11-23-9E

May 6, 1950

11-23-9E

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 cable tool core taken from the K. E. Snyder, etal., Green Lease, Well No. 1, Greenwood County, Kansas, and submitted to our laboratory on April 27, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bb
c.c. to Mr. Fred Klunk

Green 1

K. E. SNYDER, ETAL.

CORE ANALYSIS REPORT

GREEN LEASE WELL NO. 1

GREENWOOD COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

MAY 6, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company K. Z. Snyder, etal. Lease Green Well No. 1

Location Center of NW¼, NW¼,

Section 11 Twp. 23S Rge. 9E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2346.00
Bottom of Core	2375.00
Top of Sand	2346.30
Bottom of Sand	2372.00
Total Feet of Permeable Sand	12.60

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	1.65	1.65
5 - 10	2.20	3.85
10 - 20	2.50	6.35
20 - 40	0.90	7.25
40 - 80	0.80	8.05
80 - 100	2.15	10.20
100 & above	2.40	12.60

Average Permeability, Millidarcys	53.23
Average Percent Porosity	16.78
Average Percent Oil Saturation	19.05
Average Percent Water Saturation	63.56
Average Oil Content, Bbls./A. Ft.	262.
Total Oil Content, Bbls./Acre	4,302.
Average Percent Oil Recovery by Laboratory Flooding Tests	7.94
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	114.
Aotal Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	967.
Total Calculated Oil Recovery, Bbls./Acre	900.
Casing Point, Packer Setting, Feet	2343.0
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	

In an effort to get a dry core, crude oil was used as a circulating fluid in the coring of the sand in this well. However, some water was used between each run to assist in cleaning out the hole before the next run was made. As a result, some water would probably be left in the hole during each run, thereby, causing the sand to be flushed to a certain degree.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2346.00 - 2346.30	Gray shale.
2346.30 - 2347.15	Brownish gray fine grained micaceous shaley calcareous sandstone.
2347.15 - 2350.70	Gray fine grained micaceous shaley sandstone.
2350.70 - 2352.00	Gray sandy shale.
2352.00 - 2353.60	Gray shale.
2353.60 - 2356.45	Gray fine grained micaceous shaley sandstone.
2356.45 - 2359.00	Brownish gray fine grained micaceous slightly shaley sandstone.
2359.00 - 2360.40	Brownish gray fine grained micaceous sandstone.
2360.40 - 2360.60	Gray sandy shale.
2360.60 - 2362.15	Light brown fine grained micaceous sandstone.
2362.15 - 2362.30	Gray shale.
2362.30 - 2362.90	Light brown fine grained micaceous sandstone.
2362.90 - 2363.40	Loss.
2363.40 - 2364.30	Light brown fine grained micaceous sandstone.
2364.30 - 2364.50	Gray shale.
2364.50 - 2366.00	Loss.
2366.00 - 2367.45	Light brown fine grained micaceous sandstone.
2367.45 - 2367.60	Gray shale.

2367.60 - 2368.80 - Light brown fine grained micaceous shaley sandstone.
2368.80 - 2372.00 - Light brown fine grained micaceous sandstone.
2372.00 - 2375.00 - Lost.

Coring was started at a depth of 2346.00 feet in gray shale and completed at 2375.00 feet. There was a three foot loss at the bottom and, as a result, we do not know the depth of the bottom of the sand. There was also a loss extending from 2364.50 to 2366.00 feet. This core shows a total of 20.10 feet of sandstone. For the most part, the sand body is made up of fine grained micaceous to shaley 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 0.00, 7.34, and 89.79 millidarcys respectively; while the overall average for the middle and lower sections is 53.23 millidarcys (See Table II). From a study of the above data and that given on the coregraph, it is noticeable that the lower part of the sand section has a considerable higher permeability.

PERCENT SATURATION & OIL CONTENT

The sand in this core has a low overall weighted average percent oil saturation, namely, 19.05. The weighted average percent oil saturation of the upper, middle and lower sections are 7.59, 14.66 and 34.34 respectively. The weighted average percent water saturation of the upper, middle and lower sections are 81.80, 67.47 and 46.38 respectively; the overall average being 63.56 (See Table IV). This gives an overall weighted average total fluid saturation of 82.61 percent.

In order to get some idea of the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chlor

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 very difficult to interpret the results as one would expect the zones of higher permeability to have the lower chloride content. If certain parts of the sand section was producing some gas or water, naturally, this would alter the results we expected to obtain.

The weighted average oil content of the upper, middle and lower sections are 84, 201 and 489 barrels per acre foot respectively; the overall average being 262. The total oil content, as shown by the core, is 4,302 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded only fairly well to laboratory flooding tests, as a total recovery of 967 barrels per acre was obtained from 8.50 feet of sand. The weighted average percent oil saturation was reduced from 20.75 to 20.81, or represents an average recovery of 7.94 percent. The weighted average effective permeability of the samples is 5.06 millidarcys, while the average initial fluid production pressure is 21.0 pounds per square inch (See Table VI). By observing the data given in this table, you will note that by far most of the oil recovered was obtained from the lower section. Furthermore, the lower part of the sand section has a much higher effective permeability.

From the data given in Table V, you will note that of the 18 samples tested 10 produced oil and 13 took water. From the results of these tests, it is evident that most of the flood-ble sand is in the lower section.

CONCLUSION

From a study of the above data, we believe that an efficient water

flood within the vicinity of this well will recover approximately 900 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 and it was assumed that the true water saturation of the sand is 40 percent.

The principle drawback of this core is the fact that it does not contain very much good floodable sand. Of course, part of the loss could be good sand.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company K. F. Snyder, etal. Lease Green Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	2346.55	Imp.	0.50	0.50	0.00
2	2347.05	Imp.	0.35	0.85	0.00
3	2347.50	Imp.	0.55	1.40	0.00
4	2347.95	Imp.	0.55	1.95	0.00
5	2348.60	Imp.	0.65	2.60	0.00
6	2349.25	Imp.	0.50	3.10	0.00
7	2349.70	Imp.	0.70	3.80	0.00
8	2351.70	Imp.	0.30	4.10	0.00
9	2354.20	Imp.	0.80	4.90	0.00
10	2354.60	1.6	0.40	5.30	0.64
11	2355.00	1.1	0.30	5.60	0.33
12	2355.30	3.3	0.50	6.10	1.65
13	2355.90	13.	0.85	6.95	11.05
14	2356.65	5.7	0.30	7.25	1.71
15	2356.95	6.5	0.60	7.85	3.90
16	2357.70	5.0	0.55	8.40	2.75
17	2358.10	11.	0.40	8.80	4.40
18	2358.60	11.	0.45	9.25	4.95
19	2358.95	9.2	0.25	9.50	2.30
20	2359.30	Imp.	0.40	9.90	0.00
21	2359.60	Imp.	0.35	10.25	0.00
22	2359.95	Imp.	0.35	10.60	0.00
23	2360.35	7.7	0.30	10.90	2.31
24	2360.70	7.4	0.20	11.10	1.48
25	2361.00	2.1	0.45	11.55	9.45
26	2361.55	29.	0.50	12.05	14.50
27	2362.00	27.	0.40	12.45	10.80
28	2362.60	90.	0.60	13.05	54.00
29	2363.50	16.	0.50	13.55	8.00
30	2364.25	95.	0.40	13.95	38.00
31	2366.10	97.	0.30	14.25	29.10
32	2366.55	104.	0.40	14.65	41.60
33	2366.90	92.	0.45	15.10	41.40
34	2367.40	11.	0.30	15.40	3.30
35	2368.20	Imp.	0.60	16.00	0.00
36	2369.10	141.	0.40	16.40	56.40
37	2369.35	116.	0.30	16.70	34.80
38	2369.66	79.	0.40	17.10	31.60
39	2370.10	104.	0.40	17.50	41.60
40	2370.53	111.	0.40	17.90	44.40
41	2370.85	41.	0.40	18.30	16.40
42	2371.30	94.	0.40	18.70	37.60
43	2371.75	148.	0.50	19.20	74.00

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company K. E. Snyder, etal. Lease Green Well No. 1

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
2346.30 - 2350.10	4.10	Imp.	0.00
2354.40 - 2362.15	4.90	7.34	35.99
2362.30 - 2372.00	6.15	89.79	552.20
2354.40 - 2372.00	11.05	53.23	588.19

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RESULTS OF SATURATION TESTS

TABLE III

Company K. E. Snyder Lease Green 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	2346.35	9.0	5.3	84.6	89.9	37	0.85	0.85	31
2	2347.75	14.7	5.4	85.9	91.3	62	1.10	1.95	68
3	2348.85	15.2	7.4	79.0	86.4	89	0.95	2.90	85
4	2349.35	14.8	9.5	81.5	91.0	109	0.80	3.70	87
5	2350.55	14.8	12.0	76.0	88.0	138	0.70	4.40	97
7	2354.35	15.9	14.9	66.7	81.6	184	1.30	5.70	239
8	2355.55	15.3	9.8	69.0	78.8	117	1.55	7.25	181
9	2357.05	18.2	11.5	64.7	76.2	163	0.90	8.15	147
10	2357.85	18.9	12.5	64.0	76.5	184	0.95	9.10	175
11	2358.75	18.8	22.8	52.0	74.8	333	0.70	9.80	233
12	2359.75	19.2	18.3	56.9	75.2	273	1.00	10.80	273
F13A	2360.23	17.8	21.5	-	-	297	0.40	11.20	119
14	2362.45	19.1	40.7	32.5	73.2	603	0.60	11.80	362
15	2366.65	16.6	42.5	45.0	87.5	547	1.45	13.25	795
16	2368.85	20.6	39.7	35.7	75.4	635	0.40	13.65	254
17	2369.45	19.6	27.1	56.2	83.3	412	0.80	14.45	329
18	2370.65	19.7	28.5	53.0	81.5	475	1.20	15.65	521
19	2371.85	17.6	28.1	58.3	86.4	383	0.80	16.45	306
							Total - - - - -		4,302

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SUMMARY OF SATURATION TESTS

TABLE IV

Company K. E. Snyder, etal. Lease Green 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
2346.30-2350.70	4.40	13.77	7.59	81.80	84	368
2353.60-2360.40	6.80	17.38	14.66	63.47	201	1,367
2362.30-2372.00	5.25	18.51	34.34	48.38	489	2,567
2346.30-2372.00	16.45	16.78	19.05	63.56	262	4,302

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company K. B. Snyder, etal. Lease Green Well No. 1

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	[redacted] Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	2346.45	10.4	5.1	41	0.0	0	5.1	87.8	41	0	Imp.	50+
2	2347.65	16.1	4.1	51	0.0	0	4.1	79.2	51	0	Imp.	50+
3	2348.95	15.9	5.7	70	0.0	0	5.7	76.8	70	0	Imp.	50+
4	2349.45	14.1	9.2	101	0.0	0	9.2	68.5	101	0	Imp.	50+
5	2350.65	17.9	10.7	149	0.0	0	10.7	73.4	149	0	Imp.	50+
7	2354.45	16.2	12.9	162	0.0	0	12.9	81.8	162	2	0.052	45
8	2355.65	18.9	9.9	145	0.0	0	9.9	75.2	145	4.5	0.134	35
9	2357.15	17.0	19.6	259	0.3	4	19.3	73.2	255	2	0.086	35
10	2357.95	17.5	20.8	282	1.2	16	19.6	75.0	266	5	0.091	35
11	2358.85	17.9	25.7	358	0.0	0	25.7	68.3	358	6	0.151	25
12	2359.85	19.4	19.0	287	4.3	65	14.7	75.4	222	52	1.00	20
13A	2360.23	17.8	21.5	297	2.1	29	19.4	77.5	268	83.5	3.30	25
14	2362.45	19.0	41.6	613	15.9	234	25.7	63.0	379	5	0.251	30
15	2366.75	15.7	42.3	516	11.9	145	30.4	56.5	371	11.5	0.446	25
16	2368.95	20.3	36.9	579	20.4	320	16.5	70.0	259	86.5	6.02	10
17	2369.55	19.2	27.7	414	11.1	166	16.6	72.5	248	251.5	12.33	10
18	2370.75	19.1	29.7	441	8.4	125	21.3	73.1	316	68.5	6.82	10
19	2371.95	20.5	25.3	401	8.6	137	16.7	68.0	264	106.	20.00	10

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.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company E. E. Snyder Lease Green Well No. 1

Depth, Interval, Feet	2356.45-2360.40	2362.30-2372.00	2356.45-2372.00
Feet of Core Analyzed	3.25	5.25	8.50
Average Percent Porosity	17.97	18.48	18.29
Average Percent Original Oil Saturation	20.00	34.17	28.75
Average Percent Oil Recovery	2.00	11.62	7.94
Average Percent Residual Oil Saturation	18.00	22.55	20.81
Average Percent Residual Water Saturation	74.98	66.27	69.49
Average Percent Total Residual Fluid Saturation	92.98	88.82	90.30
Average Original Oil Content, Bbls./A. Ft.	280.	482.	405.
Average Oil Recovery, Bbls./A. Ft.	30.	166.	114.
Average Residual Oil Content, Bbls./A. Ft.	250.	316.	291.
Total Original Oil Content, Bbls./Acre	907.	2,532.	3,439.
Total Oil Recovery, Bbls./Acre	96.	871.	967.
Total Residual Oil Content, Bbls./Acre	811.	1,661.	2,472.
Average Effective Permeability, Millidarcys	0.764.	7.71	5.06
Average Initial Fluid Production Pressure, p.s.i.	28.8	15.8	21.0

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 K. E. Snyder, etal. Lease Green Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2346.35	27,200			
2	2347.75	28,400			
3	2348.85	30,300			
4	2349.35	28,400			
5	2350.55	24,000			
7	2354.35	43,400			
8	2355.55	23,100			
9	2357.05	21,900			
10	2357.85	17,100			
11	2358.75	20,100			
12	2359.75	23,700			
14	2362.45	57,100			
15	2366.65	48,900			
16	2368.85	63,800			
17	2369.45	28,600			
18	2370.65	25,700			
19	2371.85	37,900			

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company K. E. Snyder Lease Green Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2346.30 - 2350.70	27,864		
2353.60 - 2360.00	25,945		
2362.30 - 2372.00	40,895		
2346.30 - 2372.00	31,361		

Note: ppm - parts per million.