



OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND · CHANUTE, KANSAS 66720 · PHONE (316) 431-2650

January 23, 1981

Ajax Drilling Company
166 Harbor Drive # 2
Key Biscayne, Florida 33149

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Kirchhofer Lease, Well No. 3, located in Franklin County, Kansas and submitted to our laboratory on December 8, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

4 c to Key Biscayne, Florida
1 c to Rantoul, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Ajax Drilling Company Lease Kirchhofer Well No. 3

Location -

Section 29 Twp 15S Rge 22E County Franklin State Kansas

Elevation, Feet -

Name of Sand - Upper Squirrel

Top of Core - 725.0

Bottom of Core - 764.5

Top of Sand - 725.0

Bottom of Sand - 764.5

Total Feet of Permeable Sand - 39.5

Total Feet of Floodable Sand - 11.9

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	8.2	8.2
10 - 30	11.0	19.2
30 - 50	8.4	27.6
50 - 100	6.0	33.6
100 & Above	5.9	39.5

Average Permeability Millidarcys - 48.3

Average Percent Porosity - 20.4

Average Percent Oil Saturation - 42.9

Average Percent Water Saturation - 40.0

Average Oil Content, Bbls./A. Ft. - 690.

Total Oil Content, Bbls./Acre - 27,266.

Average Percent Oil Recovery by Laboratory Flooding Tests - 5.8

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - 102.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - 1,216.

Total Calculated Oil Recovery, Bbls./Acre - See "Calculated Recovery" Section

The core was sampled by a representative of Oilfield Research Laboratories. Fresh water mud was used as a drilling fluid.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
725.0 - 727.9	Light brown and gray laminated slightly calcareous sandstone and shale.
727.9 - 730.2	Light brown slightly calcareous sandstone.
730.2 - 737.4	Light brown and gray laminated slightly calcareous sandstone and shale.
737.4 - 749.7	Dark brown slightly calcareous sandstone.
749.7 - 750.8	Brown and gray laminated sandstone and shale.
750.8 - 764.5	Light brown slightly calcareous sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,216 barrels of oil per acre was obtained from 11.9 feet of sand. The weighted average percent oil saturation was reduced from 49.7 to 43.9, or represents an average recovery of 5.8 percent. The weighted average effective permeability of the samples is 4.97 millidarcys, while the average initial fluid production pressure is 26.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 39 samples tested, 12 produced water and oil, and 14 samples produced water only. This indicates that approximately 31 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

It would appear from a study of the core data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 3,300 barrels of oil per acre. This is an average recovery of 277 barrels per acre foot from 11.9 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor, estimated	1.05
Reservoir water saturation, percent, estimated	20.0
Average porosity, percent	22.1
Oil Saturation after flooding, percent	43.9
Performance factor, percent, estimated	50.0
Net floodable sand, feet	11.9

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Ajax Drilling Company Lease Kirchhofer 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.		
1	725.4	18.9	36	41	77	528	6.0	1.0	1.0	528	6.00
2	726.5	18.1	44	37	81	618	2.8	1.0	2.0	618	2.80
3	727.5	19.0	38	39	77	560	9.9	0.9	2.9	504	8.91
4	728.5	19.0	40	47	87	590	13.	1.3	4.2	767	16.90
5	729.5	16.9	33	47	80	433	17.	1.0	5.2	433	17.00
6	730.5	20.2	58	39	97	909	9.6	1.0	6.2	909	9.60
7	731.5	20.1	45	40	85	702	7.8	1.0	7.2	702	7.80
8	732.5	19.7	38	47	85	581	10.	1.0	8.2	581	10.00
9	733.6	16.1	22	72	94	275	0.95	1.0	9.2	275	0.95
10	734.4	19.9	36	47	83	556	17.	1.0	10.2	556	17.00
11	735.5	15.3	43	52	95	510	127.	1.0	11.2	510	127.00
12	736.5	9.0	25	68	93	175	0.95	1.2	12.4	210	1.14
13	737.6	22.8	56	30	86	991	96.	1.0	13.4	991	96.00
14	738.7	20.5	40	40	80	636	61.	1.0	14.4	636	61.00
15	739.5	24.9	52	27	79	1005	145.	1.0	15.4	1005	145.00
16	740.5	23.6	59	22	81	1080	103.	1.0	16.4	1080	103.00
17	741.5	24.4	55	24	79	1041	123.	0.9	17.3	937	110.70
18	742.4	23.1	50	24	78	896	65.	1.0	18.3	896	65.00
19	743.5	23.3	51	30	81	922	113.	1.0	19.3	922	113.00
20	744.5	23.1	52	29	81	932	253.	1.0	20.3	932	253.00
21	745.5	20.9	47	35	82	762	90.	1.0	21.3	762	90.00
22	746.5	21.3	51	31	82	843	40.	1.0	22.3	843	40.00
23	747.4	21.0	52	32	84	847	29.	1.0	23.3	847	29.00
24	748.5	22.0	46	37	83	785	66.	1.0	24.3	785	66.00
25	749.5	21.6	52	33	85	871	42.	0.4	24.7	348	16.80
26	750.5	14.5	39	57	96	439	2.0	1.1	25.8	483	2.20
27	751.5	20.3	38	42	80	599	11.	1.0	26.8	599	11.00
28	752.5	19.7	56	32	88	856	22.	1.0	27.8	856	22.00
29	753.5	21.7	44	41	85	741	37.	1.0	28.8	741	37.00
30	754.5	21.4	43	35	78	714	38.	1.0	29.8	714	38.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

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Company Ajax Drilling Company Lease Kirchhofer 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.		
31	755.5	21.1	28	47	75	458	47.	1.0	30.8	458	47.00
32	756.5	21.7	34	44	78	572	47.	1.0	31.8	572	47.00
33	757.5	21.3	40	43	83	661	26.	1.0	32.8	661	26.00
34	758.5	18.0	41	49	90	573	24.	1.0	33.8	573	24.00
35	759.5	24.3	33	43	76	622	44.	1.0	34.8	622	44.00
36	760.5	22.1	43	36	79	737	38.	1.0	35.8	737	38.00
37	761.6	23.2	41	36	77	738	39.	1.0	36.8	738	39.00
38	762.5	20.3	49	38	87	772	90.	1.0	37.8	772	90.00
39	763.4	23.2	38	35	73	684	18.	1.7	39.5	1163	30.60

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company		Lease		Well No.	
Ajax Drilling Company		Kirchhofer		3	
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.		
725.0 - 737.4	12.4	18.2	225.10		
737.4 - 748.3	11.9	98.5	1171.70		
748.3 - 764.5	15.2	33.7	512.60		
725.0 - 764.5	39.5	48.3	1909.40		

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
725.0 - 737.4	12.4	17.6	38.0	48.4	532	6,593
737.4 - 748.3	11.9	22.6	50.9	30.1	894	10,636
748.3 - 764.5	15.2	21.0	40.7	40.9	660	10,037
725.0 - 764.5	39.5	20.4	42.9	40.0	690	27,266

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company			Lease			Well No.			3		
Ajax Drilling Company			Kirchhofer								
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			
1	725.4	19.4	35	527	0	0	35	42	0	Imp.	-
2	726.5	17.7	45	618	0	0	45	36	0	Imp.	-
3	727.5	18.9	38	557	0	0	38	42	0	Imp.	-
4	728.5	19.2	40	596	0	0	40	48	0	Imp.	-
5	729.5	16.9	33	433	0	0	33	49	0	Imp.	-
6	730.5	20.0	58	900	0	0	58	38	6	0.45	45
7	731.5	20.2	45	705	0	0	45	50	10	0.30	50
8	732.5	19.8	38	584	0	0	38	47	0	Imp.	-
9	733.6	16.6	21	270	0	0	21	73	0	Imp.	-
10	734.4	19.7	36	550	0	0	36	48	0	Imp.	-
11	735.5	15.8	42	515	0	0	42	53	0	Imp.	-
12	736.5	9.0	25	175	0	0	25	68	0	Imp.	-
13	737.6	22.9	56	995	12	213	44	44	139	3.45	25
14	738.7	20.9	39	632	0	0	39	57	6	0.56	25
15	739.5	24.7	52	996	0	0	52	29	0	Imp.	-
16	740.5	23.8	59	1089	14	258	45	48	197	18.49	25
17	741.5	24.3	55	1037	10	189	45	46	219	8.40	25
18	742.4	23.0	50	892	5	89	45	43	77	1.50	25
19	743.5	23.4	51	926	5	91	46	51	219	9.00	25
20	744.5	22.9	52	924	4	71	48	49	66	1.50	30
21	745.5	21.1	47	769	2	33	45	47	43	0.75	35
22	746.5	21.3	51	843	4	66	47	49	123	2.55	10
23	747.4	20.9	52	843	6	97	46	41	14	0.45	45
24	748.5	21.8	46	778	0	0	46	44	68	1.20	10
25	749.5	21.1	53	868	0	0	53	35	0	Imp.	-
26	750.5	14.8	38	436	0	0	38	59	0	Imp.	-
27	751.5	20.1	38	593	0	0	38	60	136	3.45	25
28	752.5	19.8	56	860	0	0	56	37	390	7.05	20
29	753.5	21.6	44	737	0	0	44	44	53	1.05	30

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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

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Company			Ajax Drilling Company			Lease Kirchhofer			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			
30	754.5	21.5	43	717	0	0	43	44	36	0.75	30
31	755.5	21.0	28	456	0	0	28	57	12	0.60	50
32	756.5	21.2	35	576	0	0	35	52	44	0.90	35
33	757.5	21.2	40	658	3	49	37	55	214	11.06	15
34	758.5	18.1	41	576	2	28	39	57	46	1.12	30
35	759.5	24.1	33	617	0	0	33	59	278	4.95	20
36	760.5	22.1	43	737	3	51	40	53	85	1.65	25
37	761.6	23.4	41	744	0	0	41	53	489	7.83	15
38	762.5	20.5	49	779	0	0	49	45	156	3.00	25
39	763.4	23.2	38	684	0	0	38	55	238	8.50	20

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	Ajax Drilling Company	Lease	Kirchhofer	Well No.	3
Depth Interval, Feet	737.4 - 748.3	748.3 - 764.5	737.4 - 764.5		
Feet of Core Analyzed	8.9	3.0	11.9		
Average Percent Porosity	22.6	20.5	22.1		
Average Percent Original Oil Saturation	52.6	41.4	49.7		
Average Percent Oil Recovery	6.9	2.7	5.8		
Average Percent Residual Oil Saturation	45.7	38.7	43.9		
Average Percent Residual Water Saturation	46.5	55.0	48.6		
Average Percent Total Residual Fluid Saturation	92.2	93.7	92.5		
Average Original Oil Content, Bbls./A. Ft.	923.	657.	856.		
Average Oil Recovery, Bbls./A. Ft.	122.	43.	102.		
Average Residual Oil Content, Bbls./A. Ft.	801.	614.	754.		
Total Original Oil Content, Bbls./Acre	8,214.	1,971.	10,185.		
Total Oil Recovery, Bbls./Acre	1,088.	128.	1,216.		
Total Residual Oil Content, Bbls./Acre	7,126.	1,843.	8,969.		
Average Effective Permeability, Millidarcys	5.1	4.6	5.0		
Average Initial Fluid Production Pressure, p.s.i.	27.2	23.3	26.3		

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