

OILFIELD RESEARCH LABORATORIES

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

July 1, 1980

Hickory Creek Oil Company
Box 379
Parsons, Kansas 67357

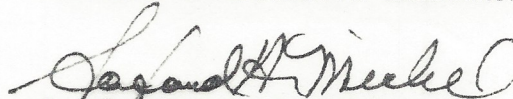
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-172, and submitted to our laboratory on May 16, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Sanford A. Michel

SAM/tem

4 c to Parsons, Kansas
1 c to Chanute, Kansas

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GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease --- Well No. HCO-172

Location ---

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

Elevation, Feet

Name of Sand

Top of Core 189.0

Bottom of Core 209.3

Top of Sand 189.7

Bottom of Sand (Tested) 208.2

Total Feet of Permeable Sand (Tested) 10.3

Total Feet of Floodable Sand (Tested) 3.0

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 10 5.4 5.4

10 - 20 2.9 8.3

30 - 40 2.0 10.3

Average Permeability Millidarcys 12.7

Average Percent Porosity 18.2

Average Percent Oil Saturation 39.5

Average Percent Water Saturation 48.6

Average Oil Content, Bbls./A. Ft. 558.

Total Oil Content, Bbls./Acre 5,749.

Average Percent Oil Recovery by Laboratory Flooding Tests 3.7

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 55.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 166.

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

-2-

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>
189.0 - 189.7	Gray sandy shale.
189.7 - 191.7	Brown sandstone.
191.7 - 192.5	Grayish brown very shaly sandstone.
192.5 - 193.9	Gray sandy shale.
193.9 - 195.0	Grayish brown very shaly sandstone.
195.0 - 195.8	Gray sandy shale.
195.8 - 197.8	Brown slightly shaly sandstone.
197.8 - 203.2	Grayish brown shaly sandstone.
203.2 - 207.3	Gray laminated sandstone and shale.
207.3 - 208.2	Light brown slightly shaly sandstone.
208.2 - 209.3	Gray laminated sandstone and shale.

LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded to laboratory flooding tests, as a total recovery of 166 barrels of oil per acre was obtained from 3.0 feet of sand. The weighted average percent oil saturation was reduced from 40.7 to 37.0, or represents an average recovery of 3.7 percent. The weighted average effective permeability of the samples is 0.45 millidarcys, while the average initial fluid production pressure is 31.7 pounds per square inch (See Table V).

LONG 24

-3-

By observing the data given in Table IV, you will note that of the 10 samples tested, 3 produced water and oil, and 3 samples produced water only. This indicates that approximately 30 percent of the sand represented by these samples is floodable pay sand.

CALCULATED RECOVERY

It would appear from a study of the core data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 770 barrels of oil per acre. This is an average recovery of 255 barrels per acre foot from 3.0 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	30.0 / 40.0
Average porosity, percent	✓ 19.3
Oil saturation after flooding, percent	✓ 37.0
Performance factor, percent, estimated	✓ 55.0
Net floodable sand, feet	3.0 / 4.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

110 SKS 10/20 SAND
OCT. 6, 1980

Company Hickory Creek Oil Company Lease - LONG 24 Well No. HCO-172

1986.2 182.4 443 129.2

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			Ft.	Cum. Ft.		
1 188	190.5	21.1	43	35	704	31.	1.0	1.0	704	31.00
2 189	191.5	17.2	44	40	587	30.	1.0	2.0	587	30.00
3 194	196.5	19.0	37	44	545	19.	1.0	3.0	545	19.00
4 195	197.5	17.8	43	47	594	11.	1.0	4.0	594	11.00
5 196	198.5	17.1	35	50	464	5.7	1.4	5.4	650	7.98
6 197	199.5	18.6	45	35	649	7.4	1.0	6.4	649	7.40
7 198	200.5	18.1	42	47	590	5.2	1.0	7.4	590	5.20
8 199	201.5	17.4	41	47	554	5.2	1.0	8.4	554	5.20
9 200	202.5	18.0	31	57	433	3.7	1.0	9.4	433	3.70
10 203	207.7	18.1	35	47	492	11.	0.9	10.3	443	9.90

1.3 = 40
1.4 = 60

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease -- Well No. HCO-172

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
189.7 - 197.8	4.0	22.8	91.00
197.8 - 208.2	6.3	6.3	39.38
189.7 - 208.2	10.3	12.7	130.38

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
189.7 - 197.8	4.0	18.8	41.8	40.0	608	2,430
197.8 - 208.2	6.3	17.8	38.0	54.0	527	3,319
189.7 - 208.2	10.3	18.2	39.5	48.6	558	5,749

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

L10SKs 10-20 SAND
Oct. 6, 1980

Company Hickory Creek Oil Company

Lease LONG - 24

Well No. HCO-172

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	190.5	21.0	43	701	5	81	38	54	620	26	0.30	35
2	191.5	17.4	44	594	0	0	44	41	594	0	Imp.	-
3	196.5	18.7	37	537	2	29	35	58	508	50	0.67	30
4	197.5	18.1	42	590	4	56	38	49	534	36	0.37	30
5	198.5	17.0	35	462	0	0	35	56	462	0	Imp.	-
6	199.5	18.2	46	649	0	0	46	37	649	0	Imp.	-
7	200.5	18.3	42	596	0	0	42	52	596	30	0.30	30
8	201.5	17.4	41	553	0	0	41	53	553	12	0.15	50
9	202.5	18.0	31	433	0	0	31	59	433	0	Imp.	-
10	207.7	17.9	35	486	0	0	35	63	486	38	0.45	30

191
12
202

Soil = 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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Hickory Creek Oil Company	Lease	-	Well No.	HCO-172
Depth Interval, Feet	189.7 - 197.8				
Feet of Core Analyzed	3.0				
Average Percent Porosity	19.3				
Average Percent Original Oil Saturation	40.7				
Average Percent Oil Recovery	3.7				
Average Percent Residual Oil Saturation	37.0				
Average Percent Residual Water Saturation	53.7				
Average Percent Total Residual Fluid Saturation	90.7				
Average Original Oil Content, Bbls./A. Ft.	609.				
Average Oil Recovery, Bbls./A. Ft.	55.				
Average Residual Oil Content, Bbls./A. Ft.	554.				
Total Original Oil Content, Bbls./Acre	1,828.				
Total Oil Recovery, Bbls./Acre	166.				
Total Residual Oil Content, Bbls./Acre	1,662.				
Average Effective Permeability, Millidarcys	0.45				
Average Initial Fluid Production Pressure, p.s.i.	31.7				

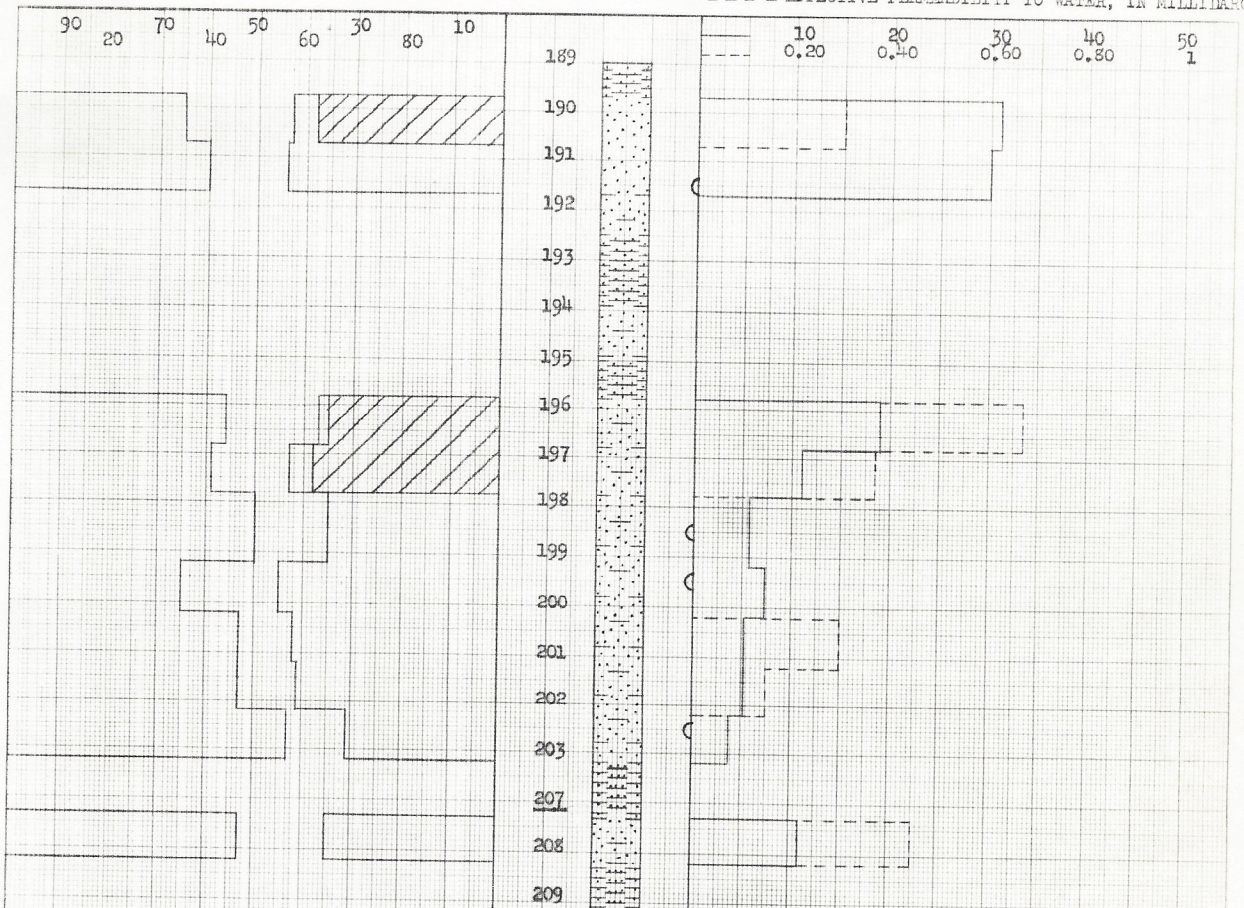
NOTE: Only those samples which recovered oil were used in calculating the above averages.

WATER SAT., PERCENT →

← OIL SAT., PERCENT

PERMEABILITY, IN MILLIDARCYs

--- EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYs



KEY:

- SANDY SHALE
- SHALY SANDSTONE
- SANDSTONE
- LAMINATED SANDSTONE & SHALE
- FLOODPOT RESIDUAL OIL SATURATION
- IMPERMEABLE TO WATER

HICKORY CREEK OIL COMPANY

LEASE

COUNTY, _____

WELL NO. HCO-172

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY MILLIDARCYs	CALCULATED OIL RECOVERY, BBLs./ACRE
189.7 - 197.8	4.0	18.8	41.8	40.0	22.8	
197.8 - 208.2	6.3	17.8	38.0	54.0	6.3	
189.7 - 208.2	10.3	18.2	39.5	48.6	12.7	770 (PRIMARY & WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
 CHANUTE, KANSAS
 JULY, 1980

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