



OILFIELD RESEARCH LABORATORIES

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

July 10, 1979

APP: 15-037-20383

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-11, and submitted to our laboratory on June 29, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Benjamin R. Pearman

BRP:km
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

- 2 -

This core was sampled and the samples sealed in plastic bags by a representative of the client prior to being submitted to the laboratory.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
174.5 - 182.2	Brown sandstone.
182.2 - 182.8	Brown sandstone with coal partings.
182.8 - 184.4	Brown sandstone.
184.4 - 185.9	Brown sandstone with fine coal partings.
185.9 - 186.9	Brown sandstone.
186.9 - 187.9	Brown sandstone with fine coal partings.
187.9 - 196.0	Brown sandstone.
196.0 - 200.8	Light brown sandstone.
200.8 - 202.0	Light brown slightly shaly sandstone.
202.0 - 209.0	Light brown sandstone.
209.0 - 210.2	Light brown shaly sandstone.
210.2 - 211.2	Coal.
211.2 - 214.0	Gray conglomeratic shale.

LABORATORY FLOODING TESTS

The upper and middle portions of the sand in this core responded to laboratory flooding tests, as a total recovery of 2,494 barrels of oil per acre was obtained from 21.5 feet of sand. The weighted average percent oil saturation was reduced from 44.4 to 38.2, or represents an average recovery of 6.2 percent. The weighted average effective permeability of the samples is 9.09 millidarcys, while the average initial fluid production

pressure is 20.5 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 6,860 barrels of oil per acre. This is an average recovery of 319 barrels per acre foot from the 21.3 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	20.0	✓ 24.4
Average porosity, percent	✓ 23.1	
Oil saturation after flooding, percent	38.2	✓ 39.2
Performance factor, percent	✓ 45.0	
Net floodable pay sand, feet	21.3	✓ 14.0

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease -SARTIN 5 Well No. HCO-11

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	174.9	20.9	49	24	73	794	259.	0.5	0.5	397	129.50
2	175.5	26.6	49	21	70	1012	97.	1.0	1.5	1012	97.00
3	176.5	24.2	55	20	75	1031	273.	1.0	2.5	1031	273.00
4	177.1	21.2	39	24	63	641	115.	1.0	3.5	641	115.00
5	178.5	26.0	44	21	65	886	276.	1.0	4.5	886	276.00
6	179.5	26.6	45	24	69	928	192.	1.0	5.5	928	192.00
7	180.2	26.4	48	22	70	982	109.	1.0	6.5	982	109.00
8	181.5	27.0	44	21	65	921	358.	1.2	7.7	1104	429.60
9	182.5	21.6	44	27	71	736	122.	0.5	8.2	368	61.00
10	183.5	23.2	48	25	73	864	311.	1.7	9.9	1418	528.70
11	184.5	26.5	39	40	79	801	199.	0.5	10.4	401	99.50
12	185.5	15.2	43	17	60	507	370.	1.0	11.4	507	370.00
13	186.5	23.9	41	30	71	760	288.	1.0	12.4	760	288.00
14	187.3	23.3	39	25	64	705	109.	1.0	13.4	705	109.00
15	188.3	21.5	45	18	63	751	112.	1.1	14.5	826	123.20
16	189.5	23.5	43	25	68	781	108.	1.0	15.5	781	108.00
17	190.5	23.6	42	19	71	767	115.	1.0	16.5	767	115.00
18	191.5	20.1	43	26	69	671	212.	1.0	17.5	671	212.00
19	192.5	24.1	39	27	66	729	87.	1.0	18.5	729	87.00
20	193.5	21.4	49	24	73	814	104.	1.0	19.5	814	104.00
21	194.5	21.3	40	34	74	661	44.	1.0	20.5	661	44.00
22	195.5	22.9	50	30	80	888	94.	1.0	21.5	888	94.00
23	196.4	21.6	34	46	80	570	39.	1.0	22.5	570	39.00
24	197.5	20.1	26	33	59	405	178.	1.0	23.5	405	178.00
25	198.5	23.3	36	49	85	651	121.	1.0	24.5	651	121.00
26	199.5	26.1	38	44	82	769	195.	1.0	25.5	769	195.00
27	200.6	23.9	36	50	86	668	250.	0.8	26.3	534	200.00
28	201.7	19.7	34	32	66	520	13.	1.2	27.5	624	15.60
29	202.5	23.3	38	36	74	687	56.	1.0	28.5	687	56.00
30	203.5	16.5	38	30	68	486	165.	1.0	29.5	486	165.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease S-5 Well No. HCO-11

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.		
31	204.5	21.6	38	36	74	637	62.	1.0	30.5	637	62.00
32	205.3	24.2	37	36	73	695	40.	1.0	31.5	695	40.00
33	206.5	23.8	49	23	72	905	72.	1.0	32.5	905	72.00
34	207.5	22.3	61	23	84	1055	38.	1.0	33.5	1055	38.00
35	208.5	23.5	61	17	78	1112	27.	1.0	34.5	1112	27.00
36	209.5	20.7	40	28	68	642.	1.7	1.2	35.7	770	2.04

6911.3

821.6

1027

5211.7

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease --- Well No. HCO-11

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
174.5 - 184.4	9.9	223.3	2210.80
184.4 - 196.0	11.6	151.2	1753.70
196.0 - 210.2	14.2	85.3	1210.64
174.5 - 210.2	35.7	145.0	5175.14

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
174.5 - 184.4	9.9	24.7	46.6	22.8	886	8,767
184.4 - 196.0	11.6	22.1	42.9	25.6	734	8,510
196.0 - 210.2	14.2	22.1	40.4	34.2	697	9,900
174.5 - 210.2	35.7	22.8	42.9	28.2	761	27,177

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - SARTIN 5 Well No. HCO-11

Sartin 5

1725
177

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	174.9	20.6	49	783	15 ^{10.3} _{20.6}	240	34	57	543	20	0.60	30
2	175.5	26.4	49	1004	14 ^{10.3} _{28.5}	287	35	57	717	331	31.85	15
3	176.5	24.7	55	1054	20 ^{10.3} _{36.3}	383	35	59	671	260	23.36	15
4	177.1	21.5	39	651	4 ^{10.3} _{30.3}	67	35	56	584	53	1.27	30
5	178.5	26.4	44	901	6 ^{10.3} _{36.6}	123	38	54	778	259	24.23	15
6	179.5	26.2	45	915	5 ^{11.1} _{31.1}	102	40	57	813	253	5.75	20
7	180.2	25.9	48	964	12 ^{11.1} _{25.5}	241	36	55	723	229	11.99	15
8	181.5	26.8	44	915	8 ^{11.1} _{17.5}	166	36	61	749	168	11.03	15
9	182.5	21.4	44	730	2 ^{11.1} _{15.5}	33	42	48	697	80	1.97	30
10	183.5	23.5	48	875	11 ^{11.1} _{22.9}	201	37	58	674	333	11.34	15
11	184.5	26.2	39	793	4	81	35	62	712	505	8.00	15
12	185.5	15.6	43	520	2	24	41	56	496	438	7.16	15
13	186.5	24.1	41	767	3	56	38	60	711	173	11.78	15
14	187.3	23.0	39	696	2	36	37	59	660	22	0.52	40
15	188.3	21.2	45	740	7	115	38	60	625	181	4.87	25
16	189.5	23.0	43	767	4	71	39	55	696	66	1.35	25
17	190.5	24.0	42	782	2	37	40	58	745	192	10.71	15
18	191.5	20.1	43	671	5	78	38	58	593	77	1.35	25
19	192.5	23.9	39	723	2	37	37	62	686	391	7.65	15
20	193.5	21.1	49	802	2	33	47	49	769	243	7.50	20
21	194.5	21.0	40	652	2	33	38	60	619	77	1.35	25
22	195.5	22.7	50	881	3	53	47	52	828	242	4.87	15
23	196.4	21.1	34	557	0	0	34	63	557	64	1.42	30
24	197.5	20.5	26	414	0	0	26	69	414	274	16.71	10
25	198.5	23.7	35	644	0	0	35	60	644	235	9.56	15
26	199.5	26.0	38	766	0	0	38	58	766	399	7.57	15
27	200.6	24.4	37	700	0	0	37	61	700	452	8.17	15
28	201.7	20.0	34	528	0	0	34	64	528	294	5.47	20
29	202.5	23.0	37	660	0	0	37	62	660	254	4.16	15

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.

11.5 or 13 = 30.1

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease 1408 S-5 Well No. HCO-11 248.57

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.			
30	203.5	17.0	36	475	0	0	36	61	475	45	1.05	30
31	204.5	22.8	38	672	0	0	38	61	672	100	1.95	20
32	205.3	24.0	37	689	0	0	37	56	689	69	1.27	25
33	206.5	23.5	49	893	0	0	49	45	893	28	0.42	25
34	207.5	22.0	62	1058	0	0	62	37	1058	10	0.17	40
35	208.5	23.3	60	1085	0	0	60	30	1085	9	0.15	40
36	209.5	20.7	42	674	0	0	42	31	674	0	Imp.	-
											249.14	

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

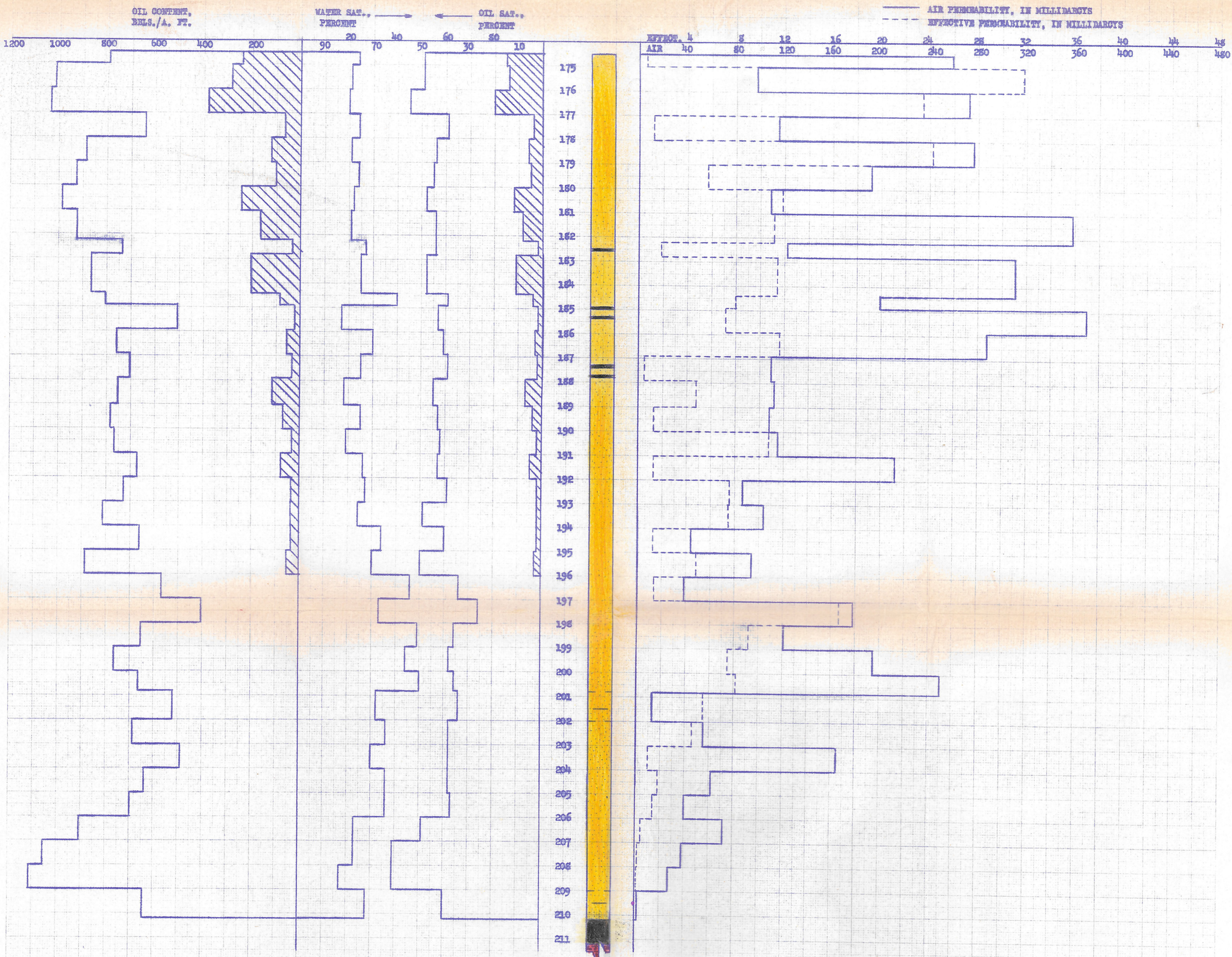
**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Hickory Creek Oil Company		Lease	-	Well No.	HCO-11
Depth Interval, Feet	174.5 - 184.4		184.4 - 196.0		174.5 - 196.0	
Feet of Core Analyzed	9.9		11.6		21.5	
Average Percent Porosity	24.7		21.8		23.1	
Average Percent Original Oil Saturation	46.6		42.5		44.4	
Average Percent Oil Recovery	9.9		3.1		6.2	
Average Percent Residual Oil Saturation	36.7		39.4		38.2	
Average Percent Residual Water Saturation	56.8		56.9		56.9	
Average Percent Total Residual Fluid Saturation	93.5		96.3		95.1	
Average Original Oil Content, Bbls./A. Ft.	892.		724.		801.	
Average Oil Recovery, Bbls./A. Ft.	190.		53.		116.	
Average Residual Oil Content, Bbls./A. Ft.	702.		671.		685.	
Total Original Oil Content, Bbls./Acre	8,829.		8,397.		17,226.	
Total Oil Recovery, Bbls./Acre	1,881.		613.		2,494.	
Total Residual Oil Content, Bbls./Acre	6,948.		7,784.		14,732.	
Average Effective Permeability, Millidarcys	13.36		5.44		9.09	
Average Initial Fluid Production Pressure, p.s.i.	20.0		20.8		20.5	

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



- KEY:
- SANDSTONE
 - SHALY SANDSTONE
 - COAL
 - CONGLOMERATIC SHALE
 - SANDSTONE WITH COAL PARTINGS
 - FLOOD POT RECOVERY
 - IMPERMEABLE TO WATER

HICKORY CREEK OIL COMPANY
 ——— WASH ——— COUNTY, ——— WELL NO. HCO-11

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, MILLIDARYS	CALCULATED OIL RECOVERY, BBL./ACRE
174.5 - 184.4	9.9	24.7	46.6	22.6	886	8,767	223.3	6,860 (PRIMARY & WATERFLOOD)
184.4 - 196.0	11.6	22.1	42.9	25.6	734	8,510	151.2	
196.0 - 210.2	14.2	22.1	40.4	34.2	697	9,900	85.3	
174.5 - 210.2	35.7	22.8	42.9	28.2	761	27,177	145.0	

OILFIELD RESEARCH LABORATORIES
 CHANUTE, KANSAS
 JULY, 1979.