OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

August 15, 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. Thrall 101, Greenwood County, Kansas, and submitted to our laboratory on July 30, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Clayton A. Nattier

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SINCLAIR OIL & GAS COMPANY

CORE ANALYSIS REPORT

THRALL, McKEE CONSOLIDATED UNIT

WELL NO. THRALL 101

GREENWOOD COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

AUGUST 15, 1951

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Sinclair Oil & Gas Company Lease Thrall, McKasa Consol Idated Unit Well No. Thrall 101

Location NE of the NW

Section 33 Twp. 23S Rge. 10E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2254.00
Bottom of Core	2283.00
Top of Sand	2250.00
Bottom of Sand	2282.80
Total Feet of Permeable Sand	23.70
Total Feet of Floodable Sand	19.75

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 4	3.40	3.40
4 - 8	6.65	10.05
8 - 12	3.00	13.05
12 - 16	3.15	16.20
16 - 24	4.70	20.90
24 - 32	3.20	24.30
32 & above	2.40	26.70

Average Permeability Millidarcys	15.69
Average Percent Porosity	15.88
Average Percent Oil Saturation	83.83
Average Percent Water Saturation	38.45
Average Oil Content, Bbls./A. Ft.	294.
Total Oil Content, Bbls./Acre	7,846.
Average Percent Oil Recovery by Laboratory Flooding Tests	3.64
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	46.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	902.
Total Calculated Oil Recovery, Bbls./Acre	4,150.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	1394.

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, Feet	Description
2254.00 - 2255.60	Brownish gray fine grained micaceous shaley sandstone.
2255.60 - 2257.60	Grayish light brown fine grained micaceous sandstone.
2257.60 - 2260.00	Grayish light brown fine grained micaceous slightly shaley sandstone.
2260.00 - 2261.95	Grayish light brown medium grained micaceous sandstone.
2261.95 - 2269.00	Light brown fine grained micaceous sandstone.
2269.00 - 2272.65	Light brown fine grained micaceous slightly calcareous sandstone.
2272.65 - 2278.50	Light brown fine grained micaceous sandstone.
2278.50 - 2279.90	Light brown medium grained micaceous calcareous sandstone.
2279.90 - 2280.00	Coal.
2280.00 - 2282.00	According to log, lost.
2282.00 - 2282.80	Light brown fine grained micaceous sandstone.
2282.80 - 2283.40	Dark gray shale.
2283.40 - 2285.00	Black shale.

Coring was started at a depth of 2254.00 feet in brownish gray fine grained micaceous shaley sandstone and completed at 2285.00 feet in black shale. That part of the cored section extending from 2280.00 to 2282.00 feet was lost. This core shows a total of 26.70 feet of sand which is mainly light brown 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 is 8.20, 11.26 and 28.98 millidarcys respectively; while the overall average is 15.69 millidarcys (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has an irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

Due to flushing during coring, the sand in this well shows a low weighted average percent oil saturation, namely, 23.83. The weighted average percent oil saturation of the upper, middle and lower sections is 20.89, 24.78 and 25.48 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 44.70, 35.15 and 36.65 respectively; while the overall average is 38.45 (See Table IV). This is an overall weighted average total fluid saturation of 62.28 percent. The low total fluid saturation indicates that there was some flushing due to gas expansion.

In an effort to get some idea of the degree of flushing by water that occurred during coring, each of the saturation samples was analyzed for chloride content. The results of these tests, which are given in Tables VII and VIII, indicate that considerable flushing took place.

The weighted average oil content of the upper, middle and lower sections is 263, 306 and 309 barrels per acre foot respectively; while the overall average is 294 barrels per acre foot. The total oil content, as shown by this core, is 7,846 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

This core responded very well to laboratory flooding tests in that most of the samples tested took water and produced oil. A total recovery

of 902 barrels of oil per acre was obtained from 19.75 feet of sand analyzed. The weighted average percent oil saturation was reduced from 25.06 to 21.42, or represents an average recovery of 3.64 percent. The weighted average effective permeability of the samples is 2.05 millidarcys, while the average initial fluid production pressure is 26.4 pounds per square inch (See Table VI).

By observing the data given on Table V and on the coregraph, you will note that of the 28 samples tested, 25 produced water and 21 oil. This indicates that most of the sand represented by the samples is floodable. The tests also show 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 4,150 barrels of oil per acre. This is an average recovery of 210 barrels per acre foot from the 19.75 feet of floodable sand analyzed. This recovery does not include the sand from 2250.00 to 2254.00 feet or the two feet of formation lost which may have been sand. In calculating the above recovery, an allowance was made for oil lost during coring, and it was assumed that the true water saturation of the sand is 37 percent.

Since this well is fairly close to the edge of the trend, primary production has undoubtedly been less than the unit average of 17 percent. In calculating the above recovery, primary production of 10 percent was assumed.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Well No. Unit Thrall 101

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	2254.32	4.8	0.60	0.60	2.88
2	2254.82	3.2	0.50	1.10	1.60
3	2255.32	3.8	0.50	1.60	1.90
4	2255.85	7.2	0.50	2.10	3.60
5	2256.30	9.8	0.50	2.60	4.90
6	2256.83	7.7	0.50	3.10	3.85
7	2257.30	0.77	0.50	3.60	0.38
8	2257.82	7.3	0.50	4.10	3.65
9	2258.30	12.	0.50	4.60	6.00
10	2258.82	6.4	0.50	5.10	3.20
11	2259.30	10.	0.40	5.50	4.00
12	2259.76	11.	0.50	6.00	5.50
13	2260.22	14.	0.50	6.50	7.00
14	2260.72	15.	0.40	6.90	6.00
15	2261.22	7.7	0.55	7.45	4.24
16	2261.72	13.	0.50	7.95	6.50
17	2262.22	5.6	0.55	8.50	3.08
18	2262.74	6.2	0.50	9.00	3.10
19	2263.30	12.	0.60	9.60	7.20
20	2263.84	8.4	0.50	10.10	4.20
21	2264.31	6.9	0.50	10.60	3.45
22	2264.85	2.8	0.50	11.10	1.40
23	2265.34	10.	0.50	11.60	5.00
24	2265.85	20.	0.50	12.10	10.00
25	2266.35	12.	0.50	12.60	6.00
26	2266.90	0.42	0.50	13.10	0.21
27	2267.37	29.	0.50	13.60	14.50
28	2267.85	5.4	0.50	14.10	2.70
29	2268.40	30.	0.50	14.60	15.00
30	2268.86	22.	0.40	15.00	8.80
31	2269.30	24.	0.50	15.50	12.00
32	2269.76	11.	0.60	16.10	6.60
33	2270.33	2.6	0.50	16.60	1.30
34	2270.84	5.5	0.50	17.10	2.75
35	2271.30	4.5	0.50	17.60	2.25
36	2271.80	3.1	0.40	18.00	1.24
37	2272.30	15.	0.65	18.65	9.75
38	2272.84	5.0	0.45	19.10	2.25
39	2273.32	43.	0.50	19.60	21.50
40	2273.85	45.	0.50	20.10	22.50

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Thrall Well No. 101

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	2274.35	15.	0.50	20.60	7.50
42	2274.85	27.	0.50	21.10	13.50
43	2275.35	22.	0.50	21.60	11.00
44	2275.85	27.	0.50	22.10	13.50
45	2276.34	19.	0.50	22.60	9.50
46	2276.83	19.	0.50	2 3.10	9.50
47	2277.34	12.	0.50	23.60	6.00
48	2277.85	31.	0.50	24.10	15.50
49	2278.25	27.	0.40	24.50	10.80
50	2278.75	13.	0.50	25.00	6.50
51	2279.25	18.	0.30	25.30	5.40
52	2279.80	41.	0.60	25.90	24.60
53	2282.06	89.	0.30	26.20	26.70
54	2282.50	84.	0.50	26.70	27.00

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Well No. Unit Thrall 101

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
2254.00 - 2261.95	7.95	8.20	65.20
2261.95 - 2272.65	10.70	11.86	180.53
2272.65 - 2282.80	8.05	28.98	233.25
2254.00 - 2282.80	26.70	15.69	418.98

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Sinclair Oil & Gas Company Lease Thrall McKee Consol. Unit Well No. Thrall 101

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	2254.10	15.1	17.4	40.0	57.4	204	0.60	0.60	122
2	2255.04	15.4	13.3	52.5	65.8	159	1.00	1.60	159
3	2256.12	17.7	26.7	35.3	62.0	367	1.00	2.60	367
4	2257.10	17.4	23.9	39.2	63.1	323	1.00	3.60	323
5	2258.15	15.4	21.0	33.3	54.3	251	1.05	4.65	264
6	2259.15	15.1	21.4	56.9	78.3	251	1.35	6.00	339
7	2260.05	16.1	20.7	55.7	76.4	2 59	0.50	6.50	130
8	226095	16.2	21.0	44.6	65.6	264	1.45	7.95	383
9	2262.04	18.0	22.5	30.9	53.4	314	0.65	8.60	204
10	2263.10	17.7	23.5	31.5	55.0	323	1.00	9.60	323
11	2264.05	16.9	28.7	40.6	69.3	298	1.00	10.60	298
12	2265.10	15.2	25.1	32.2	57.3	296	1.00	11.60	296
13	2266.10	15.8	23.2	41.5	64.7	284	1.00	12.60	284
14	2267.15	16.5	26.0	36.3	62.3	333	1.00	13.60	353
15	2268.15	16.0	25.9	32.8	58.7	322	1.40	15.00	451
16	2269.11	16.5	30.1	36.4	66.5	385	0.60	15.60	231
17	2270.15	14.2	24.5	37.8	62.3	270	1.00	16.60	270
18	2271.10	14.4	25.9	35.2	61.1	289	1.00	17.60	289

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Well No. Thrall 101

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	2278.10	14.9	24.1	31.6	55.7	279	1.05	18.65	293
20	2273.05	16.4	22.4	34.9	57.3	285	0.95	19.60	271
21	2274.15	16.1	26.6	31.3	57.9	332	1.00	20.60	332
22	2275.07	16.9	24.1	33.8	57.9	316	1.00	21.60	316
23	2276.10	14.2	26.1	34.5	60.6	357	1.00	22.60	357
24	2277.15	15.2	25.4	29.5	57.5	335	1.00	23.60	335
25	2278.10	15.9	27.7	47.3	75.0	342	0.90	24.50	308
26	2278.95	14.0	24.6	36.4	61.0	267	0.80	25.30	214
27	2279.75	14.9	23.8	42.5	66.3	275	0.60	25.90	165
28	2282.70	16.9	24.7	44.8	69.5	324	0.80	26.70	259
								Total - - - -	7,846

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company Sinclair Oil & Gas Company Lease Thrall, Hokes Consol. Unit Well No. Thrall 101

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
2254.00 - 2261.95	7.95	16.08	50.89	44.70	263	2,087
2261.95 - 2272.65	10.70	15.93	24.78	35.15	306	3,272
2272.65 - 2282.80	8.05	15.64	25.48	36.65	309	2,487
2254.00 - 2282.80	26.70	15.88	33.83	38.45	294	7,846

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Company Sinclair Oil & Gas Company

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery	
			Percent	Bbls./A. Ft.	Percent	Bbls./A. I
1	2254.10	15.3	17.4	209	0.0	0
2	2255.04	15.1	14.5	170	0.0	0
3	2256.12	17.5	27.4	372	4.4	60
4	2257.10	17.3	25.0	309	1.2	16
5	2258.15	15.7	21.6	265	0.0	0
6	2259.15	15.2	21.9	259	0.0	0
7	2260.05	15.5	21.1	259	0.0	0
8	2260.95	16.2	21.9	275	0.0	0
9	2262.04	18.0	22.5	314	3.8	33
10	2263.10	17.4	23.6	321	4.1	35
11	2264.05	17.0	21.7	286	3.2	42
12	2265.10	15.4	25.9	310	7.2	66
13	2266.10	16.3	25.8	305	5.9	49
14	2267.15	16.4	27.0	345	4.0	51
15	2268.15	16.5	25.2	322	3.3	42
16	2269.11	16.2	28.9	364	3.7	47
17	2270.15	14.4	24.0	268	0.0	0
18	2271.10	14.8	26.6	305	2.9	33
19	2272.10	14.9	23.5	272	3.0	35
20	2273.05	16.7	23.8	308	3.4	44
21	2274.15	16.1	25.5	319	1.1	14
22	2275.07	15.8	24.1	314	3.3	43
23	2276.10	15.3	25.7	277	2.6	28
24	2277.15	15.6	28.2	341	6.7	81
25	2278.10	15.7	26.9	352	5.6	66
26	2278.95	14.5	24.7	278	0.7	8
27	2279.75	14.3	25.3	251	1.4	16
28	2282.70	17.1	25.0	305	6.2	82

Notes: cc - cubic centimeter
* - Volume of water recovered at
** -, Determined by passing water th

eld Research Laboratories

' LABORATORY FLOODING TESTS

TABLE V

_____ Lease Thrall-McKee Consolidated Well No. Thrall-101

ery	Residual Saturation			Volume of Water Recovered cc*	Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
0	17.4	72.9	309	2	0.161	50
0	14.5	70.0	170	5	0.328	45
60	23.0	65.0	312	75	1.35	23
16	21.8	66.8	295	67	1.87	25
0	21.6	62.6	265	0	Imp.	80+
0	21.9	59.9	259	8	0.242	40
0	21.1	75.2	259	0	Imp.	50+
0	21.9	69.0	275	0	Imp.	50+
25	18.7	75.0	281	120	5.06	20
25	19.7	75.3	296	51	1.08	25
42	18.6	78.0	344	54	1.54	25
26	18.7	70.5	224	30	1.15	30
49	19.9	70.4	252	19	0.625	35
51	23.0	68.0	292	47	2.07	25
42	21.9	69.1	280	54	1.69	25
47	25.2	72.2	317	6	0.251	55
0	24.0	69.7	288	8	0.307	40
53	23.7	70.5	272	18	0.692	30
35	20.5	76.6	257	50	1.90	30
44	20.4	77.0	264	55	2.26	25
14	24.4	70.0	305	52	1.60	30
43	20.8	65.1	271	100	5.20	20
28	23.1	59.3	249	25	0.842	30
21	21.5	71.4	260	49	1.12	25
66	25.3	71.8	284	76	2.28	25
8	24.0	68.8	270	18	0.716	35
16	20.9	75.7	255	125	2.85	20
82	16.8	70.5	225	157	7.96	20

d at the time of maximum oil recovery.
ter through sample which still contains residual oil.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Unit Well No. Thrall 101

Depth, Interval, Feet	2235.60 - 2257.60	2261.95 - 2272.65	2272.65 - 2288.80	2855.60 - 2882.80
Feet of Core Analyzed	2.00	9.70	8.05	19.75
Average Percent Porosity	17.40	16.24	15.70	16.14
Average Percent Original Oil Saturation	85.20	84.83	85.31	85.36
Average Percent Oil Recovery	2.80	3.90	3.53	3.64
Average Percent Residual Oil Saturation	82.40	80.93	81.78	81.72
Average Percent Residual Water Saturation	65.80	72.29	69.84	70.56
Average Percent Total Residual Fluid Saturation	66.30	93.22	91.48	91.98
Average Original Oil Content, Bbls./A. Ft.	341.	318.	306.	313.
Average Oil Recovery, Bbls./A. Ft.	38.	48.	44.	46.
Average Residual Oil Content, Bbls./A. Ft.	303.	263.	264.	267.
Total Original Oil Content, Bbls./Acre	681.	3,085.	2,479.	6,185.
Total Oil Recovery, Bbls./Acre	76.	474.	338.	908.
Total Residual Oil Content, Bbls./Acre	605.	2,551.	2,137.	5,293.
Average Effective Permeability, Millidarcys	1.61	1.56	2.75	2.03
Average Initial Fluid Production Pressure, p.s.i.	25.0	28.0	25.0	26.4

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

Unit Thrall

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol. Well No. 101

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2254.10	12,700	7.6	32.4	40.0
2	2255.04	29,200	22.9	29.6	52.5
3	2256.12	10,100	5.3	30.0	35.3
4	2257.10	13,900	8.1	31.1	39.2
5	2258.15	28,900	14.4	18.9	33.3
6	2259.15	34,500	29.3	27.6	56.9
7	2260.05	28,800	23.9	31.8	55.7
8	2260.95	24,100	16.1	28.5	44.6
9	2262.04	9,000	4.2	26.7	30.9
10	2263.10	12,600	5.9	25.6	31.5
11	2264.05	19,100	11.6	29.0	40.6
12	2265.10	20,000	9.6	22.6	32.2
13	2266.10	29,000	18.0	23.5	41.5
14	2267.15	25,900	14.0	22.3	36.3
15	2268.15	25,900	12.7	20.1	32.8
16	2269.11	20,500	11.1	25.3	36.4
17	2270.15	14,500	8.2	29.6	37.8
18	2271.10	11,200	5.9	29.3	35.2
19	2272.10	14,900	7.0	24.6	31.6
20	2273.05	17,000	8.9	26.0	34.9
21	2274.15	17,600	8.2	23.1	31.3
22	2275.07	9,800	4.9	28.9	33.8
23	2276.10	17,700	9.1	25.4	34.5
24	2277.15	14,100	6.1	23.0	29.1
25	2278.10	18,300	12.9	34.4	47.3
26	2278.95	21,500	11.7	24.7	36.4
27	2279.75	20,800	13.2	29.3	42.5
28	2282.70	17,200	11.5	33.3	44.8

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTATION TESTS

TABLE VIII

Company Sinclair Oil & Gas Company Lease Thrall, McKee Consol Unit Thrall Well No. 101

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2254.00 - 2261.95	23,533	16.42	28.24
2261.95 - 2272.65	18,912	10.07	25.09
2272.65 - 2282.80	16,802	9.30	27.34
2254.00 - 2282.80	19,652	11.75	26.71

Note: ppm - parts per million.