



OILFIELD RESEARCH LABORATORIES

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

December 27, 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-75, 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 -

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-75

Location

Section Twp. Rge. County State

Name of Sand	-	
Top of Core	-	170.0
Bottom of Core	-	209.7
Top of Sand	-	170.0
Bottom of Sand	-	209.7
Total Feet of Permeable Sand	-	34.1
Total Feet of Floodable Sand	-	19.5

Distribution of Permeable Sand:
Permeability Range
Millidarcys

	Feet	Cum. Ft.
1 - 10	4.7	4.7
10 - 100	10.8	15.5
100 - 200	8.6	24.1
200 & Above	10.0	34.1

Average Permeability Millidarcys	-	142.9
Average Percent Porosity	-	21.5
Average Percent Oil Saturation	-	47.6
Average Percent Water Saturation	-	32.4
Average Oil Content, Bbls./A. Ft.	-	807.
Total Oil Content, Bbls./Acre	-	27,693.
Average Percent Oil Recovery by Laboratory Flooding Tests	-	12.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	-	230.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	-	4,476.
Total Calculated Oil Recovery, Bbls./Acre	-	See "Calculated Recovery" Section.
Packer Setting, Feet	-	
Viscosity, Centipoises @	-	
A. P. I. Gravity, degrees @ 60 °F	-	
Elevation, Feet	-	

This core was sampled and 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 - 178.0	Brown sandstone.
178.0 - 178.2	Gray and brown laminated shale and sandstone.
178.2 - 179.6	Gray sandy shale.
179.6 - 181.1	Brown slightly shaly sandstone.
181.1 - 187.6	Light brown shaly sandstone.
187.6 - 192.1	Brown sandstone containing thin streaks of shale.
192.1 - 192.9	Gray and light brown laminated shale and sandstone.
192.9 - 198.0	Brown sandstone containing thin streaks of shale.
198.0 - 199.0	Gray and light brown laminated shale and sandstone.
199.0 - 199.7	Brown sandstone.
199.7 - 201.2	Light brown slightly shaly sandstone.
201.2 - 202.2	Gray shaly sandstone.
202.2 - 204.3	Light brown slightly shaly sandstone.
204.3 - 206.0	Light brown shaly sandstone.
207.0 - 209.7	Light brown sandstone.

LABORATORY FLOODING TESTS

In particular, the upper portion of the sand in this core (170.0 - 181.1 feet) responded to laboratory flooding tests. Overall, a total recovery of 4,476 barrels of oil per acre was obtained from 19.5 feet of sand. The weighted average percent oil saturation was reduced from 54.5 to 41.9, or represents an average recovery of 12.6 percent. The weighted average effective permeability of the samples is 10.97 millidarcys, while the average initial fluid production pressure is 17.6 pounds per square inch (See Table V).

CALCULATED RECOVERY

The results of the laboratory testing indicate that efficient primary and waterflooding operations in the vicinity of this well should recover approximately 6,950 barrels of oil per acre. This is an average recovery of 356 barrels per acre foot from the 19.5 feet of floodable 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 / 20.1 ✓
Average porosity, percent	22.4 / 24.3 ✓
Oil saturation after flooding, percent	41.9 / 30.0 ✓
Performance factor, percent, estimated	✓ 45.0
Net floodable pay sand, feet	19.5 / 9.0 ✓

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - Well No. 1-4 HCO-75

78

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 in.
			Oil	Water			Ft.	Cum. Ft.		
1	170.5	25.5	59	14	1167	383.	1.0	1.0	1167	383.00
2	171.5	23.6	48	18	879	273.	1.0	2.0	879	273.00
3	172.6	26.0	61	13	1230	369.	1.0	3.0	1230	369.00
4	173.4	25.8	60	8	1201	420.	1.0	4.0	1201	420.00
5	174.5	23.8	56	15	1034	503.	1.0	5.0	1034	503.00
6	175.5	24.5	59	11	1121	323.	1.0	6.0	1121	323.00
7	176.4	23.1	56	20	1004	299.	1.0	7.0	1004	299.00
8	177.5	25.6	58	10	1152	262.	1.0	8.0	1152	262.00
9	178.1	13.7	33	59	351	Imp.	0.2	8.2	70	0.00
10	179.7	23.2	57	21	1026	71.	0.5	8.7	513	35.50
11	180.2	22.6	55	14	964	118.	1.0	9.7	964	118.00
12	181.5	17.5	50	45	679	8.6	1.0	10.7	679	8.60
13	184.5	19.8	59	30	906	13.	1.0	11.7	906	13.00
14	186.5	20.0	56	29	869	6.4	1.0	12.7	869	6.40
15	187.5	19.8	47	36	722	17.	0.5	13.2	361	8.50
16	188.5	20.7	56	26	899	104.	1.4	14.6	1259	145.60
17	190.5	22.6	50	30	877	108.	2.0	16.6	1754	216.00
18	191.5	19.8	52	33	799	108.	1.1	17.7	879	118.80
19	192.5	15.9	41	52	506	12.	0.8	18.5	405	9.60
20	193.5	22.3	49	32	848	102.	1.1	19.6	932	112.20
21	194.5	23.4	41	46	744	236.	1.0	20.6	744	236.00
22	195.5	20.6	41	41	719	231.	1.0	21.6	719	231.00
23	196.3	23.1	43	48	771	118.	1.0	22.6	771	118.00
24	197.3	22.3	48	26	830	49.	1.0	23.6	830	49.00
25	198.5	18.3	42	38	596	1.0	1.0	24.6	596	1.00
26	199.5	20.3	35	49	551	42.	0.7	25.3	386	29.40
27	200.5	22.7	37	38	652	82.	1.5	26.8	978	123.00
28	201.5	15.0	15	56	175	41.	1.0	27.8	175	41.00
29	202.5	21.1	46	36	753	41.	0.8	28.6	602	32.80

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE I-B

Company Hickory Creek Oil Company Lease - Well No. HCO-75

6651.5 741.5 1171 4743.4

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 m.d.
			Oil	Water			Total	Ft.		
30	203.5	20.5	40	46	636	53.0	1.3	29.9	826	68.90
31	204.5	20.3	28	43	441	3.0	0.7	30.6	309	2.10
32	205.5	18.5	43	39	617	9.4	1.0	31.6	617	9.40
33	207.5	18.7	54	40	783	145.0	1.0	32.6	783	145.00
34	208.5	20.8	39	46	629	92.0	1.0	33.6	629	92.00
35	209.5	20.1	32	63	499	100.0	0.7	34.3	349	70.00

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease --- Well No. HCO-75

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	Total Oil Content Bbls./Acre
170.0 - 181.1	9.5	24.6	56.5	15.0	314.3	2985.50	10,335
181.1 - 209.7	24.6	20.4	44.2	39.3	76.7	1887.30	17,358
170.0 - 209.7	34.1	21.5	47.6	32.4	142.9	4872.80	27,693

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

$1 - 20.1 \div 79.9 = 20.13$

Company Hickory Creek Oil Company Lease - 1-4 Well No. HCO-75

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 Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water			
1	170.5	25.2	59	1153	20	391	39	51	384	33.00	10
2	171.5	24.0	48	894	14	261	34	56	284	27.00	10
3	172.6	25.7	61	1216	23	459	38	45	218	11.80	10
4	173.4	25.4	60	1182	25	493	35	55	306	25.80	10
5	174.5	24.1	56	1047	20	374	36	56	238	24.00	10
6	175.5	25.0	59	1144	25	485	34	53	198	16.20	10
7	176.4	23.0	56	999	17	303	39	54	353	13.33	10
8	177.5	25.3	58	1138	17	334	41	47	130	15.60	10
9	178.1	14.0	35	380	0	0	35	62	0	Imp.	-
10	179.7	23.0	57	1017	20	357	37	60	284	8.25	10
11	180.2	22.5	55	960	17	297	38	52	100	3.00	15
12	181.5	17.5	50	679	7	95	43	56	0	0.03	40
13	184.5	19.5	59	893	13	197	46	48	0	0.04	30
14	186.5	19.5	56	847	9	136	47	43	0	0.02	30
15	187.5	19.7	47	718	6	92	41	46	0	0.02	35
16	188.5	21.0	56	912	6	98	50	44	286	9.50	15
17	190.5	22.2	50	861	5	86	45	49	128	3.30	30
18	191.5	20.2	52	815	3	47	49	49	186	4.50	20
19	192.5	16.0	40	497	0	0	40	55	0	Imp.	-
20	193.5	22.6	49	859	0	0	49	43	242	13.48	10
21	194.5	23.3	42	759	0	0	42	49	320	23.95	10
22	195.5	20.9	42	681	0	0	42	49	232	10.89	15
23	196.3	22.7	42	757	2	35	41	52	304	12.19	15
24	197.3	22.6	48	842	0	0	48	41	162	3.75	25
25	198.5	18.5	44	632	0	0	44	51	6	0.15	40
26	199.5	20.7	35	562	0	0	35	57	290	5.55	15
27	200.5	22.2	38	654	0	0	38	49	20	0.45	40
28	201.5	15.0	15	175	0	0	15	60	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.

20.13
= 20.13

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease V-y Well No. HCO-75

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			
29	202.5	20.7	47	755	0	0	47	48	38	0.75	25
30	203.5	20.4	40	633	0	0	40	58	104	4.11	15
31	204.5	20.0	27	419	0	0	27	47	0	Imp.	-
32	205.5	19.0	42	619	0	0	42	47	26	0.45	20
33	207.5	19.2	54	804	2	30	52	45	150	3.00	15
34	208.5	21.0	38	619	0	0	38	54	320	5.90	15
35	209.5	19.9	35	540	0	0	35	64	380	9.94	10

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	Lease	Well No.	HCO-75
Hickory Creek Oil Company	--		
Depth Interval, Feet	170.0 - 181.1	181.1 - 209.7	170.0 - 209.7
Feet of Core Analyzed	9.5	10.0	19.5
Average Percent Porosity	24.4	20.4	22.4
Average Percent Original Oil Saturation	56.9	52.1	54.5
Average Percent Oil Recovery	19.8	5.8	12.6
Average Percent Residual Oil Saturation	37.1	46.3	41.9
Average Percent Residual Water Saturation	52.5	48.1	50.2
Average Percent Total Residual Fluid Saturation	89.6	94.4	92.1
Average Original Oil Content, Bbls./A. Ft.	1,078.	823.	948.
Average Oil Recovery, Bbls./A. Ft.	376.	90.	230.
Average Residual Oil Content, Bbls./A. Ft.	702.	733.	718.
Total Original Oil Content, Bbls./Acre	10,242.	8,234.	18,476.
Total Oil Recovery, Bbls./Acre	3,576.	900.	4,476.
Total Residual Oil Content, Bbls./Acre	6,666.	7,334.	14,000.
Average Effective Permeability, Millidarcys	18.30	4.01	10.97
Average Initial Fluid Production Pressure, p.s.i.	10.5	25.6	17.6

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