WILLIAM S. FARISH, III

CORE ANALYSIS REPORT

UMBARGER LEASE WELL NO. W-1

WILSON COUNTY, KANSAS

1

OILFIELD RESEARCH LABORATORIES

536 N. HIGHLAND
CHANUTE, KANSAS

700 N. MISSION
OKMULGEE, OKLA.

OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

700 NORTH MISSION - OKMULGEE, OKLAHOMA - PHONE SK6-4444

Chanute, Kansas

February 12, 1965

William S. Farish, III
c/o Underwood Neuhouse
Houston Club Building
Houston 2, Texas

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Umbarger Lease, Well No. W-1, Wilson County, Kansas, and submitted to our laboratory on February 8, 1965.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

CLP:rf

1 c. - Jim Guinotte

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company William S. Farish, III Lease Umbarger Well No. W-1

Location

Section 36 Twp. 28S Rge. 16E County Wilson State Kansas

Name of Sand	Squirrel
Top of Core	660.0
Bottom of Core	687.0
Top of Sand	666.0
Bottom of Oil Sand	680.0
Total Feet of Permeable Sand	13.3
Total Feet of Floodable Sand	7.2

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	3.1	3.1
10 - 30	3.6	6.7
30 - 50	4.6	11.3
50 & above	2.0	13.3

Average Permeability Millidarcys	35.0
Average Percent Porosity	19.1
Average Percent Oil Saturation	54.9
Average Percent Water Saturation	19.6
Average Oil Content, Bbls./A. Ft.	809.
Total Oil Content, Bbls./Acre	10,761.
Average Percent Oil Recovery by Laboratory Flooding Tests	8.4
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	136.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	979.
Total Calculated Oil Recovery, Bbls./Acre	1,635.
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. The core was sampled and sealed in tin cans by an employee of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
660.0 - 666.0	Laminated sandstone and shale.
666.0 - 667.3	Brown, calcareous sandstone.
667.3 - 668.0	Gray sandy limestone.
668.0 - 673.6	Dark brown, slightly shaly sandstone.
673.6 - 680.0	Brown to dark, laminated, shaly, carbonaceous sandstone.
680.0 - 684.5	Shaly sandstone.
684.5 - 687.0	Loss.

Coring was started at a depth of 660.0 feet in laminated sandstone and shale and completed at 687.0 feet, probably in shaly sandstone. There was a core loss of six inches at the bottom of core. This core shows a total of 17.8 feet of sandstone. For the most part, the pay is made up of dark 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 49.8 and 19.0 millidarcys respectively; the overall average being 35.0 (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 3.1 to a maximum of 109. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a very good weighted average percent oil saturation, namely, 54.9. The weighted average percent oil saturation of the upper and lower sections is 55.3 and 54.5 respectively. The weighted average percent water saturation of the upper and lower sections is 20.3 and 18.8 respectively; the overall average being 19.6 (See Table III). This gives an overall weighted average total fluid saturation of 74.5 percent. This fairly low total fluid saturation indicates some fluid was lost during coring which was probably oil.

The weighted average oil content of the upper and lower sections is 850 and 766 barrels per acre foot respectively; the overall average being 809. The total oil content, as shown by this core, is 10,761 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

Part of the sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 979 barrels of oil per acre was obtained from 7.2 feet of sand. The weighted average percent oil saturation was reduced from 53.6 to 45.2, or represents an average recovery of 8.4 percent. The weighted average effective permeability of the samples is 1.79 millidarcys, while the average initial fluid production pressure is 27.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 14 samples tested, 12 produced water and 8 oil. This indicates that approximately 57 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand, after flooding, had a high residual oil saturation.

CONCLUSION

From a study of the above data, we estimate that approximately

1,635 barrels of oil per acre or an average of 247 barrels per acre foot can be recovered from the area, represented by this core, by efficient water-flooding. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.04
Present formation volume factor	1.01
Irreducible water saturation, percent	16.0
Primary oil recovery, percent	5.0
Present oil saturation, percent	76.6
Oil saturation after flooding, percent	45.2
Percent porosity	20.5
Performance factor, percent	50.0
Feet of floodable pay sand	7.2

This core shows a fairly clean sand section having a very good oil saturation, a low water saturation and a fair permeability.

Because of the visceous nature of the formation oil, we believe some type of thermal recovery method would be much more effective in recovering the oil from this reservoir.

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company William S. Farish, III Lease Umbarger Well No. W-1

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	666.2	18.4	40	26	66	570	39.	0.6	0.6	342	23.40
2	667.1	12.4	59	19	78	568	4.0	0.7	1.3	397	2.80
3	668.2	22.8	64	16	80	1131	29.	0.6	1.9	678	17.40
4	669.1	22.0	62	16	78	1059	22.	1.0	2.9	1,059	22.00
5	670.1	23.8	60	23	83	1108	35.	1.0	3.9	1,108	35.00
6	671.1	22.2	44	22	66	756	109.	1.0	4.9	756	109.00
7	672.1	19.2	44	21	65	655	92.	1.0	5.9	655	92.00
8	673.1	16.8	68	20	88	866	42.	1.0	6.9	866	42.00
9	674.1	19.5	50	20	70	756	33.	1.0	7.9	756	33.00
10	675.1	18.8	46	18	64	670	26.	1.0	8.9	670	26.00
11	676.1	18.3	60	16	76	851	30.	1.0	9.9	851	30.00
12	677.1	18.5	53	17	70	759	18.	1.0	10.9	759	18.00
13	678.1	17.6	56	17	73	764	3.1	1.0	11.9	764	3.10
14	679.1	16.9	60	23	83	786	8.1	1.4	13.3	1,100	11.33
								Total		10,761	

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company William Farish, III Lease Umbarger Well No. W-1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
666.0 - 673.6	6.9	49.8	343.60
673.6 - 680.0	6.4	19.0	121.43
666.0 - 680.0	13.3	35.0	465.03

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
666.0 - 673.6	6.9	19.9	55.3	20.3	850	5,861
673.6 - 680.0	6.4	18.2	54.5	18.8	766	4,900
666.0 - 680.0	13.3	19.1	54.9	19.6	809	10,761

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company William S. Farish, III Lease Umbarger Well No. W-1

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	666.2	18.0	40	559	4	56	36	47	503	30	0.70	30
2	667.1	12.0	55	512	0	0	55	24	512	0	Imp.	-
3	668.2	23.1	64	1147	4	72	60	29	1075	7	0.30	50
4	669.1	21.7	62	1044	24	404	38	51	640	36	0.90	20
5	670.1	23.4	60	1089	9	163	51	48	926	105	2.70	20
6	671.1	21.9	44	748	6	102	38	50	646	206	5.60	20
7	672.1	19.4	44	662	2	30	42	34	632	16	0.40	40
8	673.1	17.3	68	913	14	188	54	33	725	76	1.75	20
9	674.1	19.9	47	726	0	0	47	38	726	37	1.00	30
10	675.1	19.2	46	686	1	15	45	42	671	37	0.90	30
11	676.1	17.9	57	792	0	0	57	25	792	7	0.30	50
12	677.1	18.5	50	718	0	0	50	44	718	3	0.20	50
13	678.1	17.9	55	764	0	0	55	31	764	6	0.30	50
14	679.1	16.5	57	730	0	0	57	29	730	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.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company William S. Farish, III Lease Umbarger Well No. W-1

Depth Interval, Feet	666.0 - 675.6
Feet of Core Analyzed	7.2
Average Percent Porosity	20.5
Average Percent Original Oil Saturation	53.6
Average Percent Oil Recovery	8.4
Average Percent Residual Oil Saturation	45.2
Average Percent Residual Water Saturation	32.2
Average Percent Total Residual Fluid Saturation	87.4
Average Original Oil Content, Bbls./A. Ft.	857.
Average Oil Recovery, Bbls./A. Ft.	136.
Average Residual Oil Content, Bbls./A. Ft.	721.
Total Original Oil Content, Bbls./Acre	6,166.
Total Oil Recovery, Bbls./Acre	979.
Total Residual Oil Content, Bbls./Acre	5,187.
Average Effective Permeability, Millidarcys	1.79
Average Initial Fluid Production Pressure, p.s.i.	27.5

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