OILFIELD RESEARCH LABORATORIES
536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

June 4, 1966

Russell Operating Company
101 Petroleum Building
Abilene, Texas

Attn: Mr. James E. Russell

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the McGhee Lease, Well No. 22-34, Anderson County, Kansas, and submitted to our laboratory on May 24, 1966.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

BRP:rf

2 c. - Abilene, Texas
1 c. - Colony, Kansas
2 c. - Houston, Texas
1 c. - Pittsburg, California
1 c. - Chanute, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Russell Operating Company Lease McGhee Well No. 22-34

Location

Section 31 Twp. 22S Rge. ~~19E~~ 18 County Anderson State Kansas

Name of Sand	Squirrel
Top of Core	865.0
Bottom of Core	899.0
Top of Sand (Analyzed)	865.0
Bottom of Sand (Analyzed)	896.0
Total Feet of Permeable Sand	30.0
Total Feet of Floodable Sand	28.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	4.0	4.0
5 - 10	4.0	8.0
10 - 20	12.0	20.0
20 - 50	10.0	30.0

Average Permeability Millidarcys	18.0
Average Percent Porosity	18.1
Average Percent Oil Saturation	38.4
Average Percent Water Saturation	43.1
Average Oil Content, Bbls./A. Ft.	539.
Total Oil Content, Bbls./Acre	16,690.
Average Percent Oil Recovery by Laboratory Flooding Tests	6.5
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	92.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,576.
Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary)	6,140.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

The core was sampled and the samples sealed in jars by a representative of the client. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
865.0 - 896.0	Brown, laminated, shaly sandstone.
896.0 - 899.0	Shale.

Coring was started at a depth of 865.0 feet in laminated, shaly sandstone and completed at 899.0 feet in shale. This core shows a total of 31.0 feet of sandstone. For the most part, the pay is made up of brown, laminated, shaly 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 15.2, 18.9 and 20.2 millidarcys respectively; the overall average being 18.0 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a fairly uniform permeability profile. The permeability of the sand varies from impermeable to a maximum of 46. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 38.4. The weighted average percent oil saturation of the upper, middle and lower sections is 41.6, 38.4 and 35.2 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 38.2, 45.9 and 45.5 respectively; the

overall average being 43.1 (See Table III). This gives an overall weighted average total fluid saturation of 81.5 percent.

The weighted average oil content of the upper, middle and lower sections is 584, 521 and 506 barrels per acre foot respectively; the overall average being 539. The total oil content, as shown by this core, is 16,690 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,576 barrels of oil per acre was obtained from 28.0 feet of sand. The weighted average percent oil saturation was reduced from 38.5 to 32.0, or represents an average recovery of 6.5 percent. The weighted average effective permeability of the samples is 0.725 millidarcys, while the average initial fluid production pressure is 35.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 31 samples tested, 28 produced water and oil. This indicates that approximately 90 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 6,140 barrels of oil per acre or an average of 219 barrels per acre foot from the 28.0 feet of floodable pay sand

analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.06
Reservoir water saturation, percent	35.0
Average porosity, percent	18.2
Oil saturation after flooding, percent	32.0
Performance factor, percent	50.0
Net floodable pay sand, feet	28.0

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Russell Operating Company Lease McGhee Well No. 22-34

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	865.5	18.1	43	36	79	603	10.	1.0	1.0	603	10.00
2	866.5	18.5	40	35	75	573	11.	1.0	2.0	573	11.00
3	867.5	16.3	33	51	84	417	8.4	1.0	3.0	417	8.40
4	868.5	18.0	50	37	87	698	12.	1.0	4.0	698	12.00
5	869.5	18.9	46	36	82	675	15.	1.0	5.0	675	15.00
6	870.5	18.5	45	36	81	645	11.	1.0	6.0	645	11.00
7	871.5	18.5	47	32	79	674	37.	1.0	7.0	674	37.00
8	872.5	18.7	41	35	76	594	12.	1.0	8.0	594	12.00
9	873.5	16.4	38	44	82	483	15.	1.0	9.0	483	15.00
10	874.5	18.5	38	39	77	545	18.	1.0	10.0	545	18.00
11	875.5	18.5	37	40	77	531	18.	1.0	11.0	531	18.00
12	876.5	16.5	38	47	85	486	10.	1.0	12.0	486	10.00
13	877.5	16.8	42	45	87	547	3.7	1.0	13.0	547	3.70
14	878.5	14.1	41	55	96	448	9.4	1.0	14.0	448	9.40
15	879.5	17.4	32	47	79	432	15.	1.0	15.0	432	15.00
16	880.5	18.1	41	42	83	575	24.	1.0	16.0	575	24.00
17	881.5	17.5	37	42	79	502	18.	1.0	17.0	502	18.00
18	882.5	19.9	37	40	77	570	30.	1.0	18.0	570	30.00
19	883.5	19.2	41	49	90	610	31.	1.0	19.0	610	31.00
20	884.5	18.7	36	46	82	522	29.	1.0	20.0	522	29.00
21	885.5	19.8	33	41	74	506	12.	1.0	21.0	506	12.00
22	886.5	16.9	42	38	80	550	0.47	1.0	22.0	550	0.47
23	887.5	18.3	34	38	72	482	30.	1.0	23.0	482	30.00
24	888.5	18.6	36	46	82	519	32.	1.0	24.0	519	32.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Russell Operating Company Lease McGhee Well No. 22-34

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
25	889.5	19.4	35	44	79	526	27.	1.0	25.0	526	27.00
26	890.5	19.5	35	48	83	529	46.	1.0	26.0	529	46.00
27	891.5	19.5	42	47	89	635	16.	1.0	27.0	635	16.00
28	892.5	20.5	32	42	74	509	5.0	1.0	28.0	509	5.00
29	893.5	18.7	33	47	80	478	33.	1.0	29.0	478	33.00
30	894.5	17.5	35	44	79	475	0.32	1.0	30.0	475	0.32
31	895.5	14.6	31	66	97	351	Imp.	1.0	31.0	351	0.00
								Total	-------	16,690	

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Russell Operating Company Lease McGhee Well No. 22-34

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
865.0 - 876.0	11.0	15.2	167.40
876.0 - 885.0	9.0	18.9	170.10
885.0 - 896.0	10.0	20.2	201.79
865.0 - 896.0	30.0	18.0	539.29

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
865.0 - 876.0	11.0	18.1	41.6	38.2	584	6,438
876.0 - 885.0	9.0	17.6	38.4	45.9	521	4,692
885.0 - 896.0	11.0	18.5	35.2	45.5	506	5,560
865.0 - 896.0	31.0	18.1	38.4	43.1	539	16,690

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Russell Operating Company Lease McGhee Well No. 22-34

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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	865.5	17.8	43	594	14	193	29	65	401	20	0.665	30
2	866.5	18.9	40	586	9	132	31	68	454	26	0.665	20
3	867.5	16.5	33	422	3	38	30	61	384	2	0.067	50
4	868.5	17.8	50	691	17	235	33	66	456	5	0.067	40
5	869.5	19.1	46	681	16	237	30	64	444	14	0.332	30
6	870.5	18.0	45	629	12	168	33	55	461	5	0.067	40
7	871.5	18.9	47	689	10	147	37	62	542	31	0.798	30
8	872.5	18.2	41	579	12	169	29	70	410	11	0.332	40
9	873.5	16.6	38	488	9	116	29	69	372	6	0.133	40
10	874.5	18.0	38	531	6	84	32	64	447	7	0.133	40
11	875.5	18.2	37	521	3	42	34	59	479	9	0.266	40
12	876.5	16.1	39	486	0	0	39	49	486	0	Imp.	-
13	877.5	16.6	42	540	0	0	42	47	540	0	Imp.	-
14	878.5	14.6	41	464	6	68	35	64	396	8	0.166	40
15	879.5	17.0	32	421	2	26	30	67	395	10	0.332	40
16	880.5	17.7	41	563	4	55	37	57	508	49	1.13	20
17	881.5	18.0	37	516	4	56	33	65	460	20	0.462	40
18	882.5	19.4	37	556	3	45	34	65	511	116	3.46	30
19	883.5	18.6	41	591	2	29	39	57	562	113	3.99	30
20	884.5	18.4	36	514	7	100	29	67	414	100	2.73	30
21	885.5	19.6	33	501	2	30	31	67	471	34	0.798	30
22	886.5	17.1	42	556	11	146	31	68	410	17	0.465	40
23	887.5	17.9	34	471	3	42	31	67	429	26	0.598	30

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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Russell Operating Company Lease McGhee Well No. 22-34

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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
24	888.5	18.4	36	514	2	29	34	60	485	19	0.465	30
25	889.5	19.8	35	536	4	61	31	65	475	10	0.358	50
26	890.5	19.4	35	526	4	60	31	61	466	35	0.751	30
27	891.5	19.4	42	631	8	120	34	60	511	10	0.205	40
28	892.5	20.0	32	496	3	47	29	62	449	8	0.100	45
29	893.5	19.0	33	486	4	59	29	62	427	25	0.500	30
30	894.5	17.9	35	485	3	42	32	55	443	18	0.286	30
31	895.5	14.3	32	355	0	0	32	67	355	0	Imp.	-

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.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Russell Operating Company Lease McGhee Well No. 22-34

Depth Interval, Feet	865.0 - 876.0	876.0 - 885.0	885.0 - 896.0	865.0 - 896.0
Feet of Core Analyzed	11.0	7.0	10.0	28.0
Average Percent Porosity	18.0	17.7	18.9	18.2
Average Percent Original Oil Saturation	41.7	37.8	35.7	38.5
Average Percent Oil Recovery	10.2	4.0	4.4	6.5
Average Percent Residual Oil Saturation	31.5	33.8	31.3	32.0
Average Percent Residual Water Saturation	63.9	63.2	62.7	63.4
Average Percent Total Residual Fluid Saturation	95.4	97.0	94.0	95.4
Average Original Oil Content, Bbls./A. Ft.	583.	518.	521.	544.
Average Oil Recovery, Bbls./A. Ft.	142.	54.	64.	92.
Average Residual Oil Content, Bbls./A. Ft.	441.	464.	457.	452.
Total Original Oil Content, Bbls./Acre	6,411.	3,625.	5,202.	15,238.
Total Oil Recovery, Bbls./Acre	1,561.	379.	636.	2,576.
Total Residual Oil Content, Bbls./Acre	4,850.	3,246.	4,566.	12,662.
Average Effective Permeability, Millidarcys	0.320	1.75	0.453	0.725
Average Initial Fluid Production Pressure, p.s.i.	36.4	32.9	35.5	35.2

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