



OILFIELD RESEARCH LABORATORIES

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15-133-21362

January 16, 1980

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-89, and submitted to our laboratory on December 15, 1979.

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

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease - Well No. HCO-89

Location -

Section - Twp - Rge - County - State -

Elevation, Feet -

Name of Sand -

Top of Core - 172.0

Bottom of Core - 212.5

Top of Sand - 172.0

Bottom of Sand - 212.5

Total Feet of Permeable Sand - 39.5

Total Feet of Floodable Sand - 20.4

Distribution of Permeable Sand: Permeability Range Millidarcys

Feet

Cum. Ft.

0 - 50

16.8

16.8

50 - 100

5.9

22.7

100 - 200

12.8

35.5

200 - 300

4.0

39.5

161.1

Average Permeability Millidarcys -

21.6

Average Percent Porosity -

41.0

Average Percent Oil Saturation -

35.4

Average Percent Water Saturation -

687.

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

27,836.

Total Oil Content, Bbls./Acre -

5.9

Average Percent Oil Recovery by Laboratory Flooding Tests -

108.

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

2,200.

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

Total Calculated Oil Recovery, Bbls./Acre -

See "Calculated
Recovery" Section.

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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>
172.0 - 172.9	Dark brown sandstone.
172.9 - 177.2	Brown and gray laminated sandstone and shale.
177.2 - 188.9	Dark brown sandstone.
188.9 - 189.7	Grayish brown very shaly sandstone.
189.7 - 191.0	Brown slightly shaly sandstone.
191.0 - 194.7	Brown sandstone.
194.7 - 196.6	Black carbonaceous sandstone.
196.6 - 198.1	Brown and gray laminated sandstone and shale.
198.1 - 199.3	Brown slightly shaly sandstone.
199.3 - 200.1	Brown sandstone.
200.1 - 200.9	Brown shaly sandstone.
200.9 - 208.0	Brown sandstone.
208.0 - 209.0	Brown shaly sandstone.
209.0 - 212.5	Brown sandstone.

LABORATORY FLOODING TESTS

The upper portion of the sand in this core responded well, relative to the lower portion of the sand, to laboratory flooding tests, as a total overall recovery of 2,200 barrels of oil per acre was obtained from 20.4 feet of sand. The weighted average percent oil saturation was reduced from 44.4 to 38.5, or represents an average recovery of 5.9 percent. The weighted

-3-

average effective permeability of the samples is 13.08 millidarcys, while the average initial fluid production pressure is 17.9 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 41 samples tested, 21 produced water and oil, and 11 samples produced water only. This indicates that approximately 51 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has an erratic permeability profile.

Please note that the coregraph now presents residual oil saturation instead of recovery, as in the past.

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 7,400 barrels of oil per acre. This is an average recovery of 363 barrels per acre foot from 20.4 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	15.0 / 23.6 ✓
Average porosity, percent	23.6 / 24.6 ✓
Oil saturation after flooding, percent	38.5 / 42.0 ✓
Performance factor, percent, estimated	✓ 45.0
Net floodable sand, feet	20.4 / 12.0 ✓

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease

- H 25

Well No. HCO-89

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.		
~~4~~											
1	172.6	23.4	53	16	69	962	186.	0.9	0.9	866	167.40
2	173.4	16.6	57	37	94	734	0.45	1.1	2.0	807	0.50
3	174.5	13.0	34	65	99	343	Imp.	1.0	3.0	343	0.00
4	175.4	16.5	51	43	94	653	1.1	1.0	4.0	653	1.10
5	176.5	14.5	21	67	88	236	0.43	1.2	5.2	283	0.52
6	177.4	19.9	35	35	70	540	38.	0.8	6.0	432	30.40
7	178.5	24.4	62	37	99	1174	20.	1.0	7.0	1174	20.00
8	179.5	24.2	40	20	60	751	175.	1.0	8.0	751	175.00
9	180.5	25.4	49	20	69	966	290.	1.0	9.0	966	290.00
10	181.5	23.7	51	24	75	938	161.	1.0	10.0	938	161.00
11	182.3	21.8	59	23	82	998	170.	1.0	11.0	998	170.00
12	183.5	26.2	51	16	67	1037	275.	1.0	12.0	1037	275.00
13	184.4	26.0	48	19	67	968	218.	1.0	13.0	968	218.00
14	185.5	26.7	43	22	65	891	136.	1.0	14.0	891	136.00
15	186.5	25.7	47	43	70	937	185.	1.0	15.0	937	185.00
16	187.5	24.1	42	21	63	785	170.	1.0	16.0	785	170.00
17	188.5	24.0	43	36	79	801	180.	0.9	16.9	721	162.00
18	189.5	12.2	63	35	98	596	0.92	0.8	17.7	477	0.74
19	190.6	18.3	42	39	81	596	12.	1.3	19.0	775	15.60
20	191.9	23.2	45	29	74	810	258.	1.0	20.0	810	258.00
21	192.4	23.3	46	29	75	832	153.	1.0	21.0	832	153.00
22	193.5	22.7	24	29	53	423	118.	1.0	22.0	423	118.00
23	194.5	23.1	44	31	75	789	109.	0.7	22.7	552	76.30
24	195.5	23.2	41	30	71	738	72.	0.9	23.6	664	64.80
25	196.5	23.3	36	38	74	651	60.	1.0	24.6	651	60.00
26	197.5	24.7	28	23	51	537	0.94	1.5	26.1	806	1.41
27	198.5	22.5	41	25	66	716	10.	1.2	27.3	859	12.00
28	199.5	23.5	36	46	82	656	127.	0.8	28.1	525	101.60

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - Well No. HCO-89

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.		
29	200.4	17.5	41	41	82	557	4.2	0.8	28.9	446	3.36
30	201.5	16.7	36	50	86	466	36.	1.1	30.0	513	39.60
31	202.4	22.6	31	50	81	544	62.	1.0	31.0	544	62.00
32	203.5	20.7	34	53	87	546	62.	1.0	32.0	546	62.00
33	204.5	21.4	38	41	79	631	35.	1.0	33.0	631	35.00
34	205.6	21.6	42	36	78	704	37.	1.0	34.0	704	37.00
35	206.5	21.6	44	31	75	737	22.	1.0	35.0	737	22.00
36	207.5	20.8	32	38	70	516	27.	1.0	36.0	516	27.00
37	208.5	15.2	28	59	87	330	2.2	1.0	37.0	330	2.20
38	209.5	21.5	35	46	81	584	133.	1.0	38.0	584	133.00
39	210.5	21.8	37	41	78	626	53.	1.0	39.0	626	53.00
40	211.6	20.8	29	65	94	468	97.	1.0	40.0	468	97.00
41	212.3	22.9	30	46	76	533	137.	0.5	40.5	267	68.50

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease — Well No. HCO-89

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
172.0 - 188.9	15.9	136.0	2161.92
188.9 - 212.5	23.6	178.1	4203.11
172.0 - 212.5	39.5	161.1	6365.03

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
172.0 - 188.9	16.9	22.2	46.1	32.5	802	13,550
188.9 - 212.5	23.6	21.1	37.3	37.6	605	14,286
172.0 - 212.5	40.5	21.6	41.0	35.4	687	27,836

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - H 25 Well No. HCO-89

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.			
171 4	172.6	23.1	53	950	13	$.9 \times 233 = 210$ 233	40	50	717	296	16.00	15
174	173.4	16.3	57	721	0	0	57	38	721	0	Imp.	-
3	174.5	13.4	34	353	0	0	34	61	353	0	Imp.	-
4	175.4	16.5	51	653	0	0	51	44	653	0	Imp.	-
5	176.5	14.7	21	239	0	0	21	69	239	0	Imp.	-
6	177.4	19.7	35	535	0	0	35	48	535	0	Imp.	-
178	178.5	24.0	62	1154	0	0	62	28	1154	23	0.40	50
7	179.5	24.4	40	757	2	38	38	61	719	268	18.74	20
8	180.5	25.2	49	958	10	196	39	51	762	240	11.33	20
9	181.5	24.1	51	954	10	187	41	47	767	225	21.13	15
10	182.3	22.0	59	1007	18	307	41	44	700	398	39.97	10
11	183.5	26.2	51	1037	7	142	44	49	895	369	34.27	15
184	184.4	25.8	48	961	4	80	44	48	881	285	18.49	20
14	185.5	26.4	43	881	2	41	41	53	840	212	11.40	20
15	186.5	25.5	47	930	4	79	43	51	851	391	18.59	20
16	187.5	24.0	42	782	2	37	40	53	745	268	12.88	15
17	188.5	24.3	43	811	3	57	40	55	754	317	13.99	10
18	189.5	12.5	63	611	0	0	63	35	611	0	Imp.	-
19	190.6	18.1	42	590	0	0	42	44	590	0	Imp.	-
20	191.9	23.6	45	824	4	73	41	55	751	305	28.65	10
21	192.4	23.2	46	828	10	180	36	60	648	282	8.80	20
22	193.5	23.0	24	428	0	0	24	74	428	366	12.00	20
23	194.5	23.1	44	789	9	161	35	58	628	139	4.20	30
24	195.5	23.2	41	738	7	126	34	58	612	134	1.80	25
25	196.5	23.0	36	642	0	0	36	56	642	92	1.00	25
26	197.5	24.4	28	530	0	0	28	50	530	23	0.60	40
27	198.5	22.3	41	709	6	104	35	52	605	64	1.20	20

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.

50.11
41.0

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company		Hickory Creek Oil Company					Lease		Well No. HCO-89			
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.			
28	199.5	23.5	36	656	3	55	33	61	601	108	2.40	10
29	200.4	17.5	40	543	0	0	40	54	543	0	Imp.	-
30	201.5	17.0	36	475	0	0	36	55	475	35	0.60	35
31	202.4	22.8	31	548	0	0	31	57	548	90	1.80	15
32	203.5	21.0	34	554	0	0	33	62	554	56	1.00	20
33	204.5	21.4	38	631	3	50	35	59	581	45	0.60	20
34	205.6	21.7	42	707	4	67	38	55	640	63	1.20	25
35	206.5	21.6	44	737	0	0	44	49	737	46	0.80	30
36	207.5	20.8	32	516	0	0	32	62	516	46	0.80	30
37	208.5	15.4	28	335	0	0	28	61	335	0	Imp.	-
38	209.5	21.4	35	581	2	33	33	64	548	211	4.20	15
39	210.5	21.6	37	620	2	34	35	60	586	87	1.60	20
40	211.6	20.8	29	468	0	0	29	68	468	168	2.40	10
41	212.3	22.5	30	524	0	0	30	66	524	316	12.66	10

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.

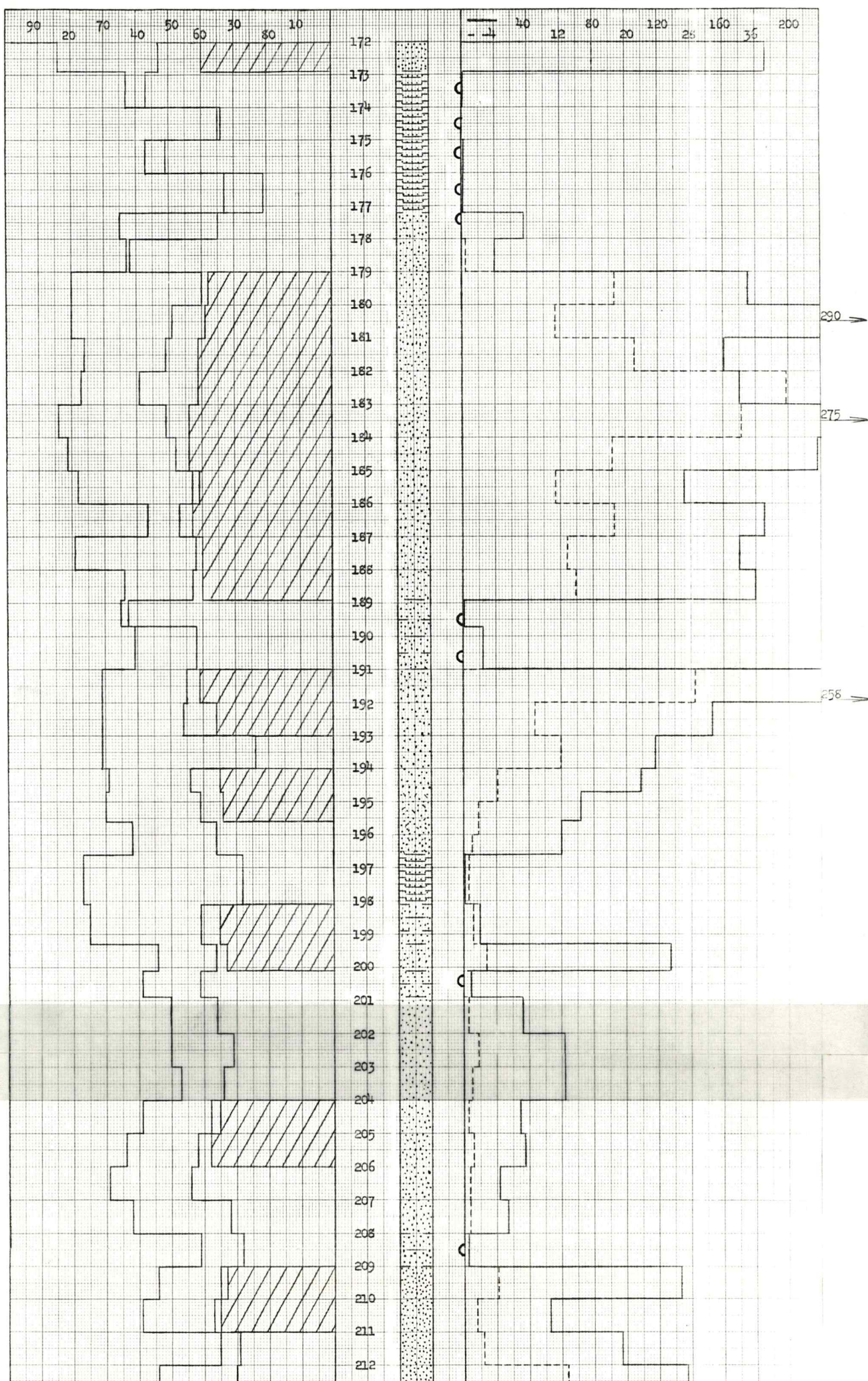
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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Hickory Creek Oil Company		Lease	—	Well No.	HCO-89
Depth Interval, Feet	172.0 - 188.9	188.9 - 212.5	172.0 - 212.5			
Feet of Core Analyzed	10.8	9.6	20.4			
Average Percent Porosity	24.7	22.5	23.6			
Average Percent Original Oil Saturation	47.8	40.5	44.4			
Average Percent Oil Recovery	6.8	4.9	5.9			
Average Percent Residual Oil Saturation	41.0	35.6	38.5			
Average Percent Residual Water Saturation	51.1	58.0	54.3			
Average Percent Total Residual Fluid Saturation	92.1	93.6	92.8			
Average Original Oil Content, Bbls./A. Ft.	913.	707.	816.			
Average Oil Recovery, Bbls./A. Ft.	127.0	87.	108.			
Average Residual Oil Content, Bbls./A. Ft.	786.	620.	708.			
Total Original Oil Content, Bbls./Acre	9,852.	6,783.	16,635.			
Total Oil Recovery, Bbls./Acre	1,368.	832.	2,200.			
Total Residual Oil Content, Bbls./Acre	8,484.	5,951.	14,435.			
Average Effective Permeability, Millidarcys	19.80	5.52	13.08			
Average Initial Fluid Production Pressure, p.s.i.	16.4	19.5	17.9			

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



KEY:

SANDSTONE

LAMINATED SANDSTONE AND SHALE

FLOODPOT RESIDUAL OIL SATURATION

SHALY SANDSTONE

CARBONACEOUS SANDSTONE

IMPERMEABLE TO WATER

HICKORY CREEK OIL COMPANY

—LEASE

WELL NO. HCO - 89

--- COUNTY, ---

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
172.0 - 188.9	16.9	22.2	46.1	32.5	136.0	
188.9 - 212.5	23.6	21.1	37.3	37.6	178.1	
172.0 - 212.5	40.5	21.6	41.0	35.4	161.1	7,400 (PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHAMUTE, KANSAS
JANUARY, 1960

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