MACK C. COLT, INC.

CORE ANALYSIS REPORT

SOUTH VEZIE LEASE WELL NO. 51-AO

ALLEN COUNTY, KANSAS

OILFIELD RESEARCH LABORATORIES

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April 28, 1978

Mack C. Colt, Inc.
P.O. Box 427
Iola, Kansas 66749

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the South Vezie Lease, Well No. 51-AO, Allen County, Kansas, and submitted to our laboratory on April 20, 1978.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:cb
4 c to Iola, Kansas
1 c to Lawrence, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

Location 1000' FWL & 530' FNL, NW/4

Section 27 Twp. 23S Rge. 18E County Allen State Kansas

Name of Sand		Squirrel
Top of Core	(Received)	838.0
Bottom of Core	(Received)	884.0
Top of Sand (Good)		860.6
Bottom of Sand (Good)		879.5
Total Feet of Permeable Sand	(Analyzed)	15.9
Total Feet of Floodable Sand	(Analyzed)	6.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	6.1	6.1
10 - 30	4.6	10.7
30 & Above	5.2	15.9

Average Permeability Millidarcys	32.9
Average Percent Porosity	18.2
Average Percent Oil Saturation	31.6
Average Percent Water Saturation	62.8
Average Oil Content, Bbls./A. Ft.	449.
Total Oil Content, Bbls./Acre	7,143.
Average Percent Oil Recovery by Laboratory Flooding Tests	13.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	201.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,309.
Total Calculated Oil Recovery, Bbls./Acre	-
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet (Ground Level)	1082.

A salt water mud was used as a circulating fluid in the coring of the sand in this well. The core was sampled by a representative of the client.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet		Description
838.0 - 841.2		Gray finely laminated sandstone and shale.
841.2 - 849.2		Brownish gray shaly sandstone.
849.2 - 852.4		Light brown shaly sandstone.
852.4 - 856.6		Alternate thin layers sandstone and shale.
856.6 - 858.0	1.4	Brown fine grained sandstone.
858.0 - 858.2		Gray sandy shale.
858.2 - 860.0	1.8	Brown laminated shaly sandstone.
860.0 - 860.6		Gray sandy shale.
860.6 - 861.9	1.3	Dark brown slightly shaly sandstone.
861.9 - 862.6		Gray laminated sandy shale.
862.6 - 864.4	1.8	Light brown laminated shaly sandstone.
864.4 - 864.9		Gray laminated sandy shale.
864.9 - 868.7	3.8	Brown fine grained sandstone.
868.7 - 869.4	0.7	Light brown shaly sandstone.
869.4 - 869.6		Gray sandy shale.
869.6 - 879.5	9.9	Dark brown fine grained sandstone.
879.5 - 884.0	4.5	Dark carbonaceous sandstone.

Coring was started at a depth of 638.0 feet in gray finely laminated sandstone and shale and completed at 884.0 feet in dark carbonaceous sandstone. This core shows a total of 36.6 feet of sandstone. For the most part, the pay is made up of brown fine grained 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 16.0 and 41.4 millidarcys respectively; the overall average being 32.9 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from 0.82 to a maximum of 90 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fair weighted average percent oil saturation, namely, 31.6. The weighted average percent oil saturation of the upper and lower sections is 12.7 and 41.1 respectively. The weighted average percent water saturation of the upper and lower sections is 82.9 and 52.8 respectively; the overall average being 62.8 (See Table III). This gives an overall weighted average total fluid saturation of 94.4 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 VI and VII. From the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur during the coring operation.

The chloride content of the circulating fluid was 10,638 parts per million.

The weighted average oil content of the upper and lower sections is 176 and 586 barrels per acre foot respectively; the overall average being 449. The total oil content, as shown by this core, is 7,143 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

Part of the sand in this core responded very well to laboratory flooding tests, as a total recovery of 1,309 barrels of oil per acre was obtained from 6.5 feet of sand. The weighted average percent oil saturation was reduced from 43.6 to 30.5, or represents an average recovery of 13.1 percent. The weighted average effective permeability of the samples is 1.98 millidarcys, while the average initial fluid production pressure is 20 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 14 samples tested, 11 produced water and 6 oil. This indicates that approximately 43 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

No calculated oil value is given as only part of the sand section was analyzed. Furthermore, it is evident the sand section is or has been repressured with water.

The core shows a broken sand section having a fair oil saturation, a high water saturation, and a fairly good permeability and porosity. The tests show the pay sand section extends from 860.6 to 879.5 feet.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., M'll.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	841.9	18.1	8	88	96	112	26.	1.3	1.3	146	33.80
2	844.0	19.2	6	90	96	89	25.	1.0	2.3	89	25.00
3	847.3	17.9	11	86	97	153	16.	1.0	3.3	153	16.00
4	850.3	18.1	20	75	95	281	6.7	1.0	4.3	281	6.70
5	852.6	16.9	20	74	94	262	3.1	1.0	5.3	262	3.10
6	861.0	18.4	61	36	97	871	15.	1.3	6.6	1132	19.50
7	863.9	16.0	35	55	90	435	0.82	1.8	8.4	783	1.48
8	866.8	17.1	30	66	96	398	90.	1.2	9.6	478	108.00
9	868.5	17.9	23	71	94	319	6.4	1.3	10.9	415	8.32
10	872.2	20.0	28	68	96	435	58.	1.0	11.9	435	58.00
11	875.9	21.3	45	52	97	744	75.	1.0	12.9	744	75.00
12	876.9	18.9	39	58	97	572	74.	1.0	13.9	572	74.00
13	879.4	19.6	56	33	89	852	90.	1.0	14.9	852	90.00
14	880.9	17.5	59	31	90	801	5.0	1.0	15.9	801	5.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
841.2 - 853.4	5.3	16.0	84.60
860.6 - 881.4	10.6	41.4	439.30
841.2 - 881.4	15.9	32.9	523.90

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
841.2 - 853.4	5.3	18.0	12.7	82.9	176	931
860.6 - 881.4	10.6	18.3	41.1	52.8	586	6,212
841.2 - 881.4	15.9	18.2	31.6	62.8	449	7,143

Oil Viscosity

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

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	841.9	19.7	5	76	0	0	5	93	76	264	7.70	10
2	844.0	19.8	7	108	0	0	7	90	108	443	12.90	10
3	847.3	18.8	9	131	0	0	9	89	131	163	4.70	10
4	850.3	19.2	19	283	0	0	19	77	283	37	0.70	10
5	852.6	17.6	21	287	0	0	21	75	287	11	.090.30	25
6	861.0	19.1	61	904	32	474	29	68	430	0	.0040.07	20
7	863.9	16.0	35	435	0	0	35	55	435	0	Imp.	-
8	866.8	18.3	30	426	7	99	23	74	327	32	.0121.10	20
9	868.5	18.6	27	390	0	0	27	70	390	15	.0420.30	25
10	872.2	20.7	28	450	2	32	26	68	418	149	.0583.40	10
11	875.9	22.1	45	771	16	274	29	68	497	153	.07 5.30	15
12	876.9	20.2	39	611	8	125	31	67	486	69	.0322.40	20
13	879.4	20.5	56	891	9	143	47	44	748	10	.0020.37	35
14	880.9	17.5	59	801	0	0	59	31	801	0	Imp.	-

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 Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

Depth Interval, Feet	860.6 - 879.5
Feet of Core Analyzed	6.5
Average Percent Porosity	20.0
Average Percent Original Oil Saturation	43.6
Average Percent Oil Recovery	13.1
Average Percent Residual Oil Saturation	30.5
Average Percent Residual Water Saturation	65.3
Average Percent Total Residual Fluid Saturation	95.8
Average Original Oil Content, Bbls./A. Ft.	678.
Average Oil Recovery, Bbls./A. Ft.	201.
Average Residual Oil Content, Bbls./A. Ft.	477.
Total Original Oil Content, Bbls./Acre	4,409.
Total Oil Recovery, Bbls./Acre	1,309.
Total Residual Oil Content, Bbls./Acre	3,100.
Average Effective Permeability, Millidarcys	1.98
Average Initial Fluid Production Pressure, p.s.i.	20.0

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

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	841.9	27,288			
2	844.0	26,419			
3	847.3	35,633			
4	850.3	54,162			
5	852.6	44,252			
6	861.0	47,038			
7	863.9	41,009			
8	866.8	48,980			
9	868.5	29,859			
10	872.2	33,597			
11	875.9	26,860			
12	876.9	46,072			
13	879.4	47,039			
14	880.9	42,528			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Mack C. Colt, Inc. Lease South Vezie Well No. 51-AO

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
841.2 - 853.4	36,970		
860.6 - 881.4	40,439		
841.2 - 881.4	39,283		

Note: ppm — parts per million.