OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

August 21, 1951

Sinclair Oil & Gas Company
P. O. Box 460
Independence, Kansas

Attention: Mr. J. T. Reeves

Gentlemen:

Enclosed herewith is the report of the analysis of the 8¾" Rotary core taken from the Thrall, McKee Consolidated Unit, Well No. 102, Greenwood County, Kansas, and submitted to our laboratory on August 12, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

CLP:pmd

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SINCLAIR OIL & GAS COMPANY

CORE ANALYSIS REPORT

THRALL, McKEE CONSOLIDATED UNIT

WELL NO. THRALL 108

GREENWOOD COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

AUGUST 21, 1951

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Well No. Thrall 102

Location SW¼

Section 32 Twp. 23S Rge. 10E County Greenwood State Kansas

Name of Sand		Bartlesville
Top of Core		2293.00
Bottom of Core		2318.00
Top of Sand	(According to field log)	2291.00
Bottom of Sand		2307.45
Total Feet of Permeable Sand	(Analyzed)	7.35
Total Feet of Floodable Sand	(Analyzed)	1.35

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	3.70	3.70
1 - 2	3.00	6.70
2 & above	0.65	7.35

Average Permeability Millidarcys	1.14
Average Percent Porosity	14.62
Average Percent Oil Saturation	23.61
Average Percent Water Saturation	53.66
Average Oil Content, Bbls./A. Ft.	272.
Total Oil Content, Bbls./Acre	2,516.
Average Percent Oil Recovery by Laboratory Flooding Tests	1.20
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	15.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	6.
Total Calculated Oil Recovery, Bbls./Acre	350.
Packer Setting, Feet	-
Viscosity, Centipoises @	-
A. P. I. Gravity, degrees @ 60 °F	-
Elevation, Feet	1371.00

Fresh water was used in making up the circulating fluid used in the coring of the sand in this well. This well is located approximately 60 feet Southeast of abandoned dry hole Well No. 71.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2293.00 - 2293.10	Gray fine grained micaceous sandstone.
2293.10 - 2294.80	Limestone.
2294.80 - 2295.75	Light brown fine grained micaceous sandstone.
2295.75 - 2297.70	Greyish brown fine grained laminated micaceous shaley sandstone.
2297.70 - 2298.30	Light brown fine grained slightly laminated micaceous shaley sandstone.
2298.30 - 2299.30	Laminated sandy shale.
2299.30 - 2299.85	Laminated sandstone and shale.
2299.85 - 2300.25	Light brown fine grained micaceous sandstone.
2300.25 - 2301.10	Light brown fine grained laminated micaceous shaley sandstone.
2301.10 - 2301.30	Light brown fine grained micaceous sandstone.
2301.30 - 2302.00	Light brown fine grained laminated micaceous shaley sandstone.
2302.00 - 2302.90	Light brown fine grained slightly laminated micaceous shaley sandstone.
2302.90 - 2303.45	Brownish gray fine grained micaceous sandstone.
2303.45 - 2303.75	Light brown fine grained laminated micaceous shaley sandstone.
2303.75 - 2304.20	Light brown fine grained micaceous sandstone.
2304.20 - 2305.85	Light brown fine grained laminated micaceous shaley sandstone.
2305.85 - 2307.45	Light brown fine grained micaceous sandstone.
2307.45 - 2308.00	Gray shale.

2308.00 - 2310.30 - Laminated sandy shale.

2310.30 - 2311.80 - Gray shale.

2311.80 - 2314.00 - Laminated sandy shale.

2314.00 - 2314.70 - Gray sandy shale.

2314.70 - 2315.65 - Gray shale.

2315.65 - 2317.00 - Dark gray shale.

2317.00 - 2318.00 - Lost.

Coring was started at a depth of 2293.00 feet in gray fine grained micaceous sandstone and completed at 2318.00 feet, probably in shale. There was a loss extending from 2317.00 to 2318.00 feet. This core shows a total of 11.15 feet of sandstone. For the most part, the pay sand is made up of fine grained micaceous to shaley sandstone.

PERMEABILITY

The sand in this core is very tight; having an overall weighted average permeability of only 1.14 millidarcys. For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 0.74 and 1.30 millidarcys respectively (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a fairly uniform permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 23.61. The weighted average percent oil saturation of the upper and lower sections is 21.29 and 25.03 respectively. The weighted average percent water saturation of the upper and lower sections is 55.63 and 52.47 respectively; the overall average being 53.66 (See Table IV). This gives an overall weighted average total fluid saturation of 77.27 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 the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content which in turn were used in the calculation of percent connate water. The average chloride content of the true formation water produced on this property is approximately 67,000 parts per million. This value was also used in the calculation of percent connate water. 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 very little flushing of the sand occurred during coring as the tests show an average of only 2.55 percent of drilling and foreign water. This would indicate 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 is 240 and 292 barrels per acre foot respectively; the overall average being 272. The total oil content, as shown by this core, is 2,518 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

From the data given in Table V, you will note that of the 12 samples tested, 1 produced oil and 1 water. This indicates that only 1.35 feet of the sand represented by these samples is floodable or is permeable to water.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 350

barrels of oil per acre or an average of 259 barrels per acre foot from the 1.35 feet of floodable sand 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 and the primary production are 37 and 9 percent respectively.

Chances are, the effective permeability of the sand to water could be increased considerably by shooting the sand in this well as there is a good possibility of exposing more permeable sand a short distance from the well-bore. From the location of this well on the map, it is apparent that this well was drilled very close to the edge of the trend.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consolidated Unit Well No. Thrall 102

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	2294.85	Imp.	0.25	0.25	0.00
2	2295.20	1.5	0.35	0.60	0.53
3	2295.67	1.0	0.35	0.95	0.35
4	2296.35	Imp.	0.75	1.70	0.00
5	2296.75	Imp.	0.50	2.20	0.00
6	2297.27	0.28	0.45	2.65	0.13
7	2297.60	0.31	0.25	2.90	0.08
8	2298.00	0.63	0.60	3.50	0.38
9	2297.77	Imp.	0.55	4.05	0.00
10	2300.20	2.4	0.40	4.45	0.96
11	2300.72	0.41	0.85	5.30	0.35
12	2301.35	0.78	0.35	5.65	0.27
13	2301.95	Imp.	0.60	6.25	0.00
14	2302.50	0.96	0.65	6.90	0.62
15	2302.95	2.3	0.25	7.15	0.58
16	2303.35	1.5	0.30	7.45	0.45
17	2303.80	1.6	0.45	7.90	0.72
18	2304.45	1.7	0.50	8.40	0.85
19	2304.95	Imp.	0.65	9.05	0.00
20	2305.80	Imp.	0.50	9.55	0.00
21	2306.30	1.5	0.55	10.10	0.83
22	2306.54	1.6	0.50	10.60	0.80
23	2307.20	0.94	0.55	11.15	0.52

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Thrall Well No. 102

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
2294.60 - 2296.30	2.00	0.74	1.47
2299.85 - 2307.45	5.35	1.30	6.95
2294.60 - 2307.45	7.35	1.14	8.42

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RESULTS OF SATURATION TESTS

TABLE III

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Well No. Thrall 108

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	2295.00	16.1	16.7	58.1	74.8	209	0.95	0.95	199
2	2296.10	13.2	22.1	55.7	77.8	225	0.85	1.80	192
3	2297.10	14.0	21.9	55.2	77.1	238	1.10	2990	262
4	2298.20	15.3	26.2	52.3	78.5	311	0.60	3.50	187
5	2299.94	16.5	28.7	48.0	76.7	368	0.40	3.90	147
6	2301.20	15.9	29.7	46.1	75.8	366	0.20	4.10	73
7	2302.20	15.4	24.7	53.2	77.9	295	0.90	5.00	266
8	2303.14	14.2	25.0	58.5	83.5	276	0.55	5.55	152
9	2304.10	15.5	27.4	55.0	82.4	330	0.45	6.00	149
10	2304.75	13.8	22.4	51.5	73.9	240	1.65	7.65	396
11	2305.95	15.8	25.4	47.2	72.6	312	0.60	8.25	187
12	2306.90	15.2	25.1	55.1	81.2	308	1.00	9.25	308
							Total -	- - - -	2,518

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Well No. Thrall 102

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
2294.80-2298.30	3.50	14.60	21.29	56.63	340	840
2299.85-2307.45	5.75	14.96	25.05	52.47	292	1,678
2294.80-2307.45	9.25	14.82	23.61	53.66	272	2,518

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OF LABORATORY FLOODING TESTS

TABLE V

se Thrall, McKee Consol. Unit Well No. Thrall 102

overy Bbls./A. Ft.	Residual Saturation % Oil	% Water	Bbls./A. Ft.	Volume of Water Recovered cc*	Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
0	17.6	79.2	225	3	0.193	45
0	22.8	54.3	242	0	Imp.	50#
0	20.9	55.8	229	0	Imp.	50#
0	27.5	61.0	315	0	Imp.	50#
15	28.6	65.9	364	0	0.002	50
0	29.5	56.6	363	0	Imp.	50#
0	24.0	57.1	292	0	Imp.	50#
0	26.2	62.5	293	0	Imp.	50#
0	27.9	71.6	335	0	Imp.	50#
0	23.7	56.0	265	0	Imp.	50#
0	25.3	60.6	312	0	Imp.	50#
0	24.7	62.6	290	0	Imp.	50#

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Well No. Thrall 102

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2295.00	66,300	57.5	0.6	58.1
2	2296.10	65,800	54.7	1.0	55.7
3	2297.10	62,600	51.6	3.6	55.2
4	2298.20	62,100	48.5	3.8	52.3
5	2299.94	63,800	45.7	2.3	48.0
7	2301.20	61,700	42.5	3.6	46.1
8	2302.20	59,600	47.4	5.8	53.2
9	2303.14	63,200	55.2	3.3	58.5
10	2304.10	63,500	52.1	2.9	55.0
11	2304.75	66,000	50.7	0.8	51.5
12	2305.95	67,600	47.2	0.0	47.2
13	2306.90	63,200	52.0	3.1	55.1

Note: ppm - parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol Unit Well No. Thrall 102

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2294.80-2298.30	64,371	53.40	2.23
2299.85-2307.45	63,969	49.95	2.76
2294.80-2307.45	64,121	51.25	2.55

Note: ppm - parts per million