Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Jackson Heirs Well No. 24

Location NW SW SW

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

Name of Sand	Bartlesville
Top of Core	2510.0
Bottom of Core	2526.0
Top of Sand (Cored)	2510.0
Bottom of Sand	2524.2
Total Feet of Permeable Sand	13.2
Total Feet of Floodable Sand	7.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	1.6	1.6
1 - 5	7.0	8.6
5 - 10	2.0	10.6
10 & above	2.6	13.2

Average Permeability Millidarcys	5.5
Average Percent Porosity	17.0
Average Percent Oil Saturation	26.6
Average Percent Water Saturation	58.1
Average Oil Content, Bbls./A. Ft.	349.
Total Oil Content, Bbls./Acre	4,951.
Average Percent Oil Recovery by Laboratory Flooding Tests	4.5
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	63.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	513.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	1,500.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

23-25-8E

Jackson Heirs 24

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Jackson Brothers Lease Jackson Heirs Well No. 24

Depth Interval, Feet	2510.0 - 2516.6	2516.6 - 2524.2	2510.0 - 2524.2
Feet of Core Analyzed	4.0	4.1	8.1
Average Percent Porosity	18.3	16.5	17.4
Average Percent Original Oil Saturation	28.5	22.4	25.4
Average Percent Oil Recovery	7.8	1.4	4.5
Average Percent Residual Oil Saturation	20.7	21.0	20.9
Average Percent Residual Water Saturation	76.5	73.3	74.9
Average Percent Total Residual Fluid Saturation	97.2	94.3	95.8
Average Original Oil Content, Bbls./A. Ft.	405.	287.	345.
Average Oil Recovery, Bbls./A. Ft.	110.	18.	63.
Average Residual Oil Content, Bbls./A. Ft.	295.	269.	282.
Total Original Oil Content, Bbls./Acre	1,622.	1,177.	2,799.
Total Oil Recovery, Bbls./Acre	441.	72.	513.
Total Residual Oil Content, Bbls./Acre	1,181.	1,105.	2,286.
Average Effective Permeability, Millidarcys	0.85	0.75	0.80
Average Initial Fluid Production Pressure, p.s.i.	35.0	31.0	33.0

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

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Brothers Lease Jackson Heirs Well No. 24

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2510.0 - 2516.6	95,015		
2516.6 - 2524.2	101,106		
2510.0 - 2524.2	98,171		

Note: ppm — parts per million.

A fresh water mud was used as a circulating fluid in the coring of the sand in this well. This well was drilled in a virgin area. The core was sampled and sealed in tin cans by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2510.0 - 2524.2	Light brown fine grained micaceous slightly shaly sandstone.
2524.2 - 2526.0	Dark shale.

Coring was started at a depth of 2510.0 feet in light brown fine grained micaceous slightly shaly sandstone and completed at 2526.0 feet in dark shale. This core shows a total of 14.2 feet of 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 5.8 and 5.2 millidarcys respectively; the overall average being 5.5 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 20 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 26.6. The weighted average percent oil saturation

of the upper and lower sections is 28.1 and 25.4 respectively. The weighted average percent water saturation of the upper and lower sections is 54.8 and 61.2 respectively; the overall average being 58.1 (See Table III). This gives an overall weighted average total fluid saturation of 84.7 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 a small amount of flushing of the sand did occur during the cutting of same.

The weighted average oil content of the upper and lower sections is 389 and 314 barrels per acre foot respectively; the overall average being 349. The total oil content, as shown by this core, is 4,951 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

Inasmuch as the sand in the core has a fairly low oil saturation, one would expect very little oil to be recovered by laboratory flooding tests.

A total recovery of 513 barrels of oil per acre was obtained from 8.1 feet of sand. The weighted average percent oil saturation was reduced from 25.4 to 20.9, or represents an average recovery of 4.5 percent. The weighted average effective permeability of the samples if 0.80 millidarcys, while the average initial fluid production pressure is 33.0

pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 14 samples tested, 9 produced water and 8 oil. This indicates that approximately 57 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

On the basis of the above data, we estimate that approximately 1,500 barrels of oil per acre or an average of 200 barrels per acre-foot can be recovered from the area, represented by this core, by efficient primary and secondary operations. The following data and assumptions were used in calculating the above oil recovery value:

Present formation volume factor	1.22
Irreducible water saturation, percent	41.0
Primary recovery	None
Present oil saturation, percent	48.3
Average porosity, percent	17.4
Oil saturation after flooding, percent	20.9
Performance factor, percent	55.0
Net floodable pay sand, feet	7.5

This core shows a thin sand section having a fairly low oil saturation a high water saturation, an average porosity, and a low permeability.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Jackson Heirs Well No. 24

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	2510.1	14.4	26	41	73	291	0.16	0.6	0.6	176	0.10
2	2511.1	18.9	27	59	86	396	2.6	1.0	1.6	396	2.60
3	2512.1	17.7	27	59	86	371	3.3	1.0	2.6	371	3.30
4	2513.1	18.2	34	56	90	480	2.0	1.0	3.6	480	2.00
5	2514.1	18.6	27	53	80	390	7.0	1.0	4.6	390	7.00
6	2515.1	17.2	27	53	80	360	3.1	1.0	5.6	360	3.10
7	2516.1	18.2	28	57	85	395	20.	1.0	6.6	395	20.00
8	2517.1	16.7	22	57	79	285	2.6	1.0	7.6	285	2.60
9	2518.1	17.6	22	55	77	300	1.8	1.0	8.6	300	1.80
10	2519.1	15.1	35	62	97	410	0.73	1.0	9.6	410	0.73
11	2520.0	15.5	32	54	86	385	Imp.	0.5	10.1	192	0.00
F-11	2520.2	16.2	24	-	-	301	-	0.5	10.6	150	-
12	2521.1	14.4	28	70	98	313	8.8	1.0	11.6	313	8.80
13	2522.1	17.3	24	58	82	322	2.8	1.0	12.6	322	2.80
14	2523.1	15.7	21	66	87	256	11.	1.6	14.2	411	17.60

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Jackson Heirs Well No. 24

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2510.0 - 2516.6	6.6	5.8	38.10
2516.6 - 2524.2	6.6	5.2	34.33
2510.0 - 2524.2	13.2	5.5	72.43

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
2510.0 - 2516.6	6.6	17.8	28.1	54.8	389	2,568
2516.6 - 2524.2	7.6	16.1	25.4	61.2	314	2,383
2510.0 - 2524.2	14.2	17.0	26.6	58.1	349	4,951

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Jackson Heirs Well No. 24

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	2510.1	14.7	24	274	0	0	24	54	274	0	Imp.	-
2	2511.1	18.4	24	343	0	0	24	68	343	0	Imp.	-
3	2512.1	17.4	25	337	0	0	25	65	337	0	Imp.	-
4	2513.1	18.6	34	490	10	144	24	75	346	9	0.30	50
5	2514.1	18.6	27	390	5	72	22	75	318	27	0.80	30
6	2515.1	17.5	27	339	6	81	19	75	258	41	0.90	30
7	2516.1	18.5	28	403	10	144	18	81	259	56	1.40	30
8	2517.1	16.9	22	289	1	13	21	79	276	20	0.60	30
9	2518.1	17.2	20	267	0	0	20	75	267	8	0.30	50
10	2519.1	14.8	32	368	0	0	32	66	368	0	Imp.	-
11	2520.2	16.2	24	301	2	25	22	71	276	24	0.50	30
12	2521.1	14.8	25	287	0	0	25	73	287	0	Imp.	-
13	2522.1	16.9	24	315	2	26	22	66	289	8	0.30	50
14	2523.1	16.2	21	264	1	13	20	75	251	50	1.20	20

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 WATER DIFFERENTIATION TESTS

TABLE VI

Company Jackson Brothers Lease Jackson Heirs Well No. 24

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2510.1	102,200			
2	2511.1	92,700			
3	2512.1	89,100			
4	2513.1	95,200			
5	2514.1	93,100			
6	2515.1	98,200			
7	2516.1	97,500			
8	2517.1	103,000			
9	2518.1	101,600			
10	2519.1	95,500			
11	2520.0	67,900			
12	2521.1	106,000			
13	2522.1	102,000			
14	2523.1	109,850			

Note: ppm — parts per million