

HICKORY CREEK OIL COMPANY

CORE ANALYSIS REPORT

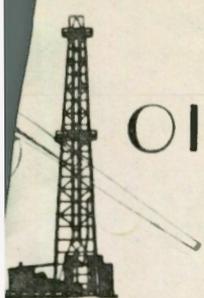
WELL NO. HCO-71

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OILFIELD RESEARCH LABORATORIES

536 N. HIGHLAND

CHANUTE, KANSAS



OILFIELD RESEARCH LABORATORIES

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

December 26, 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-71, and submitted to our laboratory on December 3, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman
Benjamin R. Pearman

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



- REGISTERED ENGINEERS -

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

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease - Well No. HCO-71

Location -

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

Name of Sand	-
Top of Core	170.0
Bottom of Core	208.3
Top of Sand	170.3
Bottom of Sand	208.3
Total Feet of Permeable Sand	34.5
Total Feet of Floodable Sand	24.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.	
0 - 50	8.9	8.9	
50 - 100	10.4	19.3	
100 - 200	10.2	29.5	
200 - 500	5.0	34.5	
Average Permeability Millidarcys			115.6
Average Percent Porosity			20.9
Average Percent Oil Saturation			48.3
Average Percent Water Saturation			29.6
Average Oil Content, Bbls./A. Ft.			786.
Total Oil Content, Bbls./Acre			27,115.
Average Percent Oil Recovery by Laboratory Flooding Tests			12.9
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.			227.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre			5,564.
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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The 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>
170.0 - 170.3	Gray sandy shale.
170.3 - 179.0	Brown sandstone.
181.0 - 184.6	Light brown and gray laminated sandstone and shale, 80% sandstone.
184.6 - 186.6	Brown sandstone.
186.6 - 187.8	Dark brown sandstone containing thin widely scattered shale and carbon partings.
187.8 - 188.6	Brown sandstone containing thin carbon partings.
188.6 - 189.0	Gray sandy shale.
189.0 - 191.7	Brown sandstone containing thin widely scattered carbon partings.
191.7 - 196.3	Brown sandstone.
196.3 - 196.8	Brown sandstone containing clay nodules.
196.8 - 198.0	Brown sandstone.
198.0 - 198.3	Gray sandy shale.
198.3 - 199.4	Brown shaly sandstone.
199.4 - 202.2	Brown sandstone containing thin widely scattered carbon partings.
202.2 - 202.4	Gray sandy shale.
202.4 - 204.3	Light brown sandstone.
204.3 - 205.3	Light brown shaly sandstone.
205.3 - 206.0	Light brown sandstone.

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206.0 - 206.3	Gray sandy shale.
206.3 - 207.3	Light brown sandstone.
207.3 - 207.6	Gray shale.
207.6 - 208.3	Light brown sandstone.

LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded well relative to the lower portion of the sand, to laboratory flooding tests, as a total overall recovery of 5,564 barrels of oil per acre was obtained from 24.5 feet of sand. The weighted average percent oil saturation was reduced from 51.2 to 38.3, or represents an average recovery of 12.9 percent. The weighted average effective permeability of the samples is 11.91 millidarcys, while the average initial fluid production pressure is 9.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 36 samples tested, 25 produced water and oil, and 8 samples produced water only. This indicates that approximately 69 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

It would appear from a study of the data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 9,360 barrels of oil per acre. This is an average recovery of 382 barrels per acre foot from 24.5 feet of floodable sand analyzed in this core.

VILMER 5

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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 / 14.4
Average porosity, percent	22.0 / 23.7
Oil saturation after flooding, percent	38.3 / 33.7
Performance factor, percent, estimated	✓ 45.0
Net floodable sand, feet	24.5 / 9.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

$1.144 \div 9 = 12.7$
 $1.144 = 85.6$

Company Hickory Creek Oil Company

Lease - VILMER 5

Well No. HCO-71

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbbs. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	170.5	20.3	54	14	68	850	143.	0.7	0.7	595	100.10
2	171.5	20.2	64	17	81	1,003	172.	1.0	1.7	1,003	172.00
3	172.5	25.4	62	8	70	1,222	424.	1.0	2.7	1,222	424.00
4	173.5	26.1	49	20	69	992	292.	1.0	3.7	992	292.00
5	174.5	26.0	68	10	78	1,372	384.	1.0	4.7	1,372	384.00
6	175.5	23.3	66	14	80	1,193	284.	1.0	5.7	1,193	284.00
7	176.5	24.4	57	12	69	1,079	162.	1.0	6.7	1,079	162.00
8	177.5	23.0	45	21	66	803	78.	1.0	7.7	803	78.00
9	178.5	23.7	59	14	73	1,085	301.	1.0	8.7	1,085	301.00
10	181.5	13.2	25	67	92	256	4.9	1.0	9.7	256	4.90
11	182.5	15.2	51	26	77	601	1.1	1.0	10.7	601	1.10
12	183.5	15.1	81	10	91	949	1.3	1.0	11.7	949	1.30
13	184.5	18.3	56	23	79	795	42.	0.6	12.3	477	25.20
14	185.5	21.2	51	26	77	839	41.	1.0	13.3	839	41.00
15	186.5	19.9	61	20	81	942	78.	1.0	14.3	942	78.00
16	187.5	13.8	19	72	91	203	65.	1.2	15.5	244	78.00
17	188.5	21.0	44	33	77	717	5.3	0.8	16.3	574	4.24
18	189.5	20.1	45	29	74	702	26.	1.0	17.3	702	26.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease - VILMER 5

Well No. HCO-71

6822.3

749.6

1047

419.6

419.6

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.		
19	190.5	19.6	52	29	81	791	74.	1.0	18.3	791	74.00
20	191.5	23.5	47	27	74	857	130.	0.7	19.0	600	91.00
21	192.5	23.0	51	26	77	910	22.	1.3	20.3	1,183	28.60
22	193.5	24.0	51	23	74	950	123.	1.0	21.3	950	123.00
23	194.5	23.4	35	43	78	635	149.	1.0	22.3	635	149.00
24	195.5	22.1	52	30	82	892	67.	1.3	23.6	1,160	87.10
25	196.5	12.1	83	10	93	779	34.	0.5	24.1	390	17.00
26	197.5	21.0	40	41	81	652	90.	1.2	25.3	782	108.00
27	198.5	16.1	52	36	88	650	110.	1.1	26.4	715	121.00
28	199.5	20.3	49	32	81	772	139.	0.6	27.0	463	83.40
29	200.5	24.7	40	35	75	767	83.	1.0	28.0	767	83.00
30	201.5	22.0	35	33	68	597	102.	1.2	29.2	716	122.40
31	202.5	22.4	34	27	61	591	103.	1.0	30.2	591	103.00
32	203.5	23.5	31	56	87	565	114.	0.9	31.1	509	102.60
33	204.5	15.5	44	42	86	529	80.	1.0	32.1	529	80.00
34	205.5	22.0	33	49	82	563	86.	0.7	32.8	394	60.20
35	206.5	21.7	34	45	79	572	68.	1.0	33.8	572	68.00
36	207.8	22.5	36	27	63	628	41.	0.7	34.5	440	28.70

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease - Well No. HCO-71

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
170.3 - 179.0	8.7	252.5	2,197.10
181.0 - 196.3	14.9	54.5	812.44
196.3 - 208.3	10.9	89.7	977.30
170.3 - 208.3	34.5	115.6	3,986.84

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
170.3 - 179.0	8.7	23.7	58.4	14.5	1,074	9,344
181.0 - 196.3	14.9	19.5	47.7	33.0	732	10,903
196.3 - 208.3	10.9	20.6	40.9	37.2	630	6,868
170.3 - 208.3	34.5	20.9	48.3	29.6	786	27,115

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - VILMER 5 Well No. HCO-71

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	170.5	20.6	54	863	29	463	25	71	400	291	6.60	10
2	171.5	20.7	64	1028	27	434	37	55	594	185	16.86	10
3	172.5	25.9	62	1246	24	482	38	60	764	547	53.72	10
4	173.5	25.9	49	985	16	321	33	63	664	492	49.34	10
5	174.5	25.6	68	1351	37	735	31	66	616	224	20.99	10
6	175.5	23.7	66	1214	34	625	32	62	589	462	44.35	10
7	176.5	24.0	57	1061	20	372	37	49	689	139	3.60	20
8	177.5	23.0	45	803	9	161	36	59	642	180	14.46	15
9	178.5	23.5	59	1076	25	456	34	50	620	285	8.62	10
10	181.5	13.7	25	266	0	0	25	72	266	4	0.30	35
11	182.5	15.2	50	590	0	0	50	40	590	0	Imp.	-
12	183.5	15.2	80	943	0	0	80	12	943	0	Imp.	-
13	184.5	18.0	56	782	22	307	34	63	475	95	1.72	30
14	185.5	20.8	51	823	12	194	39	58	629	327	5.17	30
15	186.5	20.2	61	956	17	266	44	39	690	69	1.27	35
16	187.5	14.0	19	206	0	0	19	78	206	304	4.35	25
17	188.5	20.5	44	700	4	64	40	54	636	92	1.50	30
18	189.5	19.7	45	688	0	0	45	49	688	8	0.22	50

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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11.9.11.33.7

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - V-5 Well No. HCO-71

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		¹⁴²² Residual Saturation			Volume of Water Recovered cc*	^{337.20} Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
19	190.5	20.0	52	807	8	124	44	53	683	231	3.67	25
20	191.5	23.0	47	839	3	54	44	54	785	159	2.62	30
21	192.5	23.0	51	910	4	71	47	51	839	280	7.87	25
22	193.5	23.8	51	942	11	203	40	57	739	187	10.77	25
23	194.5	23.3	35	633	2	36	33	62	597	260	12.18	25
24	195.5	22.3	52	900	8	138	44	51	762	275	4.12	30
25	196.5	12.4	83	798	0	0	83	13	798	219	4.91	20
26	197.5	20.6	40	639	2	32	38	60	607	108	2.10	15
27	198.5	16.5	52	666	4	51	48	50	615	249	5.66	15
28	199.5	20.7	49	787	7	112	42	50	675	69	1.67	25
29	200.5	24.5	40	760	3	57	37	58	703	167	3.42	15
30	201.5	22.4	35	608	2	35	33	65	573	318	6.08	10
31	202.5	22.1	34	583	0	0	34	64	583	156	2.67	15
32	203.5	23.3	31	560	0	0	31	64	560	201	13.12	10
33	204.5	15.9	44	543	2	25	42	52	518	120	2.02	10
34	205.5	21.8	33	558	0	0	33	64	558	329	8.75	15
35	206.5	21.7	34	572	0	0	34	61	572	279	9.58	15
36	207.8	22.2	36	620	0	0	36	58	620	116	2.92	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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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Lease				Well No.
Hickory Creek Oil Company	-				HCO-71
Depth Interval, Feet	170.3 - 179.0	181.0 - 196.3	196.3 - 208.3	170.3 - 208.3	
Feet of Core Analyzed	8.7	9.7	6.1	24.5	
Average Percent Porosity	23.8	21.7	20.1	22.0	
Average Percent Original Oil Saturation	58.4	50.1	42.7	51.2	
Average Percent Oil Recovery	24.4	8.7	3.0	12.9	
Average Percent Residual Oil Saturation	34.0	41.4	39.7	38.3	
Average Percent Residual Water Saturation	59.1	53.7	56.6	56.3	
Average Percent Total Residual Fluid Saturation	93.1	95.1	96.3	94.6	
Average Original Oil Content, Bbls./A. Ft.	1,076.	838.	657.	875.	
Average Oil Recovery, Bbls./A. Ft.	449.	141.	47.	227.	
Average Residual Oil Content, Bbls./A. Ft.	627.	697.	610.	648.	
Total Original Oil Content, Bbls./Acre	9,368.	8,131.	4,004.	21,503.	
Total Oil Recovery, Bbls./Acre	3,910.	1,368.	286.	5,564.	
Total Residual Oil Content, Bbls./Acre	5,458.	6,763.	3,718.	15,939.	
Average Effective Permeability, Millidarcys	24.89	5.43	3.69	11.91	
Average Initial Fluid Production Pressure, p.s.i.	11.7	28.5	15.0	19.2	

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