.I. gravity of the oil is 26.2° at 60° F. The viscosity of this oil is considerable higher than most of the oil being recovered by secondary recovery.

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 3,010 barrels of oil per acre was obtained

from 14.32 feet of sandstone. The weighted average percent oil saturation was reduced from 46.37 to 33.83, or represents an average recovery of 12.54 percent. The weighted average effective permeability of the samples is 7.62 millidarcys, while the average initial fluid production pressure is 13.5 pounds per square inch (See Table VI). The above tests show that the sand has a fairly high residual oil saturation, however, this is to be expected inasmuch as the sand in place has a rather high viscosity.

By observing the data given in Table V, you will note that of the 21 samples tested, 20 produced water and 17 oil. This indicates that most of the sand represented by these samples is floodable. The tests also show that the sand has a comparatively uniform 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 5,250 barrels of oil per acre, or an average of 364 barrels per acre foot from the 14.32 feet of good floodable sand. In calculating this recovery, an allowance was made for oil lost during coring, and it was assumed that this well was drilled in semi-virgin territory.

On the basis of the core analysis, this core shows more recoverable oil than any other taken on this property and analyzed by us to date. Another favorable factor is the fact that the permeability of the good sand is fairly uniform.

Oil Field Research Laboratories

SHOT RECOMMENDATION

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

Depth Interval, Feet	Feet of Sand	Size of Shell Inches	Qts./Ft.	Total Quarts
814.00 - 834.50	20.5	3 1/2	2.0	41.0

Recommended Packer Setting 810.00 Feet.
Note: plug hole back to 835.50 Feet.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company E. F. P. Oil Company

Lease Doty

Well No. 6

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	810.04	1.9	0.20	0.20	0.38
2	810.40	1.7	0.65	0.85	1.11
3	811.26	9.0	0.22	1.07	1.98
4	812.09	58.	0.45	1.52	26.10
5	812.65	15.	0.55	2.07	8.25
6	813.25	49.	0.60	2.67	29.40
7	813.90	30.	0.40	3.07	12.00
8	814.49	36.	0.30	3.37	10.80
9	814.85	36.	0.20	3.57	7.20
10	815.80	37.	0.60	4.17	22.20
11	817.91	Broken	0.05	4.22	-
12	818.45	84.	0.15	4.37	12.60
13	818.66	50.	0.15	4.52	7.50
14	819.66	55.	0.20	4.80	15.40
15	819.84	32.	0.30	5.10	9.60
16	820.40	53.	0.40	5.50	21.20
17	820.60	144.	0.25	5.75	36.00
18	820.85	98.	0.35	6.10	34.30
19	821.40	80.	0.40	6.50	32.00
20	821.55	85.	0.15	6.65	12.75
21	821.755	126.	0.45	7.10	56.70
22	822.40	42.	0.40	7.50	16.80
23	822.65	117.	0.20	7.70	23.40
24	822.80	59.	0.35	8.05	20.65
25	823.32	74.	0.40	8.45	29.60
26	823.61	150.	0.25	8.70	37.50
27	823.85	103.	0.40	9.10	41.20
28	824.35	94.	0.50	9.60	47.00
29	824.81	134.	0.50	10.10	67.00
30	825.36	67.	0.40	10.50	26.80
31	825.60	100.	0.20	10.70	20.00
32	825.85	71.	0.40	11.10	28.40
33	826.40	100.	0.50	11.60	50.00
34	826.75	128.	0.50	12.10	64.00
35	827.45	62.	0.40	12.50	24.80
36	827.60	69.	0.20	12.70	13.80
37	827.85	96.	0.40	13.10	38.40
38	828.40	92.	0.40	13.50	36.80
39	828.70	51.	0.30	13.80	18.30
40	828.90	137.	0.50	14.30	68.50

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS
TABLE I

Company **R. E. P. Oil Company** Lease **Doby** Well No. **4**

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	829.57	48.	0.35	14.65	16.80
42	829.76	90.	0.40	15.05	36.00
43	830.35	77.	0.60	15.65	43.80
44	830.95	40.	0.55	16.20	22.00
45	831.50	101.	0.50	16.70	50.50
46	831.84	247.	0.30	17.00	74.10
47	832.12	206.	0.40	17.40	82.40
48	832.65	234.	0.35	17.75	81.90
49	832.85	111.	0.60	18.35	66.60
50	833.40	44.	0.20	18.55	8.80

Oil Field Research Laboratories
SUMMARY OF PERMEABILITY TESTS

TABLE II

Company <u>R. H. F. Oil Company</u>		Lease <u>Doty</u>	Well No. <u>6</u>
Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
810.00 - 818.70	4.47	31.21	139.52
819.45 - 833.35	14.03	97.70	1,370.80
810.00 - 835.30	18.50	81.64	1,510.32

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RESULTS OF SATURATION TESTS

TABLE III

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

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	810.77	16.7	29.1	62.1	91.7	378	0.85	0.85	321
F-2	811.72	21.0	33.2	-	-	540	0.15	1.00	61
2	811.83	14.5	31.1	63.1	94.2	451	0.15	1.15	89
3	813.10	20.0	34.6	52.0	86.6	382	1.60	2.75	611
4	814.33	13.8	20.3	70.0	90.3	218	0.15	2.90	33
F-4A	814.65	20.4	30.0	-	-	475	0.90	3.40	237
F-6	816.10	16.3	29.7	-	-	376	0.60	4.00	225
6	816.31	16.8	34.1	54.8	88.9	445	0.15	4.15	67
7	817.23	19.7	33.0	47.3	80.3	504	0.35	4.50	177
F-9A	819.55	19.7	30.3	-	-	463	0.28	4.78	130
10	820.22	21.0	41.1	37.0	78.1	669	0.89	5.67	395
11	821.20	22.4	40.8	47.0	87.8	710	0.90	6.57	639
12	822.20	22.0	47.0	31.4	78.4	804	1.10	7.67	885
13	823.20	22.4	46.6	31.6	78.0	810	1.00	8.67	810
14	824.20	21.6	50.2	28.2	78.4	841	1.00	9.67	841
15	825.20	22.4	50.4	32.9	83.3	877	1.00	10.67	877
16	826.20	21.4	41.3	38.7	70.0	687	1.00	11.67	687
17	827.19	21.7	50.2	38.4	88.6	845	1.00	12.67	845
18	828.20	20.6	51.8	41.9	93.7	828	11.00	13.67	828

RESULTS OF SATURATION TESTS

TABLE III

Company R. E. F. Oil Company Lease 2017 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.	
19	829.23	21.4	47.2	43.3	90.5	784	1.00	14.67	784
20	830.10	20.5	53.1	40.8	93.9	845	1.00	15.67	845
21	831.31	21.4	53.3	32.9	86.2	885	1.10	16.77	975
22	832.43	22.4	49.3	33.5	82.8	858	1.00	17.77	858
23	833.20	19.6	48.0	35.3	83.3	730	0.55	18.32	<u>402</u>
							Total - - - - -	12,822	
Note: "A" samples were taken 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 Butte Well No. 6

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
810.00 - 817.40	4.50	18.47	28.07	50.68	404	1,821
819.45 - 833.35	13.82	21.51	47.66	35.78	796	11,001
810.00 - 835.50	18.32	20.76	42.84	38.67	700	12,822

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company E. E. P. Oil Company

Lease 247

Well No. 6

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	801.83	18.4	82.7	378	0.0	0	22.7	84.2	378	0	Imp.	50.4
2	811.72	21.0	33.2	340	1.8	22	31.4	65.2	511	204	6.73	18
3	812.95	19.9	24.2	374	0.0	0	24.2	70.4	374	78	1.87	20
4A	814.65	20.4	30.0	475	0.0	0	30.0	63.9	475	88	1.98	20
5	816.10	16.3	29.7	376	0.0	0	29.7	63.4	376	1	0.110	50
6	817.10	19.4	34.0	312	3.1	77	28.9	65.4	435	190	8.42	16
7	819.55	19.7	30.3	465	3.1	47	27.2	67.1	416	150	8.61	16
8A	820.04	21.1	39.9	654	10.1	164	29.8	64.3	488	144	6.92	15
10	821.05	22.0	41.0	700	12.3	210	28.7	66.0	490	130	6.62	16
11	822.05	22.1	46.0	788	13.9	238	32.1	64.2	550	190	11.03	15
12	823.00	22.8	45.9	812	13.3	235	32.6	61.0	577	187	7.95	16
13	824.03	21.2	50.0	631	16.0	263	34.6	59.7	566	119	4.83	20
14	825.05	22.3	49.2	682	16.3	266	32.7	62.5	566	151	9.31	16
15	826.04	21.3	41.0	601	8.1	134	33.7	61.7	557	159	6.96	15
16	827.05	21.9	48.8	830	15.3	280	33.3	60.5	570	104	6.08	15
17	828.05	20.7	49.5	796	14.6	235	34.9	58.7	561	163	4.87	20
18	829.10	21.0	46.0	742	11.5	187	34.8	55.8	562	201	4.35	15
19	829.96	20.6	52.3	835	11.2	173	41.1	55.7	656	46	2.39	20
20	831.15	22.0	31.9	386	16.0	273	35.9	56.4	613	110	3.31	16
22	832.30	22.9	48.3	842	10.8	192	37.7	56.2	670	565	19.60	8
23	833.03	19.7	47.3	722	11.4	174	35.9	62.7	948	111	7.79	16

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" = Sample was taken from core after it was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company	R. E. F. Oil Company			Lease	Doby			Well No.	
Depth, Interval, Feet	811.65 - 817.40			819.65 - 833.35			810.00 - 835.50		
Feet of Core Analyzed	0.59			13.82			14.32		
Average Percent Porosity	19.80			21.57			21.51		
Average Percent Original Oil Saturation	33.80			46.82			46.37		
Average Percent Oil Recovery	4.20			12.84			12.54		
Average Percent Residual Oil Saturation	29.60			22.08			33.83		
Average Percent Residual Water Saturation	65.40			60.45			60.62		
Average Percent Total Residual Fluid Saturation	95.00			94.43			94.45		
Average Original Oil Content, Bbls./A. Ft.	529.			784.			774.		
Average Oil Recovery, Bbls./A. Ft.	62.			216.			210.		
Average Residual Oil Content, Bbls./A. Ft.	458.			568.			564.		
Total Original Oil Content, Bbls./Acre	260.			10,827.			11,087.		
Total Oil Recovery, Bbls./Acre	31.			2,979.			3,010.		
Total Residual Oil Content, Bbls./Acre	229.			7,848.			8,077.		
Average Effective Permeability, Millidarcys	7.90			7.50			7.62		
Average Initial Fluid Production Pressure, p.s.i.	10.0			14.0			13.5		

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 A. E. F. 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	810.77	23,600		
2	811.85	18,900		
3	813.10	18,800		
4	814.33	19,800		
6	816.31	23,000		
7	817.23	24,200		
10	820.22	21,700		
11	821.20	8,700		
12	822.20	13,900		
13	823.20	20,300		
14	824.20	28,300		
15	825.20	14,600		
16	826.20	18,100		
17	827.19	20,600		
18	828.20	10,700		
19	829.23	10,500		
20	830.10	14,100		
21	831.30	11,700		
22	832.43	15,400		
23	833.20	18,700		
Note: ppm = parts per million.				

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company R. E. P. Oil Company Lease Doty Well No. 6

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
810.00 - 817.40	20,871		
819.80 - 833.35	16,192		
810.00 - 835.50	17,038		

Note: ppm - parts per million.