

# OILFIELD RESEARCH LABORATORIES

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

June 17, 1980

Hickory Creek Oil Company  
P.O. Box 379  
Parsons, Kansas 67357

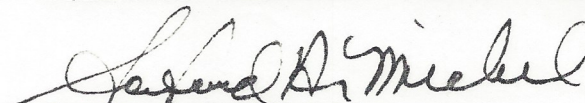
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-169, and submitted to our laboratory on May 6, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

  
Sanford A. Michel

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

- REGISTERED ENGINEERS -

ORE 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-169

Location     

Section      Twp.      Rge.      County      State     

Elevation, Feet	- . . . . .	-
Name of Sand	- . . . . .	-
Top of Core	- . . . . .	178.5
Bottom of Core	- . . . . .	277.8
Top of Sand	- . . . . .	178.5
Bottom of Sand	- . . . . . (Tested)	277.0
Total Feet of Permeable Sand	- . . . . . (Tested)	26.9
Total Feet of Floodable Sand	- . . . . . (Tested)	6.5

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	6.5	6.5
10 - 20	4.7	11.2
20 - 50	3.2	14.4
50 - 100	6.0	20.4
100 - 200	6.5	26.9

Average Permeability Millidarcys	- . . . . .	54.3
Average Percent Porosity	- . . . . .	18.1
Average Percent Oil Saturation	- . . . . .	21.8
Average Percent Water Saturation	- . . . . .	59.1
Average Oil Content, Bbls./A. Ft.	- . . . . .	324.
Total Oil Content, Bbls./Acre	- . . . . .	9,699.
Average Percent Oil Recovery by Laboratory Flooding Tests	- . . . . .	2.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	- . . . . .	43.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	- . . . . .	278.
Total Calculated Oil Recovery, Bbls./Acre	- . . . . .	

See "Calculated Recovery" Section

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>
178.5 - 180.7	Brown sandstone.
180.7 - 192.2	Brown slightly calcareous sandstone.
192.2 - 196.0	Brown slightly shaly slightly calcareous sandstone.
196.0 - 198.9	Brown slightly calcareous sandstone.
267.5 - 277.8	Light brown slightly calcareous shaly sandstone.

#### LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded to laboratory flooding tests, as a total recovery of 278 barrels of oil per acre was obtained from 6.5 feet of sand. The weighted average percent oil saturation was reduced from 32.7 to 30.1, or represents an average recovery of 2.6 percent.

The weighted average effective permeability of the samples is 13.29 millidarcys, while the average initial fluid production pressure is 20.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 30 samples tested, 6 produced water and oil, and 15 samples produced water only. This indicates that approximately 20 percent of the sand represented by these samples is

WONG L5

-3-

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 2,040 barrels of oil per acre. This is an average recovery of 313 barrels per acre foot from 6.5 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	30.0 / 39.5
Average porosity, percent	21.5
Oil saturation after flooding, percent	30.1
Performance factor, percent, estimated	50.0 E
Net floodable sand, feet	6.5

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease Long 15 Well No. HCO-169

6500.1  
178.5

538.6

1764

1378.5

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	179.5	23.3	31	33	64	560	137.	1.5	1.5	840	205.50
2	180.5	16.6	41	55	96	528	137.	0.7	2.2	370	95.90
3	181.5	21.8	32	35	67	541	100.	1.3	3.5	703	130.00
4	182.5	20.4	29	40	69	459	100.	1.0	4.5	459	100.00
5	183.5	21.3	31	41	72	512	109.	1.0	5.5	512	109.00
6	184.5	22.7	25	37	62	440	99.	1.0	6.5	440	99.00
7	185.5	13.8	12	81	93	129	64.	1.0	7.5	129	64.00
8	186.5	20.3	29	40	69	457	76.	1.0	8.5	457	76.00
9	187.5	22.4	37	38	75	643	115.	1.0	9.5	643	115.00
10	188.5	22.1	30	36	66	514	71.	1.0	10.5	514	71.00
11	189.5	20.8	26	44	70	420	95.	1.0	11.5	420	95.00
12	190.5	20.6	28	43	71	448	77.	1.0	12.5	448	77.00
13	191.5	17.2	27	50	77	360	38.	1.2	13.7	432	45.60
14	192.5	14.3	25	70	95	277	12.	0.8	14.5	222	9.60
15	193.5	18.8	23	56	79	336	9.9	1.0	15.5	336	9.90
16	194.5	18.2	12	65	77	169	14.	1.0	16.5	169	14.00
17	195.5	18.8	28	49	77	408	9.9	1.0	17.5	408	9.90
18	196.5	18.7	20	56	76	290	25.	1.0	18.5	290	25.00
19	197.5	19.8	26	54	80	399	21.	1.0	19.5	399	21.00
20	198.5	18.8	13	62	75	190	18.	0.9	20.4	171	16.20
21	267.6	17.0	9	86	95	119	6.6	0.5	20.9	60	3.30
22	268.5	20.1	20	73	93	312	8.2	1.0	21.9	312	8.20
23	269.5	11.4	31	63	94	274	3.3	1.0	22.9	274	3.30
24	270.5	19.7	9	83	92	138	4.1	1.0	23.9	138	4.10
25	271.5	12.1	7	42	49	66	1.5	1.0	24.9	66	1.50
26	272.5	11.0	1	90	91	9	Imp.	1.0	25.9	9	0.00
27	273.5	14.4	11	82	93	123	15.	1.0	26.9	123	15.00
28	274.5	19.7	19	77	96	290	12.	1.0	27.9	290	12.00
29	275.5	12.3	1	93	94	10	Imp.	1.0	28.9	10	0.00
30	276.5	10.2	1	90	97	55	Imp.	1.0	29.9	55	0.00

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Well No.				
Hickory Creek Oil Company	-		HCO-169			
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.			
178.5 - 189.0	10.5	101.4	1065.40			
189.0 - 198.9	9.9	35.2	348.20			
267.0 - 277.0	6.5	7.3	47.40			
178.5 - 277.0	26.9	54.3	1461.00			
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content, Bbl./A. Ft.	Total Oil Content, Bbls./Acre	
178.5 - 189.0	10.5	20.8	29.5	42.5	483	5,067
189.0 - 198.9	9.9	18.7	22.9	54.4	333	3,295
267.0 - 277.0	9.5	14.7	12.1	82.3	141	1,337
178.5 - 277.0	29.9	18.1	21.8	59.1	324	9,699

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## RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease Long 15 Well No. HCO-169

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			
1	179.5	23.3	31	560	2	36 <sup>1.5</sup>	29	64	173	13.00	20
2	180.5 <sup>18.5</sup>	17.0	40	528	3	40 <sup>0.7</sup>	37	57	195	13.28	20
3	181.5	21.6	32	536	2	34 <sup>1.3</sup>	30	68	298	11.66	20
4	182.5	20.3	29	457	0	0	29	69	251	10.00	20
5	183.5	21.7	31	522	0	0	31	65	178	11.57	20
6	184.5	22.5	25	436	0	0	25	70	198	9.93	20
7	185.5	14.0	12	130	0	0	12	86	374	15.00	20
8	186.5	20.1	29	452	2	31 <sup>1.0</sup>	27	70	277	11.16	20
9	187.5	22.4	37	643	5	87 <sup>1.0</sup>	32	64	273	11.16	20
10	188.5 <sup>88</sup>	22.0	30	512	2	34 <sup>1.0</sup>	28	70	286	20.13	20
11	189.5 <sup>90.5</sup>	20.8	26	420	0	0	26	71	161	10.71	20
12	190.5	20.5	28	445	0	0	28	68	234	9.00	20
13	191.5	17.6	26	355	0	0	26	70	231	13.12	10
14	192.5	14.5	25	281	0	0	25	69	9	0.15	50
15	193.5	18.7	23	334	0	0	23	74	13	0.22	45
16	194.5	18.0	12	168	0	0	12	83	16	0.30	45
17	195.5	18.6	28	404	0	0	28	70	51	1.05	35
18	196.5	18.6	20	289	0	0	20	73	29	0.60	40
19	197.5	19.7	26	397	0	0	26	71	49	0.97	35
20	198.5	18.8	13	190	0	0	13	83	113	1.87	30
21	267.6	16.5	10	128	0	0	10	85	0	Imp.	-
22	268.5	20.0	20	310	0	0	20	74	0	Imp.	-
23	269.5	11.8	30	275	0	0	30	65	8	0.15	50
24	270.5	20.0	9	140	0	0	9	85	0	Imp.	-
25	271.5	12.1	7	66	0	0	7	48	0	Imp.	-
26	272.5	11.3	2	18	0	0	2	92	0	Imp.	-
27	273.5	14.2	11	121	0	0	11	82	0	Imp.	-
28	274.5	19.5	19	287	0	0	19	78	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.

Sox: 6  
= 30.5

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## RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company		Lease		Well No.		HCO-169						
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.	%	Bbls./A. Ft.	%	Water			
29	275.5	11.9	18	0	0	2	94	18	0	165103	Imp.	--
30	276.5	10.2	55	0	0	7	90	55	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

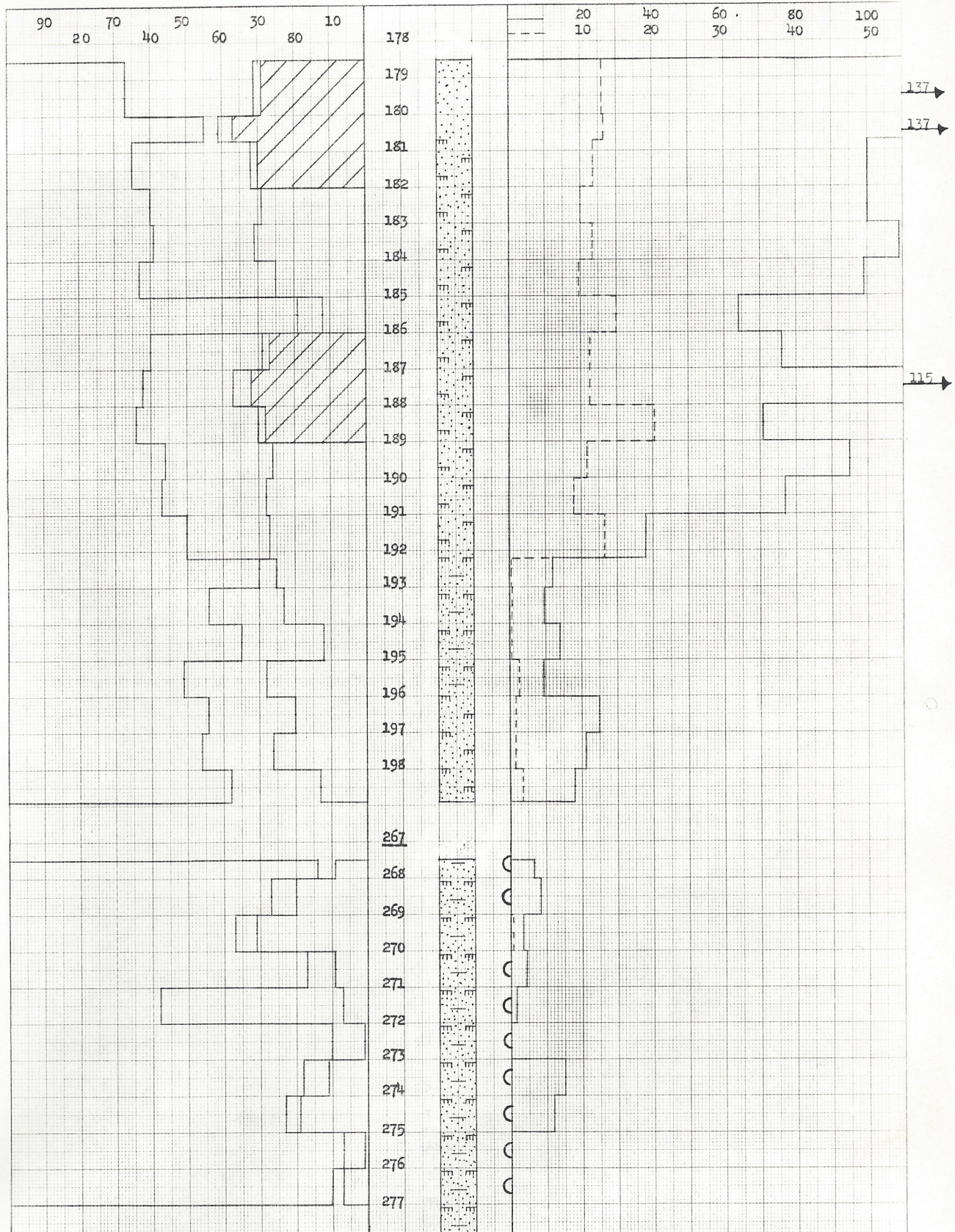
Company	Hickory Creek Oil Company	Lease	--	Well No.	HCO-169
Depth Interval, Feet	178.5 - 189.0				
Feet of Core Analyzed	6.5				
Average Percent Porosity	21.5				
Average Percent Original Oil Saturation	32.7				
Average Percent Oil Recovery	2.6				
Average Percent Residual Oil Saturation	30.1				
Average Percent Residual Water Saturation	65.9				
Average Percent Total Residual Fluid Saturation	96.0				
Average Original Oil Content, Bbls./A. Ft.	541.				
Average Oil Recovery, Bbls./A. Ft.	43.				
Average Residual Oil Content, Bbls./A. Ft.	498.				
Total Original Oil Content, Bbls./Acre	3,513.				
Total Oil Recovery, Bbls./Acre	278.				
Total Residual Oil Content, Bbls./Acre	3,235.				
Average Effective Permeability, Millidarcys	13.29				
Average Initial Fluid Production Pressure, p.s.i.	20.0				

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

WATER SAT.,  
PERCENTOIL SAT.,  
PERCENT

PERMEABILITY, IN MILLIDARCY

EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCY



KEY:



SANDSTONE



CALCAREOUS SANDSTONE



SHALY CALCAREOUS SANDSTONE



FLOODPOT RESIDUAL OIL SATURATION



IMPERMEABLE TO WATER

## HICKORY CREEK OIL COMPANY

----- LEASE

----- COUNTY, -----

WELL NO. HCO-169

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE PERCENT POROSITY	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVERAGE PERMEABILITY MILLIDARCYS	CALCULATED OIL RECOVERY BBL./ACRE
178.5 - 189.0	10.5	20.8	29.5	42.5	101.4	
189.0 - 198.9	9.9	18.7	22.9	54.4	35.2	
267.0 - 277.0	9.5	14.7	12.1	82.3	7.3	
178.5 - 277.0	29.9	18.1	21.8	59.1	54.3	2,040 (PRIMARY & WATERFLOODING)

OILFIELD RESEARCH LABORATORIES  
 CHANUTE, KANSAS  
 JUNE, 1980

VM