OILFIELD RESEARCH LABORATORIES
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Chanute, Kansas

July 26, 1965

J. H. Wagner Drilling Company
Box 751
El Dorado, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Teasdall Lease, Well No. 3, Cowley County, Kansas, and submitted to our laboratory on July 19, 1965.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:rf

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20-34-3E

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GENERAL INFORMATION & SUMMARY

Company J. H. Wagner Drilling Co. Lease Teasdall Well No. 3

Location NW SE SW

Section 20 Twp. 34S Rge. 3E County Cowley State Kansas

Name of Sand	Bartlesville
Top of Core	3366.0
Bottom of Core	3393.0
Top of Oil Sand	3373.6
Bottom of Sand	3391.6
Total Feet of Permeable Sand (Analyzed)	14.5
Total Feet of Floodable Sand (Analyzed)	13.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 15	4.0	4.0
15 - 20	6.0	10.0
20 - 30	2.5	12.5
30 & above	2.0	14.5

Average Permeability Millidarcys	37.8
Average Percent Porosity	18.5
Average Percent Oil Saturation	25.4
Average Percent Water Saturation	49.7
Average Oil Content, Bbls./A. Ft.	356.
Total Oil Content, Bbls./Acre	5,873.
Average Percent Oil Recovery by Laboratory Flooding Tests	8.8
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	134.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,271.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	4,070.
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 an employee of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
3366.0 - 3368.0	Sandy shale.
3368.0 - 3373.0	Gray and light brown, shaly sandstone.
3373.0 - 3391.6	Brown, fine grained, slightly shaly sandstone with vertical fractures from 3373.5 to 3379.3, 3383.0 to 3384.3 and 3384.9 to 3387.7.
3391.6 - 3393.0	Shale.

Coring was started at a depth of 3366.0 feet in sandy shale and completed at 3393.0 feet in shale. This core shows a total of 22 feet of sandstone. The pay is made up of brown, fine grained, 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 57.3 and 16.9 millidarcys respectively; the overall average being 37.8 (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 7.5 to a maximum of 195. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 25.4. The weighted average percent oil saturation of the upper and lower sections is 21.8 and 29.9 respectively. The weighted average percent water saturation of the upper and lower sections is 50.4 and 49.1 respectively; the overall average being 49.7 (See Table III). This gives an overall weighted average total fluid saturation of 75.1 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 tests are given in Table VI and VII. From the data given in these tables and on the coregraph, it is evident that considerable flushing of the sand occurred during the cutting of the core as the chloride content of most of the sand is considerably lower than the average for the Bartlesville section in this area.

The weighted average oil content of the upper and lower sections is 337 and 378 barrels per acre foot respectively; the overall average being 356. The total oil content, as shown by this core, is 5,873 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core has a fairly low oil saturation, one would not expect very much oil to be recovered by laboratory flooding tests. However, a total recovery of 1,271 barrels of oil per acre was obtained from 9.5 feet of sand. The weighted average percent oil saturation was reduced from 27.8 to 19.0, or represents an

average recovery of 8.8 percent. The weighted average effective permeability of the samples is 8.1 millidarcys, while the average initial fluid production pressure is 33.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 16 samples tested, 14 produced water and 9 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 wide variation in effective permeability.

CONCLUSION

From a study of the above data, we estimate that approximately 2,322 barrels of oil per acre can be recovered from the area, represented by this core, by efficient primary production methods. An additional oil recovery of 1,748 barrels per acre or an average of 129 barrels per acre foot can be expected from efficient water-flooding of the reservoir. The following data and assumptions were used in calculating the above oil recovery values:

Original formation volume factor	1.25
Irreducible water saturation, percent	35.0
Primary recovery, estimated, percent	None
Present oil saturation, percent	52.0
Average porosity, percent	18.5
Oil saturation after flooding, percent	19.0
Performance factor, percent	50.0
Net floodable pay sand analyzed, feet	13.5
Reported A.P.I. gravity of oil, degrees	36.0

The core shows a rather clean section having a fairly low oil saturation, a rather high water saturation and a good average permeability. No doubt, considerable flushing of the sand in the core occurred during coring, otherwise the chloride content of the water in the core would be much higher.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company J. H. Wagner Drilling Co. Lease Teasdall Well No. 3

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.		
F-1	3373.4	20.2	11	-	-	172	-	0.5	0.5	86	-
1	3373.6	22.2	19	48	67	327	83.	0.5	1.0	163	41.50
2	3376.1	22.1	28	44	72	479	195.	1.5	2.5	719	292.50
F-3	3378.0	22.4	15	-	-	260	-	1.0	3.5	260	-
3	3378.2	19.8	23	59	82	353	11.	0.5	4.0	176	5.50
F-4	3379.0	17.0	19	-	-	224	-	0.5	4.5	112	-
4	3379.2	21.6	20	55	75	335	14.	0.5	5.0	167	7.00
5	3380.1	21.2	27	49	76	444	14.	1.0	6.0	444	14.00
6	3381.1	17.8	20	53	73	276	25.	1.0	7.0	276	25.00
7	3382.1	17.7	28	52	80	384	19.	1.0	8.0	384	19.00
8	3383.1	17.8	18	55	73	248	11.	1.0	9.0	248	11.00
P-9	3384.0	-	-	-	-	-	29.	0.5	9.5	-	14.50
9	3384.2	16.5	22	62	84	281	-	0.5	10.0	140	-
10	3385.1	17.4	26	48	74	351	18.	1.0	11.0	351	18.00
11	3386.1	17.1	27	51	78	358	15.	1.0	12.0	358	15.00
12	3387.1	17.6	20	50	70	273	17.	1.0	13.0	273	17.00
13	3388.1	18.8	26	46	72	379	19.	1.0	14.0	379	19.00
14	3389.1	19.0	31	41	72	456	26.	1.0	15.0	456	26.00
15	3390.1	17.0	42	49	91	553	16.	1.0	16.0	553	16.00
16	3391.1	10.3	41	52	93	328	7.5	1.0	17.0	328	7.50
								Total-		5,873	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company J. H. Wagner Drilling Company Lease Teasdall Well No. 3

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
3373.5 - 3384.1	7.5	57.3	430.00
3384.6 - 3391.6	7.0	16.9	118.50
3373.5 - 3391.6	14.5	37.8	548.50

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
3373.0 - 3383.6	9.0	20.0	21.8	50.4	337	3,035
3384.1 - 3391.6	7.5	16.7	29.9	49.1	378	2,838
3373.0 - 3391.6	16.5	18.5	25.4	49.7	356	5,873

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company J. H. Wagner Drilling Company Lease Teasdall Well No. 3

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	3373.4	20.2	11	172	0	0	11	76	172	7	0.400	50
2	3376.1	22.6	28	491	15	263	13	80	228	398	36.20	10
3	3378.0	22.4	15	260	1	17	14	81	243	193	17.48	20
4	3379.0	17.0	17	224	0	0	17	57	224	0	Imp.	-
5	3380.1	21.0	27	440	11	179	16	80	261	52	1.80	30
6	3381.1	17.4	18	243	0	0	18	78	243	10	0.400	50
7	3382.1	17.5	28	380	9	122	19	75	258	19	0.400	40
8	3383.1	17.8	16	221	0	0	16	78	221	14	0.400	40
9	3384.2	16.1	20	250	0	0	20	66	250	0	Imp.	-
10	3385.1	16.9	26	341	3	39	23	70	302	6	0.200	50
11	3386.1	17.5	27	367	5	68	22	70	299	39	0.532	40
12	3387.1	17.9	18	250	0	0	18	71	250	21	0.749	40
13	3388.1	18.7	26	377	10	145	16	75	232	22	0.625	40
14	3389.1	18.6	31	447	9	130	22	68	317	29	0.874	40
15	3390.1	17.5	42	570	13	176	29	65	394	19	0.625	40
16	3391.1	10.8	37	310	0	0	37	60	310	2	0.100	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 J. H. Wagner Drilling Company Lease Teasdall Well No. 3

Depth Interval, Feet	3375.6 - 3382.6	3384.6 - 3390.6	3375.6 - 3390.6
Feet of Core Analyzed	4.5	5.0	9.5
Average Percent Porosity	21.1	17.8	19.4
Average Percent Original Oil Saturation	24.9	30.4	27.8
Average Percent Oil Recovery	9.7	8.0	8.8
Average Percent Residual Oil Saturation	15.2	22.4	19.0
Average Percent Residual Water Saturation	79.2	69.6	74.1
Average Percent Total Residual Fluid Saturation	94.4	92.0	93.1
Average Original Oil Content, Bbls./A. Ft.	403.	421.	413.
Average Oil Recovery, Bbls./A. Ft.	158.	112.	134.
Average Residual Oil Content, Bbls./A. Ft.	245.	309.	279.
Total Original Oil Content, Bbls./Acre	1,817.	2,102.	3,919.
Total Oil Recovery, Bbls./Acre	713.	558.	1,271.
Total Residual Oil Content, Bbls./Acre	1,104.	1,544.	2,648.
Average Effective Permeability, Millidarcys	16.4	0.57	8.1
Average Initial Fluid Production Pressure, p.s.i.	23.3	42.0	33.2

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

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company J.H. Wagner Drilling Company Lease Teasdall Well No. 3

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	3373.6	20,920			
2	3376.1	19,125			
3	3378.2	9,810			
4	3379.2	30,450			
5	3380.1	20,100			
6	3381.1	32,800			
7	3382.1	51,200			
8	3383.1	43,550			
9	3384.2	54,300			
10	3385.1	23,050			
11	3386.1	26,900			
12	3387.1	22,400			
13	3388.1	22,310			
14	3389.1	19,865			
15	3390.1	111,700			
16	3391.1	168,000			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company J. H. Wagner Drilling Co. Lease Teasdall Well No. 3

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
3373.0 - 3383.6	29,561		
3384.1 - 3391.6	56,183		
3373.0 - 3391.6	43,331		

Note: ppm — parts per million.