Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

elevation 1475

Company Jackson Brothers Lease Crew Well No. 24

Location SE NW NE

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

3-26-8E

Crew 24

Name of Sand	Bartlesville
Top of Core	2516.0
Bottom of Core	2544.0
Top of Sand (Cored)	2516.0
Bottom of Sand Pay	2542.0
Total Feet of Permeable Sand (Analyzed)	27.1
Total Feet of Floodable Sand	24.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	3.1	3.1
10 - 20	11.2	14.3
20 - 50	7.3	21.6
50 - 75	3.5	25.1
75 & above	2.0	27.1

Average Permeability Millidarcys	28.1
Average Percent Porosity	17.6
Average Percent Oil Saturation	19.4
Average Percent Water Saturation	63.0
Average Oil Content, Bbls./A. Ft.	264
Total Oil Content, Bbls./Acre	7,266
Average Percent Oil Recovery by Laboratory Flooding Tests	2.3
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	33
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	369
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	5,000
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 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
2516.0 - 2517.5	Light brown fine grained micaceous slightly shaly sandstone.
2517.5 - 2518.0	Light brown shaly sandstone.
2518.0 - 2528.3	Light brown fine grained micaceous slightly shaly sandstone.
2528.3 - 2542.0	Light brown fine grained micaceous sandstone.
2542.0 - 2542.5	Light brown fine grained micaceous shaly sandstone.
2542.5 - 2544.0	Light brown fine grained micaceous sandstone.

Coring was started at a depth of 2516.0 feet in light brown fine grained micaceous slightly shaly sandstone and completed at 2544.0 feet in light brown fine grained micaceous sandstone. This core shows a total of 28.0 feet of sandstone. For the most part, the pay is made up of light brown fine grained micaceous to 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 17.3 and 59.0 millidarcys respectively; the overall average being 28.1 (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 6.9 to a maximum of 112. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 19.4. The weighted average percent oil saturation of the upper and lower sections is 20.3 and 16.7 respectively. The weighted average percent water saturation of the upper and lower sections is 61.6 and 67.2 respectively; the overall average being 63.0 (See Table III). This gives an overall weighted average total fluid saturation of 82.4 percent. This fairly low total fluid saturation 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 some flushing of the sand did occur during the cutting of same as, for the most part, the zones of higher permeability have the lower chloride content.

The weighted average oil content of the upper and lower sections is 278 and 226 barrels per acre foot respectively; the overall average being 264. The total oil content, as shown by this core, is 7,266 barrels per acre. (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the core shows a low oil saturation, one would expect very little oil to be recovered from laboratory flooding tests. However, a total recovery of 369 barrels of oil per acre was obtained from 11.3 feet of sand. The weighted average percent oil saturation was reduced from 22.4 to 20.1, or represents an average recovery of 2.3 percent. The weighted average effective permeability of the samples is 2.63 millidarcys, while the average initial fluid production pressure is 22.8 pounds per square inch. (See Table V).

By observing the data given in Table IV, you will note that of the 28 samples tested, all produced water and 11 oil. This indicates that all of the sand represented by these samples is permeable to water.

CONCLUSION

On the basis of the above data, we estimate that approximately 5,000 barrels of oil per acre or an overage of 204 barrels per acre-foot can be recovered from the area, represented by this core, by efficient primary and waterflood operations. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.23
Irreducible water saturation, percent	42.0
Primary recovery	None
Present oil saturation, percent	47.2
Average porosity, percent	17.6

Oil saturation after flooding, percent	20.1
Performance factor, percent	55.0
Net floodable pay sand, feet	24.5

This core shows a clean sand section having a low oil saturation, a rather high water saturation, a fair porosity and a good permeability. Chances are, the low oil and rather high water saturation are partly due to the flushing of the sand and expansion of solution gas during the removal of the core from the well. No difficulty should be encountered in forcing the sand to take an ample volume of water.

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Crew Well No. 24

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2516.0 - 2536.6	20.1	17.3	347.48
2536.6 - 2544.0	7.0	59.0	412.95
2516.0 - 2544.0	27.1	28.1	760.43

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
2516.0 - 2536.6	20.1	17.6	20.3	61.6	278	5,592
2536.6 - 2544.0	7.4	17.5	16.7	67.2	226	1,674
2516.0 - 2544.0	27.5	17.6	19.4	63.0	264	7,266

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Jackson Brothers Lease Crew Well No. 24

Depth Interval, Feet	2516.0 to 2544.0
Feet of Core Analyzed	11.3
Average Percent Porosity	18.1
Average Percent Original Oil Saturation	22.4
Average Percent Oil Recovery	2.3
Average Percent Residual Oil Saturation	20.1
Average Percent Residual Water Saturation	73.6
Average Percent Total Residual Fluid Saturation	93.7
Average Original Oil Content, Bbls./A. Ft.	315.
Average Oil Recovery, Bbls./A. Ft.	33.
Average Residual Oil Content, Bbls./A. Ft.	282
Total Original Oil Content, Bbls./Acre	3,560
Total Oil Recovery, Bbls./Acre	369
Total Residual Oil Content, Bbls./Acre	3,191
Average Effective Permeability, Millidarcys	2.63
Average Initial Fluid Production Pressure, p.s.i.	22.8

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 Crew Well No. 24

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2516.0 - 2536.6	88,487		
2536.6 - 2544.0	60,491		
2516.0 - 2544.0	81,255		

Note: ppm — parts per million.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Crew Well No. 24

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Millidarcys	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	2516.1	19.2	16	58	74	238	10.	0.6	0.6	143	6.00
2	2517.1	19.0	21	57	78	309	10.	0.9	1.5	278	9.00
3	2518.1	18.4	16	59	75	228	9.3	0.6	2.1	137	5.58
4	2519.1	18.4	19	60	79	271	15.	1.0	3.1	271	15.00
5	2520.1	18.4	27	59	86	386	9.7	1.0	4.1	386	9.70
6	2521.1	18.2	32	60	92	452	10.	1.0	5.1	452	10.00
7	2522.1	17.2	18	60	78	240	6.9	1.0	6.1	240	6.90
8	2523.1	16.9	22	65	87	289	11.	1.0	7.1	289	11.00
9	2524.1	17.6	18	61	79	246	13.	1.0	8.1	246	13.00
10	2525.1	16.5	27	64	91	346	12.	1.0	9.1	346	12.00
11	2526.1	18.5	24	58	82	345	14.	1.0	10.1	345	14.00
12	2527.1	17.7	14	60	74	192	14.	1.0	11.1	192	14.00
13	2528.1	18.5	16	59	75	230	19.	0.7	11.8	161	13.30
14	2529.1	18.0	21	60	81	293	20.	1.3	13.1	381	26.00
15	2530.1	18.1	19	62	81	267	46.	1.0	14.1	267	46.00
16	2531.1	17.7	20	63	83	275	21.	1.0	15.1	275	21.00
17	2532.1	18.9	20	62	82	293	10.	1.0	16.1	293	10.00
18	2533.1	15.2	15	63	78	177	20.	1.0	17.1	177	20.00
19	2534.1	15.8	22	68	90	270	48.	1.0	18.1	270	48.00
20	2535.1	15.3	18	65	83	214	12.	1.0	19.1	214	12.00
21	2536.1	17.4	17	63	75	229	25.	1.0	20.1	229	25.00
22	2537.1	16.1	20	69	89	250	112.	1.0	21.1	250	112.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

beautiful Ripples w/ little shale to stop K

Company Jackson Brothers Lease Crew 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.		
23	2538.1	17.9	19	63	82	264	53.	1.0	22.1	264	53.00
24	2539.1	16.9	19	62	81	249	78.	1.0	23.1	249	78.00
25	2540.1	18.4	12	67	79	171	33.	1.0	24.1	171	33.00
26	2541.1	19.0	17	59	76	251	52.	1.0	25.1	251	52.00
F-27	2541.9	18.6	18	--	--	260	--	0.4	25.5	104	-----
27	2542.1	17.4	17	76	93	230	7.9?	0.5	26.0	115	3.95
28	2543.1	16.6	14	75	89	180	54.	1.5	27.5	270	81.00

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Crew 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	2516.1	18.8	16	233	0	0	16	67	233	20	0.50	30
2	2517.1	18.6	19	274	0	0	19	70	274	20	0.50	30
3	2518.1	17.9	15	208	0	0	15	71	208	17	0.40	30
4	2519.1	18.7	19	276	1	15	18	71	261	35	0.67	25
5	2520.1	18.6	27	389	3	43	24	69	346	28	0.60	30
6	2521.1	18.4	32	457	9	129	23	67	328	28	0.60	30
7	2522.1	17.7	19	261	0	0	19	67	261	26	0.60	30
8	2523.1	16.7	20	259	0	0	20	72	259	20	0.40	30
9	2524.1	17.2	16	213	0	0	16	69	213	33	0.70	30
10	2525.1	16.8	27	352	4	52	23	74	300	34	0.70	30
11	2526.1	18.1	24	337	2	28	22	67	309	24	0.60	30
12	2527.1	17.4	13	176	0	0	13	79	176	38	0.80	25
13	2528.1	19.0	18	266	0	0	18	62	266	47	1.10	25
14	2529.1	18.4	21	300	1	14	20	72	286	38	0.80	25
15	2530.1	18.6	18	260	0	0	18	80	260	123	3.60	15
16	2531.1	18.1	20	281	1	14	19	72	267	96	2.30	20
17	2532.1	19.1	20	297	1	15	19	78	282	118	3.40	15
18	2533.1	15.1	13	152	0	0	13	73	152	29	0.70	25
19	2534.1	16.2	23	289	0	0	23	74	289	61	1.10	20
20	2535.1	15.8	16	196	0	0	16	80	196	69	1.30	20
21	2536.1	17.7	19	261	1	14	18	79	247	185	5.00	15
22	2537.1	16.6	18	232	0	0	18	81	232	228	6.40	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.

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Crew 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.			
23	2538.1	18.2	19	268	2	28	17	82	240	226	6.60	15
24	2539.1	17.1	19	252	1	13	18	79	239	268	8.20	15
25	2540.1	18.8	14	204	0	0	14	80	204	89	1.90	20
26	2541.1	18.7	17	247	0	0	17	81	247	158	4.80	15
27	2541.9	18.6	18	260	0	0	18	81	260	110	2.60	20
28	2543.1	16.2	12	151	0	0	12	82	151	52	1.10	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 Crew Well No. 24

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation Connate	Drilling & Foreign	Total
1	2516.1	10,300			
2	2517.1	102,800			
3	2518.1	78,800			
4	2519.1	89,600			
5	2520.1	88,500			
6	2521.1	92,100			
7	2522.1	106,000			
8	2523.1	97,800			
9	2524.1	97,800			
10	2525.1	93,600			
11	2526.1	85,950			
12	2527.1	105,000			
13	2528.1	95,600			
14	2529.1	105,000			
15	2530.1	48,600			
16	2531.1	102,800			
17	2532.1	59,300			
18	2533.1	75,000			
19	2534.1	74,000			
20	2535.1	105,700			
21	2536.1	107,450			
22	2537.1	70,850			
23	2538.1	44,600			
24	2539.1	26,200			
25	2540.1	18,820			
26	2541.1	61,820			
27	2542.1	107,800			
28	2543.1	98,200			

Note: ppm — parts per million