OILFIELD RESEARCH LABORATORIES

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

December 5, 1966

R. L. Orr
930 West First
El Dorado, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Krusky Lease, Well No. 1, Chautauqua County, Kansas, and submitted to our laboratory on November 28, 1966.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

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GENERAL INFORMATION & SUMMARY

Company R. L. Orr Lease Krusky Well No. 1

Location SW Corner NE

Section 18 Twp. 32S Rge. 13E County Chautauqua State Kansas

	Peru	Wiser
Name of Sand	Peru	Wiser
Top of Core	968.0	1059.0
Bottom of Core	980.0	1081.0
Top of Sand (Analyzed)	968.0	1059.0
Bottom of Sand (Analyzed)	973.6	1073.6
Total Feet of Permeable Sand	2.5	12.0
Total Feet of Floodable Sand		5.1

Distribution of Permeable Sand:

	Permeability Range Millidarcys	Feet	Cum. Ft.
Peru	0.30 - 14	2.5	2.5
Wiser	1 - 10	5.4	5.4
	10 - 20	3.5	8.9
	20 - 100	2.1	11.0
	100 & above	1.0	12.0

Average Permeability Millidarcys	7.1	24.2
Average Percent Porosity	14.1	15.5
Average Percent Oil Saturation	39.1	26.3
Average Percent Water Saturation	48.0	61.4
Average Oil Content, Bbls./A. Ft.	430.	320.
Total Oil Content, Bbls./Acre	2,406	4,548.
Average Percent Oil Recovery by Laboratory Flooding Tests		4.7
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.		66.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre		339.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)		1,160.
Packer Setting, Feet		
Viscosity, Centipoises @		
A. P. I. Gravity, degrees @ 60 °F		
Elevation, Feet		

Fresh water mud was used as the circulating fluid while taking these cores. The cores were sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in non-virgin territory. Only the Wiser core was subjected to a complete analysis and will be discussed below.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
	-PERU SAND-
968.0 - 971.5	Dark, fine grained sandstone.
971.5 - 975.5	Grayish brown, shaly sandstone.
975.5 - 980.0	Gray shaly sandstone.
	-WISER SAND-
1059.0 - 1059.8	Dark, carbonaceous, shaly sandstone.
1059.8 - 1060.2	Dark shale.
1060.2 - 1061.6	Gray, finely laminated, sandy shale.
1061.6 - 1065.2	Gray and brown, fine grained sandstone.
1065.2 - 1071.7	Brown, fine grained sandstone.
1071.7 - 1074.3	Gray, fine grained sandstone.
1074.3 - 1076.5	Gray shaly sandstone.
1076.5 - 1081.0	Gray shaly sandstone.

Coring in the Wiser sand was started at a depth of 1059.0 feet in shaly sandstone and completed at 1081.0 feet in shaly sandstone. For the most part, the pay is made up of brown, fine grained 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 5.1 and 32.4 millidarcys respectively; the overall average being 24.2 (See Table III). By observing the data given on the core-graph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 131. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 26.3. The weighted average percent oil saturation of the upper and lower sections is 22.0 and 29.2 respectively. The weighted average percent water saturation of the upper and lower sections is 68.6 and 56.4 respectively; the overall average being 61.4 (See Table III). This gives an overall weighted average total fluid saturation 87.7 percent.

The weighted average oil content of the upper and lower sections is 244 and 372 barrels per acre foot respectively; the overall average being 320. The total oil content, as shown by this core, is 4,548 barrels per acre of which 2,127 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 339 barrels of oil per acre was obtained from 5.1 feet of sand. The weighted average percent oil saturation was reduced from 29.9 to 25.2, or represents an average recovery of 4.7 percent. The weighted average effective permeability of the samples

is 0.655 millidarcys, while the average initial fluid production pressure is 30.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 14 samples tested, 8 produced water and 5 oil. This indicates that approximately 36 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a fairly uniform effective permeability to water.

CONCLUSION

Based on the results of the laboratory tests it appears that efficient primary and secondary operations in the vicinity of this well should recover approximately 1,160 barrels of oil per acre or an average of 227 barrels per acre foot from the 5.1 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.07
Reservoir water saturation, percent	40.0
Average porosity, percent	18.0
Oil saturation after flooding, percent	25.2
Performance factor, percent	50.0
Net floodable pay sand, feet	5.1

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a fairly uniform effective permeability to water. Any oil already recovered from the area, represented by this core, should be subtracted from the above calculated recovery values.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company R. L. Orr Lease Krusky Well No. 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.		
						-PERU-					
1	968.1	13.5	40	49	89	419	5.8	0.6	0.6	251	3.48
2	969.1	11.5	36	50	86	321	Imp.	1.0	1.6	321	0.00
3	970.1	13.6	38	42	80	401	14.	1.0	2.6	401	14.00
4	971.1	16.4	40	41	81	522	0.30	0.9	3.5	470	0.27
5	972.1	14.7	49	43	92	559	Imp.	1.1	4.6	614	0.00
6	973.1	14.5	31	63	94	349	Imp.	1.0	5.6	349	0.00
						-WISER-					
7	1059.1	17.5	33	60	93	448	Imp.	0.8	0.8	358	0.00
8	1061.1	12.1	25	71	96	235	Imp.	1.4	2.2	329	0.00
9	1062.1	13.4	25	60	85	260	3.6	1.0	3.2	260	3.60
10	1063.1	13.3	22	72	94	227	1.8	1.0	4.2	227	1.80
11	1064.1	11.2	3	85	88	26	1.1	1.0	5.2	26	1.10
12	1065.1	17.4	27	56	83	365	20.	0.6	5.8	219	12.00
13	1066.1	13.0	46	48	94	464	8.8	1.4	7.2	650	12.32
14	1067.1	16.8	29	59	88	378	6.0	1.0	8.2	378	6.00
15	1068.1	16.6	31	54	85	399	16.	1.0	9.2	399	16.00
16	1069.1	18.3	32	49	81	455	131.	1.0	10.2	455	131.00
17	1070.1	18.9	32	49	81	469	53.	1.0	11.2	469	53.00
18	1071.1	18.2	26	56	82	367	21.	1.1	12.3	404	23.10
19	1072.1	18.1	11	75	86	155	18.	0.9	13.2	140	16.20
20	1073.1	15.9	19	67	86	234	15.	1.0	14.2	234	15.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company R. L. Orr Lease Krusky Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
		-PERU-	
968.0 - 973.6	2.5	7.1	17.75
		-WISER-	
1059.0 - 1065.2	3.6	5.1	18.50
1065.2 - 1073.6	8.4	32.4	272.62
1059.0 - 1073.6	12.0	24.2	291.12

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
			-PERU-			
968.0 - 973.6	5.6	14.1	39.1	48.0	430	2,406
			-WISER-			
1059.0 - 1065.2	5.8	13.7	22.0	68.6	244	1,419
1065.2 - 1073.6	8.4	16.8	29.2	56.4	372	3,126
1059.0 - 1073.6	14.2	15.5	26.3	61.4	320	4,548

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company R. L. Orr Lease Krusky Well No. 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.			
						-WISER-						
7	1059.1	17.2	34	454	0	0	34	61	454	0	Imp.	-
8	1061.1	12.0	26	242	0	0	26	70	242	0	Imp.	-
9	1062.1	13.4	25	260	0	0	25	62	260	0	Imp.	-
10	1063.1	13.4	22	229	0	0	22	72	229	0	Imp.	-
11	1064.1	11.1	8	69	0	0	8	82	69	0	Imp.	-
12	1065.1	17.8	27	372	0	0	27	60	372	11	0.300	40
13	1066.1	13.1	45	456	0	0	45	51	456	0	Imp.	-
14	1067.1	17.1	29	385	6	80	23	67	305	17	0.400	30
15	1068.1	17.0	31	408	4	53	27	62	355	8	0.200	50
16	1069.1	18.6	32	461	6	87	26	65	374	65	1.30	20
17	1070.1	18.6	32	461	6	87	26	57	374	49	1.00	20
18	1071.1	18.6	26	374	2	29	24	60	345	18	0.400	30
19	1072.1	18.4	13	185	0	0	13	77	185	12	0.300	50
20	1073.1	16.1	17	212	0	0	17	81	212	76	1.20	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 R. L. Orr Lease Krusky Well No. 1

Depth Interval, Feet	1065.2 - 1071.7
Feet of Core Analyzed	5.1
Average Percent Porosity	18.0
Average Percent Original Oil Saturation	29.9
Average Percent Oil Recovery	4.7
Average Percent Residual Oil Saturation	25.2
Average Percent Residual Water Saturation	62.1
Average Percent Total Residual Fluid Saturation	87.3
Average Original Oil Content, Bbls./A. Ft.	416.
Average Oil Recovery, Bbls./A. Ft.	66.
Average Residual Oil Content, Bbls./A. Ft.	350.
Total Original Oil Content, Bbls./Acre	2,127.
Total Oil Recovery, Bbls./Acre	339.
Total Residual Oil Content, Bbls./Acre	1,788.
Average Effective Permeability, Millidarcys	0.655
Average Initial Fluid Production Pressure, p.s.i.	30.0

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