August 9, 1950

The Ohio Oil Company
Thompson Building
Tulsa, Oklahoma

Attention: Mr. R. E. McMillen

Gentlemen:

Enclosed herewith is the report of the analysis made on the 2½" rotary core taken from the Martindell Lease, Well No. W-25, Greenwood County, Kansas, and submitted to our laboratory on July 26, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:dt
2 - cc - Mr. Fred Kluck

THE OHIO OIL COMPANY

CORE ANALYSIS REPORT

MARTINDELL LEASE WELL NO. W-25

GREENWOOD COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

AUGUST 9, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company The Ohio Oil Company Lease Martindell Well No. W-25

Location

Section 31 Twp. 23 S Rge. 10 E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2243.00
Bottom of Core	2283.00
Top of Sand	?
Bottom of Sand	2281.20
Total Feet of Permeable Sand	21.77

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	5.78	5.78
5 -10	2.88	8.66
10 - 20	4.83	13.49
20 - 40	5.68	19.17
20 - 60	1.00	20.17
60 - 100	1.00	21.17
100 & above	0.60	21.77

Average Permeability, Millidarcys	25.15
Average Percent Porosity	16.62
Average Percent Oil Saturation	43.09
Average Percent Water Saturation	48.31
Average Oil Content, Bbls./A. Ft.	564.
Total Oil Content, Bbls./Acre	12,596.
Average Percent Oil Recovery by Laboratory Flooding Tests	24.06
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	327.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	6,346.
Total Calculated Oil Recovery, Bbls./Acre	5,050.
Casing Point, ~~Packer Setting~~, Feet	2240.0
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	

Oil 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
2243.00 - 2244.52	Gray fine grained micaceous sandstone.
2244.52 - 2245.00	Gray shale.
2245.00 - 2245.35	Brownish gray fine grained micaceous shaley sandstone.
2245.35 - 2245.55	Gray shale.
2245.55 - 2245.72	Brownish gray fine grained micaceous shaley sandstone.
2245.72 - 2246.35	Brownish gray fine grained micaceous slightly shaley sandstone.
2246.35 - 2246.55	Light brown fine grained micaceous slightly calcareous sandstone.
2246.55 - 2247.05	Gray shale.
2247.05 - 2247.47	Laminated shaley sandstone.
2247.47 - 2251.05	Brown fine grained micaceous sandstone.
2251.05 - 2251.80	Brownish gray fine grained micaceous shaley sandstone.
2251.80 - 2254.65	Brown fine grained micaceous sandstone.
2254.65 - 2255.50	Brown fine grained micaceous slightly shaley sandstone.
2255.50 - 2260.43	Brown fine grained micaceous sandstone.
2260.43 - 2260.70	Brownish gray fine grained micaceous slightly shaley sandstone.
2260.70 - 2261.55	Brown fine grained micaceous sandstone.
2261.55 - 2261.85	Brown fine grained micaceous calcareous sandstone.
2261.85 - 2263.85	Loss.

2263.85 - 2266.45 - Brown fine grained micaceous sandstone.

2266.45 - 2266.85 - Light brown fine grained micaceous sandstone.

2266.85 - 2267.85 - Loss.

2267.85 - 2268.05 - Hard brownish gray fine grained micaceous calcareous sandstone.

2268.05 - 2268.30 - Light brown fine grained micaceous sandstone.

2268.30 - 2272.50 - Gray shale.

2272.50 - 2273.77 - Finely laminated sandy shale.

2273.77 - 2274.25 - Gray fine grained laminated micaceous shaley sandstone.

2274.25 - 2275.30 - Finely laminated sandstone and shale.

2275.30 - 2275.53 - Laminated shaley sandstone.

2275.53 - 2276.70 - Light brown fine grained micaceous sandstone.

2276.70 - 2277.70 - Loss.

2277.70 - 2278.00 - Light brown fine grained micaceous sandstone.

2278.00 - 2280.25 - Loss.

2280.25 - 2280.45 - Light brown fine grained micaceous sandstone.

2280.45 - 2281.20 - Light brown fine grained laminated micaceous shaley sandstone.

2281.20 - 2281.87 - Finely laminated sandy shale.

2281.87 - 2282.80 - Gray sandy shale.

2282.80 - 2282.90 - Light brown fine grained micaceous sandstone.

2282.90 - 2283.00 - Gray shale.

Coring was started at a depth of 2243.00 in fine grained micaceous sandstone and completed at 2283.00 feet in gray shale. This core shows a total of 23.07 feet of sandstone. There was a total core loss of 6.00 feet which was probably 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 three sections. The weighted average permeability of the upper, middle and lower sections are 4.10, 30.44 and 8.64 millidarcys respectively; the overall average being 25.15 (See Table II). By observing the data given on the coregraph you will note that the cored section has a fairly irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 43.09. The weighted average percent oil saturation of the upper, middle and lower sections are 26.32, 48.64 and 24.88 respectively. The weighted average percent water saturation of the upper, middle and lower sections are 66.57, 43.48 and 69.50 respectively; the overall average being 48.31 (See Table IV). This gives an overall weighted average total fluid saturation of 91.40 percent. The above data shows that the upper and lower parts of the sand section have a high water saturation even though oil was used as a circulating fluid during the coring operation.

For the sake of future information all of the saturation samples were analyzed for percent connate water. The results of these tests are given in Tables VII and VIII. From the results given in Table VIII it is noticeable that the connate water saturation of the good part of the sand section is 38.58 percent, while the overall average is 41.33. By comparing the values given in this table with that of the percent water saturation given in Table IV, it is evident that the whole core contains considerable foreign water, especially the upper and lower sections.

The weighted average oil content of the upper, middle and lower sections are 350, 640 and 300 barrels per acre foot respectively; the overall average being 564. The total oil content, as shown by this core is 12,596 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests as a total recovery of 6,346 barrels of oil per acre was obtained from 19.40 feet of sandstone. The weighted average percent oil saturation was reduced from 45.49 to 21.43, or represents an average recovery of 24.06 percent. The weighted average effective permeability of the samples is 2.63 millidarcys, while the average initial fluid production pressure is 25.0 pounds per square inch (See Table VI). By observing the data given in Table V you will note that of the 28 samples tested, 21 produced water and 23 produced oil. This indicates that most of the sand represented by these samples is floodable. The tests show that the lower part of the sand section is very tight in relationship to the upper and middle sections.

CONCLUSION

From a study of the above data we believe that an efficient water flood within the vicinity of this well will recover approximately 5,050 barrels of oil per acre. In calculating this recovery no allowance was made for oil lost during coring, and the above value was figured directly from the results of core analysis. When this recovery value is calculated on the basis of primary production and percent water and residual oil saturation it is considerable less. This indicates that the water saturation shown by the analysis of the core is higher than it should be, or that the primary production from this area is considerable lower than the value we used. We are

inclined to doubt the possibility of oil entering the core and replacing the water permanently . Of course, it could be possible that considerable foreign water may have entered the sand through old holes. The above discussion is based on the assumption that the area within the vicinity of this well is not pressured up by water entering the injection wells.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company The Ohio Oil Company Lease Martindell Well No. W-25

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	2243.60	4.8	0.75	0.75	3.60
2	2243.95	6.7	0.45	1.20	3.02
3	2244.48	0.56	0.32	1.52	0.18
4	2245.63	0.79	0.17	1.69	0.13
5	2246.50	11.	0.20	1.89	2.20
6	2247.30	0.65	0.42	2.31	0.27
7	2247.75	17.	0.43	2.74	7.30
8	2248.19	5.1	0.50	3.24	2.55
9	2248.60	2.3	0.35	3.59	0.80
10	2248.90	16.	0.45	4.04	7.20
11	2249.40	13.	0.40	4.44	5.20
12	2249.75	39.	0.30	4.74	11.70
13	2250.05	26.	0.40	5.14	10.40
14	2250.57	17.	0.50	5.64	8.50
15	2251.00	9.5	0.25	5.89	2.38
16	2251.57	1.1	0.75	6.64	0.83
17	2251.85	16.	0.35	6.99	5.60
18	2252.35	45.	0.55	7.54	24.80
19	2252.95	98.	0.40	7.94	39.20
20	2253.18	22.	0.50	8.44	11.00
21	2253.90	37.	0.50	8.94	18.50
22	2254.27	32.	0.55	9.49	17.60
23	2254.73	152.	0.25	9.74	38.00
24	2255.10	62.	0.60	10.34	37.20
25	2255.55	24.	0.25	10.59	6.00
26	2255.90	232.	0.35	10.94	81.10
27	2256.35	8.2	0.50	11.44	4.10
28	2256.77	2.8	0.40	11.84	1.12
29	2257.20	10.	0.40	12.24	4.00
30	2257.60	32.	0.50	12.74	16.00
31	2258.13	37.	0.45	13.19	16.65
32	2258.57	15.	0.45	13.64	6.75
33	2259.00	11.	0.45	14.09	4.95
34	2259.47	23.	0.45	14.54	10.33
35	2259.95	29.	0.45	14.99	13.04
36	2260.33	33.	0.28	15.27	9.24

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company The Ohio Oil Company Lease Martindell Well No. W-25

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
37	2261.07	16.	0.50	15.77	8.00
38	2261.50	17.	0.35	16.12	5.95
39	2264.13	60.	0.45	16.57	27.00
40	2264.53	38.	0.55	17.12	20.90
41	2265.15	17.	0.75	17.87	12.75
42	2266.05	3.4	0.85	18.72	2.88
43	2266.50	3.0	0.40	19.12	1.20
44	2267.95	Imp.	0.20	19.32	0.00
45	2268.40	Imp.	0.20	19.52	0.00
46	2273.25	29.	0.50	20.02	14.50
47	2273.87	5.9	0.48	20.50	2.83
48	2275.05	Imp.	0.50	21.00	0.00
49	2275.45	Imp.	0.23	21.23	0.00
50	2275.80	1.3	0.47	21.70	0.61
51	2276.28	4.9	0.70	22.40	3.43
52	2277.95	10.	0.30	22.70	3.00
53	2280.35	3.9	0.20	22.90	0.78
54	2280.85	Imp.	0.55	23.45	0.00

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company The Ohio Oil Company Lease Martindell Well No. W-25

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
2243.00 - 2246.35	1.69	4.10	6.93
2247.47 - 2266.45	16.41	30.44	499.52
2266.45 - 2281.20	3.05	8.64	26.35
2243.00 - 2281.20	21.15	25.15	532.80

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company The Ohio Oil Company Lease Martindell Well No. W-25

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	2243.23	16.7	24.1	69.8	88.9	312	0.75	0.75	234
F1A	2244.10	17.8	25.3	-	-	349	0.77	1.52	269
2	2245.27	13.9	19.5	77.3	96.8	210	0.35	1.87	74
3	2246.27	18.0	33.9	56.7	90.6	474	0.63	2.50	298
4	2248.04	18.1	53.0	36.6	89.6	745	1.13	3.63	842
5	2249.27	17.0	52.2	33.9	86.1	689	1.20	4.83	827
6	2250.41	16.8	56.6	40.9	97.5	738	1.25	6.08	922
7	2251.32	14.2	34.2	60.0	94.2	377	0.75	6.83	283
8	2252.68	14.6	48.1	48.6	96.7	545	1.30	8.13	708
9	2253.68	17.1	48.8	46.2	95.0	648	1.00	9.13	648
F9A	2254.59	17.7	44.6	-	-	612	0.55	9.68	337
F10	2255.25	16.3	35.7	-	-	453	0.85	10.53	385
F10A	2256.09	17.9	53.9	-	-	748	1.00	11.53	748
F10B	2256.93	19.1	38.1	-	-	564	0.80	12.33	451
11	2257.93	17.8	60.0	36.1	96.1	829	0.80	13.13	663
12	2258.47	18.3	54.8	40.3	95.1	778	1.00	14.13	778
13	2259.76	18.2	58.5	37.2	95.7	826	1.33	15.46	1,099
F13A	2260.65	14.7	24.8	-	-	283	0.27	15.73	77
14	2261.63	12.6	38.8	59.3	98.1	380	1.15	16.88	437

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company The Ohio Oil Company Lease Martindell Well No. W-25

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.	
F14A	2263.92	17.9	27.5	-	-	382	0.45	17.33	172
F14B	2264.70	16.8	46.9	-	-	610	0.70	18.03	427
F14C	2265.40	17.2	54.7	-	-	729	1.45	19.48	1,057
F14D	2266.80	16.2	44.2	-	-	555	0.40	19.88	222
15	2268.13	15.8	36.7	35.9	72.6	450	0.25	20.13	113
F18A	2275.62	16.0	22.3	-	-	277	0.47	20.60	130
F18B	2276.55	16.3	21.7	-	-	275	0.70	21.30	193
F18C	2277.80	15.5	26.3	-	-	316	0.30	21.60	95
19	2280.53	12.7	14.5	80.7	95.2	143	0.75	22.35	107
								Total -	-12,596

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company The Ohio Oil Company Lease Martindell Well No. W-25

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
2243.00-2246.35	2.50	17.00	26.32	66.57	350	875
2247.47-2266.45	16.98	16.81	48.64	43.48	640	10,861
2266.45-2281.20	2.87	15.16	24.88	69.50	300	860
2243.00-2281.20	22.35	16.62	43.09	48.31	564	12,596

Oil F

RESULTS O

Company The Ohio Oil Company Lease

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recov
			Percent	Bbls./A. Ft.	Percent
1	2243.07	17.0	23.5	310	2.1
1A	2244.10	17.8	25.3	349	8.0
2	2245.08	13.7	18.4	196	0.0
3	2246.09	16.0	33.7	419	12.8
4	2247.88	16.4	53.5	681	34.7
5	2249.08	16.9	57.9	759	41.3
6	2250.25	17.9	58.3	810	39.2
7	2251.15	14.6	31.6	358	8.2
8	2252.52	16.8	47.7	622	24.8
9	2253.49	17.7	50.9	700	34.7
9A	2254.59	17.7	44.6	612	27.4
10	2255.25	16.3	35.7	453	2.5
10A	2256.09	17.9	53.9	748	31.7
10B	2256.93	19.1	38.1	564	14.6
11	2257.75	18.2	60.7	858	43.8
12	2258.28	18.4	51.3	739	32.2
13	2259.59	18.4	58.9	849	36.5
13A	2260.65	14.7	24.8	283	0.9
14	2261.75	11.6	38.4	298	0.0
14A	2263.92	17.9	27.5	382	6.5
14B	2264.70	16.8	46.9	610	26.6
14C	2265.40	17.2	54.7	729	25.9
14D	2266.80	16.2	44.2	555	0.0
15	2268.22	15.7	39.2	478	8.7
18A	2275.62	16.0	22.3	277	3.2
18B	2276.55	16.3	21.7	275	0.6
18C	2277.80	15.5	26.3	316	0.0
19	2280.62	12.8	16.0	159	0.0

Notes: cc - cubic centimeter.
*Volume of water recovered at the time
**Determined by passing water through s
"A" samples were taken after the core a

ield Research Laboratories

F LABORATORY FLOODING TESTS

TABLE V

Martindell Well No. W-25

ery Bbls./A. Ft.	Residual Saturation % Oil	% Water	Bbls./A. Ft.	Volume of Water Recovered cc*	[redacted] Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
28	21.4	70.0	282	2	0.0758	40
110	17.3	72.2	239	8	0.197	35
0	18.4	78.0	196	0	Imp.	50+
159	20.9	72.9	260	6	0.148	40
441	18.8	76.0	240	41	0.687	20
541	16.6	80.7	218	213	3.73	10
544	19.1	77.5	266	203	5.10	10
93	23.4	75.0	265	7	0.125	35
324	22.9	73.6	298	140	1.30	10
477	16.2	80.8	223	209	3.41	10
376	17.2	80.6	236	193	3.50	10
32	33.3	61.5	421	0	0.0024	40
440	22.2	75.0	308	172	2.56	15
216	23.5	75.0	348	84	1.54	15
619	16.9	78.5	239	152	6.41	10
464	19.1	76.3	275	164	3.82	10
526	22.4	80.7	323	163	6.99	10
10	23.9	69.2	273	14	0.440	40
0	38.4	54.0	298	0	Imp.	50+
90	21.0	74.0	292	70	1.21	35
346	20.3	76.5	264	139	3.00	15
345	28.8	65.7	384	43	1.29	25
0	44.2	38.2	555	0	Imp.	50+
106	30.5	64.5	372	0	0.014	40
40	19.1	63.8	237	2	0.148	50
8	21.1	65.8	267	0	0.0016	50
0	26.3	63.4	316	12	0.202	30
0	16.0	75.5	159	0	Imp.	50+

of maximum oil recovery.
ample which still contains residual oil.
rrived at the laboratory.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company The Ohio Oil Company Lease Martindell Well No. W-25

Depth Interval, Feet	2243.00-2246.35	2247.47-2266.45	2268.05-2276.70	2243.00-2276.70
Feet of Core Analyzed	2.15	15.83	1.42	19.40
Average Percent Porosity	16.98	17.34	16.06	17.21
Average Percent Original Oil Saturation	27.20	49.81	25.00	45.49
Average Percent Oil Recovery	7.39	28.22	2.89	24.06
Average Percent Residual Oil Saturation	19.81	21.59	22.11	21.43
Average Percent Residual Water Saturation	71.63	75.23	64.93	74,08
Average Percent Total Residual Fluid Saturation	91.44	96.82	87.04	95.51
Average Original Oil Content, Bbls./A. Ft.	356.	675.	312.	613.
Average Oil Recovery, Bbls./A. Ft.	96.	385.	37.	327.
Average Residual Oil Content, Bbls./A. Ft.	260.	290.	275.	286.
Total Original Oil Content, Bbls./Acre	766.	10,678.	443.	11,887.
Total Oil Recovery, Bbls./Acre	206.	6,088.	52.	6,346.
Total Residual Oil Content, Bbls./Acre	560.	4,590.	391.	5,541.
Average Effective Permeability, Millidarcys	0.143	2.87	0.0527	2.36
Average Initial Fluid Production Pressure, p.s.i.	38.3	18.8	46.6	25.0

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 The Ohio Oil Company Lease Martindell Well No. W-25

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2243.23	31,300	34.7	35.1	69.8
2	2245.27	56,100	69.0	8.3	77.3
3	2246.27	64,800	56.7	0.0	56.7
4	2248.04	53,500	31.1	5.5	36.6
5	2249.27	54,500	29.4	4.5	33.9
6	2250.41	65,900	40.9	0.0	40.9
7	2251.32	60,700	57.9	2.1	60.0
8	2252.68	55,400	43.8	4.8	48.6
9	2253.68	56,300	41.4	4.8	46.2
11	2257.93	31,900	18.3	17.8	36.1
12	2258.47	53,600	34.4	5.9	40.3
13	2259.76	58,400	34.6	2.6	37.2
14	2261.63	57,800	54.5	4.8	59.3
15	2268.13	48,700	27.8	8.1	35.9
19	2280.53	51,800	66.5	14.2	80.7

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company The Ohio Oil Company Lease Martindell Well No. W-25

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2243.00 - 2246.35	48,526	49.65	16.88
2247.47 - 2261.85	55,463	38.58	4.89
2268.05 - 2281.20	51,100	56.90	12.70
2243.00 - 2281.20	54,256	41.33	6.98

Note: ppm - parts per million.