● CORE ANALYSIS ● WATER REPRESSURING ENGINEERING ● WATER ANALYSIS ● FLOODING WATER TREATMENT ● SURVEYING

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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May 31, 1962

Charley Murphy
Box 59
Cherryvale, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Uhren Lease, Well No. 1, Wilson County, Kansas, and submitted to our laboratory on May 24, 1962.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

BRP:rf

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GENERAL INFORMATION & SUMMARY

Company Charley Murphy Lease Uhren Well No. 1

Location W½ NW

Section 16 Twp. 28S Rge. 17E County Wilson State Kansas

Name of Sand	Bartlesville
Top of Core	943.0
Bottom of Core	962.0
Top of Sand (Analyzed)	943.0
Bottom of Sand (Analyzed)	962.0
Total Feet of Permeable Sand	19.0
Total Feet of Floodable Sand	17.0

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	3.0	3.0
10 - 50	2.0	5.0
50 - 100	6.0	11.0
100 - 200	6.0	17.0
200 - 300	1.0	18.0
300 & above	1.0	19.0

Average Permeability Millidarcys	115.0
Average Percent Porosity	19.4
Average Percent Oil Saturation	51.1
Average Percent Water Saturation	23.2
Average Oil Content, Bbls./A. Ft.	770.
Total Oil Content, Bbls./Acre	14,631.
Average Percent Oil Recovery by Laboratory Flooding Tests	23.2
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	352.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	5,981.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	7,760.
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 this core. The core was sampled and the samples sealed in plastic bags by a representative of the client. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
943.0 - 960.0	Dark brown, laminated, slightly shaly sandstone.
960.0 - 962.0	Dark carbonaceous shaly sandstone.

Coring was started at a depth of 943.0 feet in slightly shaly sandstone and completed at 962.0 feet in carbonaceous sandstone. This core shows a total of 19.0 feet of sandstone. For the most part, the pay is made up of dark brown, laminated, 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 167.10 and 91.0 millidarcys respectively; the overall average being 115.0 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather irregular permeability profile. The permeability of the sand varies from 2.2 to a maximum of 400. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a very good weighted average percent oil saturation, namely, 51.1. The weighted average percent oil saturation of the upper and lower sections is 50.5 and 51.5 respectively. The weighted average percent water saturation of the upper and lower sections is 24.0 and 22.8 respectively; the overall average being 23.2 (See Table III). This gives an overall weighted average total fluid

saturation of 74.3 percent. This low total fluid saturation indicates considerable fluid was lost during coring, most of which probably was oil.

The weighted average oil content of the upper and lower sections is 743 and 783 barrels per acre foot respectively; the overall average being 770. The total oil content, as shown by this core, is 14,631 barrels per acre of which 13,101 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 5,981 barrels of oil per acre was obtained from 17.0 feet of sand. The weighted average percent oil saturation was reduced from 50.8 to 27.6, or represents an average recovery of 23.2 percent. The weighted average effective permeability of the samples is 5.49 millidarcys, while the average initial fluid production pressure is 18.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 16 produced water and 17 oil. This indicates that approximately 90 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a more or less uniform effective permeability to water.

CONCLUSION

A study of the laboratory data indicates that efficient primary and secondary operations in the vicinity of this well should recover approximately 1,460 and 6,300 barrels of oil per acre respectively. These represent average recoveries of 86 and 371 barrels of oil per acre foot from 17.0 feet of pay sand analyzed in this core.

The above recovery values were calculated using the following data and assumptions.

Original formation volume factor 1.06

Reservoir water saturation, percent	18.0
Primary recovery, estimated, percent	6.0
Average porosity, percent	19.6
Oil saturation after flooding, percent	27.6
Performance factor, percent	55.0
Net floodable pay sand, feet	17.0

This core shows a pay sand section having a good oil saturation, a low water saturation and good effective permeability to water. No difficulty should be encountered in obtaining necessary injection rates.

The above 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 Charley Murphy Lease Uhren 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.		
1	943.5	21.2	46	24	70	756	55.	1.0	1.0	756	55.00
2	944.5	16.6	39	36	75	502	8.1	1.0	2.0	502	8.10
3	945.5	22.6	60	21	81	1,050	266.	1.0	3.0	1,050	266.00
4	946.5	19.2	48	14	62	715	183.	1.0	4.0	715	183.00
5	947.5	15.8	55	27	82	674	89.	1.0	5.0	674	89.00
6	948.5	17.7	55	22	77	756	400.	1.0	6.0	756	400.00
7	949.5	19.9	61	15	76	942	173.	1.0	7.0	942	173.00
8	950.5	20.2	53	18	71	830	99.	1.0	8.0	830	99.00
9	951.5	20.3	51	25	76	804	89.	1.0	9.0	804	89.00
10	952.5	21.1	35	20	55	573	92.	1.0	10.0	573	92.00
11	953.5	19.8	37	28	65	568	114.	1.0	11.0	568	114.00
12	954.5	20.8	48	20	68	774	195.	1.0	12.0	774	195.00
13	955.5	22.0	56	20	76	956	156.	1.0	13.0	956	156.00
14	956.5	16.6	61	29	90	785	39.	1.0	14.0	785	39.00
15	957.5	15.5	54	35	89	650	39.	1.0	15.0	650	39.00
16	958.5	22.8	52	22	74	920	67.	1.0	16.0	920	67.00
17	959.5	18.6	53	32	85	765	114.	1.0	17.0	765	114.00
18	960.5	18.4	56	18	74	799	2.2	1.0	18.0	799	2.20
19	961.5	19.5	53	15	68	812	2.3	1.0	19.0	812	2.30
								Total	-------	14,631	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Charley Murphy Lease Uhren Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
943.0 - 949.0	6.0	167.1	1001.10
949.0 - 962.0	13.0	91.0	1181.50
943.0 - 962.0	19.0	115.0	2182.60

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
943.0 - 949.0	6.0	18.9	50.5	24.0	743	4,453
949.0 - 962.0	13.0	19.6	51.5	22.8	783	10,178
943.0 - 962.0	19.0	19.4	51.1	23.2	770	14,631

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Charley Murphy Lease Uhren 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 Field Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	943.5	20.9	46	745	22	356	24	73	389	27	0.800	20
2	944.5	17.0	39	514	13	171	26	71	343	0	0.010	50
3	945.5	22.2	60	1,032	30	516	30	67	516	429	30.00	10
4	946.5	19.7	48	734	21	321	27	66	413	245	15.00	10
5	947.5	16.4	55	699	27	343	28	71	356	83	2.50	20
6	948.5	17.9	55	763	25	347	30	68	416	260	6.60	20
7	949.5	20.0	61	945	28	434	33	64	511	318	9.10	10
8	950.5	20.5	53	842	24	382	29	67	460	97	2.80	10
9	951.5	20.5	51	810	29	460	22	69	350	94	3.02	20
10	952.5	20.8	35	564	9	145	26	69	419	148	4.40	10
11	953.5	20.2	37	579	12	188	25	73	391	190	5.40	10
12	954.5	21.0	48	781	23	374	25	73	407	164	4.50	10
13	955.5	21.6	56	937	32	535	24	68	402	104	3.50	20
14	956.5	16.9	61	799	31	406	30	67	393	16	0.600	20
15	957.5	16.0	54	670	24	298	30	59	372	13	0.500	40
16	958.5	22.5	52	906	21	366	31	64	540	129	3.90	20
17	959.5	19.0	53	781	23	339	30	67	442	20	0.700	20
18	960.5	18.1	54	758	0	0	54	22	758	0	Imp.	-
19	961.5	19.6	50	760	0	0	50	18	760	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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Charley Murphy Lease Uhren Well No. 1

Depth Interval, Feet	943.0 - 949.0	949.0 - 962.0	943.0 - 962.0
Feet of Core Analyzed	6.0	11.0	17.0
Average Percent Porosity	19.1	19.9	19.6
Average Percent Original Oil Saturation	50.5	51.0	50.8
Average Percent Oil Recovery	23.0	23.2	23.2
Average Percent Residual Oil Saturation	27.5	27.8	27.6
Average Percent Residual Water Saturation	69.4	67.3	68.0
Average Percent Total Residual Fluid Saturation	96.9	95.1	95.6
Average Original Oil Content, Bbls./A. Ft.	747.	783.	771.
Average Oil Recovery, Bbls./A. Ft.	342.	358.	352.
Average Residual Oil Content, Bbls./A. Ft.	405.	425.	419.
Total Original Oil Content, Bbls./Acre	4,487.	8,614.	13,101.
Total Oil Recovery, Bbls./Acre	2,054.	3,927.	5,981.
Total Residual Oil Content, Bbls./Acre	2,433.	4,687.	7,120.
Average Effective Permeability, Millidarcys	9.15	3.50	5.49
Average Initial Fluid Production Pressure, p.s.i.	21.6	17.3	18.8

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