



OILFIELD RESEARCH LABORATORIES

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

15-133-21309

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-76, 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

SAM/tem
1 c to Chanute, Kansas
4 c to Parsons, 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-76

Location ---

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

Name of Sand	-
Top of Core	170.0
Bottom of Core	191.0
Top of Sand	173.4
Bottom of Sand	189.7
Total Feet of Permeable Sand	15.5
Total Feet of Floodable Sand	6.6

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	8.2	8.2
5 - 10	0.6	8.8
10 - 20	1.7	10.5
20 - 30	4.0	14.5
60 - 70	1.0	15.5

Average Permeability Millidarcys	13.4
Average Percent Porosity	16.1
Average Percent Oil Saturation	42.5
Average Percent Water Saturation	41.5
Average Oil Content, Bbls./A. Ft.	541.
Total Oil Content, Bbls./Acre	8,386.
Average Percent Oil Recovery by Laboratory Flooding Tests	11.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	156.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,027.

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 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 - 173.4	Gray sandy shale.
173.4 - 173.8	Brown shaly sandstone.
173.8 - 177.4	Gray and brown laminated shale and sandstone, 30% sandstone.
177.4 - 179.0	Brown shaly sandstone.
179.0 - 180.4	Gray and light brown laminated shale and sandstone, 20% sandstone.
180.4 - 182.6	Light brown shaly sandstone.
182.6 - 184.8	Gray and light brown laminated shale and sandstone, 10% sandstone.
184.8 - 186.2	Brown shaly sandstone.
186.2 - 187.8	Light brown and gray laminated sandstone and shale, 60% sandstone.
187.8 - 188.6	Gray limestone.
188.6 - 189.7	Light brown shaly sandstone.
189.7 - 191.0	Gray shale.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,027 barrels of oil per acre was obtained from 6.6 feet of sand. The weighted average percent oil saturation was reduced from 51.1 to 39.5, or represents an average recovery of 11.6 percent. The weighted average effective permeability of the samples is 0.48 millidarcys,

while the average initial fluid production pressure is 36.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 17 samples tested, 8 produced water and oil and 1 sample produced water only. This indicates that approximately 47 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a very low permeability profile.

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 1,720 barrels of oil per acre. This is an average recovery of 261 barrels per acre foot from 6.6 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	20.0 / 36.8 ✓
Average porosity, percent	17.6 / 17.2 ✓
Oil saturation after flooding, percent	39.5 / 37.4 ✓
Performance factor, percent, estimated	✓ 50.0
Net floodable sand, feet	6.6 / 5.0 ✓

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease - H13

Well No. HCO-76

Sample No.	Depth, Feet X	Effective Porosity Percent X	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill. X	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water X	Total			Ft.	Cum. Ft.		
1 171	173.6	15.9	35	51	86	432	0.86	0.4	0.4	173	0.34
2 172	174.5	14.8	13	50	63	149	1.8	1.2	1.6	179	2.16
3 173	175.5	18.2	32	37	69	452	0.40	1.0	2.6	452	0.40
4 174	176.5	17.9	67	28	95	930	2.2	1.4	4.0	1302	3.08
5 175	177.5	19.0	46	28	74	678	11.	0.6	4.6	409	6.60
6 176	178.5	18.0	50	29	79	698	21.	1.0	5.6	698	11.00
7 177	179.5	9.0	44	51	95	307	1.9	1.4	7.0	430	33.60
8 178	180.5	15.4	43	45	88	514	24.	0.6	7.6	308	14.40
9 179	181.5	18.1	54	31	85	758	61.	1.0	8.6	758	61.00
10 180	182.5	18.2	42	32	74	593	12.	0.6	9.2	356	7.20
11 181	183.5	14.2	22	70	92	242	0.67	1.2	10.4	290	0.80
12 182	184.5	13.7	33	60	93	351	1.1	1.0	11.4	351	1.10
13 183	185.5	19.0	53	25	78	781	21.	1.4	12.8	1093	29.40
14 184	186.5	15.2	27	62	89	318	8.2	0.6	13.4	191	4.92
15 185	187.5	17.1	52	40	92	690	24.	1.0	14.4	690	24.00
16 186	188.7	14.9	65	25	90	751	0.75	0.6	15.0	451	0.45
17 187	189.6	17.3	38	43	81	510	13.	0.5	15.5	255	6.50
	<u>3085.9</u>	<u>275.9</u>		<u>36.8</u> <u>1.368 = 632</u>	<u>70.7</u>		<u>204.85</u>				

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease - Well No. HCO-76

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
173.4 - 182.6	9.2	15.2	139.78
182.6 - 189.7	6.3	10.7	67.17
173.4 - 189.7	15.5	13.4	206.95

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
173.4 - 182.6	9.2	16.1	43.4	38.2	551	5,065
182.6 - 189.7	6.3	16.1	41.2	46.5	527	3,321
173.4 - 189.7	15.5	16.1	42.5	41.5	541	8,386

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - H 13 Well No. HCO-76

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.
			%	Bbbs./A. Ft.	%	Bbbs./A. Ft.	% Oil	% Water	Bbbs./A. Ft.			
1	171 173.6	16.3	35	443	3	38	32	62	405	4	0.15	45
2	172 174.5	15.0	15	175	0	0	15	81	175	0	Imp.	-
3	173 175.5	18.2	32	452	0	0	32	64	452	0	Imp.	-
4	174 176.5	17.5	67	910	0	0	67	29	910	0	Imp.	-
5	175 177.5	18.7	46	653	6	87	40	42	566	0	0.01	50
6	176 178.5	17.5	50	679	7	95	43	47	584	0	0.01	45
7	177 179.5	9.4	44	321	0	0	44	49	321	0	Imp.	-
8	178 180.5	15.4	43	514	10	119	33	60	395	6	0.15	45
9	179 181.5	17.9	54	750	15	208	39	48	542	7	0.15	30'
10	180 182.5	18.2	42	593	0	0	42	40	593	0	0.02	40
11	181 183.5	14.5	21	236	0	0	21	73	236	0	Imp.	-
12	182 184.5	14.0	33	358	0	0	33	61	358	0	Imp.	-
13	183 185.5	19.4	53	798	12	181	41	53	617	45	1.42	25
14	184 186.5	15.4	27	323	0	0	27	65	323	0	Imp.	-
15	185 187.5	17.5	52	706	12	163	40	58	543	28	0.75	25
16	186 188.7	15.1	65	761	24	281	41	49	488	2	0.15	25
17	187 189.6	17.4	38	513	0	0	38	60	513	10	0.30	40
		15.8 17.2					5.0 5.5 37.4	628			3.11	

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.

CORE 173
 GR 171
 CORE 172
 GR 172
 CORE 171
 GR 171
 CORE 170
 GR 170
 CORE 180
 GR 180
 CORE 182
 GR 182
 CORE 180
 GR 180

171'
 180'
 180'

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Hickory Creek Oil Company		
Lease	-		
Well No.	HCO-76		
Depth Interval, Feet	173.4 - 182.6	182.6 - 189.7	173.4 - 189.7
Feet of Core Analyzed	3.6	3.0	6.6
Average Percent Porosity	17.3	17.9	17.6
Average Percent Original Oil Saturation	47.6	55.1	51.1
Average Percent Oil Recovery	9.1	14.4	11.6
Average Percent Residual Oil Saturation	38.5	40.7	39.5
Average Percent Residual Water Saturation	50.3	53.9	51.9
Average Percent Total Residual Fluid Saturation	88.8	94.6	91.4
Average Original Oil Content, Bbls./A. Ft.	646.	762.	696.
Average Oil Recovery, Bbls./A. Ft.	128.	195.	156.
Average Residual Oil Content, Bbls./A. Ft.	518.	567.	540.
Total Original Oil Content, Bbls./Acre	2,307.	2,285.	4,592.
Total Oil Recovery, Bbls./Acre	442.	585.	1,027.
Total Residual Oil Content, Bbls./Acre	1,865.	1,700.	3,565.
Average Effective Permeability, Millidarcys	0.09	0.94	0.48
Average Initial Fluid Production Pressure, p.s.i.	43.0	25.0	36.3

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

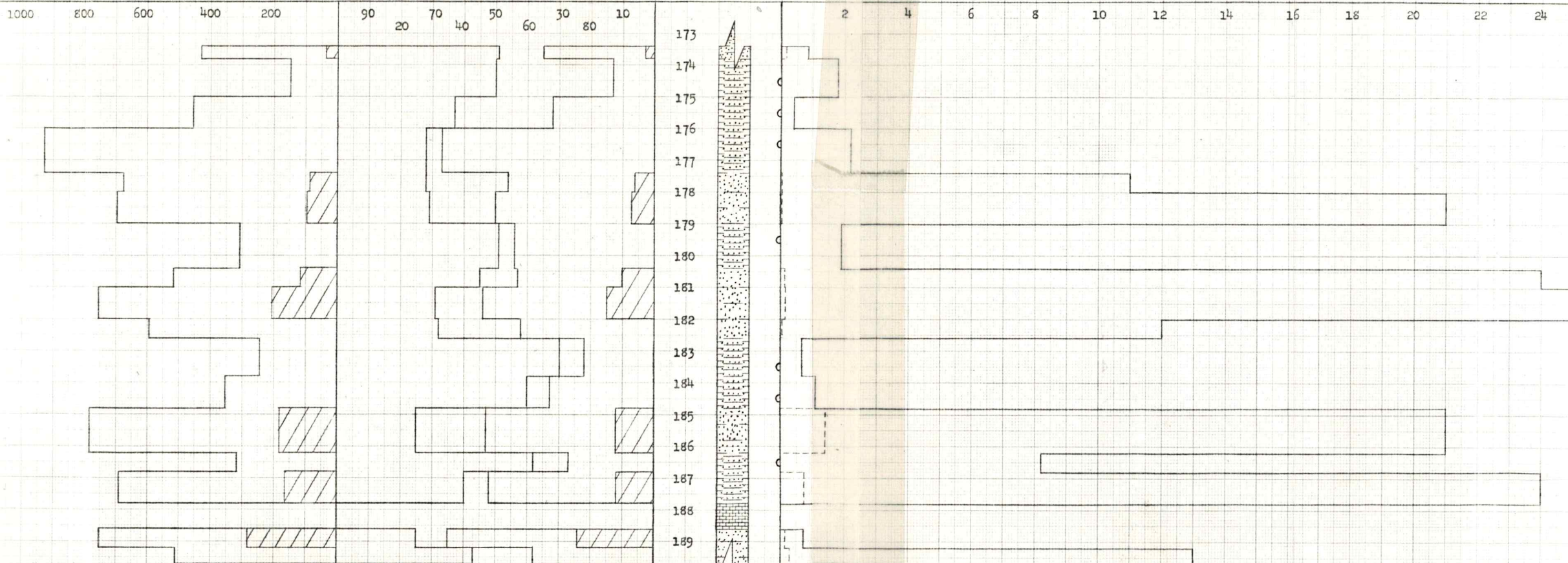
OIL CONTENT,
BBL./A. FT.

WATER SAT.,
PERCENT

OIL SAT.,
PERCENT

PERMEABILITY, IN MILLIDARCYs

EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYs



KEY:

- SHALY SANDSTONE
- LAMINATED SANDSTONE AND SHALE
- SANDY SHALE
- SHALE
- LIMESTONE

HICKORY CREEK OIL COMPANY

-- LEASE

WELL NO. HCO - 76

-- COUNTY, --

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	AVERAGE PERMEABILITY, MILLIDARCYs	CALCULATED OIL RECOVERY BBL./ACRE
173.4 - 182.6	9.2	16.1	43.4	38.2	551	5,065	15.2	
182.6 - 189.7	6.3	16.1	41.2	46.5	527	3,321	10.7	
173.4 - 189.7	15.5	16.1	42.5	41.5	541	8,386	13.4	1,720 (PRIMARY & WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANDLER, KANSAS
DECEMBER, 1979 HR