DAVIS OIL COMPANY

CORE ANALYSIS REPORT

UMBARGER LEASE WELL NO. ~~P-11~~ E-14

WILSON COUNTY, KANSAS

OILFIELD RESEARCH LABORATORIES
530 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 No. P-11, Wilson County, Kansas, and submitted to our laboratory on May 12, 1978.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:cb
5 c to Independence, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Davis Oil Company Lease Umbarger Well No. P-11

Location

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

Name of Sand	Squirrel
Top of Core (Received)	657.0
Bottom of Core (Received)	677.0
Top of Pay Sand	661.7
Bottom of Pay Sand	672.2
Total Feet of Permeable Sand	15.5
Total Feet of Floodable Sand	8.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	6.0	6.0
10 - 20	3.1	9.1
20 - 50	3.3	12.4
50 & Above	3.1	15.5

Average Permeability Millidarcys	42.0
Average Percent Porosity	18.1
Average Percent Oil Saturation	46.4
Average Percent Water Saturation	28.4
Average Oil Content, Bbls./A. Ft.	650.
Total Oil Content, Bbls./Acre	6,824.
Average Percent Oil Recovery by Laboratory Flooding Tests	7.4
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	112.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	949.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Waterflooding)	2,524.
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 (661.7 - 672.2 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 - 659.0	Grayish brown very shaly sandstone.
659.0 - 660.3	Dark brown sandstone.
660.3 - 661.7	Hard grayish brown calcareous sandstone.
661.7 - 665.0	Dark brown sandstone.
665.0 - 669.3	Dark carbonaceous shaly sandstone.
669.3 - 675.0	Dark carbonaceous laminated shaly sandstone.
675.0 - 677.0	Grayish brown very shaly sandstone.

Coring was started at a depth of 657.0 feet in grayish brown very shaly sandstone and completed at 677.0 feet in the same type of material. This core shows a total of 20 feet of sandstone. For the most part, the pay is made up of dark brown 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 17.6, 42.0 and 5.3 millidarcys respectively; the overall average being 31.9 (See Table III). By observing the data given on the coregraph, it is noticeable

that the sand has a wide variation in permeability. The permeability of the sand varies from impermeable to a maximum of 137 millidarcys.

The pay sand section extends from a depth of 661.7 to 672.2 feet.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core shows a very good weighted average percent oil saturation, namely, 46.4. The weighted average percent oil saturation of the upper, middle and lower sections is 24.5, 46.4 and 40.8 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 53.4, 28.4 and 45.2 respectively; the overall average being 37.7 (See Table III). This gives an overall weighted average total fluid saturation of 78.2 percent.

The weighted average oil content of the upper, middle and lower sections is 208, 650 and 447 barrels per acre foot respectively; the overall average being 509. The total oil content, as shown by this core, is 9,780 barrels per acre of which 6,824 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The pay sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 949 barrels of oil per acre was obtained from 8.5 feet of sand. The weighted average percent oil saturation was reduced from 46.9 to 39.5, or represents an average recovery of 7.4 percent. The weighted average

effective permeability of the samples is 5.99 millidarcys, while the average initial fluid production pressure is 19.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 20 samples tested, 11 produced water and 9 oil. This indicates that approximately 45 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 residual oil saturation.

CONCLUSION

From a study of the above data we estimate approximately 2,524 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	1.04
Irreducible water saturation, percent	19.0
Primary recovery	None
Average porosity, percent	18.1
Oil saturation after flooding, percent	39.5
Performance factor	0.55
Net floodable pay sand, feet	8.5

The core shows a fairly clean pay sand section (661.7 to 672.2 feet) having a very good oil saturation, a low water saturation and a rather good permeability and porosity.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Davis Oil Company Lease Umbarger Well No. P-11

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	657.3	14.1	25	64	89	274	Imp.	0.9	0.9	247	0.00
2	658.5	12.2	14	74	88	133	Imp.	1.1	2.0	146	0.00
3	659.4	13.8	62	21	83	665	-	0.5	2.5	332	-
P-3	659.6	-	-	-	-	-	43.	0.8	3.3	-	34.40
4	660.7	4.2	19	42	61	62	3.1	1.4	4.7	87	4.34
5	661.9	19.6	48	29	77	732	49.	0.7	5.4	512	34.30
6	662.9	19.8	51	24	75	785	35.	0.8	6.2	628	28.00
7	663.5	20.8	40	36	76	647	66.	0.8	7.0	518	52.80
8	664.4	21.5	46	28	74	769	137.	1.0	8.0	769	137.00
9	665.7	19.4	44	22	66	664	73.	1.3	9.3	863	94.90
10	666.9	18.5	46	28	74	662	47.	1.0	10.3	662	47.00
11	667.9	18.9	45	29	74	661	12.	0.9	11.2	595	10.80
12	668.5	14.9	43	33	76	498	11.	1.1	12.3	548	12.10
13	669.6	16.4	46	29	75	587	9.7	0.9	13.2	528	8.73
14	670.9	15.2	53	30	83	626	7.6	1.2	14.4	751	9.12
15	671.9	15.1	48	33	81	562	7.5	0.8	15.2	450	6.00
16	672.6	13.7	49	40	89	522	1.1	1.0	16.2	522	1.10
17	673.7	14.2	49	44	93	541	12.	1.1	17.3	595	13.20
18	674.9	14.2	55	33	88	607	0.69	0.7	18.0	425	0.48
19	675.5	14.0	22	60	82	240	Imp.	1.2	19.2	288	0.00
20	676.8	14.4	35	42	77	392	Imp.	0.8	20.0	314	0.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Davis Oil Company Lease Umbarger Well No. P-11

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
657.0 - 661.7	2.2	17.6	38.74
661.7 - 672.2	10.5	42.0	440.75
672.2 - 677.0	2.8	5.3	14.78
657.0 - 677.0	15.5	31.9	494.27

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 - 661.7	3.9	10.0	24.5	53.4	208	812
661.7 - 672.2	10.5	18.1	46.4	28.4	650	6,824
672.2 - 677.0	4.8	14.1	40.8	45.2	447	2,144
657.0 - 677.0	19.2	15.4	40.5	37.7	509	9,780

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Davis Oil Company Lease Umbarger Well No. P-11

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	657.3	14.1	25	274	0	0	25	64	274	0	Imp.	-
2	658.5	12.2	14	133	0	0	14	74	133	0	Imp.	-
3	659.4	13.3	48	495	0	0	48	52	495	0	Imp.	-
4	660.7	4.2	19	62	0	0	19	42	62	0	Imp.	-
5	661.9	19.4	48	723	11	166	37	55	557	11	0.22	20
6	662.9	19.5	51	772	15	227	36	54	545	16	0.37	25
7	663.5	20.0	40	621	7	109	33	61	512	76	1.69	25
8	664.4	21.4	46	764	10	166	36	60	598	342	9.77	15
9	665.7	21.4	44	731	6	100	38	52	631	220	15.74	15
10	666.9	19.1	46	682	7	104	39	57	578	201	12.15	15
11	667.9	18.0	45	629	2	28	43	52	601	46	0.88	20
12	668.5	16.2	45	566	0	0	45	48	566	4	0.14	45
13	669.6	16.3	48	607	0	0	48	40	607	3	0.09	40
14	670.9	16.7	53	687	5	65	48	51	622	130	2.58	20
15	671.9	16.4	48	611	6	76	42	53	535	179	3.60	20
16	672.6	13.7	49	522	0	0	49	40	522	0	Imp.	-
17	673.7	14.2	49	541	0	0	49	44	541	0	Imp.	-
18	674.9	14.2	55	607	0	0	55	33	607	0	Imp.	-
19	675.5	14.0	22	240	0	0	22	60	240	0	Imp.	-
20	676.8	14.4	35	392	0	0	35	42	392	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 Davis Oil Company Lease Umbarger Well No. P-11

Depth Interval, Feet	661.7 - 672.2
Feet of Core Analyzed	8.5
Average Percent Porosity	19.2
Average Percent Original Oil Saturation	46.9
Average Percent Oil Recovery	7.4
Average Percent Residual Oil Saturation	39.5
Average Percent Residual Water Saturation	54.8
Average Percent Total Residual Fluid Saturation	94.3
Average Original Oil Content, Bbls./A. Ft.	694.
Average Oil Recovery, Bbls./A. Ft.	112.
Average Residual Oil Content, Bbls./A. Ft.	582.
Total Original Oil Content, Bbls./Acre	5,896.
Total Oil Recovery, Bbls./Acre	949.
Total Residual Oil Content, Bbls./Acre	4,947.
Average Effective Permeability, Millidarcys	5.99
Average Initial Fluid Production Pressure, p.s.i.	19.0

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