October 24, 1952

Emery Construction Company, Inc.
P. O. Box 498
Topeka, Kansas

Attention: Mr. George B. Emery, Jr.

Gentlemen:

Enclosed herewith is the report of the analysis made on the 3" Rotary core taken from the Farmer Lease, Well No. 1, Montgomery County, Kansas, and submitted to our laboratory on October 15, 1952.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:eda

c.c. to Mr. E. A. Whitworth
Coffeyville, Kansas

3-35-15E

Farmer 1

EMERY CONSTRUCTION COMPANY

CORE ANALYSIS REPORT

FARMER LEASE WELL NO. 1

MONTGOMERY COUNTY, KANSAS

OILFIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

OCTOBER 24, 1952

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Emery Construction Company Lease Farmer Well No. 1

Location 990' South of North Line & 990' West of East Line, SE¼, NW¼,

Section 3 Twp. 35S Rge. 15E County Montgomery State Kansas

Name of Sand	Bartlesville
Top of Core	1182.00
Bottom of Core	1278.00
Top of Pay Sand	1257.85
Bottom of Sand	1275.00
Total Feet of Permeable Sand (Analyzed)	20.60
Total Feet of Floodable Pay Sand (Analyzed)	9.60

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 4	1.45	1.45
4 - 12	5.10	6.55
12 - 20	5.30	11.85
20 - 40	4.55	16.40
40 - 80	3.15	19.55
80 & above	1.10	20.65

Average Permeability Millidarcys	27.70
Average Percent Porosity	16.68
Average Percent Oil Saturation	23.42
Average Percent Water Saturation	48.37
Average Oil Content, Bbls./A. Ft.	306.
Total Oil Content, Bbls./Acre	6,448.
Average Percent Oil Recovery by Laboratory Flooding Tests	3.24
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	44.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	514.
Total Calculated Oil Recovery, Bbls./Acre	2,150.
Packer Setting, Feet	1257.0
Viscosity, Centipoises @ 93° F.	10.1
A. P. I. Gravity, degrees @ 60 °F	30.4
Elevation, Feet	

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
1182.00 - 1189.13	Gray slightly laminated sandy shale (Discarded at well).
1189.13 - 1189.50	Light brown fine grained micaceous sandstone.
1189.50 - 1190.32	Gray slightly laminated sandy shale.
1190.32 - 1192.20	Light brown fine grained micaceous sandstone.
1192.20 - 1192.60	Gray sandy shale.
1192.60 - 1193.65	Light brown fine grained micaceous sandstone containing a shale streak.
1193.65 - 1194.10	Laminated sandy shale.
1194.10 - 1197.60	Light brown fine grained micaceous sandstone.
1197.60 - 1198.75	Gray sandy shale.
1198.75 - 1200.15	Light brown fine grained micaceous sandstone.
1200.15 - 1203.15	Gray sandy shale.
1203.15 - 1204.15	Light brown fine grained micaceous sandstone containing a vertical fracture.
1204.15 - 1208.50	Gray slightly laminated sandy shale containing a sand streak.
1208.50 - 1209.00	Loss.
1209.00 - 1209.50	Light brown fine grained micaceous sandstone.
1209.50 - 1212.00	Laminated sandy shale.
1212.00 - 1214.70	Light brown fine grained micaceous sandstone.
1214.70 - 1217.15	Laminated sandy shale.
1217.15 - 1217.80	Light brown fine grained micaceous sandstone.

1217.80 - 1227.35 - Laminated sandy shale.

1227.35 - 1230.00 - Grayish light brown slightly laminated shaley sandstone.

1230.00 - 1236.00 - Loss.

1236.00 - 1245.10 - Gray shale.

1245.10 - 1245.60 - Light brown fine grained laminated micaceous shaley sandstone.

1245.60 - 1247.00 - Loss.

1247.00 - 1248.00 - Light brown fine grained micaceous sandstone.

1248.00 - 1255.80 - Gray slightly laminated sandy shale.

1255.80 - 1257.00 - Light brown fine grained micaceous calcareous sandstone.

1257.00 - 1257.85 - Light brown fine grained slightly laminated micaceous shaley sandstone.

1257.85 - 1265.25 - Light brown fine grained micaceous sandstone.

1265.25 - 1266.00 - Loss.

1266.00 - 1275.00 - Light brown fine grained micaceous sandstone.

1275.00 - 1275.50 - Conglomeratic calcareous sandstone.

1275.50 - 1276.55 - Gray shale.

1276.55 - 1278.00 - Loss.

Coring was started at a depth of 1182.00 feet in laminated sandy shale and completed at 1278.00 feet probably in shale. There was a loss extending from 1276.55 feet to the bottom of the core. This core shows a total of 35.65 feet of sandstone. For the most part, the pay is made up of fine grained micaceous sandstone. There was a loss extending from 1265.25 to 1266.00 feet, which was probably pay sand.

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 6.68, 16.76 and 58.37 millidarcys respectively; the overall average being 26.83 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile and that the upper part of the cored section is very tight. The permeability of the sand varies from impermeable to a maximum of 110 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 23.42. The weighted average percent oil saturation of the upper, middle and lower sections is 27.77, 20.87 and 26.12 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 45.04, 50.55 and 45.79 respectively; the overall average being 48.37 (See Table IV). This gives an overall weighted average total fluid saturation of 71.79 percent. This low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil.

In an effort to determine whether or not any flushing of the sand occurred during coring, all of the saturation samples were analyzed for chloride 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 noticeable that the more permeable sand located at the bottom of the core was badly flushed during coring. We are of the opinion, however, 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, middle and lower sections is 346, 274 and 348 barrels per acre foot respectively; the overall average being 306. The total oil content, as shown by this core, is 6,448 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of crude oil taken from the bleeder at a nearby pumping well on this lease is 10.1 centipoises at 93° F. The A.P.I. gravity of the oil is 30.4° 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 this core shows a low weighted average percent oil saturation, naturally, one would expect very little oil to be recovered by laboratory flooding tests. A total recovery of 514 barrels of oil per acre was obtained from 11.65 feet of sand. The weighted average percent oil saturation was reduced from 26.40 to 23.16, or represents an average recovery of 3.24 percent. The weighted average effective permeability of the samples is 4.27 millidarcys, while the average initial fluid production pressure is 17.7 pounds per square inch (See Table VI).

From the data given in Table V, you will note that of the 24 samples tested, 22 produced water and 13 oil. This indicates that approximately 47 percent of the sand represented by these samples is floodable pay sand. It is also noticeable that a number of the samples produced water, but no oil, thereby, indicating that part of the sand may be watered out.

CONCLUSION

From a study of the above data, it is evident that an efficient water-flood within the vicinity of this well will recover approximately 2,150 barrels of oil per acre, or an average of 224 barrels per acre foot from the 9.6 feet of floodable pay sand analyzed. In calculating this

recovery, an allowance was made for oil lost during coring, and it is assumed that the primary production and the true water saturation of the sand are 10 and 40 percent respectively.

On the basis of the above data, it is evident that part of the sand may be watered out as no oil was recovered from the sand in question even though it produced considerable water. The chloride content of the water in this zone is comparatively high, thereby, indicating that it was not flushed to any appreciable degree during coring. This would indicate that there may be an old hole located near this well.

Oil Field Research Laboratories

SHOT RECOMMENDATION

Company Emery Construction Company Lease Farmer Well No. 1

Depth Interval, Feet	Feet of Sand	Size of Shell Inches	Qts./Ft.	Total Quarts
1261.0-1267.0	6.0	4½	3.1	18.6
1267.0-1274.0	7.0	3½	2.0	14.0
Total	13.0			32.6

Oilfield Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Emery Construction Company Lease Farmer Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	1208.45	2.2	0.15	0.15	0.33
2	1209.15	5.1	0.50	0.65	2.55
3	1212.15	Imp.	0.45	1.10	0.00
4	1212.70	1.1	0.35	1.45	0.40
5	1212.98	2.6	0.35	1.80	0.91
6	1213.30	11.	0.40	2.20	4.40
7	1213.85	14.	0.50	2.70	7.00
8	1214.28	5.8	0.65	3.35	3.77
9	1217.33	Imp.	0.65	4.00	0.00
10	1227.72	Imp.	0.70	4.70	0.00
11	1228.35	Imp.	0.70	5.40	0.00
12	1229.10	Imp.	0.65	6.05	0.00
13	1229.75	Imp.	0.60	6.65	0.00
14	1245.40	Imp.	0.50	7.15	0.00
15	1247.12	Imp.	0.40	7.55	0.00
16	1247.70	Imp.	0.60	8.15	0.00
17	1256.95	Imp.	1.20	9.35	0.00
18	1257.35	2.8	0.60	9.95	1.68
19	1257.80	5.5	0.25	10.20	1.38
20	1258.40	15.	0.80	11.00	12.00
21	1258.95	19.	0.60	11.60	11.40
22	1259.56	31.	0.45	12.05	13.95
23	1259.87	9.8	0.45	12.50	4.41
24	1260.42	17.	0.45	12.95	7.65
25	1260.87	13.	0.50	13.45	6.50
26	1261.34	12.	0.50	13.95	6.00
27	1261.86	9.4	0.55	14.50	5.17
28	1262.40	21.	0.50	15.00	10.50
29	1262.93	23.	0.55	15.55	12.65
30	1263.46	8.4	0.45	16.00	3.78
31	1263.86	5.1	0.45	16.45	2.30
32	1264.37	5.2	0.45	16.90	2.34
33	1264.80	13.	0.70	17.60	9.10
34	1266.50	15.	0.70	18.30	10.50
35	1266.90	8.1	0.45	18.75	3.65
36	1267.45	14.	0.55	19.30	7.70
37	1267.90	27.	0.50	19.80	13.50
38	1268.51	27.	0.50	20.30	13.50
39	1268.91	25.	0.45	20.75	11.25
40	1269.41	31.	0.50	21.25	15.50

Oilfield Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Emery Construction Company Lease Farmer Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	1269.91	104.	0.60	21.85	62.40
42	1270.60	23.	0.55	22.40	12.65
43	1271.03	30.	0.55	22.95	16.50
44	1271.60	110.	0.50	23.45	55.00
45	1272.10	67.	0.50	23.95	33.50
46	1272.60	42.	0.45	24.40	18.90
47	1272.97	65.	0.50	24.90	32.50
48	1273.60	70.	0.50	25.40	35.00
49	1274.06	61.	0.50	25.90	30.50
50	1274.55	67.	0.70	26.60	46.90
51	1275.33	8.9	0.50	27.10	4.45

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Emery Construction Company Lease Farmer Well No. 1

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
1208.35 - 1214.70	2.90	6.68	19.36
1257.00 - 1269.80	12.05	16.76	202.01
1269.80 - 1275.50	5.70	58.37	332.70
1208.35 - 1275.50	20.65	26.83	554.07

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RESULTS OF SATURATION TESTS

TABLE III

Company Emery Construction Company Lease Farmer 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	1209.35	14.9	21.8	45.6	67.4	252	0.50	0.50	126
2	1212.35	16.4	21.0	48.0	69.0	267	0.95	1.45	254
3	1213.55	17.8	39.3	42.4	81.7	543	1.10	2.55	597
4	1214.55	15.8	21.3	49.2	70.5	262	0.65	3.20	170
5	1217.65	12.7	29.2	40.6	69.8	288	0.65	3.85	187
6	1257.18	14.4	11.3	58.5	69.8	126	0.85	4.70	107
7	1258.15	17.8	25.2	50.0	75.2	348	0.80	5.50	278
8	1259.15	17.5	22.6	52.9	75.5	307	1.00	6.50	307
9	1260.15	16.9	23.1	44.3	67.4	303	1.00	7.50	303
10	1261.15	17.8	25.6	42.6	68.2	354	0.95	8.45	336
11	1262.15	17.4	18.2	50.9	69.1	246	1.05	9.50	258
12	1263.15	18.2	23.0	50.7	73.7	325	1.00	10.50	325
13	1264.15	14.8	13.7	55.0	68.7	157	1.00	11.50	157
14	1265.15	15.2	21.2	52.4	73.6	250	0.60	12.10	150
15	1266.15	18.3	28.8	51.5	80.3	409	0.65	12.75	266
16	1267.15	16.2	19.7	50.0	69.7	248	1.05	13.80	260
17	1268.25	15.8	20.3	54.0	74.3	249	1.05	14.85	262
18	1269.26	16.7	21.5	46.3	67.8	279	1.05	15.90	293
19	1270.40	16.3	22.7	50.0	72.7	287	1.00	16.90	287
20	1271.35	18.2	27.2	46.3	73.5	384	1.05	17.95	403
21	1272.35	17.6	30.2	43.0	73.2	413	1.00	18.95	413
22	1273.35	16.8	25.7	44.3	70.0	336	1.00	19.95	336
23	1274.30	16.7	25.2	44.6	69.8	326	0.75	20.70	244
24	1274.95	17.0	24.4	47.0	71.4	322	0.40	21.10	129
								Total	6,448

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Emery Construction Company Lease Farmer 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
1209.00-1217.80	3.85	16.05	27.77	45.04	346	1,334
1257.00-1269.80	12.05	16.69	20.87	50.55	274	3,302
1269.80-1275.00	5.20	17.13	26.12	45.79	348	1,812
1209.00-1275.00	21.10	16.68	23.42	48.37	306	6,448

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Emery Construction Company Lease Farmer 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	1209.35	15.4	20.2	242	0.0	0	20.2	63.8	242	0	Imp.	50#
2	1212.35	16.6	21.0	270	1.2	15	19.8	70.2	255	9	0.325	35
3	1213.55	17.5	39.3	435	11.3	154	28.0	61.0	381	2	0.152	40
4	1214.55	15.9	19.5	241	0.0	0	19.5	61.0	241	3	0.144	40
5	1217.65	13.0	27.9	282	0.0	0	27.9	44.4	282	0	Imp.	50#
6	1257.18	14.6	10.1	114	0.0	0	10.1	76.1	114	11	0.244	25
7	1258.15	17.8	25.2	348	4.2	58	21.0	75.0	290	102	3.32	15
8	1259.15	17.8	22.6	314	1.1	15	21.5	71.6	297	49	1.44	20
9	1260.15	17.3	23.1	310	1.2	16	21.9	71.5	294	51	1.14	15
10	1261.15	17.4	25.6	346	1.6	22	24.0	63.5	324	20	0.466	25
11	1262.15	17.4	17.4	235	0.0	0	17.4	77.6	235	48	1.53	20
12	1263.15	18.6	23.0	333	1.7	25	21.3	76.8	308	168	4.45	15
13	1264.15	14.9	13.7	158	0.0	0	13.7	78.1	158	11	0.300	25
14	1265.15	15.4	21.7	260	0.0	0	21.7	73.4	260	41	1.27	20
15	1266.15	18,2	28.8	406	5.2	73	23.6	70.0	333	132	6.24	10
16	1267.15	16.1	19.6	247	0.0	0	19.6	77.5	247	81	2.71	15
17	1268.25	16.3	21.0	266	0.0	0	21.0	78.6	266	192	5.09	15
18	1269.26	16.6	19.8	255	0.0	0	19.8	76.8	255	70	2.09	15
19	1270.40	16.4	22.6	288	0.0	0	22.6	77.1	288	164	5.12	15
20	1271.35	18.2	27.2	385	2.4	34	24.8	65.0	351	167	8.05	10
21	1272.35	17.5	30.2	410	4.6	62	25.6	74.0	348	127	8.00	10
22	1273.35	16.8	25.1	328	1.2	16	23.9	71.6	312	183	8.07	15
23	1274.30	16.8	25.2	328	4.0	52	21.2	75.0	276	114	8.50	10
24	1274.95	17.1	24.4	324	1.6	21	22.8	76.5	303	119	10.77	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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Emery Construction Company Lease Farmer Well No. 1

Depth Interval, Feet	1212.00-1214.05	1257.85-1266.65	1270.80-1275.00	1212.00-1275.00
Feet of Core Analyzed	2.05	5.40	4.20	11.65
Average Percent Porosity	17.12	17.81	17.33	17.52
Average Percent Original Oil Saturation	30.79	24.45	26.76	26.40
Average Percent Oil Recovery	6.59	2.28	2.83	3.24
Average Percent Residual Oil Saturation	24.20	22.17	23.93	23.16
Average Percent Residual Water Saturation	65.27	71.44	71.60	70.41
Average Percent Total Residual Fluid Saturation	89.47	93.61	95.53	93.57
Average Original Oil Content, Bbls./A. Ft.	412.	337.	361.	359.
Average Oil Recovery, Bbls./A. Ft.	89.	31.	38.	44.
Average Residual Oil Content, Bbls./A. Ft.	323.	306.	323.	315.
Total Original Oil Content, Bbls./Acre	845.	1,825.	1,517.	4,187.
Total Oil Recovery, Bbls./Acre	183.	170.	161.	514.
Total Residual Oil Content, Bbls./Acre	662.	1,655.	1,356.	3,673.
Average Effective Permeability, Millidarcys	0.232	2.60	8.38	4.27
Average Initial Fluid Production Pressure, p.s.i.	37.5	16.7	11.0	17.7

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

Oilfield Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Emery Construction Company Lease Farmer Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	1209.35	25,200			
2	1212.35	15,100			
3	1213.55	54,800			
4	1214.55	54,700			
5	1217.65	58,100			
6	1257.18	46,500			
7	1258.15	59,500			
8	1259.15	47,600			
9	1260.15	64,400			
10	1261.15	64,600			
11	1262.15	61,800			
12	1263.15	53,800			
13	1264.15	57,700			
14	1265.15	63,400			
15	1266.15	7,380			
16	1267.15	51,800			
17	1268.25	51,400			
18	1269.26	56,600			
19	1270.40	51,600			
20	1271.35	4,380			
21	1272.35	6,240			
22	1273.35	4,380			
23	1274.30	4,250			
24	1274.95	5,910			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Emery Construction Company Lease Farmer Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
1209.00-1217.80	41,700		
1257.00-1269.80	53,735		
1269.80-1275.00	13,917		
1209.00-1275.00	41,726		

Note: ppm - parts per million.