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February 24, 1959

Graybol Oil Corporation
2200 National Bank Building
Tulsa 3, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the 2 11/16" Rotary core taken from the Winchell Lease, Well No. 8, Chautauqua County, Kansas, and submitted to our laboratory on February 18, 1959.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. McElrea
Carl L. McElrea

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GENERAL INFORMATION & SUMMARY

Company Graybol Oil Corporation Lease Winchell Well No. 8

Location NE $\frac{1}{4}$, SW $\frac{1}{4}$, SW $\frac{1}{4}$

Section 13 Twp. 35S Rge. 9E County Chautauqua State Kansas

Name of Sand	Wayside
Top of Core	1580.0
Bottom of Core	1599.0
Pay	
Top of Sand	1581.6
Pay	
Bottom of Sand	1587.6
Total Feet of Permeable Sand	13.0
Total Feet of Floodable Sand	4.0

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 1	4.4	4.4
1 - 2	4.6	9.0
2 & above	4.0	13.0

Average Permeability Millidarcys	2.1
Average Percent Porosity	14.4
Average Percent Oil Saturation	25.1
Average Percent Water Saturation	58.5
Average Oil Content, Bbls./A. Ft.	283.
Total Oil Content, Bbls./Acre	5,380.
Average Percent Oil Recovery by Laboratory Flooding Tests	
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	
Total Calculated Oil Recovery, Bbls./Acre, <u>primary production</u>	500.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

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

This core was sampled and the samples were sealed in plastic bags by a representative of our laboratory.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
1580.0 - 1596.0	- Grayish light brown shaley sandstone.
1596.0 - 1596.3	- Laminated sandstone and shale.
1596.3 - 1599.0	- Grayish light brown shaley sandstone.

Coring was started at a depth of 1580.0 feet in grayish light brown shaley sandstone and completed at 1599.0 feet in like formation. This core shows a total of 18.7 feet of sandstone. For the most part, the pay is made up of grayish light brown 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 2.7 and 1.2 millidarcys respectively; the overall average being 2.1 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand is tight. The permeability of the sand varies from 0.68 to a maximum of 10 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 25.1. The weighted average percent oil saturation of the upper and lower sections is 24.2 and 25.7 respectively. The weighted average percent water saturation of the upper and lower sections

is 55.8 and 60.6 respectively; the overall average being 58.5 (See Table III). This gives an overall weighted average total fluid saturation of 83.6 percent.

The weighted average oil content of the upper and lower sections is 272 and 290 barrels per acre foot respectively; the overall average being 283. The total oil content, as shown by this core, is 5,380 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core did not respond very satisfactorily to laboratory flooding tests, as none of the samples tested produced oil.

By observing the data given in Table IV, you will note that of the 19 samples tested, 6 produced water. This indicates that approximately 32 percent of the sand represented by these samples will take water. The tests also show that the sand is rather tight.

CONCLUSION

On the basis of the enclosed data, it is evident that efficient hydraulic fracturing and primary production methods will recover approximately 500 barrels of oil per acre from the area represented by this core. An efficient water-flood in this area should achieve an additional recovery of approximately 460 barrels of oil per acre, provided fracturing does not cause channeling or by-passing of the water. The following factors and assumptions were used in calculating this recovery:

Original formation volume factor	1.11
True water saturation, percent	47.0
Primary recovery, percent	None
Calculated present oil saturation, percent	47.8
Porosity, percent	14.5

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Oil saturation at abandonment, percent 25.0

Performance factor 0.50

This core shows a shaley tight sand section having fairly low oil and rather high water saturations.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Graybol Oil Corporation Lease Winchell Well No. 8

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	1580.4	1.9	0.6	0.6	1.14
2	1580.9	0.88	0.5	1.1	0.44
3	1581.4	0.70	0.5	1.6	0.35
4	1581.9	1.4	0.5	2.1	0.70
5	1582.4	4.6	0.5	2.6	2.30
6	1582.9	1.5	0.5	3.1	0.75
7	1583.4	2.2	0.5	3.6	1.10
8	1583.9	3.9	0.5	4.1	1.95
9	1584.4	2.2	0.5	4.6	1.10
10	1584.9	0.77	0.5	5.1	0.38
11	1585.4	4.7	0.5	5.6	2.35
12	1585.9	10.	0.5	6.1	5.00
13	1586.4	1.7	0.5	6.6	0.85
14	1586.9	3.4	0.5	7.1	1.70
15	1587.4	0.85	0.5	7.6	0.42
16	1587.9	Imp.	0.5	8.1	0.00
17	1588.4	1.1	0.5	8.6	0.55
18	1588.9	1.5	0.5	9.1	0.75
19	1589.4	Imp.	0.5	9.6	0.00
20	1589.9	1.3	0.5	10.1	0.65
21	1590.4	1.8	0.5	10.6	0.90
22	1590.9	0.87	0.5	11.1	0.43
23	1591.4	1.1	0.5	11.6	0.55
24	1591.9	Imp.	0.5	12.1	0.00
25	1592.4	Imp.	0.5	12.6	0.00
26	1592.9	0.70	0.5	13.1	0.35
27	1593.4	2.4	0.5	13.6	1.20
28	1593.9	Imp.	0.5	14.1	0.00
29	1594.4	Imp.	0.5	14.6	0.00
30	1594.9	0.69	0.5	15.1	0.34
31	1595.4	Imp.	0.5	15.6	0.00
32	1595.9	0.68	0.4	16.0	0.27
33	1596.4	Imp.	0.3	16.3	0.00
34	1596.9	Imp.	0.5	16.8	0.00
35	1597.4	Imp.	0.5	17.3	0.00
36	1597.9	0.81	0.5	17.8	0.40
37	1598.4	Imp.	0.6	18.4	0.00

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RESULTS OF SATURATION TESTS

TABLE II

Company Graybol Oil Corporation Lessee Winchell Well No. 8

Sst. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation		Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water		Ft.	Cum. Ft.	
1	1580.1	12.6	25	55	244	0.6	0.6	146
2	1581.1	14.0	21	52	228	1.0	1.6	228
3	1582.1	15.0	24	55	280	1.0	2.6	280
4	1583.1	13.6	28	53	296	1.0	3.6	296
5	1584.1	13.3	19	65	196	1.0	4.6	196
6	1585.1	17.5	26	48	353	1.0	5.6	353
7	1586.1	13.7	22	64	234	1.0	6.6	234
8	1587.1	15.0	29	54	338	1.0	7.6	338
9	1588.1	14.1	20	53	219	1.0	8.6	219
10	1589.1	14.7	34	54	388	1.0	9.6	388
11	1590.1	16.3	19	52	240	1.0	10.6	240
12	1591.1	15.7	33	53	402	1.0	11.6	402
13	1592.1	14.2	28	60	309	1.0	12.6	309
14	1593.1	14.9	37	59	428	1.0	13.6	428
15	1594.1	14.8	25	61	288	1.0	14.6	288
16	1595.1	13.1	23	71	234	1.4	16.0	328
17	1596.1	14.7	32	60	365	0.3	16.3	109
18	1597.1	14.0	19	71	206	1.3	17.6	268
19	1598.1	13.8	22	64	236	1.4	19.0	330
					Total--	--	--	-5,380

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Graybol Oil Corporation	Lease	Winchell	Well No.	8
	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	
	1580.0 - 1587.6	7.6	2.7	20.53	
	1588.6 - 1598.1	5.4	1.2	6.39	
	1580.0 - 1598.1	13.0	2.1	26.92	

	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
	1580.0 - 1587.6	7.6	14.4	24.2	55.8	272	2,071
	1587.6 - 1599.0	11.4	14.4	25.7	60.6	290	3,309
	1580.0 - 1599.0	19.0	14.4	25.1	58.5	283	5,380

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company				Graybol Oil Corporation				Lease		Winchell		Well No.		8	
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	1580.1	12.7	23	226	0	0	23	62	0	Imp.	50+				
2	1581.1	13.7	18	191	0	0	18	64	0	Imp.	50+				
3	1582.1	14.6	25	284	0	0	25	67	5	0.196	50				
4	1583.1	13.6	26	274	0	0	26	62	8	0.203	50				
5	1584.1	13.5	18	189	0	0	18	66	0	Imp.	50+				
6	1585.1	17.3	28	376	0	0	28	60	7	0.173	50				
7	1586.1	14.0	19	206	0	0	19	71	5	0.200	50				
8	1587.1	15.1	27	316	0	0	27	64	2	0.202	50				
9	1588.1	14.4	19	212	0	0	19	57	0	Imp.	50+				
10	1589.1	15.0	32	373	0	0	32	56	0	Imp.	50+				
11	1590.1	16.0	16	199	0	0	16	71	4	0.099	50				
12	1591.1	15.3	32	380	0	0	32	57	0	Imp.	50+				
13	1592.1	14.2	29	320	0	0	29	57	0	Imp.	50+				
14	1593.1	15.1	37	434	0	0	37	56	0	Imp.	50+				
15	1594.1	14.7	23	262	0	0	23	67	0	Imp.	50+				
16	1595.1	13.5	20	210	0	0	20	65	0	Imp.	50+				
17	1596.1	14.6	31	351	0	0	31	59	0	Imp.	50+				
18	1597.1	13.8	22	236	0	0	22	65	0	Imp.	50+				
19	1598.1	13.9	20	216	0	0	20	71	0	Imp.	50+				

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.