DAVIS OIL COMPANY

CORE ANALYSIS REPORT

UMBARGER LEASE

WELL NO. ~~P-7~~ E-10

WILSON COUNTY, KANSAS

OILFIELD RESEARCH LABORATORIES
536 N. HIGHLAND CHANUTE, KANSAS

OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS 66720 - PHONE (316) 431-2650

May 18, 1978

Davis Oil Company
212 East Locust
Independence, Kansas 67301

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Umbarger Lease, Well #E-10 ~~No. P-7~~, Wilson County, Kansas, and submitted to our laboratory on May 11, 1978.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

Carl L. Pate

CLP:vm
5 c to Independence, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Davis Oil Company Lease Umbarger Well No. P-7

Location 1200' WEL & 740' SNL, SW¼

Section 36 Twp. 28S Rge. 16E County Wilson State Kansas

Name of Sand	Squirrel
Top of Core (Received)	657.0
Bottom of Core (Received)	678.5
Top of Pay Sand	660.0
Bottom of Pay Sand	671.0
Total Feet of Permeable Sand	17.0
Total Feet of Floodable Sand	10.3

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	6.7	6.7
10 - 30	3.3	10.0
30 - 40	2.0	12.0
40 & above	5.0	17.0

Average Permeability Millidarcys	36.4
Average Percent Porosity	18.1
Average Percent Oil Saturation	48.7
Average Percent Water Saturation	30.0
Average Oil Content, Bbls./A. Ft.	674.
Total Oil Content, Bbls./Acre	7,416.
Average Percent Oil Recovery by Laboratory Flooding Tests	14.2
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	205.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	2,109.
Total Calculated Oil Recovery, Bbls./Acre	3,306.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F (Reported)	27.0
Elevation, Feet	

Note: The above averages are for the pay sand section (660.0 to 671.0 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 the client.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
657.0 - 660.0	Light brown and gray laminated shaly sandstone.
660.0 - 667.0	Brown sandstone.
667.0 - 669.3	Brown laminated shaly sandstone.
669.3 - 672.7	Brown and gray laminated shaly sandstone.
672.7 - 675.0	Light brown shaly sandstone.
675.0 - 678.5	Gray very shaly sandstone.

Coring was started at a depth of 657.0 feet in brown and gray laminated shaly sandstone and completed at 678.5 feet in gray very shaly sandstone. This core shows a total of 21.5 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 three sections. The weighted average permeability of the upper, middle, and lower sections is 2.6, 36.4, and 3.2 millidarcys respectively; the overall average being 24.6 (See Table III).

The permeability of the sand varies from impermeable to a maximum of 60 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 41.1. The weighted average percent oil saturation of the upper, middle, and lower sections is 36.0, 48.7, and 32.1 respectively. The weighted average percent water saturation of the upper, middle, and lower sections is 51.0, 30.0, and 52.1 respectively; the overall average being 40.6 (See Table III). This gives an overall weighted average total fluid saturation of 81.7 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, middle, and lower sections is 385, 674, and 349 barrels per acre foot respectively; the overall average being 520. The total oil content, as shown by this core, is 11,189 barrels per acre of which 7,416 barrels are in the pay sand section (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 2,109 barrels of oil per acre was obtained from 10.3 feet of sand. The weighted average percent oil saturation was reduced from 48.6 to 34.4, or represents an average recovery of 14.2 percent. The weighted average effective permeability of the samples is 6.29 millidarcys, while the average initial fluid production pressure is 23.4 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 22 samples tested, 11 produced water and 10 oil. This

indicates that approximately 45 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

On the basis of the preceding data, we estimate approximately 3,306 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 preceding oil recovery value:

Original formation volume factor	1.04
Irreducible water saturation, percent	23.0
Primary recovery	None
Average porosity, percent	19.0
Oil saturation after flooding, percent	34.4
Performance factor	0.55
Net floodable pay sand, feet	10.3

The core shows a rather clean pay sand section (660.0 to 671.0 feet) having a very good oil saturation, a moderate water saturation, and a fairly good permeability and porosity.

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Davis Oil Company Lease Umbarger Well No. P-7

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	657.8	13.9	30	57	87	323	Imp.	1.0	1.0	323	0.00
2	658.8	12.3	27	68	95	258	0.98	1.0	2.0	258	0.98
3	659.7	14.5	51	28	79	573	4.3	1.0	3.0	573	4.30
4	660.9	18.5	47	26	73	673	56.	1.0	4.0	673	56.00
5	661.8	18.2	49	41	90	691	51.	1.0	5.0	691	51.00
6	662.6	21.8	36	34	70	608	60.	1.0	6.0	608	60.00
7	663.6	19.1	51	21	72	755	35.	1.0	7.0	755	35.00
8	664.9	17.8	48	27	75	661	42.	1.0	8.0	661	42.00
9	665.8	21.1	44	23	67	719	51.	1.0	9.0	719	51.00
10	666.7	14.8	59	25	84	678	22.	1.0	10.0	678	22.00
11	667.6	18.5	46	47	93	659	35.	1.0	11.0	659	35.00
12	668.7	16.8	48	30	78	625	25.	1.3	12.3	813	32.50
13	669.6	13.9	50	41	91	539	8.4	0.7	13.0	377	5.88
14	670.8	17.4	58	18	76	783	10.	1.0	14.0	782	10.00
15	671.5	15.1	55	27	82	644	6.9	1.0	15.0	644	6.90
16	672.5	14.9	41	38	79	474	6.8	0.7	15.7	331	4.76
17	673.5	15.2	26	48	74	307	0.66	1.3	17.0	399	0.86
18	674.3	12.9	21	59	80	210	0.33	1.0	18.0	210	0.33
19	675.5	14.6	35	46	81	395	Imp.	1.0	19.0	395	0.00
20	676.5	11.9	30	64	94	277	Imp.	1.0	20.0	277	0.00
21	677.3	12.3	31	65	96	296	Imp.	0.5	20.5	148	0.00
22	677.9	12.6	22	73	95	215	Imp.	1.0	21.5	215	0.00

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Davis Oil Company Lease Umbarger Well No. P-7

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
658.0 - 660.0	2.0	2.6	5.28
660.0 - 671.0	11.0	36.4	400.38
671.0 - 675.0	4.0	3.2	12.85
658.0 - 675.0	17.0	24.6	418.51

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
657.0 - 660.0	3.0	13.6	36.0	51.0	385	1,154
660.0 - 671.0	11.0	18.1	48.7	30.0	674	7,416
671.0 - 678.5	7.5	13.8	32.1	52.1	349	2,619
657.0 - 678.5	21.5	15.9	41.1	40.6	520	11,189

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Davis Oil Company Lease Umbarger Well No. P-7

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	657.8	13.9	30	323	0	0	30	57	323	0	Imp.	-
2	658.8	12.3	27	258	0	0	27	68	258	0	Imp.	-
3	659.7	14.5	51	573	0	0	51	28	573	0	Imp.	-
4	660.9	19.3	47	704	15	225	32	63	479	344	9.94	20
5	661.8	19.8	49	753	11	169	38	56	584	291	17.84	20
6	662.6	22.6	36	631	6	105	30	57	526	301	11.80	20
7	663.6	19.6	51	775	20	304	31	62	471	241	8.05	20
8	664.9	18.3	48	681	17	241	31	63	440	51	1.33	20
9	665.8	21.8	44	744	12	203	32	63	541	227	10.49	20
10	666.7	15.6	59	715	24	291	35	54	424	17	0.49	25
11	667.6	18.4	46	657	11	157	35	60	500	15	0.49	30
12	668.7	17.5	48	652	15	204	33	64	448	117	3.15	20
13	669.6	13.9	50	539	0	0	50	41	539	0	Imp.	-
14	670.8	17.4	58	784	11	149	47	50	635	10	0.21	40
15	671.5	15.1	55	644	0	0	55	27	644	0	Imp.	-
16	672.5	14.9	40	462	0	0	40	45	462	10	0.28	40
17	673.5	15.2	26	307	0	0	26	48	307	0	Imp.	-
18	674.3	12.9	21	210	0	0	21	59	210	0	Imp.	-
19	675.5	14.6	35	395	0	0	35	46	395	0	Imp.	-
20	676.5	11.9	30	377	0	0	30	64	377	0	Imp.	-
21	677.3	12.3	31	296	0	0	31	65	296	0	Imp.	-
22	677.9	12.6	22	215	0	0	22	73	215	0	Imp.	-

Notes: c—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Davis Oil Company Lease Umbarger Well No. P-7

Depth Interval, Feet	660.0 to 671.0
Feet of Core Analyzed	10.3
Average Percent Porosity	19.0
Average Percent Original Oil Saturation	48.6
Average Percent Oil Recovery	14.2
Average Percent Residual Oil Saturation	34.4
Average Percent Residual Water Saturation	53.2
Average Percent Total Residual Fluid Saturation	87.6
Average Original Oil Content, Bbls./A. Ft.	708.
Average Oil Recovery, Bbls./A. Ft.	205.
Average Residual Oil Content, Bbls./A. Ft.	503.
Total Original Oil Content, Bbls./Acre	7,291.
Total Oil Recovery, Bbls./Acre	2,109.
Total Residual Oil Content, Bbls./Acre	5,182.
Average Effective Permeability, Millidarcys	6.29
Average Initial Fluid Production Pressure, p.s.i.	23.4

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