September 17, 1952

Bud Oil Company
P. O. Box 231
Colony, Kansas

Attention: Mr. R. L. Horn

Dear Sir:

Enclosed herewith is the report of the analysis of the Baker barrel core samples taken from the Davis Carmichael Lease, Well No. 9, Crawford County, Kansas, and submitted to our laboratory on September 10, 1952.

Neosho

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate
R.E.

Carl L. Pate

CLP:cr

c.c.

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Bud Oil Company Lease Davis Carmichael Well No. 9

Location NE¼, SW¼, NE¼

Section 7 Twp. 30 Rge. 21 County ~~Crawford~~ Neosho State Kansas

Name of Sand	Bartlesville
Top of Core	313.00
Bottom of Core	338.00
Top of Sand (According to driller)	313.00
Bottom of Pay Sand	334.70
Total Feet of Permeable Sand	23.43
Total Feet of Floodable Sand	9.83

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	5.60	5.60
10 - 15	4.33	9.93
15 - 20	8.10	18.03
20 & above	5.40	23.43

Average Permeability Millidarcys	15.30
Average Percent Porosity	17.39
Average Percent Oil Saturation	38.30
Average Percent Water Saturation	51.07
Average Oil Content, Bbls./A. Ft.	520.
Total Oil Content, Bbls./Acre	12,468.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.99
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	84.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	922.
Total Calculated Oil Recovery, Bbls./Acre	2,550.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water was used as a circulating fluid in the coring of the sand in this well. This well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
313.00 - 314.00	Core discarded at well.
314.00 - 315.15	Brown fine grained micaceous sandstone.
315.15 - 316.30	Brown fine grained slightly laminated micaceous shaley sandstone.
316.30 - 325.50	Brown fine grained micaceous sandstone.
325.50 - 326.07	Laminated shaley sandstone.
326.07 - 330.10	Brown fine grained micaceous sandstone.
330.10 - 331.25	Light brown fine grained slightly laminated micaceous shaley sandstone.
331.25 - 334.70	Brown to dark fine grained micaceous sandstone.
334.70 - 335.85	Brown fine grained slightly laminated carbonaceous micaceous shaley sandstone.
335.85 - 338.00	Brown fine grained micaceous slightly shaley sandstone.

Coring was started at a depth of 313.00 feet, probably in sandstone, and completed at 338.00 feet in fine grained micaceous slightly shaley sandstone. This core shows a total of 24.00 feet of sandstone. For the most part, the pay is made up of fine grained micaceous 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 15.15 and 15.45 millidarcys respectively; the overall average being 15.30 (See Table II). By observing the data given on the coregraph,

it is noticeable that the sand has a fairly uniform permeability profile and is tight for its depth.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 38.30. The weighted average percent oil saturation of the upper and lower sections is 40.39 and 36.38 respectively. The weighted average percent water saturation of the upper and lower sections is 49.60 and 52.53 respectively; the overall average being 51.07 (See Table IV). This gives an overall weighted average total fluid saturation of 89.37 percent.

In an effort to determine whether or not any flushing of the sand occurred during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII. From the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur during coring, however, we are of the opinion that most of the oil lost during coring was due to the expansion of gas carried in solution by the oil.

The weighted average oil content of the upper and lower sections is 579 and 465 barrels per acre foot respectively; the overall average being 520. The total oil content, as shown by this core, is 12,468 barrels per acre (See Table IV).

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 922 barrels of oil per acre was obtained from 10.98 feet of sand. The weighted average percent oil saturation was reduced from 39.32 to 33.33 or represents an average recovery of

5.99 percent. The weighted average effective permeability of the samples is 0.989 millidarcys, while the average initial fluid production pressure is 21.5 pounds per square inch (See Table VI). From the above data, it is noticeable that the sand samples after flooding had a fairly high percent residual oil saturation.

By observing the data given in Table V, you will note that of the 14 samples tested, 14 produced water and 10 oil. This indicates that approximately 71 percent of the sand represented by these samples is floodable. The tests also show that the sand has a low effective permeability.

CONCLUSION

From a study of the above data, it is evident that an efficient water flood within the vicinity of this well will recover approximately 2,550 barrels of oil per acre or an average of 232 barrels per acre foot from the 10.98 feet of floodable pay sand analysed provided the sand will take water satisfactorily. In calculating this recovery, an allowance was made for oil lost during coring, and it was assumed that the true water saturation of the sand is 38 percent and that the well was drilled in virgin territory. The above data shows that the sand is very tight for its depth and it is questionable whether it will take water satisfactorily at a reasonable wellhead pressure, say 300 pounds per square inch. Chances are, the sand would take water more freely if approximately 1,000 gallons of solvent were injected into the well prior to water injection. The solvent will increase the permeability of the sand to water.

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Bud Oil Company Lease Carmichael Well No. 9

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	314.55	17.	1.15	1.15	19.55
2	315.73	12.	1.15	2.30	13.80
3	316.85	16.	1.15	3.45	18.40
4	318.04	19.	1.15	4.60	21.85
5	319.15	10.	1.15	5.75	11.50
6	320.33	17.	1.15	6.90	19.55
7	321.47	17.	1.20	8.10	20.40
8	322.64	10.	1.10	9.20	11.00
9	323.76	7.2	1.15	10.35	8.28
10	324.92	26.	1.15	11.50	29.90
11	326.40	12.	0.93	12.43	11.16
12	327.24	32.	1.00	13.43	32.00
13	328.38	26.	0.90	14.33	23.40
14	329.42	20.	1.20	15.53	24.00
15	330.68	9.7	1.15	16.68	11.16
16	331.82	16.	1.15	17.83	18.40
17	332.98	17.	1.15	18.98	19.55
18	334.13	20.	1.15	20.13	23.00
19	335.35	6.5	1.15	21.28	7.48
20	336.44	7.9	1.15	22.43	9.09
21	337.50	5.1	1.00	23.43	5.10

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Bud Oil Company Lease Carmichael Well No. 9

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
314.00 - 325.50	11.50	15.15	174.23
326.07 - 338.00	11.93	15.45	184.34
314.00 - 338.00	23.43	15.30	358.57

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RESULTS OF SATURATION TESTS

TABLE III

Company Bud Oil Company Lease Davis Carmichael Well No. 9

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	314.55	17.9	35.2	49.0	84.2	490	1.15	1.15	564
2	315.73	17.5	45.2	44.3	89.5	615	1.15	2.30	707
3	316.85	19.3	44.3	43.1	87.4	664	1.15	3.45	764
4	318.04	18.4	38.1	48.5	86.6	545	1.15	4.60	627
5	319.16	19.0	34.4	47.8	82.2	508	1.15	5.75	585
6	320.35	18.2	38.9	49.3	88.2	550	1.15	6.90	634
7	321.45	19.0	45.6	52.4	98.0	673	1.20	8.10	808
8	322.64	18.1	43.4	51.5	94.9	611	1.10	9.20	672
9	323.75	17.7	38.3	57.7	96.0	526	1.15	10.35	605
10	324.93	19.1	40.3	52.3	92.6	599	1.15	11.50	689
11	325.78	15.7	17.6	69.4	87.0	215	0.57	12.07	123
F11A	326.38	19.2	38.2	-	-	569	0.93	13.00	529
12	327.24	16.9	41.0	42.3	83.3	537	1.00	14.00	537
13	328.37	17.4	45.1	42.4	87.5	610	0.90	14.90	549
14	329.43	20.0	42.2	53.6	95.8	655	1.20	16.10	786
15	330.69	16.3	23.6	70.8	94.4	299	1.15	17.25	344
16	331.84	18.1	33.7	50.0	83.7	474	1.15	18.40	545

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Bud Oil Company Lease Davis Carmichael Well No. 9

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.	
17	332.97	16.2	37.2	52.3	89.5	468	1.15	19.55	538
18	334.13	16.7	37.1	51.5	88.6	481	1.15	20.70	553
19	335.26	14.5	38.5	54.5	93.0	433	1.15	21.85	498
20	336.45	12.0	39.3	40.4	79.7	366	1.15	23.00	421
21	337.50	14.0	35.9	55.9	91.8	390	1.00	24.00	390
						Total - - - - - - - - - -			12,468

Note: "A" Samples was taken from the core after it was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company Bud Oil Company Lease Davis Carmichael Well No. 9

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
314.00-325.50	11.50	18.43	40.39	49.60	579	6,655
325.50-338.00	12.50	16.43	36.38	52.53	465	5,813
314.00-338.00	24.00	17.39	38.30	51.07	520	12,468

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Bud Oil Company Lease Davis Carmichael Well No. 9

Depth Interval, Feet	315.15 - 325.50	326.07 - 334.70	315.15 - 334.70
Feet of Core Analyzed	3.50	7.48	10.98
Average Percent Porosity	18.51	17.77	18.01
Average Percent Original Oil Saturation	42.20	37.98	39.32
Average Percent Oil Recovery	7.23	5.41	5.99
Average Percent Residual Oil Saturation	34.97	32.57	33.33
Average Percent Residual Water Saturation	59.57	63.56	62.29
Average Percent Total Residual Fluid Saturation	94.54	96.13	95.62
Average Original Oil Content, Bbls./A. Ft.	605.	525.	550.
Average Oil Recovery, Bbls./A. Ft.	102.	76.	84.
Average Residual Oil Content, Bbls./A. Ft.	503.	449.	466.
Total Original Oil Content, Bbls./Acre	2,117.	3,927.	6,044.
Total Oil Recovery, Bbls./Acre	357.	565.	922.
Total Residual Oil Content, Bbls./Acre	1,760.	3,362.	5,122.
Average Effective Permeability, Millidarcys	0.457	1.24	0.989
Average Initial Fluid Production Pressure, p.s.i.	26.7	19.3	21.5

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

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Bud Oil Company Lease Davis Carmichael Well No. 9

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.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
2	315.73	17.3	43.8	588	10.0	134	33.8	52.2	454	28	0.650	25
4	318.04	18.0	37.5	524	0.0	0	37.5	50.7	524	6	0.253	25
5	319.16	19.4	32.1	483	0.0	0	32.1	52.5	483	11	0.360	30
7	321.45	19.0	44.3	653	10.5	155	33.8	62.8	498	17	0.498	25
10	324.93	19.2	38.4	572	1.0	15	37.4	56.5	557	12	0.241	30
11A	326.38	19.2	38.2	560	5.8	86	32.4	63.2	483	40	1.05	20
12	327.24	17.2	39.1	532	9.0	120	30.1	65.4	402	108	2.32	20
13	328.37	17.6	44.0	600	13.6	172	31.4	59.5	428	66	2.07	20
14	329.43	19.8	40.4	621	6.0	92	34.4	59.5	529	79	1.68	20
16	331.84	18.4	33.7	482	2.5	36	31.2	66.2	446	111	0.664	10
17	332.97	16.0	36.0	447	2.0	25	34.0	67.2	422	83	0.640	25
18	334.13	16.2	36.0	453	2.1	26	33.9	65.4	427	26	0.519	20
20	336.45	11.6	40.0	360	0.0	0	40.0	45.3	360	5	0.061	50
21	337.50	14.0	33.7	366	0.0	0	33.7	55.2	366	5	0.249	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.
"A" = Sample was taken from core after it was received in the laboratory.

Oil Field Research Laboratories

RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Bud Oil Company Lease Davis Carmichael Well No. 9

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation Connate	Drilling & Foreign	Total
1	314.55	8,840			
2	315.73	17,100			
3	316.85	9,240			
4	318.04	9,550			
5	319.16	8,470			
6	320.35	7,750			
7	321.45	6,970			
8	322.64	3,320			
9	323.75	10,800			
10	324.93	9,230			
11	325.78	12,600			
12	327.24	7,720			
13	328.37	6,370			
14	329.43	5,670			
15	330.69	15,100			
16	331.84	7,800			
17	332.97	8,450			
18	334.13	7,370			
19	335.26	7,070			
20	336.45	5,530			
21	337.50	6,140			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Bud Oil Company Lease Davis Carmichael Well No. 9

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
314.00 - 325.50	9,132		
325.50 - 338.00	8,008		
314.00 - 338.00	8,568		

Note: ppm - parts per million.