



Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Hawthorne Well No. 4

Location SW NE NE

Section 27 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand	- - - - -	Bartlesville
Top of Core	- - - - -	2560.0
Bottom of Core	- - - - -	2580.0
Top of Sand	- - - - -	2560.0
Bottom of Sand	- - - - -	2574.0
Total Feet of Permeable Sand	- - - - -	9.4
Total Feet of Floodable Sand	- - - - -	4.4

Distribution of Permeable Sand:	Feet	Cum. Ft.
Permeability Range Millidarcys		
0 - 1	2.0	2.0
1 - 5	5.4	7.4
5 - 11	2.0	9.4

Average Permeability Millidarcys	- - - - -	3.2
Average Percent Porosity	- - - - -	15.8
Average Percent Oil Saturation	- - - - -	19.4
Average Percent Water Saturation	- - - - -	66.5
Average Oil Content, Bbls./A. Ft.	- - - - -	238.
Total Oil Content, Bbls./Acre	- - - - -	2,961.
Average Percent Oil Recovery by Laboratory Flooding Tests	- - - - -	4.7
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	- - - - -	61.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	- - - - -	268.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	- - - - -	1,570.
Backer Settling, Feet	- - - - -	
Viscosity, Centipoises @	- - - - -	
A. P. I. Gravity, degrees @ 60 °F	- - - - -	
Elevation, Feet	- - - - -	

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
2560.0 - 2563.0	Gray shaly sandstone.
2563.0 - 2564.6	Sandy shale.
2564.6 - 2574.0	Grayish light brown, shaly sandstone.
2574.0 - 2580.0	Shale.

Coring was started at a depth of 2560.0 feet in sandstone and completed at 2580.0 feet in shale. This core shows a total of 12.4 feet of sandstone. For the most part, the pay is made up of grayish light brown, 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 1.3 and 4.7 millidarcys respectively; the overall average being 3.2 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a fairly regular permeability profile. The permeability of the sand varies from impermeable to a maximum of 11. 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 15.2 and 25.1 respectively. The weighted average percent water saturation of the upper and lower sections

is 74.0 and 57.1 respectively; the overall average being 66.5 (See Table III). This gives an overall weighted average total fluid saturation of 85.9 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 appears that very little flushing took place during coring operations.

The weighted average oil content of the upper and lower sections is 178 and 318 barrels per acre foot respectively; the overall average being 238. The total oil content, as shown by this core, is 2,961 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded rather poorly to laboratory flooding tests, as a total recovery of 268 barrels of oil per acre was obtained from 4.4 feet of sand. The weighted average percent oil saturation was reduced from 25.5 to 20.8, or represents an average recovery of 4.7 percent. The weighted average effective permeability of the samples is 0.541 millidarcys, while the average initial fluid production pressure is 45.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 12 samples tested, 4 produced water and oil. This indicates that approximately 33 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in 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 1,180 and 390 barrels of oil per acre respectively. These are average recoveries of 125 and 88 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	47.0
Expected primary recovery, estimated, percent	12.0
Average porosity, percent	16.7
Oil saturation after flooding, percent	20.8
Performance factor, percent	50.0
Net floodable pay sand, feet	4.4

This core shows a pay sand having a fairly low oil saturation, a somewhat high water saturation and a wide variation in effective permeability to water.

Central Research Laboratories

RESULTS OF LITHOLOGICAL & FUNDAMENTAL TESTS

TABLE 10

Company Jackson Brothers

Zone None

Marshborne

Well No. 4

Sample No.	Depth, Feet	Effective Purity Percent	Percent Saturation		Oil Content Dis. / A Ft.	Pen., Mill.	Feet of Sand		Total Oil Content	Pen. Capacity Ft. X md.
			Oil	Water			Pt.	Cum. Ft.		
1	2560.1	12.0	15	82	175	Imp.	0.6	0.6	105	0.00
2	2561.1	12.0	12	85	157	0.55	1.0	1.6	157	0.55
3	2562.1	12.0	5	89	65	Imp.	1.4	3.0	191	0.00
4	2563.1	17.0	19	59	255	0.67	1.0	4.0	255	0.67
5	2564.1	12.0	17	74	170	Imp.	1.0	5.0	170	0.00
6	2565.1	12.0	24	60	253	1.6	1.0	6.0	253	1.60
7	2566.1	12.0	18	65	211	2.4	1.0	7.0	211	2.40
8	2567.1	12.0	19	60	224	6.4	1.0	8.0	224	6.40
9	2568.1	12.0	23	54	289	1.4	1.0	9.0	289	1.40
10	2570.1	14.0	27	67	301	2.0	1.0	10.0	301	2.00
11	2571.1	17.0	23	53	303	11.0	1.0	11.0	303	11.00
12	2572.1	17.0	31	53	430	3.1	1.4	12.4	602	4.34

CHURCH Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

PAGE II

Company	Jackson Brothers	Case	Hawthorne	Well No.	1/4	
	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Mfd.		
	2560.0 - 2568.6	4.0	1.3	5.22		
	2568.6 - 2574.0	5.4	4.7	25.14		
	2560.0 - 2574.0	9.4	3.2	30.36		
	Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Water Saturation	Average Oil Content, Bbl./A. Ft.	Total Oil Content, Bbls./Acre
	2560.0 - 2568.6	7.0	15.5	74.0	178	1,242
	2568.6 - 2574.0	5.4	16.3	57.1	318	1,719
	2560.0 - 2574.0	12.4	15.8	66.5	238	2,961

UNITED STATES GEOLOGICAL SURVEY

REPORT OF LABORATORY RECORDS

1917

Company: Jackson Brothers Location: Hawthorne W.P.B. No. 4

Sample No.	Depth, Feet	Quantity, Pounds	Original Concentration		CR Recovery		Distilled Concentration		Volume of Water Recovered, CC's	Impurity, Percentages	Total Impurity, Pounds/CC's
			lb	Dist. A.T.A.	%	Dist. A.T.A.	lb	Dist. A.T.A.			
100	2560.1	14.9	15	173	0	0	15	61	0	Imp.	-
101	2561.1	19.0	13	157	0	0	13	65	0	Imp.	-
102	2562.1	19.0	9	116	0	0	9	60	0	Imp.	-
103	2563.1	17.2	18	244	0	0	18	61	0	Imp.	-
104	2564.1	19.0	16	166	0	0	16	75	0	Imp.	-
105	2565.1	19.0	23	242	0	0	23	62	0	Imp.	-
106	2566.1	15.0	18	209	0	0	18	67	0	Imp.	-
107	2567.1	15.0	19	230	24	24	17	75	2	Imp. .200	50
108	2570.1	15.0	22	273	0	0	22	57	0	Imp.	-
109	2571.1	14.8	27	310	60	60	20	78	5	Imp. .400	50
110	2572.1	17.4	23	310	27	27	21	77	44	1.50	30
111	2573.1	18.1	31	435	98	98	24	65	2	.200	50

Notes: CC—cubic centimeter.

a—Volume of water recovered at the time of maximum oil recovery.

aa—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 Hawthorne Well No. 4

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation	
			Connate	Drilling & Foreign Total
1	2560.1	95,450		
2	2561.1	82,500		
3	2562.1	76,100		
4	2565.1	94,600		
5	2566.1	97,500		
6	2567.1	103,550		
7	2568.1	98,400		
8	2569.1	104,000		
9	2570.1	108,300		
10	2571.1	106,450		
11	2572.1	101,900		
12	2573.1	106,200		

Note: ppm — parts per million

CHINA Research Laboratories

SUMMARY OF LABORATORY TESTING TESTS

TABLE V

Company: Jackson Brothers Lease: Hawthorne Well No. 4

Depth Interval, Feet 2560.0 - 2574.0

Feet of Core Analyzed 4.4

Average Percent Porosity 16.7

Average Percent Original Oil Saturation 25.5

Average Percent Oil Recovery 4.7

Average Percent Residual Oil Saturation 20.8

Average Percent Residual Water Saturation 73.0

Average Percent Total Residual Fluid Saturation 93.8

Average Original Oil Content, Bbls./A. Ft. 331.

Average Oil Recovery, Bbls./A. Ft. 61.

Average Residual Oil Content, Bbls./A. Ft. 270.

Total Original Oil Content, Bbls./Acre 1,458.

Total Oil Recovery, Bbls./Acre 268.

Total Residual Oil Content, Bbls./Acre 1,190.

Average Effective Permeability, Millidarcys 0.541

Average Initial Fluid Production Pressure, psi. 145.0

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

Oilfield Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company <u>Jackson Brothers</u>		Lease <u>Hawthorne</u>	Well No. <u>4</u>
Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2560.0 - 2568.6	80,100		
2568.6 - 2574.0	105,300		
2560.0 - 2574.0	90,400		

Note: ppm -- parts per million.