OILFIELD RESEARCH LABORATORIES
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October 14, 1981

Graybol-Patton Company
Suite 301, Holarud Building
10 East 3rd Street
Tulsa, Oklahoma 74103

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Bates Lease, Well No. 4, located in Wilson County, Kansas and submitted to our laboratory on October 2, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/kas

5 c to Tulsa, Oklahoma

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GENERAL INFORMATION & SUMMARY

Company Graybol-Patton Company Lease Bates Well No. 4

Location

Section 1 Twp. 29S Rge. 14E County Wilson State Kansas

Elevation, Feet	
Name of Sand	
Top of Core	1041.0
Bottom of Core	1055.9
Top of Sand	1041.0
Bottom of Sand	1055.9
Total Feet of Permeable Sand	14.6
Total Feet of Floodable Sand	10.3

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 37	4.4	4.4
110 - 260	3.1	7.5
260 - 310	1.0	8.5
405 - 465	3.0	11.5
650 - 785	3.1	14.6

Average Permeability Millidarcys	312.4
Average Percent Porosity	21.7
Average Percent Oil Saturation	36.8
Average Percent Water Saturation	28.7
Average Oil Content, Bbls./A. Ft.	620.
Total Oil Content, Bbls./Acre	9,047.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.5
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	108.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,111.
Total Calculated Oil Recovery, Bbls./Acre	See "Calculated Recovery" Section

The core was sampled and the samples sealed in plastic bags by a representative of the client.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
1041.0 - 1041.7	Brown sandstone.
1041.7 - 1042.0	Gray shale.
1042.0 - 1043.3	Brown sandstone with fine shale partings.
1043.3 - 1044.1	Brown sandstone with shale partings.
1044.1 - 1045.7	Brown sandstone with some fine coal partings.
1045.7 - 1048.8	Brown sandstone.
1048.8 - 1052.7	Brown sandstone with fine shale partings.
1052.7 - 1054.6	Brown sandstone.
1054.6 - 1055.9	Dark brown slightly carbonaceous sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,111 barrels of oil per acre was obtained from 10.3 feet of sand. The weighted average percent oil saturation was reduced from 37.7 to 32.2, or represents an average recovery of 5.5 percent. The weighted average effective permeability of the samples is 20.96 millidarcys, while the average initial fluid production pressure is 18.6 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 15 samples tested, 11 produced water and oil, and 4 produced water only. This indicates that approximately 73 percent of the sand represented

by these samples is floodable pay sand.

CALCULATED RECOVERY

It would appear from a study of the core data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 3,730 barrels of oil per acre. This is an average recovery of 362 barrels per acre foot from 10.3 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor, estimated	1.08
Reservoir water saturation, percent, estimated	20.0
Average porosity, percent	22.3
Oil saturation after flooding, percent	32.2
Performance factor, percent, estimated	50.0
Net floodable sand, feet	10.3

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Graybol-Patton Company Lease Bates Well No. 4

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	1041.6	16.7	41	21	62	531	36.	0.7	0.7	372	25.20
2	1042.6	15.4	42	26	68	502	26.	1.3	2.0	653	33.80
3	1043.6	10.5	37	54	91	301	7.1	0.8	2.8	241	5.68
4	1044.5	16.9	44	18	62	577	33.	1.0	3.8	577	33.00
5	1045.6	17.1	20	33	53	265	35.	0.6	4.4	159	21.00
6	1046.6	20.4	27	30	57	427	110.	1.1	5.5	470	121.00
7	1047.5	23.4	36	36	72	654	203.	1.0	6.5	654	203.00
8	1048.6	22.5	35	29	64	611	305.	1.0	7.5	611	305.00
9	1049.6	26.3	42	26	68	857	650.	0.9	8.4	771	585.00
10	1050.6	23.5	31	27	58	565	259.	1.0	9.4	565	259.00
11	1051.6	26.6	42	27	69	867	424.	1.0	10.4	867	424.00
12	1052.5	24.5	38	23	61	722	408.	1.0	11.4	722	408.00
13	1053.6	25.2	39	26	65	763	463.	1.0	12.4	763	463.00
14	1054.5	26.2	36	28	64	732	728.	0.9	13.3	659	655.20
15	1055.5	25.8	37	31	68	741	784.	1.3	14.6	963	1019.20

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Graybol-Patton Company Lease Bates Well No. 4

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
1041.0 - 1046.8	5.5	43.6	239.68
1046.8 - 1055.9	9.1	474.9	4321.40
1041.0 - 1055.9	14.6	312.4	4561.08

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
1041.0 - 1046.8	5.5	16.3	36.1	29.5	449	2,472
1046.8 - 1055.9	9.1	24.9	37.3	28.2	723	6,575
1041.0 - 1055.9	14.6	21.7	36.8	28.7	620	9,047

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Graybol-Patton Company Lease Bates Well No. 4

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	1041.6	17.0	40	528	3	40	37	37	488	8	0.15	40
2	1042.6	15.5	42	505	0	0	42	45	505	18	0.30	45
3	1043.6	10.6	37	304	5	41	32	60	263	120	4.50	15
4	1044.5	17.4	43	580	4	54	39	33	526	250	7.95	20
5	1045.6	17.2	20	267	0	0	20	64	267	196	9.16	25
6	1046.6	20.5	27	429	0	0	27	34	429	174	13.99	10
7	1047.5	23.3	36	651	5	90	31	42	561	276	10.12	15
8	1048.6	22.0	36	614	8	137	28	44	477	248	1.72	25
9	1049.6	26.4	42	860	10	205	32	45	655	458	63.72	10
10	1050.6	23.0	32	571	3	54	29	49	517	196	35.98	10
11	1051.6	26.5	42	863	9	185	33	37	678	170	16.10	30
12	1052.5	24.6	38	725	8	153	30	51	572	162	15.59	15
13	1053.6	25.3	39	765	7	137	32	47	628	194	20.09	15
14	1054.5	26.3	36	735	3	61	33	49	674	348	52.48	10
15	1055.5	25.9	37	743	0	0	37	38	743	146	23.24	15

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

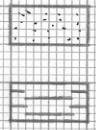
TABLE V

Company Graybol-Patton Company Lease Bates Well No. 4

Depth Interval, Feet	1041.0 - 1046.8	1046.8 - 1055.9	1041.0 - 1055.9
Feet of Core Analyzed	2.5	7.8	10.3
Average Percent Porosity	15.1	24.6	22.3
Average Percent Original Oil Saturation	40.2	37.0	37.7
Average Percent Oil Recovery	4.0	6.0	5.5
Average Percent Residual Oil Saturation	36.2	31.0	32.2
Average Percent Residual Water Saturation	42.8	45.5	44.8
Average Percent Total Residual Fluid Saturation	79.0	76.5	77.0
Average Original Oil Content, Bbls./A. Ft.	477.	722.	662.
Average Oil Recovery, Bbls./A. Ft.	46.	128.	108.
Average Residual Oil Content, Bbls./A. Ft.	431.	594.	554.
Total Original Oil Content, Bbls./Acre	1,193.	5,626.	6,819.
Total Oil Recovery, Bbls./Acre	115.	996.	1,111.
Total Residual Oil Content, Bbls./Acre	1,078.	4,630.	5,708.
Average Effective Permeability, Millidarcys	4.66	26.18	20.96
Average Initial Fluid Production Pressure, p.s.i.	25.0	16.3	18.6

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

KEY:



SANDSTONE

SHALE

SANDSTONE WITH SHALE PARTINGS

SANDSTONE WITH COAL PARTINGS

CARBONACEOUS SANDSTONE

FLOODPOT RESIDUAL OIL SATURATION

GRAYBOL - PATTON COMPANY

BATES LEASE WELL NO. 4

WILSON COUNTY, KANSAS

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY, MILLIDARCYS	CALCULATED OIL RECOVERY BBLS. / ACRE
1041.0 - 1046.8	5.5	16.3	36.1	29.5	43.6	
1046.8 - 1055.9	9.1	24.9	37.3	28.2	474.9	
1041.0 - 1055.9	14.6	21.7	36.8	28.7	312.4	3730 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
OCTOBER, 1981

PDC


WATER SAT., PERCENT
OIL SAT., PERCENT
PERMEABILITY, IN MILLIDARCYS
EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS
90 70 50 30 10
20 40 60 80
200 400 600 800 1000
10 20 30 40 50
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
63.72
KEY:
SANDSTONE
SHALE
SANDSTONE WITH SHALE PARTINGS
SANDSTONE WITH COAL PARTINGS
CARBONACEOUS SANDSTONE