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

OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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September 19, 1961

Ward A. McGinnis
114 West 4th
Eureka, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Burke Lease, Well No. 16 A, Greenwood County, Kansas, and submitted to our laboratory on September 12, 1961.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

BRP:rf

1 c. - James E. Lewis

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GENERAL INFORMATION & SUMMARY

Company Ward A. McGinnis Lease Burke Well No. 16-A

Location 1830' East of SW Corner & 330' North of South line SE¼

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

Name of Sand	Bartlesville
Top of Core	2241.0
Bottom of Core	2256.7
Top of Sand (Analyzed)	2241.7
Bottom of Sand (Analyzed)	2256.4
Total Feet of Permeable Sand	12.4
Total Feet of Floodable Sand	4.9

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	7.7	7.7
5 - 10	4.7	12.4

Average Permeability Millidarcys	4.5
Average Percent Porosity	15.9
Average Percent Oil Saturation	31.2
Average Percent Water Saturation	50.6
Average Oil Content, Bbls./A. Ft.	384.
Total Oil Content, Bbls./Acre	4,765.
Average Percent Oil Recovery by Laboratory Flooding Tests	13.5
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	162.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	795.
Total Calculated Oil Recovery, Bbls./Acre	710.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water mud was used as the circulating fluid in coring this well. The core was sampled after being received in the laboratory. The well was drilled in non-virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2241.0 - 2241.7	Laminated sandy shale.
2241.7 - 2243.9	Light brown shaley sandstone.
2243.9 - 2251.5	Light brown slightly shaley sandstone.
2251.5 - 2253.8	Laminated slightly sandy shale.
2253.8 - 2256.4	Light brown slightly shaley sandstone.
2256.4 - 2256.7	Dark carbonaceous sandstone.

The top of the core received was at 2241.0 feet and was made up of laminated shaley sandstone. The bottom of the core received was at 2256.7 feet and was dark carbonaceous sandstone. This core shows a total of 12.4 feet of sandstone. For the most part, the pay is made up of light brown, slightly shaley 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 5.7 and 3.7 millidarcys respectively; while that of the pay sand is 5.7; the overall average being 4.5 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather uniform permeability profile. The permeability of the sand varies from 1.4 to a maximum of 10. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fair weighted average percent oil saturation, namely, 31.2. The weighted average percent oil saturation of the upper and lower sections is 32.8 and 30.2 respectively. The weighted average percent water saturation of the upper and lower sections is 50.5

and 51.1 respectively; while that of the pay sand is 50.5, the overall average being 50.6 (See Table III). This gives an overall weighted average total fluid saturation of 81.8 percent.

The weighted average oil content of the upper and lower sections is 403 and 372 barrels per acre foot respectively; while that of the pay sand is 403, the overall average being 384. The total oil content, as shown by this core, is 4,765 barrels per acre of which 1,971 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 795 barrels of oil per acre was obtained from 4.9 feet of sand. The weighted average percent oil saturation was reduced from 32.9 to 19.4, or represents an average recovery of 13.5 percent. The weighted average effective permeability of the samples is 0.294 millidarcys, while the average initial fluid production pressure is 44.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 13 samples tested, 5 produced water and oil. This indicates that approximately 39 percent of the sand represented by these samples is flocdable pay sand. The tests also show that the permeable sand has a rather uniform effective permeability to water.

CONCLUSION

Based on the results of the laboratory tests, it appears that an efficient water-flood in the vicinity of this well should recover approximately 710 barrels of oil per acre. This represents an average recovery of 145 barrels per acre foot from the 4.9 feet of floodable pay sand analyzed in this core.

The following data and assumptions were used in calculating the above recovery values:

Original formation volume factor	1.21
Present formation volume factor	1.12
Reservoir water saturation, percent	40.0
Primary recovery, percent, estimated	12.0
Average porosity, percent	15.8
Abandonment oil saturation, percent	19.4
Performance factor, percent	55.0
Net floodable pay sand, feet	4.9

This core indicates a reservoir having a fair oil saturation, a moderate water saturation and a low effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Ward A McGinnis Lease Burke Well No. 16-A

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	2242.1	14.3	31	61	92	344	2.0	0.9	0.9	310	1.80
2	2243.1	14.2	33	54	87	364	3.8	1.3	2.2	474	4.94
3	2244.1	15.8	33	47	80	405	7.5	0.7	2.9	284	5.25
4	2245.1	16.6	35	46	81	451	5.8	1.0	3.9	451	5.80
5	2246.1	18.2	32	43	75	452	10.	1.0	4.9	452	10.00
6	2247.1	16.7	22	45	67	285	5.5	1.0	5.9	285	5.50
7	2248.1	14.2	31	48	79	342	3.7	1.0	6.9	342	3.70
8	2249.1	14.4	33	51	84	369	2.6	1.0	7.9	369	2.60
9	2250.1	17.1	35	48	83	464	2.0	1.0	8.9	464	2.00
10	2251.1	15.5	47	42	89	565	1.4	0.9	9.8	509	1.26
11	2254.1	16.2	28	65	93	352	1.5	0.8	10.6	282	1.20
12	2255.1	19.2	26	52	78	388	8.9	1.0	11.6	388	8.90
13	2256.1	13.9	18	61	79	194	3.3	0.8	12.4	155	2.64
								Total		4,765	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Ward A. McGinnis Lease Burke Well No. 16-A

(Permeable)

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcy's	Permeability Capacity Ft. x Md.
2241.7 - 2246.6	4.9	5.7	27.79
2246.6 - 2256.4	7.5	3.7	27.80
2241.7 - 2256.4	12.4	4.5	55.59

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
2241.7 - 2246.6	4.9	15.8	32.8	50.5	403	1,971
2246.6 - 2256.4	7.5	16.0	30.2	51.1	372	2,794
2241.7 - 2256.4	12.4	15.9	31.2	50.6	384	4,765

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Ward A McGinnis Lease Burke Well No. 16-A

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	2242.1	14.6	31	351	16	181	15	78	170	2	0.167	50
2	2243.1	14.4	33	369	17	190	16	72	179	4	0.083	45
3	2244.1	16.2	33	415	8	101	25	70	314	12	0.400	40
4	2245.1	16.4	35	446	17	216	18	68	230	13	0.300	45
5	2246.1	18.0	32	447	7	98	25	68	349	25	0.600	40
6	2247.1	16.2	24	302	0	0	24	44	302	0	Imp.	50+
7	2248.1	14.4	28	313	0	0	28	53	313	0	Imp.	50+
8	2249.1	14.7	30	342	0	0	30	56	342	0	Imp.	50+
9	2250.1	17.0	36	475	0	0	36	48	475	0	Imp.	50+
10	2251.1	15.7	45	548	0	0	45	46	548	0	Imp.	50+
11	2254.1	16.2	28	352	0	0	28	64	352	0	Imp.	50+
12	2255.1	18.9	27	396	0	0	27	52	396	0	Imp.	50+
13	2256.1	14.1	20	219	0	0	20	60	219	0	Imp.	50+

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Ward A. McGinnis Lease Burke Well No. 16-A

Depth Interval, Feet	2241.7 - 2246.6
Feet of Core Analyzed	4.9
Average Percent Porosity	15.8
Average Percent Original Oil Saturation	32.9
Average Percent Oil Recovery	13.5
Average Percent Residual Oil Saturation	19.4
Average Percent Residual Water Saturation	71.2
Average Percent Total Residual Fluid Saturation	90.6
Average Original Oil Content, Bbls./A. Ft.	404.
Average Oil Recovery, Bbls./A. Ft.	162.
Average Residual Oil Content, Bbls./A. Ft.	242.
Total Original Oil Content, Bbls./Acre	1,979.
Total Oil Recovery, Bbls./Acre	795.
Total Residual Oil Content, Bbls./Acre	1,184.
Average Effective Permeability, Millidarcys	0.294
Average Initial Fluid Production Pressure, p.s.i.	44.0

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