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

October 6, 1967

Jackson Brothers
514 North Main
Eureka, Kansas 67045

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Rice Lease, Well No. 1, Greenwood County, Kansas, and submitted to our laboratory on October 1, 1967.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bjo

6 c. - Eureka, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Rice Well No. 1

Location NW, NW

Section 10 Twp. 26S Rge. 8E County Greenwood State Kansas

Name of Sand	Upper Bartlesville
Top of Core	2430.0
Bottom of Core	2454.0
Top of Sand (Cored)	2430.0
Bottom of Sand (Cored)	2454.0
Total Feet of Permeable Sand	22.2
Total Feet of Floodable Sand	17.1

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	6.3	6.3
20 - 40	5.8	12.1
40 - 60	4.1	16.2
60 - 80	2.0	18.2
80 & above	4.0	22.2

Average Permeability Millidarcys	48.8
Average Percent Porosity	19.1
Average Percent Oil Saturation	32.8
Average Percent Water Saturation	49.2
Average Oil Content, Bbls./A. Ft.	485.
Total Oil Content, Bbls./Acre	11,022.
Average Percent Oil Recovery by Laboratory Flooding Tests	9.2
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	144.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,387.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	4,343.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Rice Well No. 1

Location NW, NW

Section 10 Twp. 26S Rge. 8E County Greenwood State Kansas

Name of Sand	Lower Bartlesville
Top of Core	2475.0
Bottom of Core	2495.0
Top of Sand	2484.3
Bottom of Sand	2492.2
Total Feet of Permeable Sand	7.9
Total Feet of Floodable Sand	5.7

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 20	2.9	2.9
20 - 60	4.0	6.9
60 & above	1.0	7.9

Average Permeability Millidarcys	38.2
Average Percent Porosity	18.4
Average Percent Oil Saturation	30.2
Average Percent Water Saturation	45.7
Average Oil Content, Bbls./A. Ft.	432.
Total Oil Content, Bbls./Acre	3,415.
Average Percent Oil Recovery by Laboratory Flooding Tests	4.2
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	59.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	335.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	1,402.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

A fresh water mud was used as a circulating fluid in the coring of the sands in this well. The cores were sampled and sealed in plastic bags by a representative of Oilfield Research Laboratories

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
	UPPER BARTLESVILLE SAND
2430.0 - 2432.6	Light brown carbonaceous sandstone.
2432.6 - 2433.2	Sandy conglomerate.
2433.2 - 2433.4	Shale.
2433.4 - 2438.5	Light brown sandstone.
2438.5 - 2439.9	Sandy conglomerate.
2439.9 - 2440.5	Brown shaly sandstone.
2440.5 - 2441.0	Gray sandy shale.
2441.0 - 2445.2	Gray and brown sandy conglomerate.
2445.2 - 2454.0	Light brown sandstone.
	LOWER BARTLESVILLE SAND
2475.0 - 2483.0	Sandy shale (discarded at well).
2483.0 - 2484.3	Dark and gray shale.
2484.3 - 2492.2	Light brown to brown sandstone.
2492.2 - 2492.4	Gray shaly sandstone.
2492.4 - 2493.0	Gray shale.
2493.0 - 2495.0	Shale (discarded at well).

Coring of the upper sand was started at a depth of 2430.0 feet in light brown carbonaceous sandstone while that of the lower sand was started at 2475.0 feet in sandy shale. The completion depths

for the upper and lower sands were at 2454.0 feet and 2495.0 feet respectively. The core shows a total of 25.0 feet of sandstone. For the most part, the pay is made up of light brown to brown sandstone.

PERMEABILITY

The weighted average permeability of the upper and lower sands is 48.8 and 38.2 millidarcys respectively (See Table III). By obsering the data given on the coregraph, it is noticeable that the sands have irregular permeability profiles. The permeability of the sands vary from 9.1 to a maximum of 199. millidarcys.

PERCENT SATURATION & OIL CONTENT

The weighted average percent oil saturation of the upper and lower sands is 32.8 and 30.2 respectively. The weighted average percent water saturation of the upper and lower sands is 49.2 and 45.7 respectively (See Table III). This gives overall weighted average total fluid saturations of 82.0 and 75.9 percent for the upper and lower sands respectively. These fairly low total fluid saturations indicates some 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 VI and VII. From the data given in these tables and on the coregraph, it is evident that considerable flushing of the sands occured during coring as the zones of higher permeability have the lower chloride content.

The weighted average oil content of the upper and lower sands is 485 and 432 barrels per acre foot respectively. The total oil content,

as shown by the cores, is 14,437 barrels per acre of which 11,022 barrels are in the upper sand (See Table III).

LABORATORY FLOODING TESTS

The upper sand in this core responded rather well to laboratory flooding tests, as a total recovery of 2,387 barrels of oil per acre was obtained from 16.6 feet of sand. The weighted average percent oil saturation was reduced from 33.5 to 24.3, or represents an average recovery of 9.2 percent. The weighted average effective permeability of the samples is 3.44 millidarcys, while the average initial fluid production pressure is 20.0 pounds per square inch (See Table V). The lower sand did not respond as well as the upper sand (See Tables IV and V).

By observing the data given in Table IV, you will note that of the 32 samples tested, 28 produced water and 24 oil. This indicates that approximately 75 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

On the basis of the above data we estimate that approximately 5,745 barrels of oil per acre can be recovered from the area represented by the cores of the two sands by efficient primary and waterflood operations. This represents 4,343 barrels per acre from the upper sand and 1,402 barrels from the lower zone. The following data and assumptions were used in calculating the above oil recovery values:

	Upper Sand	Lower Sand
Original formation volume factor	1.22	1.22
Irreducible water saturation, percent	34.0	31.0
Primary recovery, estimated, percent	None	None
Present oil saturation, percent	54.1	56.6

	Upper Sand	Lower Sand
Average porosity, percent	20.0	18.2
Oil saturation after flooding, percent	24.3	27.5
Performance factor	0.55	0.60
Net floodable pay sand, feet	17.1	5.7

The core of the upper sand shows a somewhat broken sand section having a fair oil saturation, a rather high water saturation and a good permeability. The core of the lower sand shows a thin clean sand section having reservoir characteristics similar to that of the upper sand. The results of chloride tests indicate that both sands were flushed by the circulating fluid during the cutting of the cores. This would partly account for lower oil and higher water saturations.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Rice Well No. 1

Upper Bartlesville Sand

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	2430.5	19.4	26	50	76	391	91.	1.0	1.0	391	91.00
2	2431.5	20.9	33	47	80	534	14.	1.0	2.0	534	14.00
3	2432.5	18.7	30	51	81	435	12.	0.6	2.6	261	7.20
4	2433.5	19.6	24	46	70	365	49.	0.6	3.2	218	29.40
5	2434.5	20.2	40	51	91	626	28.	1.0	4.2	626	28.00
6	2435.5	17.3	50	48	98	671	18.	1.0	5.2	671	18.00
7	2436.5	20.0	25	58	83	388	28.	1.0	6.2	388	28.00
8	2437.5	18.6	28	57	85	403	38.	1.0	7.2	403	38.00
9	2438.4	20.0	28	43	71	434	43.	0.5	7.7	217	21.50
F-9	2438.6	14.3	33	-	-	366	-	0.5	8.2	183	-
10	2439.5	14.6	35	56	91	396	4.3	0.9	9.1	356	3.97
11	2440.4	21.9	26	44	70	441	38.	0.6	9.7	264	22.80
12	2441.5	18.5	40	50	90	574	4.6	1.0	10.7	574	4.60
13	2442.6	14.1	39	56	95	430	2.9	1.0	11.7	430	2.90
14	2443.5	15.5	24	53	77	289	53.	1.0	12.7	289	53.00
15	2444.5	16.9	20	51	71	262	33.	1.2	13.9	314	39.60
16	2445.5	18.5	38	47	85	546	4.8	0.8	14.7	437	3.84
17	2446.5	21.6	44	51	95	738	101.	1.0	15.7	738	101.00
18	2447.5	20.1	26	43	69	406	62.	1.0	16.7	406	62.00
19	2448.5	22.8	40	47	87	708	50.	1.0	17.7	708	50.00
20	2449.5	20.3	28	49	77	441	199.	1.0	18.7	441	199.00
21	2450.5	21.3	39	42	81	649	78.	1.0	19.7	649	78.00
22	2451.5	20.3	41	40	81	646	35.	1.0	20.7	646	35.00
23	2452.5	18.5	26	42	68	373	43.	1.0	21.7	373	43.00
24	2453.5	21.7	30	52	82	505	111.	1.0	22.7	505	111.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Rice Well No. 1

Lower Bartlesville Sand

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	2484.5	19.6	32	46	78	486	14.	0.7	23.4	340	9.80
26	2485.5	15.4	30	48	78	358	37.	1.0	24.4	358	37.00
27	2486.5	18.8	31	47	78	451	133.	1.0	25.4	451	133.00
28	2487.5	19.9	28	47	75	432	20.	1.0	26.4	432	20.00
29	2488.5	18.1	38	43	81	533	33.	1.0	27.4	533	33.00
30	2489.5	16.9	31	35	66	406	43.	1.0	28.4	406	43.00
31	2490.5	18.6	22	50	72	318	9.1	1.0	29.4	318	9.10
32	2491.5	20.0	31	49	80	481	14.	1.2	30.6	577	16.80

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Rice Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
		Upper Bartlesville	
2430.0 - 2440.5	9.2	32.8	301.87
2441.0 - 2454.0	13.0	60.2	782.94
2430.0 - 2454.0	22.2	48.8	1,084.81
		Lower Bartlesville	
2484.3 - 2492.2	7.9	38.2	301.70

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
			Upper Bartlesville			
2430.0 - 2440.5	9.7	18.9	32.4	50.8	465	4,512
2441.0 - 2454.0	13.0	19.2	33.1	48.0	500	6,510
2430.0 - 2454.0	22.7	19.1	32.8	49.2	485	11,022
			Lower Bartlesville			
2484.3 - 2492.2	7.9	18.4	30.2	45.7	432	3,415

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Rice 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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
					Upper Bartlesville Sand							
1	2430.5	19.0	26	383	3	44	23	66	339	74	1.40	20
2	2431.5	20.4	33	522	11	174	22	70	348	50	1.10	20
3	2432.5	18.2	30	424	5	71	25	73	353	8	0.20	35
4	2433.5	19.1	24	356	1	15	23	72	341	19	0.50	25
5	2434.5	20.5	40	636	13	207	27	66	429	65	1.40	20
6	2435.5	17.0	50	659	23	303	27	72	356	17	0.40	30
7	2436.5	20.1	25	390	3	47	22	64	343	52	1.10	20
8	2437.5	19.0	28	413	3	44	25	66	369	27	0.70	25
9	2438.6	14.3	33	366	0	0	33	60	366	0	Imp.	-
10	2439.5	14.2	32	353	0	0	32	62	353	0	Imp.	-
11	2440.4	21.6	26	436	5	84	21	69	352	57	1.50	20
12	2441.5	18.0	37	517	0	0	37	56	517	0	Imp.	-
13	2442.6	14.5	36	405	0	0	36	60	405	0	Imp.	-
14	2443.5	15.4	25	299	0	0	25	67	299	14	0.27	35
15	2444.5	16.4	22	280	0	0	22	73	280	2	0.10	45
16	2445.5	18.0	38	531	11	154	27	63	377	7	0.20	35
17	2446.5	21.3	44	728	20	331	24	70	397	165	5.10	10
18	2447.5	19.7	26	398	3	46	23	72	352	119	4.70	20
19	2448.5	22.9	40	711	18	320	22	65	391	270	9.40	10
20	2449.5	20.4	28	443	5	79	23	74	364	231	8.40	10
21	2450.5	21.0	39	636	16	261	23	75	375	128	4.70	10
22	2451.5	20.6	41	655	12	192	29	62	463	62	1.40	20
23	2452.5	18.8	26	379	2	29	24	65	350	66	1.80	20
24	2453.5	21.8	30	508	5	85	25	72	423	313	14.00	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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Rice 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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
					Lower	Bartlesville		Sand				
25	2484.5	19.3	32	479	5	75	27	60	404	17	0.50	30
26	2485.5	15.8	30	368	1	12	29	63	356	32	0.80	20
27	2486.5	19.2	31	462	3	45	28	56	417	50	1.00	20
28	2487.5	20.4	28	444	3	48	25	63	396	58	1.70	20
29	2488.5	17.6	38	520	7	96	31	68	424	12	0.37	35
30	2489.5	17.3	31	417	6	81	25	63	336	33	0.80	25
31	2490.5	18.2	23	325	0	0	23	69	325	54	1.40	20
32	2491.5	19.5	29	439	0	0	29	55	439	10	0.30	35

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 Brothers Lease Rice Well No. 1

	Upper Bartlesville			
Depth Interval, Feet	2430.0 - 2440.5	2441.0 - 2454.0	2430.0 - 2454.0	2484.3 - 2492.2
Feet of Core Analyzed	7.8	8.8	16.6	5.7
Average Percent Porosity	19.4	20.6	20.0	18.2
Average Percent Original Oil Saturation	32.2	34.6	33.5	31.7
Average Percent Oil Recovery	8.1	10.2	9.2	4.2
Average Percent Residual Oil Saturation	24.1	24.4	24.3	27.5
Average Percent Residual Water Saturation	68.2	68.8	68.4	62.2
Average Percent Total Residual Fluid Saturation	92.3	93.2	92.7	89.7
Average Original Oil Content, Bbls./A. Ft.	497.	555.	528.	447.
Average Oil Recovery, Bbls./A. Ft.	118.	167.	144.	59.
Average Residual Oil Content, Bbls./A. Ft.	379.	388.	384.	388.
Total Original Oil Content, Bbls./Acre	3,873.	4,883.	8,756.	2,547.
Total Oil Recovery, Bbls./Acre	921.	1,466.	2,387.	335.
Total Residual Oil Content, Bbls./Acre	2,952.	3,417.	6,369.	2,212.
Average Effective Permeability, Millidarcys	0.951	5.64	3.44	0.878
Average Initial Fluid Production Pressure, p.s.i.	23.9	16.1	20.0	25.0

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 Brothers Lease Rice Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation Connate	Drilling & Foreign	Total
		Upper Bartlesville Sand			
1	2430.5	11,860			
2	2431.5	7,660			
3	2432.5	73,250			
4	2433.5	8,550			
5	2434.5	7,435			
6	2435.5	95,600			
7	2436.5	4,885			
8	2437.5	9,185			
9	2438.4	61,700			
10	2439.5	65,150			
11	2440.4	7,635			
12	2441.5	46,400			
13	2442.6	83,100			
14	2443.5	58,050			
15	2444.5	31,900			
16	2445.5	44,550			
17	2446.5	10,050			
18	2447.5	8,700			
19	2448.5	6,840			
20	2449.5	7,660			
21	2450.5	8,265			
22	2451.5	9,280			
23	2452.5	15,030			
24	2453.5	3,307			
		Lower Bartlesville Sand			
25	2484.5	25,390			
26	2485.5	10,860			
27	2486.5	13,140			
28	2487.5	8,085			
29	2488.5	90,300			
30	2489.5	16,650			
31	2490.5	56,250			
32	2491.5	93,150			

Note: ppm — parts per million

Oilfield Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

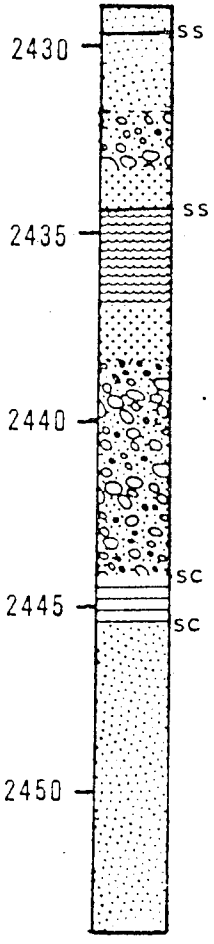
Company Jackson Brothers Lease Rice Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
	Upper Bartlesville Sand		
2430.0 - 2440.5	30,400		
2441.0 - 2454.0	25,420		
2430.0 - 2454.0	27,500		
	Lower Bartlesville Sand		
2484.3 - 2492.2	41,100		

Note: ppm — parts per million.

JACKSON BROS. RICE NO. 1
10-26S-8E

Skinner SS.



large scale inclined planar bedding

angular dark gray shale clasts
massive bedding

low amplitude asymmetrical current ripples
massive bedding

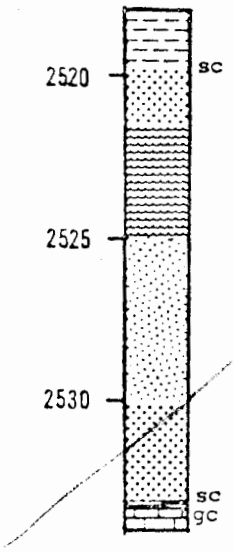
angular to rounded dark gray shale clasts

dark gray siltstone with small current ripples

large scale inclined planar bedding with some interspersed current ripples

JACKSON BROS. CREW NO. 14

34-25S-8E



greenish gray siltstone with ripples

massive bedding with dolomite cement

small scale unidirectional asymmetrical current ripples

large scale inclined planar bedding with dolomite cement

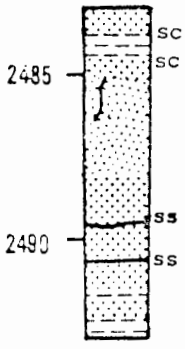
massive bedding

black calcareous siltstone; reworked lime packstone with brachiopods echinoderms, and bryozoans

Burbank SS.

JACKSON BROS. RICE NO. 1

10-26S-8E



generally a massive sandstone with faint discontinuous wavy irregular shale and carbonaceous wisps; crumbly non-laminated greenish-red-brown mottled claystone with slickensides; vertical soft sediment slump crack

large scale inclined planar bedding with dolomite cement

generally a massive sandstone with faint medium scale, tangential at the base, cross laminations

silty massive sandstone

mottled green gray siltstone with iron nodules and slickensides