OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

January 10, 1966

Jackson Brothers
514 North Main
Eureka, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the G.K. Jackson Heirs Lease, Well No. 14, Greenwood County, Kansas, and submitted to our laboratory on December 31, 1965.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

BRP:rf

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Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

Location SE SW NW

Section 23 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2403.0
Bottom of Core	2446.0
Top of Sand	2406.2
Bottom of Sand	2444.2
Total Feet of Permeable Sand	28.4
Total Feet of Floodable Sand	21.3

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	3.4	3.4
1 - 10	16.0	19.4
10 - 20	7.0	26.4
20 & above	2.0	28.4

Average Permeability Millidarcys	8.1
Average Percent Porosity	15.0
Average Percent Oil Saturation	34.6
Average Percent Water Saturation	48.1
Average Oil Content, Bbls./A. Ft.	406.
Total Oil Content, Bbls./Acre	14,161.
Average Percent Oil Recovery by Laboratory Flooding Tests	9.3
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	120.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,546.
Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary)	3,760.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2403.0 - 2406.2	Sandy shale.
2406.2 - 2410.0	Brownish gray, laminated, shaly sandstone.
2410.0 - 2413.6	Light brown, slightly shaly sandstone.
2413.6 - 2420.6	Light brown and gray, laminated, shaly sandstone.
2420.6 - 2426.6	Light brown, slightly shaly sandstone.
2426.6 - 2431.3	Gray calcareous sandstone.
2431.3 - 2444.2	Light brown, slightly shaly sandstone.
2444.2 - 2446.0	Shale.

Coring was started at a depth of 2403.0 feet in sandy shale and completed at 2446.0 feet in shale. For the most part, the pay is made up of light brown, slightly shaly sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 4.8 and 11.8 millidarcys respectively; the overall average being 8.1 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a fairly regular permeability profile. The permeability of the sand varies from impermeable to a maximum of 35.

millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 34.6. The weighted average percent oil saturation of the upper and lower sections is 35.6 and 32.6 respectively. The weighted average percent water saturation of the upper and lower sections is 48.5 and 47.6 respectively; the overall average being 48.1 (See Table III). This gives an overall weighted average total fluid saturation of 82.7 percent.

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 VI and VII. From the data given in these tables and on the coregraph, it is evident that some flushing occurred during coring operations.

The weighted average oil content of the upper and lower sections is 409 and 404 barrels per acre foot respectively; the overall average being 406. The total oil content, as shown by this core, is 14,161 barrels per acre of which 10,105 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,546 barrels of oil per acre was obtained from 21.3 feet of sand. The weighted average percent oil saturation was reduced from 37.1 to 27.8, or represents an average recovery of 9.3 percent. The weighted average effective permeability of the samples is 0.591 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 34 samples tested, 22 produced water and 21 oil. This indicates that approximately 62 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 3,760 barrels of oil per acre or an average of 185 barrels per acre foot from the 20.3 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.22
Reservoir water saturation, percent	37.0
Average porosity, percent	16.5
Oil saturation after flooding, percent	27.8
Performance factor, percent	50.0
Net floodable pay sand, feet	20.3

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 Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

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	2407.1	13.5	34	40	74	356	0.45	1.4	1.4	499	0.63
2	2408.1	12.2	22	73	95	208	Imp.	1.0	2.4	208	0.00
3	2409.1	14.0	36	60	96	390	Imp.	1.4	3.8	546	0.00
4	2410.1	9.0	18	76	94	125	4.3	0.6	4.4	75	2.58
5	2411.1	15.6	43	41	84	520	3.6	1.0	5.4	520	3.60
6	2412.1	14.3	35	45	80	388	1.8	1.0	6.4	388	1.80
7	2413.1	15.3	36	44	80	426	3.0	1.0	7.4	426	3.00
8	2414.3	20.2	32	30	62	501	3.3	1.0	8.4	501	3.30
9	2415.1	15.6	41	43	84	496	1.4	1.0	9.4	496	1.40
10	2416.1	15.6	40	42	82	484	1.4	1.0	10.4	484	1.40
11	2417.1	11.9	43	54	97	397	0.24	1.0	11.4	397	0.24
12	2418.1	10.3	23	73	96	184	Imp.	1.0	12.4	184	0.00
13	2419.1	11.3	32	56	88	280	Imp.	1.0	13.4	280	0.00
14	2420.1	11.4	44	51	95	389	Imp.	1.0	14.4	389	0.00
15	2421.1	17.4	33	46	79	444	18.	1.0	15.4	444	18.00
16	2422.1	16.2	38	41	79	477	4.2	1.0	16.4	477	4.20
17	2423.1	22.2	42	27	69	722	5.4	1.0	17.4	722	5.40
18	2424.1	17.2	35	42	77	466	5.1	1.0	18.4	466	5.10
19	2425.1	17.3	38	42	80	509	13.	1.0	19.4	509	13.00
20	2426.1	16.8	42	45	87	546	8.9	1.0	20.4	546	8.90
21	2427.1	6.7	36	59	95	187	Imp.	1.0	21.4	187	0.00
22	2431.1	7.2	25	69	94	140	5.0	0.5	21.9	70	2.50
23	2432.1	17.5	48	42	90	651	2.4	1.3	23.2	846	3.12
24	2433.1	16.1	42	43	85	524	6.9	1.0	24.2	524	6.90
25	2434.1	18.0	36	46	82	502	15.	1.0	25.2	502	15.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

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.		
26	2435.1	13.9	36	44	80	388	1.3	1.0	26.2	388	1.30
27	2436.1	16.2	29	43	72	364	0.40	1.0	27.2	364	0.40
28	2437.1	15.1	38	45	83	445	25.	1.0	28.2	445	25.00
29	2438.1	16.8	28	47	75	364	17.	1.0	29.2	364	17.00
30	2439.1	14.4	32	51	83	357	11.	1.0	30.2	357	11.00
31	2440.1	17.1	32	52	84	424	13.	1.0	31.2	424	13.00
32	2441.1	18.7	23	48	71	333	18.	1.0	32.2	333	18.00
33	2442.1	17.5	30	45	75	406	35.	1.0	33.2	406	35.00
34	2443.1	13.8	23	50	73	246	6.0	1.6	34.8	394	9.60
								Total		14,161	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2406.2 - 2427.6	15.0	4.8	72.55
2430.8 - 2444.2	13.4	11.8	157.82
2406.2 - 2444.2	28.4	8.1	230.37

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
2406.2 - 2427.6	21.4	14.5	35.6	48.5	409	8,744
2430.8 - 2444.2	13.4	15.6	32.6	47.6	404	5,417
2406.2 - 2444.2	34.8	15.0	34.6	48.1	406	14,161

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

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	2407.1	13.8	34	364	0	0	34	41	364	0	Imp.	-
2	2408.1	12.0	24	223	0	0	24	73	223	0	Imp.	-
3	2409.1	14.0	35	380	0	0	35	62	380	0	Imp.	-
4	2410.1	9.5	19	140	0	0	19	78	140	2	0.200	50
5	2411.1	15.8	43	526	12	147	31	67	379	2	0.200	40
6	2412.1	13.9	35	378	11	119	24	71	259	2	0.200	50
7	2413.1	14.9	36	416	10	116	26	69	300	0	0.010	40
8	2414.3	19.7	32	489	5	76	27	67	413	2	0.200	40
9	2415.1	16.0	41	509	13	161	28	69	348	0	0.010	40
10	2416.1	15.1	40	468	11	129	29	60	339	3	0.300	50
11	2417.1	12.1	44	413	0	0	44	55	413	0	Imp.	-
12	2418.1	10.2	23	182	0	0	23	76	182	0	Imp.	-
13	2419.1	11.3	30	263	0	0	30	57	263	0	Imp.	-
14	2420.1	11.3	46	404	0	0	46	52	404	0	Imp.	-
15	2421.1	17.0	33	435	6	79	27	72	356	31	0.800	30
16	2422.1	16.2	38	476	13	163	25	65	313	13	0.400	40
17	2423.1	21.9	42	713	17	288	25	65	425	15	0.400	30
18	2424.1	17.0	35	461	8	105	27	69	356	19	0.600	30
19	2425.1	16.9	38	498	16	210	22	69	288	36	1.10	30
20	2426.1	16.4	42	534	14	178	28	65	356	23	0.600	30
21	2427.1	7.0	37	200	0	0	37	59	200	0	Imp.	-
22	2431.1	7.3	28	158	0	0	28	68	158	0	Imp.	-
23	2432.1	17.0	48	632	16	210	32	65	422	21	0.600	30
24	2433.1	15.9	42	518	10	123	32	63	395	14	0.500	40

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

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

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.			
25	2434.1	17.6	36	491	7	96	29	70	395	63	1.50	30
26	2435.1	14.4	36	401	6	67	30	68	334	20	0.600	30
27	2436.1	15.8	29	355	0	0	29	46	355	0	Imp.	-
28	2437.1	14.8	38	436	5	57	33	59	379	39	1.00	30
29	2438.1	17.1	28	371	2	27	26	72	344	63	1.40	20
30	2439.1	14.6	32	362	7	79	25	68	283	23	0.500	30
31	2440.1	16.6	32	411	2	26	30	62	385	6	0.300	50
32	2441.1	18.6	25	360	0	0	25	68	360	53	1.20	30
33	2442.1	17.1	30	398	2	27	28	60	371	44	1.00	30
34	2443.1	14.1	23	251	0	0	23	67	251	16	0.500	40

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 Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

Depth Interval, Feet	2406.2 - 2427.6	2430.8 - 2444.2	2406.2 - 2444.2
Feet of Core Analyzed	12.0	9.3	21.3
Average Percent Porosity	16.7	16.2	16.5
Average Percent Original Oil Saturation	37.9	36.2	37.1
Average Percent Oil Recovery	11.3	6.6	9.3
Average Percent Residual Oil Saturation	26.6	29.6	27.8
Average Percent Residual Water Saturation	67.3	65.3	66.4
Average Percent Total Residual Fluid Saturation	93.9	94.9	94.2
Average Original Oil Content, Bbls./A. Ft.	492.	452.	474.
Average Oil Recovery, Bbls./A. Ft.	148.	83.	120.
Average Residual Oil Content, Bbls./A. Ft.	344.	369.	354.
Total Original Oil Content, Bbls./Acre	5,903.	4,202.	10,105.
Total Oil Recovery, Bbls./Acre	1,771.	775.	2,546.
Total Residual Oil Content, Bbls./Acre	4,132.	3,427.	7,559.
Average Effective Permeability, Millidarcys	0.419	0.815	0.591
Average Initial Fluid Production Pressure, p.s.i.	37.5	32.2	35.2

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

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2407.1	121,600			
2	2408.1	118,200			
3	2409.1	105,250			
4	2410.1	89,400			
5	2411.1	106,200			
6	2412.1	109,800			
7	2413.1	96,600			
8	2414.3	104,800			
9	2415.1	107,750			
10	2416.1	105,200			
11	2417.1	110,800			
12	2418.1	100,150			
13	2419.1	113,700			
14	2420.1	117,200			
15	2421.1	93,500			
16	2422.1	102,000			
17	2423.1	103,700			
18	2424.1	93,600			
19	2425.1	98,200			
20	2426.1	94,700			
21	2427.1	125,700			
22	2431.1	143,300			
23	2432.1	102,200			
24	2433.1	91,900			
25	2434.1	70,900			
26	2435.1	110,700			
27	2436.1	91,900			
28	2437.1	113,400			
29	2438.1	120,750			
30	2439.1	117,000			
31	2440.1	112,100			
32	2441.1	94,400			
33	2442.1	79,000			
34	2443.1	125,400			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

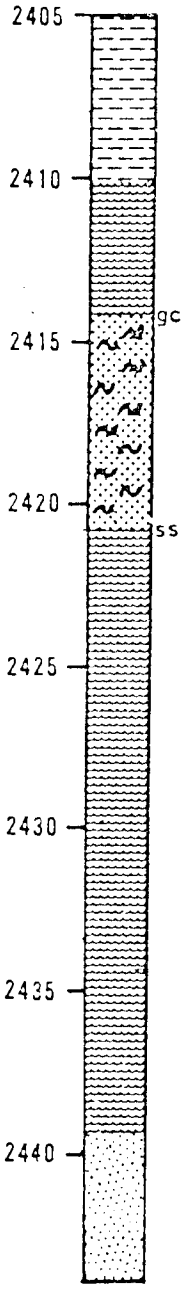
Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 14

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2406.2 - 2427.6	106,100		
2430.8 - 2444.2	104,900		
2406.2 - 2444.2	105,900		

Note: ppm — parts per million.

JACKSON BROS. JACKSON HEIRS NO. 14

23-25S-8E



mottled green gray siltstone with indistinct mottling and interbedded sandstone

small scale unidirectional asymmetrical current ripples

irregular wavy bedding

small scale unidirectional asymmetrical current ripples

large scale inclined planar crossbedding with minor contorted laminae