10

elevation

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GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease Hawthorne Well No. 2

Location SE SE SE

Section 22 Twp. 25S Rge. 8E County Greenwood State Kansas

	K. City	B'ville
Name of Sand		
Top of Core	1992.0	2485.0
Bottom of Core	2007.0	2509.0
Top of Sand	1992.0	2485.0
Bottom of Sand	2007.0	2501.4
Total Feet of Permeable Sand	4.0	15.4
Total Feet of Floodable Sand		8.8

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
K. C. 0.2 - 0.9	4.0	4.0
B'ville 0 - 1	5.6	5.6
1 - 5	3.0	8.6
5 - 10	3.0	11.6
10 & above	3.8	15.4

Average Permeability Millidarcys	0.65	5.1
Average Percent Porosity	8.5	17.1
Average Percent Oil Saturation	16.8	32.4
Average Percent Water Saturation	29.4	55.4
Average Oil Content, Bbls./A. Ft.	104.	426.
Total Oil Content, Bbls./Acre	828.	6,567.
Average Percent Oil Recovery by Laboratory Flooding Tests		9.8
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.		129.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre		1,138.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)		2,590.
Packer Setting, Feet		
Viscosity, Centipoises @		
A. P. I. Gravity, degrees @ 60 °F		
Elevation, Feet		

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Jackson Bros. Lease Hawthorne Well No. 2

Depth Interval, Feet	2485.0 - 2492.6	2493.6 - 2501.4	2485.0 - 2501.4
Feet of Core Analyzed	3.0	5.8	8.8
Average Percent Porosity	16.7	17.9	17.5
Average Percent Original Oil Saturation	33.3	28.7	30.4
Average Percent Oil Recovery	10.7	9.3	9.8
Average Percent Residual Oil Saturation	22.6	19.4	20.6
Average Percent Residual Water Saturation	67.6	75.5	73.0
Average Percent Total Residual Fluid Saturation	90.2	94.9	93.6
Average Original Oil Content, Bbls./A. Ft.	425.	398.	406.
Average Oil Recovery, Bbls./A. Ft.	133.	128.	129.
Average Residual Oil Content, Bbls./A. Ft.	292.	270.	277.
Total Original Oil Content, Bbls./Acre	1,275.	2,300.	3,575.
Total Oil Recovery, Bbls./Acre	399.	739.	1,138.
Total Residual Oil Content, Bbls./Acre	876.	1,561.	2,437.
Average Effective Permeability, Millidarcys	0.495	0.439	0.458
Average Initial Fluid Production Pressure, p.s.i.	43.4	38.4	40.0

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

OILFIELD RESEARCH LABORATORIES

SOLUBILITY TESTS

TABLE VI

Company Jackson Bros. Lease Hawthorne Well No. 2

Sample No.	Depth, Feet	Percent Solubility
1	1992.1	96
2	1993.1	95
3	1994.1	88
4	1995.1	92
5	2003.1	93
6	2004.1	90
7	2005.1	93
8	2006.1	87

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in plastic bags by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory. Only the Bartlesville core will be considered in the following discussion

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description

KANSAS CITY LIME

1992.0 - 1996.0 - Limestone.

1996.0 - 2003.0 - Limestone (discarded at well).

2003.0 - 2007.0 - Limestone.

BARTLESVILLE SAND

2485.0 - 2492.6 - Light brown, slightly shaly sandstone.

2492.6 - 2493.6 - Gray sandy shale.

2493.6 - 2501.4 - Light brown, very slightly calcareous sandstone.

2501.4 - 2509.0 - Shale.

Coring was started at a depth of 2485.0 feet in slightly shaly sandstone and completed at 2509.0 feet in shale. This core shows a total of 15.4 feet of sandstone. For the most part, the pay is made up of light brown, slightly shaly and slightly calcareous 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 4.0 and 6.2 millidarcys respectively; the overall average being 5.1 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather regular permeability profile. The permeability of the sand varies from 0.27 to a maximum of

14. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 32.4. The weighted average percent oil saturation of the upper and lower sections is 32.6 and 32.2 respectively. The weighted average percent water saturation of the upper and lower sections is 56.9 and 53.9 respectively; the overall average being 55.4 (See Table III). This gives an overall weighted average total fluid saturation of 87.8 percent.

The weighted average oil content of the upper and lower sections is 425 and 427 barrels per acre foot respectively; the overall average being 426. The total oil content, as shown by this core, is 6,567 barrels per acre of which 3,575 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 1,138 barrels of oil per acre was obtained from 8.8 feet of sand. The weighted average percent oil saturation was reduced from 30.4 to 20.6, or represents an average recovery of 9.8 percent. The weighted average effective permeability of the samples is 0.458 millidarcys, while the average initial fluid production pressure is 40.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 16 samples tested, 9 produced water and oil. This indicates that approximately 56 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a fairly uniform effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient pri-

mary and secondary operations in the vicinity of this well should recover approximately 1,280 and 1,310 barrels of oil per acre respectively. These represent average recoveries of 131 and 149 barrels per acre foot. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.21
Reservoir water saturation, percent	40.0
Expected primary recovery, estimated, percent	12.0
Average porosity, percent	17.5
Oil saturation after flooding, percent	20.6
Performance factor, percent	55.0
Net floodable pay sand, feet	8.8

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a fairly uniform effective permeability to water.

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease Hawthorne Well No. 2

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.		
						KANSAS CITY LIME					
1	1992.1	9.1	8	10	18	57	Imp.	0.6	0.6	34	0.00
2	1993.1	11.1	9	23	32	78	0.65	1.0	1.6	78	0.65
3	1994.1	7.7	19	33	52	113	Imp.	1.0	2.6	113	0.00
4	1995.1	6.7	16	36	52	83	Imp.	1.4	4.0	116	0.00
5	2003.1	2.8	34	38	72	74	0.22	0.6	4.6	44	0.13
6	2004.1	8.3	18	32	50	116	0.82	1.0	5.6	116	0.82
7	2005.1	8.9	11	11	22	76	Imp.	1.0	6.6	76	0.00
8	2006.1	11.0	21	41	62	179	0.72	1.4	8.0	251	1.01
						BARTLESVILLE SAND					
1	2485.1	19.5	29	55	84	439	0.39	0.6	0.6	263	0.23
2	2486.1	16.8	36	61	97	469	0.86	1.0	1.6	469	0.86
3	2487.1	14.1	42	53	95	460	11.	1.0	2.6	460	11.00
4	2488.1	17.3	32	53	85	429	14.	1.0	3.6	429	14.00
5	2489.1	18.4	31	59	90	442	1.1	1.0	4.6	442	1.10
6	2490.1	16.3	36	56	92	454	0.27	1.0	5.6	454	0.27
7	2491.1	17.7	27	58	85	370	0.70	1.0	6.6	370	0.70
8	2492.1	17.4	26	59	85	350	2.4	1.0	7.6	350	2.40
9	2494.1	15.2	38	57	95	448	0.72	1.0	8.6	448	0.72
10	2495.1	18.7	27	51	78	392	6.0	1.0	9.6	392	6.00
11	2496.1	17.8	25	55	80	345	6.0	1.0	10.6	345	6.00
12	2497.1	16.6	29	62	91	373	4.2	1.0	11.6	373	4.20
13	2498.1	16.8	28	53	81	364	7.9	1.0	12.6	364	7.90
14	2499.1	17.2	47	46	93	625	0.98	1.0	13.6	625	0.98
15	2500.1	18.1	26	56	82	365	12.	1.0	14.6	365	12.00
16	2501.1	17.3	39	50	89	522	13.	0.8	15.4	418	10.40

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Hawthorne Well No. 2

KANSAS CITY LIME

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
1992.0 - 1996.0	1.0	0.65	0.65
2003.0 - 2007.0	3.0	0.65	1.96
1992.0 - 2007.0	4.0	0.65	2.61

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
1992.0 - 1996.0	4.0	8.4	13.8	28.2	85	341
2003.0 - 2007.0	4.0	8.6	19.7	30.8	122	487
1992.0 - 2007.0	8.0	8.5	16.8	29.4	104	828

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Hawthorne Well No. 2

BARTLESVILLE SAND

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2485.0 - 2492.6	7.6	4.0	30.56
2493.6 - 2501.4	7.8	6.2	48.20
2485.0 - 2501.4	15.4	5.1	78.76

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
2485.0 - 2492.6	7.6	17.1	32.6	56.9	425	3,237
2493.6 - 2501.4	7.8	17.2	32.2	53.9	427	3,330
2485.0 - 2501.4	15.4	17.1	32.4	55.4	426	6,567

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease Hawthorne Well No. 2

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.			
						BARTLESVILLE SAND						
1	2485.1	19.1	28	414	0	0	28	59	414	0	Imp.	-
2	2486.1	17.0	37	487	0	0	37	61	487	0	Imp.	-
3	2487.1	14.6	42	475	17	192	25	62	283	4	0.287	50
4	2488.1	17.7	32	439	12	165	20	73	274	27	0.900	30
5	2489.1	18.0	32	446	0	0	32	61	446	0	Imp.	-
6	2490.1	16.2	35	440	0	0	35	59	440	0	Imp.	-
7	2491.1	17.4	29	391	0	0	29	59	391	0	Imp.	-
8	2492.1	17.9	26	361	3	42	23	68	319	5	0.300	50
9	2494.1	14.9	37	427	0	0	37	60	427	0	Imp.	-
10	2495.1	19.0	27	398	7	103	20	75	295	13	0.500	30
11	2496.1	18.1	25	351	5	70	20	76	281	19	0.700	30
12	2497.1	17.0	29	382	8	105	21	75	277	2	0.200	50
13	2498.1	16.9	28	366	12	157	16	79	209	9	0.400	40
14	2499.1	16.9	45	589	0	0	45	49	589	0	Imp.	-
15	2500.1	18.5	26	373	5	72	21	77	301	14	0.500	30
16	2501.1	17.8	39	538	21	290	18	71	248	5	0.300	50

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.