October 10, 1950

Mr. Harry Pittman
R. F. D. #4
Independence, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis made on the Cable Tool core taken from the Carter Lease, Well No. 1, Chautauqua County, Kansas, and submitted to our laboratory on September 26, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bb
c.c.

HARRY PITTMAN

CORE ANALYSIS REPORT

CARTER LEASE WELL NO. 1

CHAUTAUQUA COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

OCTOBER 7, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Harry Pittman Lease Carter Well No. 1

Location

Section 33 (28) Twp. 28 S (33) Rge. 11E County Chautauqua State Kansas

Name of Sand	Peru
Top of Core	1148.00
Bottom of Core	1167.40
Top of Sand 011	1148.00
Bottom of Sand	1154.95
Total Feet of Permeable Sand	6.60

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	1.30	1.30
10 - 15	2.05	3.35
15.- 20	1.30	4.65
20 - 30	1.60	6.25
30 & above	0.35	6.60

Average Permeability, Millidarcys	16.91
Average Percent Porosity	16.62
Average Percent Oil Saturation	16.23
Average Percent Water Saturation	64.89
Average Oil Content, Bbls./A. Ft.	212.
Total Oil Content, Bbls./Acre	1,570.
Average Percent Oil Recovery by Laboratory Flooding Tests	1.18
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	17.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	78.
Total Calculated Oil Recovery, Bbls./Acre	1,500.
Packer Setting, Feet	-
Viscosity, Centipoises @ 90°F.	3.75
A. P. I. Gravity, degrees @ 60 °F	33.8

Salt 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
1148.00 - 1150.15	Brown fine grained micaceous slightly shaley sandstone.
1150.15 - 1150.95	Light brown fine grained micaceous sandstone.
1150.95 - 1151.10	Light brown fine grained micaceous slightly calcareous sandstone.
1151.10 - 1151.60	Light brown fine grained micaceous sandstone.
1151.60 - 1152.25	Light gray fine grained micaceous sandstone.
1152.25 - 1152.90	Light gray fine grained slightly shaley micaceous sandstone.
1152.90 - 1154.10	Light brown fine grained micaceous sandstone.
1154.10 - 1154.30	Gray shale.
1154.30 - 1154.95	Light brown fine grained micaceous sandstone.
1154.95 - 1156.95	Gray sandy shale.
1156.95 - 1157.30	Light brown fine grained shaley micaceous sandstone.
1157.30 - 1157.90	Light gray fine grained micaceous sandstone.
1157.90 - 1158.60	Light brown fine grained micaceous sandstone.
1158.60 - 1164.30	Gray sandy shale.
1164.30 - 1166.00	Gray shale.
1166.00 - 1167.40	According to log, gray shale (discarded at well).

Coring was started at a depth of 1148.00 feet in fine grained micaceous slightly shaley sandstone and completed at 1167.40 feet in gray shale. This core shows a total of 8.40 feet of sandstone. For

the most part, the sand section is made up of fine grained micaceous to shaley sandstone. According to the driller, the top of the sand was found at a depth of 1138.00 feet. However, it was understood that practically all of this was gas sand.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections are 17.57 and 10.92 millidarcys respectively; the overall average being 16.91 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand section has a fairly irregular permeability profile and that the sand in the lower part of the core is impermeable to both air and water.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 16.23. The weighted average percent oil saturation of the upper and lower sections are 16.98 and 12.69 respectively. The weighted average percent water saturation of the upper and lower sections are 62.46 and 87.50 respectively; the overall average being 64.89 (See Table IV). This gives an overall weighted average total fluid saturation of 81.12 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 get some idea of the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. By observing the data given in these tables and on the

coregraph, it is noticeable that the chloride content did not vary very much, thereby, indicating that the water used as a circulating fluid during the coring operation had a chloride content almost as high as the formation water. As a result, these tests are of little value as far as indication of flushing is concerned.

The weighted average oil content of the upper and lower sections are 227 and 143 barrels per acre foot respectively; the overall average being 212. The total oil content, as shown by this core, is 1,570 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of crude oil taken from the bleeder at a producing well is 8.75 centipoises at 90° F. The A.P.I. gravity of the oil is 33.8° at 60° F. With other factors being favorable, a sand containing an oil of this viscosity should respond very satisfactorily to water repressuring.

LABORATORY FLOODING TESTS

Inasmuch as the sand in the core has a very low oil saturation, naturally, one would expect very little oil to be recovered by laboratory flooding tests. A total recovery of 78 barrels of oil per acre was obtained from 4.65 feet of sand. The weighted average percent oil saturation was reduced from 16.51 to 15.33, or represents an average recovery of 1.18 percent. The weighted average effective permeability of the samples is 1.63 millidarcys, while the average initial fluid production pressure is 17.0 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 7 samples tested, 6 produced water and 5 oil. This indicates

that only part of the sand represented by these samples is floodable. The tests also indicate that even though the sand has a rather low effective permeability, it took water at a comparatively low pressure. The tests also show that the sand has a fairly 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 1,500 barrels of oil per acre. 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 38 percent. The principle drawback of this core is the fact that it contains only approximately 6.00 feet of good floodable sand.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Harry Pittman Lease Carter Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	1148.10	16.	0.25	0.25	4.00
2	1148.35	14.	0.35	0.60	4.90
3	1148.90	17.	0.50	1.10	8.50
4	1149.30	23.	0.40	1.50	9.20
5	1149.80	8.2	0.65	2.15	5.33
6	1150.25	21.	0225	2.40	5.25
7	1150.55	14.	0.30	2.70	4.20
8	1150.90	19.	0.25	2.95	4.75
9	1151.30	11.	0.30	3.25	3.30
10	1151.52	28.	0.20	3.45	5.60
11	1151.72	29.	0.30	3.75	8.70
12	1152.15	38.	0.35	4.10	13.30
13	1152.50	6.4	0.40	4.50	2.56
14	1152.85	7.3	0.25	4.75	1.83
15	1153.25	12.	0.45	5.20	5.40
16	1153.55	17.	0.30	5.50	5.10
17	1153.75	28.	0.45	5.95	12.60
18	1154.20	Imp.	0.20	6.15	0.00
19	1154.40	12.	0.30	6.45	3.60
20	1154.75	10.	0.35	6.80	3.50
21	1155.30	Imp.	0.55	7.35	0.00
22	1155.70	Imp.	0.60	7.95	0.00
23	1156.70	Imp.	0.70	8.65	0.00
24	1156.92	Imp.	0.15	8.80	0.00
25	1157.10	Imp.	0.35	9.15	0.00
26	1157.75	Imp.	0.60	9.75	0.00
27	1157.95	Imp.	0.20	9.95	0.00
28	1158.25	Imp.	0.50	10.45	0.00

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Harry Pittman Lease Carter Well No. 1

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
1148.00-1154.10	5.95	17.57	104.52
1154.30-1154.95	0.65	10.92	7.10
1148.00-1154.95	6.60	16.91	111.62

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RESULTS OF SATURATION TESTS

TABLE III

Company Harry Pittman Lease Carter 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	1148.58	16.6	15.5	61.4	76.9	200	1.30	1.30	260
2	1149.91	15.3	15.3	64.2	79.5	182	0.85	2.15	155
3	1151.01	16.9	18.7	65.0	83.7	245	0.95	3.10	233
F-3	1151.17	12.4	16.6	-	-	160	0.50	3.60	80
4	1152.02	20.2	22.8	61.2	84.0	357	0.65	4.25	232
5	1152.98	18.4	15.1	63.0	78.1	216	1.15	5.40	248
6	1153.88	18.9	17.2	59.1	76.3	252	0.70	6.10	176
9	1157.52	12.3	10.6	87.5	98.1	101	0.60	6.70	61
F-10	1158.52	16.0	14.4	-	-	178	0.70	7.40	125
							Total	- - - -	1,570

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Harry Pittman Lease Carter 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
1148.00-1154.10	6.10	17.11	16.98	62.46	227	1,384
1157.30-1158.60	1.30	14.31	12.69	87.50	143	186
1148.00-1158.60	7.40	16.62	16.23	64.89	212	1,570

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Harry Pittman Lease Carter Well No. 1

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	1148.70	17.1	15.7	208	0.9	12	14.8	80.0	196	12	1.80	20
2	1150.05	16.3	15.7	173	0.9	11	12.8	85.4	162	37	1.41	20
3	1151.17	12.4	16.6	160	0.0	0	16.6	79.6	160	2	0.353	30
4	1151.88	19.7	23.7	363	2.0	31	21.7	70.2	332	101	1.74	10
5	1153.12	17.8	16.3	225	1.2	17	15.1	81.3	208	39	1.97	15
6	1154.02	19.5	15.0	227	1.2	18	13.8	80.5	209	39	0.913	20
10	1158.52	16.0	14.4	178	0.0	0	14.4	81.7	178	0	Imp.	50+

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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Harry Pittman Lease Carter Well No. 1

Depth, Interval, Feet	1148.00 - 1154.10
Feet of Core Analyzed	4.65
Average Percent Porosity	17.85
Average Percent Original Oil Saturation	16.51
Average Percent Oil Recovery	1.18
Average Percent Residual Oil Saturation	15.33
Average Percent Residual Water Saturation	80.00
Average Percent Total Residual Fluid Saturation	95.33
Average Original Oil Content, Bbls./A. Ft.	231.
Average Oil Recovery, Bbls./A. Ft.	17.
Average Residual Oil Content, Bbls./A. Ft.	214.
Total Original Oil Content, Bbls./Acre	1,071.
Total Oil Recovery, Bbls./Acre	78.
Total Residual Oil Content, Bbls./Acre	993.
Average Effective Permeability, Millidarcys	1.63
Average Initial Fluid Production Pressure, p.s.i.	17.0

NOTE: Only those samples which recovered oil were used in calculating the above averages.

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RESULTS OF WATER DIFFERENTATION TESTS

TABLE VII

Company Harry Pittman Lease Carter Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	1148.58	66,800			
2	1149.91	69,600			
3	1151.01	70,400			
4	1152.02	64,500			
5	1152.98	71,100			
6	1153.88	74,800			
9	1157.52	85,400			

Note: ppm - parts per million

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SUMMARY OF WATER DIFFERENTATION TESTS

TABLE VIII

Company Harry Pittman Lease Carter Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
1148.00 - 1157.90	71,032		

Note: ppm - parts per million