Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Barrier Well No. 43

Location SE, SE, SE, NW

Section 3 Twp. 26S Rge. 8E County Greenwood State Kansas

Name of Sand	Upper Bartlesville
Top of Core	2430.0
Bottom of Core (Received)	2440.0
Top of Sand (According to driller)	2428.0
Bottom of Sand	2439.5
Total Feet of Permeable Sand	4.5
Total Feet of Floodable Sand	4.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 60	2.5	2.5
60 - 100	2.0	4.5

Average Permeability Millidarcys	71.8
Average Percent Porosity	20.1
Average Percent Oil Saturation	23.4
Average Percent Water Saturation	28.0
Average Oil Content, Bbls./A. Ft.	364.
Total Oil Content, Bbls./Acre	1,639.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	81.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	282.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	1,317.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

3-26-8E

Barrier 43

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers [redacted] Barrier Well No. 43

Location SE, SE, SE, NW

Section 3 Twp. 26S Rge. 8E County Greenwood State Kansas

Name of Sand	Lower Burlesville
Top of Core	2490.0
Bottom of Core	2498.0
Top of Sand (According to driller)	2489.0
Bottom of Sand	2492.6
Total Feet of Permeable Sand	1.8
Total Feet of Floodable Sand	

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.

Average Permeability Millidarcys	2.5
Average Percent Porosity	14.9
Average Percent Oil Saturation	16.9
Average Percent Water Saturation	57.3
Average Oil Content, Bbls./A. Ft.	200.
Total Oil Content, Bbls./Acre	639.
Average Percent Oil Recovery by Laboratory Flooding Tests	None
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	None
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	None
Total Calculated Oil Recovery, Bbls./Acre	
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Oilfield Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company Jackson Brothers **Lease** Barrier **Well No.** 43

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2430.5	26,890			
2	2431.6	28,670			
3	2435.9	34,025			
4	2437.5	15,515			
5	2438.5	25,510			
6	2490.4	84,150			
7	2491.4	98,900			
		183 050			
		91 525			
		5 130610			
		26122			

Note: ppm — parts per million

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Jackson Brothers Lease Barrier Well No. 43

Depth Interval, Feet	2430.0 - 2439.0
Feet of Core Analyzed	3.5
Average Percent Porosity	19.9
Average Percent Original Oil Saturation	23.4
Average Percent Oil Recovery	5.1
Average Percent Residual Oil Saturation	18.3
Average Percent Residual Water Saturation	77.5
Average Percent Total Residual Fluid Saturation	95.8
Average Original Oil Content, Bbls./A. Ft.	364.
Average Oil Recovery, Bbls./A. Ft.	81.
Average Residual Oil Content, Bbls./A. Ft.	283.
Total Original Oil Content, Bbls./Acre	1,273.
Total Oil Recovery, Bbls./Acre	282.
Total Residual Oil Content, Bbls./Acre	991.
Average Effective Permeability, Millidarcys	10.5
Average Initial Fluid Production Pressure, p.s.i.	10.0

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

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 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
	UPPER BARTLESVILLE SAND
2430.0 - 2431.0	Brown fine grained micaceous sandstone.
2431.0 - 2431.3	Gray sandy shale.
2431.3 - 2431.7	Light brown fine grained micaceous slightly conglomeratic sandstone.
2431.7 - 2432.2	Light brown fine grained micaceous shaly sandstone.
2432.2 - 2435.4	Gray sandy shale.
2435.4 - 2436.0	Brown fine grained micaceous sandstone.
2436.0 - 2437.0	Gray sandy shale.
2437.0 - 2439.0	Brown fine grained micaceous sandstone.
2439.0 - 2439.5	Brown fine grained micaceous conglomeratic sandstone.
2439.5 - 2440.0	Coal.
	LOWER BARTLESVILLE SAND
2490.0 - 2490.5	Light brown fine grained micaceous slightly shaly sandstone.
2490.5 - 2491.3	Gray sandy shale.
2491.3 - 2492.6	Brown fine grained micaceous slightly shaly sandstone containing an angular fracture.
2492.6 - 2496.0	Gray sandy shale containing an angular fracture.
2496.0 - 2497.3	Brownish gray fine grained micaceous sandy shale.
2497.3 - 2498.0	Dark shale.

Coring was started in the upper Bartlesville sand at a depth of 2430.0 feet and completed at 2498.0 feet in dark shale below the lower Bartlesville sand. The break between the two sands was drilled with Rotary tools. The cores show a toral of 6.9 feet of sandstone. For the most part, the pay is made up of brown fine grained sandstone. Two feet of the upper Bartlesville and one foot of the lower Bartlesville sands were drilled before coring was started.

PERMEABILITY

The weighted average permeability of the upper and lower sands is 71.8 and 2.5 millidarcys respectively (See Table III). By observing the data given on the coregraph, it is noticeable that the upper sand has a somewhat irregular permeability profile. The permeability of the sands varies from 1.6 to a maximum of 137.0 millidarcys.

PERCENT SATURATION & OIL CONTENT

The weighted average percent oil saturation of the upper and lower sands is 23.4 and 16.9 respectively. The weighted average percent water saturation of the corresponding sands is 28.0 and 57.3 respectively (See Table III). This gives an overall weighted average total fluid saturation of 51.4 and 74.2 percent respectively for the upper and lower sands.

In an effort to determine whether or not any flushing of the sand occurred during coring, part of the saturation samples were analyzed for chloride content. The results of these tests are given in Table VI. From the data given in these tables and on the coregraph, it is evident that considerable flushing of the sand did occur during coring as the zones of higher permeability had a much lower chloride content.

The weighted average oil content of the upper and lower sands is

364 and 200 barrels per acre foot respectively. The total oil content, as shown by these cores, is 2,278 barrels per acre of which 1,639 barrels are in the upper pay sand (See Table III).

LABORATORY FLOODING TESTS

The upper Bartlesville sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 282 barrels of oil per acre was obtained from 3.5 feet of sand. The weighted average percent oil saturation was reduced from 23.4 to 18.3, or represents an average recovery of 5.1 percent. The weighted average effective permeability of the samples is 10.5 millidarcys, while the average initial fluid production pressure is 10.0 pounds per square inch (See Table V). No oil was recovered from the lower sand samples.

By observing the data given in Table IV, you will note that of the 10 samples tested, 6 produced water and 5 oil. This indicates that approximately 50 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

On the basis of the above data, we estimate that approximately 1,317 barrels of oil per acre can be recovered from the area, represented by the upper Bartlesville sand core, by efficient primary and waterflood operations. The tests indicate that the lower sand is not floodable. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.23
Irreducible water saturation, percent	39.0
Average porosity, percent	20.1

Oil saturation after flooding, percent	18.3
Performance factor	0.60
Net floodable pay sand, feet	4.5

The core of the upper Bartlesville sand shows a thin broken sand section having a low oil and water saturation and a good porosity and permeability. The low water and total fluid saturations indicate that this core may have been exposed to air for a considerable period before it was sampled. The lower Bartlesville sand core shows only 1.8 feet of tight sand.

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Barrier Well No. 43

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
		UPPER BARTLESVILLE SAND	
2430.0 - 2439.0	4.5	71.8	322.90
		LOWER BARTLESVILLE SAND	
2490.0 - 2497.3	1.8	2.5	4.44

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 SAND			
2430.0 - 2439.0	4.5	20.1	23.4	28.0	364	1,639
			LOWER BARTLESVILLE SAND			
2490.0 - 2497.3	3.2	14.9	16.9	57.3	200	639

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Barrier Well No. 43

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	20.5	21	334	0	0	21	73	334	34	1.07	20
2	2431.6	18.6	21	303	2	29	19	79	274	196	9.04	10
3	2435.9	20.2	32	501	12	188	20	70	313	109	5.33	10
4	2437.5	20.5	23	366	6	95	17	80	271	337	15.91	10
5	2438.5	20.5	21	334	3	48	18	78	286	279	6.53	10
					LOWER BARTLESVILLE SAND							
6	2490.4	16.3	22	278	0	0	22	53	278	0	Imp.	-
7	2491.4	16.4	18	229	0	0	18	65	229	3	0.09	40
8	2492.5	16.3	16	202	0	0	16	62	202	0	Imp.	-
9	2496.4	13.3	10	103	0	0	10	75	103	0	Imp.	-
10	2497.3	13.7	14	149	0	0	14	62	149	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.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Barrier Well No. 43

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.		
					UPPER BARTLESVILLE						
1	2430.5	21.0	23	20	43	375	28.	1.0	1.0	375	28.00
2	2431.6	18.3	21	22	43	298	59.	0.9	1.9	268	53.10
3	2435.9	20.6	32	27	59	512	58.	0.6	2.5	307	34.80
4	2437.6	20.2	23	48	71	361	137.	1.0	3.5	361	137.00
5	2438.5	20.1	21	22	43	328	70.	1.0	4.5	328	70.00
					LOWER BARTLESVILLE						
6	2490.4	16.7	24	46	70	311	2.2	0.5	5.0	155	1.10
7	2491.4	15.9	20	57	77	247	3.4	0.7	5.7	173	2.38
8	2492.5	16.7	14	59	73	181	1.6	0.6	6.3	109	0.96
9	2496.4	12.9	12	67	79	120	Imp.	0.8	7.1	96	0.00
10	2497.3	13.4	17	52	69	177	Imp.	0.6	7.7	106	0.00