

OILFIELD RESEARCH LABORATORIES

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

October 12, 1979

15-133-21241

Hickory Creek Oil Company
1128 Main
Parsons, Kansas 67357

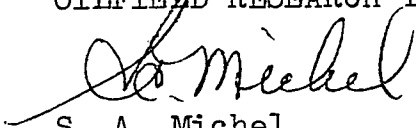
Gentlemen:

Enclosed herewith is the report of the analysis
of the rotary core taken from Well No. HCO-46, and
submitted to our laboratory on September 28, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


S. A. Michel
Chemist

SAM:km
4 c to Parsons, Kansas
1 c to Chanute, Kansas

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease - Well No. HCO-46

Location -

Section - Twp - Rge - County - State -

Name of Sand	- - - - -	-
Top of Core	- - - - -	172.0
Bottom of Core	- - - - -	191.8
Top of Sand	- - - - -	172.5
Bottom of Sand	- - - - -	191.8
Total Feet of Permeable Sand	- - - - -	17.0
Total Feet of Floodable Sand	- - - - -	9.6

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10	8.4	8.4
10 - 20	2.8	11.2
20 - 30	4.6	15.8
30 & Above	1.2	17.0

Average Permeability Millidarcys	- - - - -	18.0
Average Percent Porosity	- - - - -	18.9
Average Percent Oil Saturation	- - - - -	46.1
Average Percent Water Saturation	- - - - -	38.2
Average Oil Content, Bbls./A. Ft.	- - - - -	685.
Total Oil Content, Bbls./Acre	- - - - -	11,640.
Average Percent Oil Recovery by Laboratory Flooding Tests	- - - - -	11.9
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	- - - - -	188.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	- - - - -	1,803.
Total Calculated Oil Recovery, Bbls./Acre	- - - - -	See "Calculated Recovery" Section
Packer Setting, Feet	- - - - -	
Viscosity, Centipoises @	- - - - -	
A. P. I. Gravity, degrees @ 60 °F	- - - - -	
Elevation, Feet	- - - - -	

The core was sampled by a representative of the client.

FORMATION COFED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
172.0 - 172.5	Gray sandy shale.
172.5 - 172.9	Light brown sandstone.
172.9 - 173.5	Gray sandy shale.
173.5 - 174.0	Light brown and gray laminated sandstone and shale.
174.0 - 177.2	Brown sandstone.
177.2 - 181.2	Brown and gray laminated sandstone and shale.
181.2 - 181.8	Brown sandstone.
181.8 - 184.2	Brown slightly shaly sandstone.
184.2 - 186.9	Brown sandstone with fine carbonaceous partings.
186.9 - 187.2	Gray sandy shale.
187.2 - 189.0	Brown sandstone with fine carbonaceous partings.
189.0 - 190.4	Gray sandy shale.
190.4 - 191.8	Light brown and gray laminated sandstone and shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,803 barrels of oil per acre was obtained from 9.6 feet of sand. The weighted average percent oil saturation was reduced from 46.5 to 34.6, or represents an average recovery of 11.9 percent. The weighted average effective permeability of the samples is 1.94 millidarcys, while the average initial fluid production pressure is 26.5 pounds per

square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 10 produced water and oil, and 1 produced water only. This indicates that approximately 53 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 3,530 barrels of oil per acre. This is an average recovery of 368 barrels per acre foot from 9.6 feet of floodable sand analyzed in this core.

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

Original formation volume factor

✓ 1.03

Reservoir water saturation, percent

15.0 / 29.3

Average porosity, percent

19.8 / 20.6

Oil saturation after flooding, percent

34.6 / 31.8

Performance factor, percent

✓ 50.0

Net floodable pay sand, feet

9.6 / 6.0

RESULTS OF SATURATION & PERMEABILITY TESTS

Company Hickory Creek Oil Company Lease GRAY - 18 Well No. HCO-46

[illegible]

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease — Well No. HCO-46

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
172.5 - 177.2	4.1	40.6	166.45
177.2 - 181.8	4.6	6.4	29.24
181.8 - 191.8	8.3	13.2	110.58
172.5 - 191.8	17.0	18.0	306.27

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
172.5 - 177.2	4.1	20.8	45.1	30.5	747	3,064
177.2 - 181.8	4.6	18.4	48.3	37.4	693	3,187
181.8 - 191.8	8.3	18.2	45.3	42.5	649	5,389
172.5 - 191.8	17.0	18.9	46.1	38.2	685	11,640

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company <u>Hickory Creek Oil Company</u> Lease <u>GRAY - 18</u> Well No. <u>HCO-46</u>												
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	172.6	14.0	40	434	0	0	40	33	434	5	0.15	40
2	173.6	14.8	22	253	0	0	22	54	253	0	Imp.	-
3	174.5	20.3	46	724	18	238	28	59	441	12	0.25	20
4	175.5	22.0	50	853	22	375	28	63	478	278	8.41	10
5	176.6	24.5	51	969	21	399	30	65	570	340	7.05	10
6	177.5	14.8	39	448	0	0	39	56	448	0	Imp.	-
7	178.5	19.5	58	877	0	0	58	37	877	0	Imp.	-
8	179.5	18.2	49	692	14	198	35	56	494	8	0.22	25
9	180.5	18.4	48	685	14	200	34	56	485	12	0.25	30
10	181.6	20.3	46	724	10	157	36	59	567	11	0.33	30
11	182.5	20.6	69	1103	0	0	69	26	1103	0	Imp.	-
12	183.7	19.9	51	787	0	0	51	40	787	0	Imp.	-
13	184.5	18.0	44	614	4	56	40	55	558	8	0.33	30
14	185.5	18.0	44	614	5	70	39	55	544	9	0.30	40
15	186.7	16.7	27	350	0	0	27	68	350	8	0.15	35
16	187.7	19.3	41	614	3	45	38	55	569	7	0.15	35
17	188.5	18.0	43	600	2	28	41	54	572	12	0.15	35
18	190.5	15.6	37	448	0	0	37	56	448	0	Imp.	-
19	191.5	15.5	32	385	0	0	32	58	385	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	Hickory Creek Oil Company			Lease	—	Well No.	HCO-46
Depth Interval, Feet	172.5 - 177.2	177.2 - 181.8	181.8 - 191.8	172.5 - 191.8			
Feet of Core Analyzed	3.2	2.8	3.6	9.6			
Average Percent Porosity	22.4	18.8	18.3	19.8			
Average Percent Original Oil Saturation	49.2	47.9	43.1	46.5			
Average Percent Oil Recovery	20.4	13.1	3.5	11.9			
Average Percent Residual Oil Saturation	28.8	34.8	39.6	34.6			
Average Percent Residual Water Saturation	62.5	56.6	54.7	57.9			
Average Percent Total Residual Fluid Saturation	91.3	91.4	94.3	92.5			
Average Original Oil Content, Bbls./A. Ft.	842.	696.	579.	701.			
Average Oil Recovery, Bbls./A. Ft.	341.	190.	50.	188.			
Average Residual Oil Content, Bbls./A. Ft.	501.	506.	529.	513.			
Total Original Oil Content, Bbls./Acre	2,695.	1,948.	2,085.	6,728.			
Total Oil Recovery, Bbls./Acre	1,092.	532.	179.	1,803.			
Total Residual Oil Content, Bbls./Acre	1,603.	1,416.	1,906.	4,925.			
Average Effective Permeability, Millidarcys	5.32	0.26	0.23	1.94			
Average Initial Fluid Production Pressure, p.s.i.	13.3	28.3	35.0	26.5			

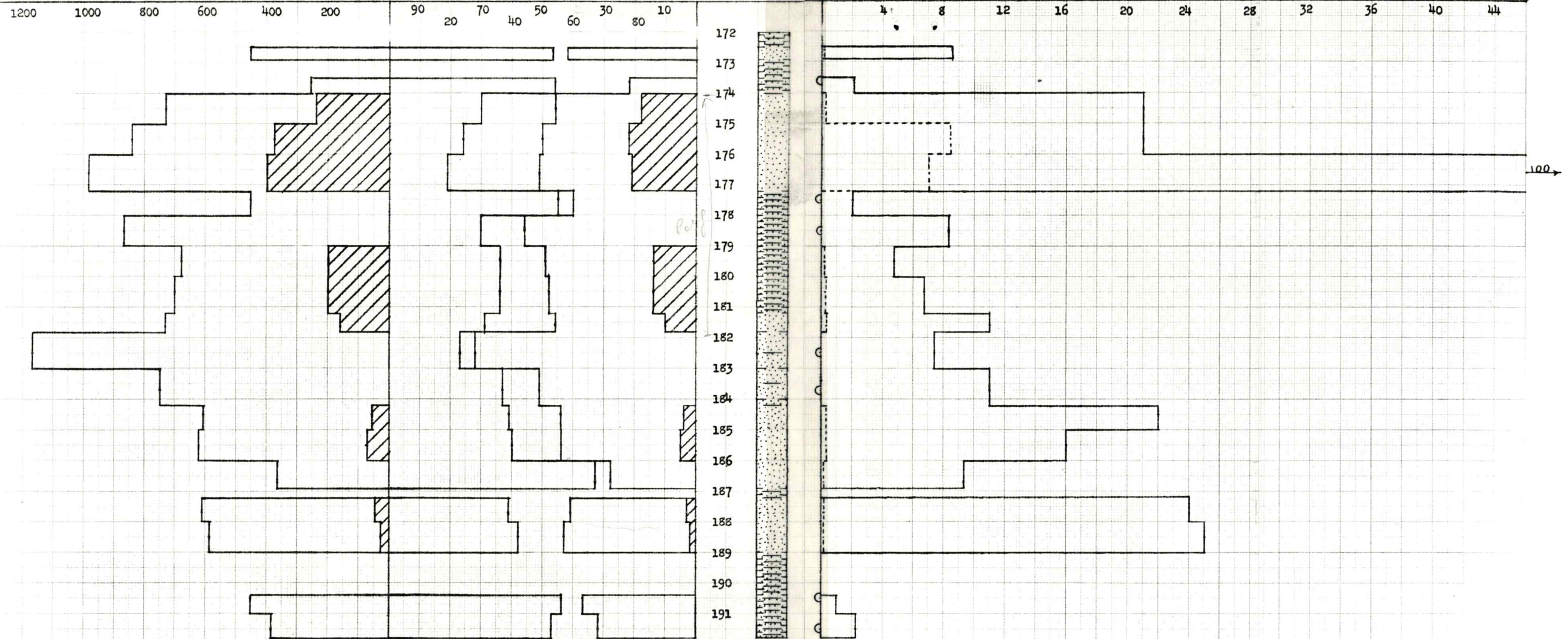
NOTE: Only those samples which recovered oil were used in calculating the above averages.

OIL CONTENT,
BBL./A. FT.

WATER SAT.,
PERCENT

OIL SAT.,
PERCENT

AIR PERMEABILITY, IN MILLIDARCY
EFFECTIVE PERMEABILITY, IN MILLIDARCY



KEY:
FLOOD POT RECOVERY
SANDSTONE

CARBONACEOUS SANDSTONE
LAMINATED SANDSTONE AND SHALE

SHALY SANDSTONE
SANDY SHALE

○ IMPERMEABLE TO WATER

HICKORY CREEK OIL COMPANY

LEASE

COUNTY

WELL NO. HCC-46

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVG. OIL CONTENT BBL./A. FT.	TOTAL OIL CONTENT BBL./ACRE	AVG. AIR PERMEABILITY, MILLIDARCY	CALCULATED OIL RECOVERY, BBL./ACRE
172.5 - 177.2	4.1	20.8	45.1	30.5	747	3,064	40.6	
177.2 - 181.8	4.6	18.4	48.3	37.4	693	3,187	6.4	
181.8 - 191.8	8.3	18.2	45.3	42.5	649	5,389	13.2	
172.5 - 191.8	17.0	18.9	46.1	38.2	685	11,640	18.0	

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CHANUTE, KANSAS
OCTOBER, 1979 EL

3,530 (PRIMARY & WATERFLOODING)