

HICKORY CREEK OIL COMPANY

CORE ANALYSIS REPORT

WELL NO. HCO-74

W. Denlin 22

OILFIELD RESEARCH LABORATORIES

536 N. HIGHLAND

CHANUTE, KANSAS



OILFIELD RESEARCH LABORATORIES

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

January 3, 1979

Hickory Creek Oil Company
1128 Main Street
Parsons, Kansas 67357

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-74, and submitted to our laboratory on December 4, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman
Benjamin R. Pearman

BRP/tem
4 c to Parsons, Kansas
1 c to Chanute, Kansas



- REGISTERED ENGINEERS -

ORE ANALYSIS - WATER ANALYSIS - REPRESSURING ENGINEERING - SURVEYING & MAPPING - PROPERTY EVALUATION & OPERATION

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GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease - Well No. HCO-74

Location -

Section - Twp. - Rge. - County - State -

Name of Sand - - - - -

Top of Core - - - - - 176.0

Bottom of Core - - - - - 215.0

Top of Sand - - - - - (Analyzed) 176.4

Bottom of Sand - - - - - 215.0

Total Feet of Permeable Sand - - - - - 36.2

Total Feet of Floodable Sand - - - - - 22.8

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

1 - 50

7.9

7.9

50 - 100

8.3

16.2

100 - 200

13.0

29.2

200 & Above

7.0

36.2

Average Permeability Millidarcys - - - - - 130.0

Average Percent Porosity - - - - - 23.0

Average Percent Oil Saturation - - - - - 48.0

Average Percent Water Saturation - - - - - 27.6

Average Oil Content, Bbls./A. Ft. - - - - - 859.

Total Oil Content, Bbls./Acre - - - - - 31,088.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 13.7

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 250.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 5,698.

Total Calculated Oil Recovery, Bbls./Acre - - - - - See "Calculated Recovery" Section.

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

A. P. I. Gravity, degrees @ 60 °F - - - - -

Elevation, Feet - - - - -

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This core was sampled and the samples sealed in plastic bags 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>
176.0 - 176.4	Brown slightly shaly sandstone.
176.4 - 177.8	Light brown and gray laminated sandstone and shale.
177.8 - 186.5	Brown sandstone.
186.5 - 186.8	Gray shale.
186.8 - 187.8	Light brown shaly sandstone.
187.8 - 190.0	Brown sandstone.
190.0 - 191.0	Gray laminated shale and sandstone.
191.0 - 191.4	Light brown shaly sandstone.
191.4 - 194.2	Brown sandstone.
194.2 - 194.6	Gray laminated shale and sandstone.
194.6 - 195.0	Brown sandstone.
195.0 - 195.6	Light brown shaly sandstone.
195.6 - 197.7	Brown sandstone.
197.7 - 198.3	Gray and light brown laminated shale and sandstone.
198.3 - 201.6	Brown sandstone.
201.6 - 202.3	Light brown sandstone.
202.3 - 205.8	Brown sandstone.
205.8 - 206.7	Gray laminated shaly sandstone.
206.7 - 213.4	Brown sandstone.
213.4 - 215.0	Light brown slightly shaly sandstone.

LABORATORY FLOODING TESTS

In particular, the upper portion of the sand in this core (176.8 - 187.8 feet) responded to laboratory flooding tests. Overall, a total recovery of 5,698 barrels of oil per acre was obtained from 22.8 feet of sand. The weighted average percent oil saturation was reduced from 52.9 to 39.2, or represents an average recovery of 13.7 percent. The weighted average effective permeability of the samples is 11.88 millidarcys, while the average initial fluid production pressure is 18.3 pounds per square inch (See Table V).

Please note that the coregraph now presents residual oil saturation after flooding tests instead of recovery, as in the past.

CALCULATED RECOVERY

A study of the results of the laboratory testing, indicates that efficient primary and waterflooding operations in the vicinity of this well should recover approximately 8,940 barrels of oil per acre. This is an average recovery of 392 barrels per acre foot from the 22.8 feet of floodable pay sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

Original formation volume factor, estimated	✓ 1.03 ✓
Reservoir water saturation, percent, estimated	10.0 / 23.3
Average porosity, percent	23.4 / 23.2 ✓
Oil saturation after flooding, percent	39.2 / 36.1 ✓
Performance factor, percent, estimated	✓ 45.0 ✓
Net floodable pay sand, feet	22.8 / 13.0 ✓

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease D - 22

Well No. HCO-74

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	176.5	18.3	40	33	73	568	26.	0.4	0.4	227	10.40
2	177.5	22.3	47	20	67	813	49.	1.0	1.4	813	49.00
3	178.5	24.4	51	19	70	965	371.	1.2	2.6	1158	445.20
4	179.5	24.0	56	17	73	1043	236.	1.0	3.6	1043	236.00
5	180.5	24.1	51	17	68	954	165.	1.0	4.6	954	165.00
6	181.5	23.8	63	12	75	1163	150.	1.0	5.6	1163	150.00
7	182.5	23.4	64	13	77	1162	226.	1.0	6.6	1162	226.00
8	183.5	23.9	57	17	74	1057	98.	1.0	7.6	1057	98.00
9	184.5	23.7	61	15	76	1122	176.	1.0	8.6	1122	176.00
10	185.5	25.4	65	10	75	1281	103.	1.0	9.6	1281	103.00
11	186.4	23.6	54	13	67	989	72.	0.5	10.1	495	36.00
12	187.5	20.2	59	19	78	925	24.	1.0	11.1	925	24.00
13	188.5	21.6	56	21	77	938	110.	1.2	12.3	1126	132.00
14	189.5	22.2	55	15	70	947	49.	1.0	13.3	947	49.00
15	190.5	16.2	60	34	94	754	0.91	1.0	14.3	754	0.91
16	191.5	24.3	56	15	71	1056	166.	0.6	14.9	634	99.60
17	192.5	25.2	55	16	71	1075	172.	1.0	15.9	1075	172.00
18	193.5	24.1	51	20	71	954	175.	1.2	17.1	1145	210.00
19	194.5	20.4	29	22	51	459	1.8	0.4	17.5	184	0.72
20	195.5	22.2	20	33	53	345	28.	0.6	18.1	207	16.80
21	196.5	22.3	45	26	71	779	83.	1.4	19.5	1091	116.20
22	197.5	20.7	46	29	75	739	86.	0.7	20.2	517	60.20
23	198.5	24.5	43	32	75	817	70.	0.7	20.9	572	49.00
24	199.5	25.2	36	44	80	704	314.	1.0	21.9	704	314.00
25	200.5	22.5	50	26	76	873	58.	1.0	22.9	873	58.00
26	201.5	22.7	47	29	76	828	130.	0.6	23.5	497	78.00
27	202.5	24.7	45	28	73	862	90.	0.7	24.2	603	63.00
28	203.5	24.7	45	27	72	862	223.	1.0	25.2	862	223.00
29	204.5	24.6	43	36	79	827	250.	1.0	26.2	827	250.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease D - 22 Well No. HCO-74

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.		
	<u>7624.4</u>	<u>893X</u>		<u>1068</u>			<u>4755.71</u>				
30	205.5	25.5	41	32	73	811	203.	0.8	27.0	649	162.40
31	206.5	25.6	50	29	79	993	13.	0.9	27.9	894	11.70
32	207.5	21.6	36	37	73	603	61.	1.3	29.2	784	79.30
33	208.5	23.2	42	39	81	756	166.	1.0	30.2	756	166.00
34	209.5	20.1	43	39	82	671	58.	1.0	31.2	671	58.00
35	210.5	26.0	41	44	85	827	175.	1.0	32.2	827	175.00
36	211.5	24.9	33	59	92	638	156.	1.0	33.2	638	156.00
37	212.5	24.3	35	46	81	660	181.	1.4	34.6	924	253.40
38	213.5	18.4	44	41	85	628	19.	0.6	35.2	376	11.40
39	214.5	18.2	39	44	83	551	21.	1.0	36.2	551	21.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease — Well No. HCO-74

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
176.4 - 187.8	11.1	154.8	1718.60
187.8 - 215.0	25.1	119.0	2986.63
176.4 - 215.0	36.2	130.0	4705.23

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
176.4 - 187.8	11.1	23.4	56.5	16.4	1027	11,400
187.8 - 215.0	25.1	22.8	44.4	32.4	784	19,688
176.4 - 215.0	36.2	23.0	48.0	27.6	859	31,088

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease D - 22 Well No. HCO-74

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.
			%	Bbbls./A. Ft.	%	Bbbls./A. Ft.	% Oil	% Water	Bbbls./A. Ft.			
1	176.5	18.0	40	559	0	0	40	35	559	0	Imp.	-
2	177.5	22.0	47	802	17	290	30	62	512	254	10.60	15
3	178.5	24.3	51	961	19	358	32	56	603	147	21.00	10
4	179.5	24.0	56	1043	20	372	36	53	671	245	22.15	15
5	180.5	24.1	51	954	17	318	34	57	636	132	22.00	10
6	181.5	24.0	63	1173	28	521	35	60	652	301	27.40	10
7	182.5	23.6	64	1172	30	549	34	53	623	201	15.45	10
8	183.5	23.8	57	1052	23	425	34	61	627	121	10.50	10
9	184.5	24.0	61	1136	26	484	35	56	652	169	17.48	10
10	185.5	25.0	65	1261	28	543	37	55	718	218	13.90	10
11	186.4	23.5	54	984	15	273	39	54	711	310	11.50	15
12	187.5	20.0	59	915	21	326	38	50	586	0	0.06	30
13	188.5	22.0	56	956	13	222	43	48	734	101	4.00	25
14	189.5	21.9	55	934	13	221	42	48	713	44	1.70	25
15	190.5	16.0	62	770	0	0	62	35	770	0	Imp.	-
16	191.5	23.8	56	1034	9	166	47	44	868	238	10.30	25
17	192.5	25.0	55	1067	14	272	41	52	795	352	13.10	20
18	193.5	23.8	51	942	5	92	46	42	850	192	14.62	20
19	194.5	20.0	31	481	0	0	31	28	481	0	Imp.	-
20	195.5	21.7	23	387	0	0	23	36	387	0	Imp.	-
21	196.5	21.8	45	761	2	34	43	46	727	100	3.40	25
22	197.5	21.1	46	735	2	33	44	46	720	129	3.90	25
23	198.5	24.0	43	801	2	37	41	52	764	315	11.22	20
24	199.5	24.9	38	734	0	0	38	59	734	245	20.82	10
25	200.5	22.2	50	861	3	52	47	42	809	13	0.50	35
26	201.5	23.0	47	839	4	71	43	48	768	312	8.40	20
27	202.5	24.2	45	845	2	38	43	43	807	191	6.50	20

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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease D-22 Well No. HCO-74

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.			
							1541				363.06	
28	203.5	25.2	45	880	3	59	42	51	821	203	9.20	20
29	204.5	24.7	43	824	3	57	40	55	767	218	21.65	15
30	205.5	25.3	41	805	0	0	41	49	805	245	5.00	15
31	206.5	25.2	50	978	0	0	50	31	978	0	Imp.	-
32	207.5	21.0	36	587	0	0	36	51	587	78	2.20	25
33	208.5	23.0	42	749	0	0	42	55	749	358	8.30	15
34	209.5	19.8	44	676	0	0	44	50	676	222	5.00	15
35	210.5	26.5	41	843	0	0	41	58	843	248	15.29	15
36	211.5	24.6	33	630	0	0	33	67	630	332	15.72	15
37	212.5	24.2	32	601	0	0	32	68	601	496	9.80	10
38	213.5	18.0	43	600	0	0	43	48	600	10	0.20	35
39	214.5	18.0	39	545	0	0	39	51	545	9	0.20	35

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.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Hickory Creek Oil Company		Lease	-	Well No.	HCO-74
Depth Interval, Feet	176.4 - 187.8	187.8 - 205.0	176.4 - 205.0			
Feet of Core Analyzed	10.7	12.1	22.8			
Average Percent Porosity	23.5	23.2	23.4			
Average Percent Original Oil Saturation	57.2	49.2	52.9			
Average Percent Oil Recovery	22.5	6.0	13.7			
Average Percent Residual Oil Saturation	34.7	43.2	39.2			
Average Percent Residual Water Saturation	56.4	47.4	51.6			
Average Percent Total Residual Fluid Saturation	91.1	90.6	90.8			
Average Original Oil Content, Bbls./A. Ft.	1042.	887.	959.			
Average Oil Recovery, Bbls./A. Ft.	410.	108.	250.			
Average Residual Oil Content, Bbls./A. Ft.	632.	779.	709.			
Total Original Oil Content, Bbls./Acre	11,151.	10,712.	21,863.			
Total Oil Recovery, Bbls./Acre	4,394.	1,304	5,698.			
Total Residual Oil Content, Bbls./Acre	6,757.	9,408.	16,165.			
Average Effective Permeability, Millidarcys	15.93	8.25	11.88			
Average Initial Fluid Production Pressure, p.s.i.	13.2	22.7	18.3			

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

Dec 3, 1974 Sunday

Devlin 22 HCO # 74

Core # 1 (176-196)

176-190.1

Sandstone fng brown sugar

Micaceous. Vertical fracture (176.5-176)

Shale/laminations at 178.4 + 176.5

$\approx 70^\circ$ from core axis. Coal seam

at 177.3, $\frac{1}{2}$ " thick with plant

fragments being replaced by pyrite

Carbonaceous laminations at 181.8

(182.7-182.8), Micaceous partings

at 184.4, 186.0. Shale interval

186.5-186.9) Shale is grey +

finely laminated with carbonaceous

material $\approx 55^\circ$ from core axis

Shale pebbles at 186.9 ranging to

$\frac{3}{8}$ " in diameter + somewhat elliptical

At 187.3 large shale pebbles

1" by $\frac{1}{2}$ ". Many shale pebbles at

187.8-190 up to 3"?

190.1-191.0

Shale, grey, sandy, micaceous

fine, tight. Interval is finely

laminated with micaceous carbonaceous

material throughout.

191.0-196.

Sandstone fng, brown sugar, micaceous

finely laminated with carbonaceous

material (191.0-191.6); (194.1-194.5)

Micaceous partings at 195.1 + 195.3

All sand oolitic tight.

Some water in cracks, or in some parts

194.1

End Core 1

HCO # 74