

HICKORY CREEK OIL COMPANY

CORE ANALYSIS REPORT

WELL NOL HCO-58

FLAHARTY #2

OILFIELD RESEARCH LABORATORIES

536 N. HIGHLAND

CHANUTE, KANSAS

OCT. 29, 1979 - DRK

FLAHERTY # 2

HCO # 58 CORE # 1

180-191.8

180-191.8

SANDSTONE, FNG, BROWN
(BROWN SUGAR), MICACEOUS;
SPARSE MILLIMETER CARBONACEOUS
LAMINAE THROUGHOUT INTERVAL

EXCEPT FOR CONCENTRATION
AT 183.2 TO 183.5 WHICH IS

ASSOCIATED WITH $\frac{3}{4}$ " x $\frac{1}{2}$ "

SHALE FLECKS; SIMILAR SHALE
FLECKS AT 186.3 TO 186.5;

IRREGULAR SHALE BREAK FROM
188.4 TO 188.5 VARYING IN

THICKNESS FROM $\frac{1}{2}$ " TO 1" AND

ANOTHER FROM 188.55 TO 188.6;

OCCASIONAL MINOR PYRITE

ASSOCIATED WITH CARBONACEOUS

LAMINAE AND CARBONACEOUS PLANT
FRAGMENTS; NEARLY VERTICAL
FRACTURES 183.8 TO 184.3

AND 191.4 TO 191.8; CORE

OZONE FREE ~~ON~~ THROUGHOUT
INTERVAL.

END OF HCO # 58 CORE # 1

~~(FLAHERTY # 2)~~

NOTE: INTERVAL FROM 191.8 TO
193 SAMPLED BY CHIP
SAMPLES ONLY.

HCO # 58 CORE # 2

STARTS ON NEXT PAGE

OCT. 27, 1979 - DRK

FLAHERTY # 2

HCO # 58 CORE # 2

193 - 212.7

193 - 202

SANDSTONE, FNG, BROWN TO
GRAY BROWN, MICACEOUS; SHALEY
INTERVALS WITH MILLIMETER
CARBONACEOUS LAMINAE AT:

193.7 To 194.2

194.8 To 194.9

195.7 To 195.9

196.0 To 197.2

201.0 To 201.1

OCCASIONAL MILLIMETER

CARBONACEOUS LAMINAE.

ALSO SCATTERED THROUGHOUT

SANDSTONE INTERVALS;

CORE OODING FREE OIL THROUGHOUT
INTERVAL.

202 - 212.7

SANDSTONE, FNG, DARK BROWN
TO DARK BROWNISH GRAY, MICACEOUS,
INTERVAL RELATIVELY FREE OF
SHALEY INTERVALS AND CARBONACEOUS
LAMINAE AND ORIGINAL BEDDING
FEATURES; INTERVAL GENERALLY
MASSIVE & HOMOGENIOUS EXCEPT
FOR LOCAL MICACEOUS PARTINGS;
NO FREE OIL NOTED; INTERVAL
APPEARS TO BE "WATER-WET".

END HCO # 58 CORE # 2

(FLAHERTY # 2)

212.7

180.

32.7



OILFIELD RESEARCH LABORATORIES

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

November 19, 1979

Hickory Creek Oil Company
1128 Main Street
Parsons, Kansas 67357

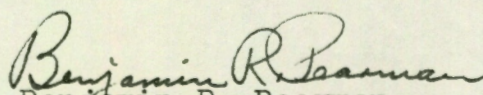
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-58, and submitted to our laboratory on October 30, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Benjamin R. Pearman

BRP/tem
4 c to Parsons, Kansas
1 c to Chanute, Kansas



- REGISTERED ENGINEERS -

ORE ANALYSIS - WATER ANALYSIS - REPRESSURING ENGINEERING - SURVEYING & MAPPING - PROPERTY EVALUATION & OPERATION

FLAHARTY # 2

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Hickory Creek Oil Company Lease - Well No. HCO-58

Location -

Section - Twp - Rge - County - State -

Name of Sand	- - - - -	-
Top of Core	- - - - -	180.0
Bottom of Core	- - - - -	212.7
Top of Sand	- - - - -	180.0
Bottom of Sand	- - - - -	212.7
Total Feet of Permeable Sand	- - - - -	30.4
Total Feet of Floodable Sand	- - - - -	15.6

Distribution of Permeable Sand:
Permeability Range
Millidarcys

	Feet	Cum. Ft.
1 - 15	6.1	6.1
15 - 50	8.0	14.1
50 - 100	7.7	21.8
100 & Above	8.6	30.4

Average Permeability Millidarcys	- - - - -	157.5
Average Percent Porosity	- - - - -	21.0
Average Percent Oil Saturation	- - - - -	45.5
Average Percent Water Saturation	- - - - -	30.5
Average Oil Content, Bbls./A. Ft.	- - - - -	748.
Total Oil Content, Bbls./Acre	- - - - -	22,443.
Average Percent Oil Recovery by Laboratory Flooding Tests	- - - - -	14.8
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	- - - - -	262.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	- - - - -	4,082.
Total Calculated Oil Recovery, Bbls./Acre	- - - - -	
Packer Setting, Feet	- - - - -	
Viscosity, Centipoises @	- - - - -	
A. P. I. Gravity, degrees @ 60 °F	- - - - -	
Elevation, Feet	- - - - -	

See "Calculated Recovery" Section.

This 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>
180.0 - 183.0	Brown sandstone.
183.0 - 183.8	Brown sandstone with fine carbonaceous partings.
183.8 - 188.6	Brown sandstone.
188.6 - 189.0	Brown and gray laminated sandstone and shale.
189.0 - 191.6	Brown sandstone.
193.0 - 194.0	Brown and gray laminated sandstone and shale.
194.0 - 194.9	Brown sandstone with shale partings.
194.9 - 196.0	Brown sandstone.
196.0 - 196.4	Gray sandy shale.
196.4 - 196.9	Brown and gray laminated sandstone and shale.
196.9 - 197.7	Light brown sandstone with fine shale partings.
197.7 - 198.0	Brown shaly sandstone.
198.0 - 201.0	Brown sandstone.
201.0 - 201.8	Brown slightly shaly sandstone.
201.8 - 208.7	Brown sandstone.
208.7 - 209.7	Brown shaly sandstone.
209.7 - 212.2	Brown sandstone.
212.2 - 212.7	Brown shaly sandstone.

LABORATORY FLOODING TESTS

In particular, the upper portion (11.6 feet) of the sand in this core responded to laboratory flooding tests. A total oil recovery of 4,082 barrels of oil per acre was obtained from 15.6

FLAHARTY #2

feet of sand. The weighted average percent oil saturation was reduced from 52.2 to 37.4, or represents an average recovery of 14.8 percent. The weighted average effective permeability of the samples is 9.54 millidarcys, while the average initial fluid production pressure is 15.9 pounds per square inch (See Table V).

CALCULATED RECOVERY

Based on a study of the laboratory tests, it appears that efficient primary and waterflooding operations in the vicinity of this well should recover approximately 5,990 barrels of oil per acre. This is an average recovery of 384 barrels per acre foot from the 15.6 feet of floodable pay 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 / 20.7 ✓
Average porosity, percent	22.0 / 22.2 ✓
Oil saturation after flooding, percent	37.4 / 36.9 ✓
Performance factor, percent	✓ 50.0 ✓
Net floodable pay sand, feet	15.6 / 12.0 ✓

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - Well No. HCO-58

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.		
1 182	180.5	21.4	57	16	73	946	13.	1.0	1.0	946	13.00
2 183	181.5	23.5	60	11	71	1,094	340.	1.0	2.0	1,094	340.00
3 184	182.5	23.1	54	20	74	968	149.	1.0	3.0	968	149.00
4 185	183.6	22.9	63	20	83	1,119	180.	0.8	3.8	887	144.00
5 186	184.6	23.9	58	14	72	1,075	1,132.	1.2	5.0	1,290	1358.40
6 187	185.8	25.2	57	15	72	1,114	764.	1.0	6.0	1,114	764.00
7 188	186.7	21.4	49	23	72	814	873.	1.0	7.0	814	873.00
8 189	187.5	21.8	54	20	74	913	68.	1.6	8.6	1,462	108.80
9 190	188.8	16.3	42	39	82	531	35.	0.4	9.0	212	14.00
10 191	189.6	23.3	54	14	68	976	53.	1.0	10.0	976	53.00
11 192	190.5	23.0	49	21	70	874	108.	1.0	11.0	874	108.00
12 193	191.5	16.6	60	35	95	773	51.	0.6	11.6	464	30.60
13 195	193.5	19.7	49	30	79	749	1.6	1.0	12.6	749	1.60
14 196	194.5	19.0	46	31	77	678	105.	0.9	13.5	610	94.50
15 197	195.5	20.2	44	35	79	690	16.	1.1	14.6	759	17.60
16 198	196.5	17.9	23	55	78	319	3.6	0.5	15.1	160	1.80
17 199	197.8	17.0	39	47	86	514	4.3	0.3	15.4	154	1.29
18 200	198.5	21.0	41	32	73	668	35.	1.0	16.4	668	35.00
19 201	199.5	19.7	44	33	77	673	11.	1.0	17.4	673	11.00
20 202	200.5	21.6	43	33	76	721	73.	1.0	18.4	721	73.00
21 203	201.5	16.4	44	48	92	560	8.0	0.8	19.2	448	6.40
22 204	202.6	22.9	41	34	75	728	96.	1.2	20.4	874	115.20
23 205	203.5	21.0	34	35	69	554	43.	1.0	21.4	554	43.00
24 206	204.5	22.0	35	47	82	597	39.	1.0	22.4	597	39.00
25 207	205.5	21.9	43	33	76	731	60.	1.0	23.4	731	60.00
26 208	206.5	18.8	39	36	75	569	42.	1.0	24.4	569	42.00
27 209	207.5	17.8	39	35	74	539	15.	1.0	25.4	539	15.00
28 210	208.5	20.4	36	45	81	570	133.	0.7	26.1	399	93.10

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - Well No. HCO-58

6293.5 659.7

1019

4574.6

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.		
29 ²¹¹	209.5	20.7	42	33	75	675	54.	1.0	27.1	675	54.00
30 ²¹²	210.5	18.3	35	44	79	497	17.	1.3	28.4	646	22.10
31 ²¹³	211.5	19.9	29	44	73	448	49.	1.2	29.6	537	58.80
32 ²¹⁴	212.5	21.1	34	41	75	557	3.1	0.5	30.1	279	1.55

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease - Well No. HCO-58

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
180.0 - 191.6	11.6	341.0	3,955.80
193.0 - 212.7	18.5	42.5	785.94
180.0 - 212.7	30.4	157.5	4,741.74

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
180.0 - 191.6	11.6	22.4	55.1	19.1	957	11,101
193.0 - 212.7	18.5	20.0	39.4	37.6	614	11,342
180.0 - 212.7	30.1	21.0	45.5	30.5	748	22,443

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - F-2 Well No. HCO-58

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	180.5	21.2	57	937	18	296	39	58	641	260	8.34	15
2	181.5	24.0	60	1,117	24	447	36	56	670	105	23.59	10
3	182.5	23.4	54	980	23	418	31	61	562	168	14.97	10
4	183.6	23.3	63	1,139	15	271	48	47	868	160	17.98	15
5	184.6	24.4	58	1,098	20	379	38	58	719	199	14.38	10
6	185.8	25.7	57	1,136	17	339	40	50	797	122	11.99	10
7	186.7	21.0	49	802	15	246	34	60	556	116	10.38	15
8	187.5	22.2	54	930	23	396	31	64	534	104	3.22	20
9	188.8	16.7	42	544	4	52	38	56	492	58	1.65	25
10	189.6	23.6	54	989	20	366	34	62	623	199	5.03	15
11	190.5	23.3	49	886	17	307	32	62	579	192	10.79	10
12	191.5	17.1	60	796	18	239	42	55	557	175	3.74	20
13	193.5	19.4	48	722	0	0	48	35	722	0	Imp.	-
14	194.5	19.5	46	696	7	106	39	55	590	232	4.95	20
15	195.5	20.4	44	696	2	32	42	55	664	60	1.50	25
16	196.5	18.2	25	353	0	0	25	69	353	46	1.35	25
17	197.8	17.4	38	513	0	0	38	53	513	18	0.45	35
18	198.5	20.8	41	662	0	0	41	55	662	252	10.27	15
19	199.5	20.0	44	683	2	31	42	56	652	128	3.15	20
20	200.5	21.1	43	704	2	33	41	54	671	175	14.85	15
21	201.5	16.2	45	566	0	0	45	50	566	0	Imp.	-
22	202.6	22.8	41	725	0	0	41	54	725	169	13.72	10
23	203.5	21.4	36	598	0	0	36	61	598	240	9.30	10
24	204.5	22.3	35	606	0	0	35	62	606	374	31.20	10
25	205.5	22.1	44	754	0	0	44	50	754	194	11.45	10
26	206.5	19.3	39	584	0	0	39	53	584	290	5.55	15
27	207.5	17.5	41	557	0	0	41	51	557	16	0.30	30
28	208.5	20.8	36	581	0	0	36	60	581	197	11.78	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.

Handwritten notes:
 5.2.58
 11.11.58
 W.G.P.

SS
 HIF
 SAMPLES
 ONLY

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease 1218 Well No. HCO-58

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	273.08 Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
29	209.5	21.0	40	652	0	0	40	56	652	300	16.09	15
30	210.5	18.5	36	517	0	0	36	56	517	61	1.13	20
31	211.5	20.4	30	475	0	0	30	67	475	264	7.88	15
32	212.5	21.0	36	587	0	0	36	60	587	105	2.10	25

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	Lease			Well No.
Hickory Creek Oil Company	-			HCO-58
Depth Interval, Feet	180.0 - 191.6	193.0 - 212.7	180.0 - 212.7	
Feet of Core Analyzed	11.6	4.0	15.6	
Average Percent Porosity	22.6	20.3	22.0	
Average Percent Original Oil Saturation	55.1	44.2	52.2	
Average Percent Oil Recovery	18.9	3.1	14.8	
Average Percent Residual Oil Saturation	36.2	41.1	37.4	
Average Percent Residual Water Saturation	58.1	55.0	57.4	
Average Percent Total Residual Fluid Saturation	94.3	96.1	94.8	
Average Original Oil Content, Bbls./A. Ft.	971.	695.	901.	
Average Oil Recovery, Bbls./A. Ft.	336.	49.	262.	
Average Residual Oil Content, Bbls./A. Ft.	635.	646.	639.	
Total Original Oil Content, Bbls./Acre	11,257.	2,778.	14,035.	
Total Oil Recovery, Bbls./Acre	3,888.	194.	4,082.	
Total Residual Oil Content, Bbls./Acre	7,369.	2,584.	9,953.	
Average Effective Permeability, Millidarcys	10.73	6.03	9.54	
Average Initial Fluid Production Pressure, p.s.i.	14.6	20.0	15.9	

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