



OILFIELD RESEARCH LABORATORIES

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May 16, 1978

TEC Drilling Company, Inc.
P.O. Box 693
El Dorado, Kansas 67042

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Tom Kee Lease, Well No. 12, Woodson County, Kansas, and submitted to our laboratory on May 5, 1978.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:cb
4 c to El Dorado, Kansas
1 c to Yates Center, Kansas

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GENERAL INFORMATION & SUMMARY

Company TEC Drilling Co., Inc. Lease Tom Kee Well No. 12

Location _____

Section 18 Twp. 25S Rge. 16E County Woodson State Kansas

Name of Sand - - - - - Squirrel

Top of Core - - - - - (Received) - - - - - 987.0

Bottom of Core - - - - - (Received) - - - - - 999.0

Pay
Top of Sand - - - - - 987.4

Pay
Bottom of Sand - - - - - 996.7

Total Feet of Permeable Sand - - - - - 9.5

Total Feet of Floodable Sand - - - - - 4.7

Distribution of Permeable Sand:		
Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 3	4.0	4.0
3 - 10	2.5	6.5
10 & Above	3.0	9.5

Average Permeability Millidarcys - - - - - 8.7

Average Percent Porosity - - - - - 16.5

Average Percent Oil Saturation - - - - - 50.6

Average Percent Water Saturation - - - - - 30.1

Average Oil Content, Bbls./A. Ft. - - - - - 660.

Total Oil Content, Bbls./Acre - - - - - 7,921.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 5.6

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 81.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 382.

Total Calculated Oil Recovery, Bbls./Acre (Primary & Waterflooding) 996.

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

A. P. I. Gravity, degrees @ 60 °F - - - - - (Reported) 23.0

Elevation, Feet - - - - -

A fresh 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:

<u>Depth Interval, Feet</u>	<u>Description</u>
987.0 - 987.4	Grayish brown calcareous shaly sandstone.
987.4 - 989.5	Dark brown slightly laminated shaly sandstone.
989.5 - 993.0	Dark brown laminated very shaly sandstone.
993.0 - 994.5	Dark brown slightly laminated shaly sandstone.
994.5 - 996.7	Brownish gray very shaly sandstone.
996.7 - 998.0	Dark carbonaceous shaly sandstone.
998.0 - 999.0	Brownish gray very shaly sandstone.

Coring was started at a depth of 987.0 feet in grayish brown calcareous shaly sandstone and completed at 999.0 feet in brownish gray very shaly sandstone. This core shows a total of 12 feet of sandstone. For the most part, the pay is made up of dark brown shaly 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 13.7 millidarcys respectively; the overall average being 8.7 (See Table III). The permeability of the sand varies from impermeable to a maximum of 28 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a very good weighted average percent oil saturation, namely, 50.6. The weighted average percent oil saturation of the upper and lower sections is 49.6 and 51.7 respectively. The weighted average percent water saturation of the upper and lower sections is 28.4 and 31.8 respectively; the overall average being 30.1 (See Table III). This gives an overall weighted average total fluid saturation of 80.7 percent. This fairly low total fluid saturation indicates some fluid was lost during coring which was probably oil.

The weighted average oil content of the upper and lower sections is 674 and 646 barrels per acre foot respectively; the overall average being 660. The total oil content, as shown by this core, is 7,921 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded poorly to laboratory flooding tests, as a total recovery of only 382 barrels of oil per acre was obtained from 4.7 feet of sand. The weighted average percent oil saturation was reduced from 52.0 to 46.4, or represents an average recovery of 5.6 percent. The weighted average effective permeability of the samples is 0.37 millidarcys, while the average initial fluid production pressure is 39.7 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 12 samples tested, 6 produced water and 5 oil. This indicates that approximately 42 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand samples, after flooding, had a high oil saturation.

CONCLUSION

On the basis of the above data we estimate approximately 996 barrels of oil per acre can be recovered from the sand reservoir, represented by this core, by efficient primary and waterflood operations. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.05
Irreducible water saturation, percent	20.0
Primary recovery	None
Present oil saturation, percent	76.2
Average porosity, percent	18.3
Oil saturation after flooding, percent	46.4
Performance factor	0.50
Net floodable pay sand, feet	4.7

The core shows a shaly sand section having a very good oil saturation, a fairly low water saturation, a low permeability and a fair porosity.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company TEC Drilling Company, Inc. Lease Tom Kee Well No. 12

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			Ft.	Cum. Ft.		
1	987.2	7.1	29	58	160	0.52	0.4	0.4	64	0.21
2	988.2	18.0	54	16	754	3.4	1.3	1.7	980	4.42
3	989.2	17.7	50	27	687	28.	0.8	2.5	550	22.40
4	990.2	18.8	54	24	788	1.5	1.2	3.7	946	1.80
5	991.2	16.0	44	43	546	1.5	1.1	4.8	601	1.65
6	992.4	18.7	52	24	755	3.3	1.2	6.0	906	3.96
7	993.2	20.2	54	18	846	17.	0.7	6.7	592	11.90
8	994.2	16.0	45	32	559	28.	0.8	7.5	447	22.40
9	995.2	13.8	35	50	375	Imp.	1.5	9.0	562	0.00
10	996.2	14.5	51	41	574	16.	0.7	9.7	402	11.20
11	997.2	16.4	58	24	738	1.8	1.3	11.0	959	2.34
12	998.2	16.1	73	18	912	Imp.	1.0	12.0	912	0.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company TEC Drilling Company, Inc. Lease Tom Kee Well No. 12

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
987.0 - 993.0	6.0	5.7	34.44
993.0 - 999.0	3.5	13.7	47.84
987.0 - 999.0	9.5	8.7	82.28

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
987.0 - 993.0	6.0	17.2	49.6	28.4	674	4,047
993.0 - 999.0	6.0	15.8	51.7	31.8	646	3,874
987.0 - 999.0	12.0	16.5	50.6	30.1	660	7,921

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

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	987.2	7.1	29	160	0	0	29	58	0	Imp.	-
2	988.2	19.2	54	804	8	119	46	48	42	0.90	30
3	989.2	17.7	50	687	0	0	50	27	0	Imp.	-
4	990.2	18.4	54	771	3	43	51	46	3	0.11	50
5	991.2	14.2	41	452	0	0	41	51	3	0.15	50
6	992.4	18.7	52	755	0	0	52	24	0	Imp.	-
7	993.2	19.2	54	805	11	164	43	53	10	0.22	45
8	994.2	17.6	45	615	3	41	42	52	11	0.24	35
9	995.2	12.1	39	366	0	0	39	55	0	Imp.	-
10	996.2	16.5	51	653	3	38	48	47	7	0.16	40
11	997.2	16.4	58	738	0	0	58	24	0	Imp.	-
12	998.2	16.1	73	912	0	0	73	18	0	Imp.	-

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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	TEC Drilling Company, Inc.	Lease	Tom Kee	Well No.	12
Depth Interval, Feet	987.0 - 999.0				
Feet of Core Analyzed	4.7				
Average Percent Porosity	18.3				
Average Percent Original Oil Saturation	52.0				
Average Percent Oil Recovery	5.6				
Average Percent Residual Oil Saturation	46.4				
Average Percent Residual Water Saturation	48.8				
Average Percent Total Residual Fluid Saturation	95.2				
Average Original Oil Content, Bbls./A. Ft.	741.				
Average Oil Recovery, Bbls./A. Ft.	81.				
Average Residual Oil Content, Bbls./A. Ft.	660.				
Total Original Oil Content, Bbls./Acre	3,484.				
Total Oil Recovery, Bbls./Acre	382.				
Total Residual Oil Content, Bbls./Acre	3,102.				
Average Effective Permeability, Millidarcys	0.37				
Average Initial Fluid Production Pressure, p.s.i.	39.7				

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