

# OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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October 25, 1962

Langdon & Finch  
309 East 5th  
Ottawa, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Cable Tool core taken from the Rader Lease, Well No. 3-A, Miami County, Kansas, and submitted to our laboratory on October 19, 1962.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

*Benjamin R. Pearman*  
Benjamin R. Pearman

BRP:rf

12 c.



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Fresh water was used as the coring fluid. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in non-virgin territory.

#### FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
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665.7 - 672.3	- Brown, slightly shaly sandstone.
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672.3 - 674.0	- Gray shaly sandstone.
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674.0 - 674.5	- Brown shaly sandstone.
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674.5 - 678.3	- Sandy shale.
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678.3 - 679.0	- Brown and gray shaly sandstone.
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679.0 - 683.6	- Shale.
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Coring was started at a depth of 665.7 feet in slightly shaly sandstone and completed at 683.6 feet in shale. For the most part, the pay is made up of brown, 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 174.9 and 7.0 millidarcys respectively; the overall average being 158.3 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 273. millidarcys.

#### PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 41.5. The weighted average percent oil saturation of the upper and lower sections is 42.0 and 38.4 respectively. The weighted average percent water saturation of the upper and lower sections

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is 47.5 and 52.6 respectively; the overall average being 48.4 (See Table III). This gives an overall weighted average total fluid saturation of 89.9 percent.

The weighted average oil content of the upper and lower sections is 694 and 594 barrels per acre foot respectively; the overall average being 679. The total oil content, as shown by this core, is 5,296 barrels per acre of which 4,601 barrels are in the pay sand sections (See Table III).

#### LABORATORY FLOODING TESTS

The sand in this core responded well to laboratory flooding tests, as a total recovery of 1,858 barrels of oil per acre was obtained from 6.6 feet of sand. The weighted average percent oil saturation was reduced from 42.1 to 25.0, or represents an average recovery of 17.1 percent. The weighted average effective permeability of the samples is 7.75 millidarcys, while the average initial fluid production pressure is 18.6 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 9 samples tested, 8 produced water and 7 oil. This indicates that approximately 78 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 laboratory data indicates that an efficient water-flood in the vicinity of this well should recover approximately 1,390 barrels per acre or an average of 210 barrels per acre foot from the 6.6 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.06
Present formation volume factor	1.02

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Reservoir water saturation, percent	40.0
Primary recovery, estimated, percent	7.0
Present oil saturation, percent	50.7
Average porosity, percent	21.5
Oil saturation after flooding, percent	25.0
Performance factor, percent	50.0
Net floodable pay sand, feet	6.6

This core shows a slightly shaly pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water.

These recovery values were calculated assuming that satisfactory injection rates will be maintained throughout the flood life of the property.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Langdon & Finch

Lease Rader

Well No. 3-A

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	666.1	23.0	42	49	91	749	273.	1.0	1.0	749	273.00
2	667.2	24.8	36	45	81	692	156.	1.0	2.0	692	156.00
3	668.3	17.7	40	57	97	549	123.	1.0	3.0	549	123.00
4	669.1	20.0	47	51	98	729	249.	1.0	4.0	729	249.00
5	670.1	18.1	48	46	94	674	15.	1.0	5.0	674	15.00
6	671.1	23.3	38	41	79	686	195.	1.0	6.0	686	195.00
7	672.1	24.6	44	41	85	839	234.	0.6	6.6	504	140.40
8	674.1	16.3	36	59	95	454	Imp.	0.5	7.1	277	0.00
9	678.6	20.1	40	48	88	623	7.0	0.7	7.8	<u>436</u>	4.90
								Total		5,296	

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Langdon & Finch	Lesse	Rader	Well No.	3-A	
	<b>Depth Interval, Feet</b>	<b>Depth Interval, Feet</b>	<b>Feet of Core Analyzed</b>	<b>Average Permeability, Millidarcys</b>	<b>Permeability Capacity Ft. x Md.</b>	
	665.7 - 672.3	665.7 - 672.3	6.6	174.9	1151.40	
	674.0 - 679.0	674.0 - 679.0	0.7	7.0	4.90	
	665.7 - 672.3	665.7 - 672.3	7.3	158.3	1156.30	
	<b>Depth Interval, Feet</b>	<b>Feet of Core Analyzed</b>	<b>Average Percent Porosity</b>	<b>Average Percent Water Saturation</b>	<b>Average Oil Content Bbl./A. Ft.</b>	<b>Total Oil Content Bbl./Acre</b>
	665.7 - 672.3	6.6	21.4	42.0	694	4,583
	674.0 - 679.0	1.2	18.6	38.4	594	713
	665.7 - 672.3	7.8	21.0	41.5	679	5,296

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Langdon & Finch Lease Rader Well No. 3-A

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	666.1	22.7	42	739	16	282	26	72	457	116	1.39	20
2	667.2	24.5	36	684	10	190	26	70	494	244	17.42	10
3	668.3	18.1	40	561	14	197	26	72	364	223	12.09	10
4	669.1	20.4	47	744	21	332	26	72	412	291	7.55	20
5	670.1	18.7	48	696	25	362	23	72	334	33	0.842	30
6	671.1	23.0	38	678	15	268	23	71	410	197	4.31	20
7	672.1	24.4	44	832	20	378	24	65	454	322	10.97	20
8	674.1	16.2	34	422	0	0	34	60	422	0	Imp.	-
9	678.6	20.3	37	582	0	0	37	51	582	6	0.214	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.

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## SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Langdon & Finch

Lease Rader

Well No. 3-A

Depth Interval, Feet 665.7 - 672.3

Feet of Core Analyzed 6.6

Average Percent Porosity 21.5

Average Percent Original Oil Saturation 42.1

Average Percent Oil Recovery 17.1

Average Percent Residual Oil Saturation 25.0

Average Percent Residual Water Saturation 70.9

Average Percent Total Residual Fluid Saturation 95.9

Average Original Oil Content, Bbls./A. Ft. 698.

Average Oil Recovery, Bbls./A. Ft. 282.

Average Residual Oil Content, Bbls./A. Ft. 416.

Total Original Oil Content, Bbls./Acre 4,601.

Total Oil Recovery, Bbls./Acre 1,858.

Total Residual Oil Content, Bbls./Acre 2,743.

Average Effective Permeability, Millidarcys 7.75

Average Initial Fluid Production Pressure, p.s.i. 18.6

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