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

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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November 7, 1959

Ward A. McGinnis
114 West Fourth
Eureka, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the 3" Rotary core taken from the Burke Lease, Well No. 1, Greenwood County, Kansas, and submitted to our laboratory by a representative of the client on November 2, 1959.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. McElrea

Carl L. McElrea

CLM:cs

1 c. to James E. Lewis

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GENERAL INFORMATION & SUMMARY

Company Ward A. McGinnis Lease Burke Well No. 1

Location SE¼

Section 12 Twp. 24S Rge. 9E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2184.0
Bottom of Core	2203.0
Top of Pay Sand	2185.0
Bottom of Sand	?
Total Feet of Permeable Sand	18.0
Total Feet of Floodable Sand	13.0

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	7.0	7.0
5 - 10	7.0	14.0
10 & above	4.0	18.0

Average Permeability Millidarcys	9.0
Average Percent Porosity	15.5
Average Percent Oil Saturation	31.0
Average Percent Water Saturation	49.4
Average Oil Content, Bbls./A. Ft.	372.
Total Oil Content, Bbls./Acre	6,690.
Average Percent Oil Recovery by Laboratory Flooding Tests	8.2
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	100.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,100.
Total Calculated Oil Recovery, Bbls./Acre	2,100.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

A fresh water mud was used as the circulating fluid during the coring of the sand.

Samples were taken from the core and sealed in cans by a representative of the client.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2184.0 - 2185.0	Grayish light brown shaley micaceous sandstone.
2185.0 - 2203.0	Grayish light brown slightly laminated slightly shaley micaceous sandstone.

Coring was started at a depth of 2184.0 feet in grayish light brown shaley micaceous sandstone and completed at 2203.0 feet in grayish light brown slightly laminated slightly shaley sandstone. This core shows a total of 19.0 feet of sandstone. For the most part, the pay is made up of grayish light brown slightly laminated slightly shaley sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into three sections. The weighted average permeability of the upper, middle and lower sections is 14.5, 7.9 and 5.7 millidarcys respectively; the overall average being 9.0 (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 0.67 to a maximum of 30 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 31.0. The weighted average percent oil saturation of the upper, middle and lower sections is 29.6, 30.8 and 32.5 respectively. The weighted average percent water saturation of the upper,

middle and lower sections is 47.4, 46.7 and 54.0 respectively; the overall average being 49.4 (See Table III). This gives an overall weighted average total fluid saturation of 80.4 percent. This total fluid saturation indicates some fluid was lost during coring, part of which probably was oil.

The weighted average oil content of the upper, middle and lower sections is 360, 366 and 388 barrels per acre foot respectively; the overall average being 372. The total oil content, as shown by this core, is 6,690 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 1,100 barrels of oil per acre was obtained from 11.0 feet of sand. The weighted average percent oil saturation was reduced from 31.6 to 23.4, or represents an average recovery of 8.2 percent. The weighted average effective permeability of the samples is 0.644 millidarcys while the average initial fluid production pressure is 39.1 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 18 samples tested, 13 produced water and 11 oil. This indicates that approximately 72 percent of the sand represented by these samples will take water. The tests also show that the sand has a comparatively uniform effective permeability.

CONCLUSION

It is evident from the enclosed data that an efficient water-flood within the vicinity of this well will recover approximately 2,100 barrels of oil per acre. This represents an average recovery of 161 barrels of oil per acre foot from the 13.0 feet of floodable sand analyzed. The following factors and assumptions were used in calculating this recovery:

Original formation volume factor	1.13
Present formation volume factor	1.03
True water saturation, percent	40.0
Primary oil recovery, percent	6.0
Calculated present oil saturation, percent	48.6
Porosity, percent	15.9
Oil saturation at abandonment, percent	24.0
Performance factor, percent	55.0

The analysis results show 13.0 feet of floodable sand in the cored section. The floodable sand has fairly good oil and normal water saturations and a comparatively uniform effective permeability.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Ward A. McGinnis Lease Burke Well No. 1

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	2184.5	0.67	1.0	1.0	0.67
2	2185.5	28.	1.0	2.0	28.00
3	2186.5	8.4	1.0	3.0	8.40
4	2187.5	5.3	1.0	4.0	5.30
5	2188.5	30.	1.0	5.0	30.00
6	2189.5	5.2	1.0	6.0	5.20
7	2190.5	4.3	1.0	7.0	4.30
8	2191.5	2.2	1.0	8.0	2.20
9	2192.5	3.4	1.0	9.0	3.40
10	2193.5	8.9	1.0	10.0	8.90
11	2195.5	19.	1.0	11.0	19.00
12	2196.5	12.	1.0	12.0	12.00
13	2197.5	2.9	1.0	13.0	2.90
14	2198.5	7.7	1.0	14.0	7.70
15	2199.5	9.2	1.0	15.0	9.20
16	2200.5	4.1	1.0	16.0	4.10
17	2201.5	5.6	1.0	17.0	5.60
18	2202.5	4.9	1.0	18.0	4.90

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RESULTS OF SATURATION TESTS

TABLE II

Company Ward A. McGinnis Lease Burke Well No. 1

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1	2184.5	13.0	35	55	90	353	1.0	1.0	353
2	2185.5	17.9	30	41	71	417	1.0	2.0	417
3	2186.5	14.8	31	49	80	356	1.0	3.0	356
4	2187.5	14.8	25	51	76	287	1.0	4.0	287
5	2188.5	18.3	27	41	68	383	1.0	5.0	383
6	2189.5	15.2	27	48	75	318	1.0	6.0	318
7	2190.5	15.8	29	49	78	356	1.0	7.0	356
8	2191.5	16.5	31	41	72	397	1.0	8.0	397
9	2192.5	14.9	29	49	78	335	1.0	9.0	335
10	2193.5	14.9	28	50	78	324	1.0	10.0	324
11	2195.5	15.3	33	47	80	392	1.0	11.0	392
12	2196.5	14.5	39	43	82	439	1.0	12.0	439
13	2197.5	15.3	36	54	90	427	1.0	13.0	427
14	2198.5	15.9	41	50	91	506	1.0	14.0	506
15	2199.5	16.5	33	50	83	422	1.0	15.0	422
16	2200.5	14.9	33	56	89	381	1.0	16.0	381
17	2201.5	14.3	28	53	81	310	1.0	17.0	310
18	2202.5	15.4	24	61	85	287	1.0	18.0	287
							Total-	- - - - -	- 6,690

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Ward A. McGinnis Lease Burke Well No. 1

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2184.0 - 2189.0	5.0	14.5	72.37
2189.0 - 2197.0	7.0	7.9	55.00
2197.0 - 2203.0	6.0	5.7	34.40
2184.0 - 2203.0	18.0	9.0	161.77

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
2184.0 - 2189.0	5.0	15.7	29.6	47.4	360	1,796
2189.0 - 2197.0	7.0	15.3	30.8	46.7	366	2,561
2197.0 - 2203.0	6.0	15.4	32.5	54.0	388	2,333
2184.0 - 2203.0	18.0	15.5	31.0	49.4	372	6,690

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Ward A. McGinnis Lease Burke 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.			
1	2184.5	13.3	32	330	0	0	32	57	330	0	Imp.	50+
2	2185.5	17.4	30	405	5	67	25	68	338	49	1.30	35
3	2186.5	14.2	30	330	0	0	30	63	330	0	Imp.	50+
4	2187.5	15.4	25	299	2	24	23	71	275	4	0.205	50
5	2188.5	18.1	27	379	3	42	24	70	337	68	2.44	25
6	2189.5	14.7	28	320	0	0	28	65	320	0	Imp.	50+
7	2190.5	15.8	29	356	4	49	25	63	307	5	0.294	45
8	2191.5	16.2	29	364	0	0	29	60	364	0	Imp.	50+
9	2192.5	14.8	29	333	7	80	22	72	253	9	0.396	45
10	2193.5	15.6	28	339	8	97	20	71	242	14	0.413	35
11	2195.5	15.4	33	394	10	119	23	73	275	17	0.512	35
12	2196.5	14.9	39	451	12	139	27	66	312	18	0.417	45
13	2197.5	15.1	33	387	0	0	33	58	387	0	Imp.	50+
14	2198.5	15.8	41	503	21	258	20	69	245	10	0.280	45
15	2199.5	17.1	33	438	11	146	22	75	292	23	0.513	35
16	2200.5	14.6	33	374	7	79	26	67	295	10	0.315	35
17	2201.5	14.6	26	295	0	0	26	67	295	10	0.400	45
18	2202.5	15.6	21	254	0	0	21	70	254	8	0.277	45

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 Ward A. McGinnis Lease Burke Well No. 1

Depth Interval, Feet	2185.0 - 2189.0	2190.0 - 2197.0	2198.0 - 2201.0	2185.0 - 2201.0
Feet of Core Analyzed	3.0	5.0	3.0	11.0
Average Percent Porosity	17.0	15.3	15.8	15.9
Average Percent Original Oil Saturation	27.3	31.6	35.7	31.6
Average Percent Oil Recovery	3.3	8.2	13.0	8.2
Average Percent Residual Oil Saturation	24.0	23.4	22.7	23.4
Average Percent Residual Water Saturation	69.6	69.1	70.3	69.5
Average Percent Total Residual Fluid Saturation	93.6	92.5	93.0	92.9
Average Original Oil Content, Bbls./A. Ft.	361.	375.	438.	388.
Average Oil Recovery, Bbls./A. Ft.	44.	97.	161.	100.
Average Residual Oil Content, Bbls./A. Ft.	317.	278.	277.	288.
Total Original Oil Content, Bbls./Acre	1,083.	1,873.	1,315.	4,271.
Total Oil Recovery, Bbls./Acre	133.	484.	483.	1,100.
Total Residual Oil Content, Bbls./Acre	950.	1,389.	832.	3,171.
Average Effective Permeability, Millidarcys	1.32	0.406	0.369	0.644
Average Initial Fluid Production Pressure, p.s.i.	36.7	41.0	38.4	39.1

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