

HICKORY CREEK OIL COMPANY

CORE ANALYSIS REPORT

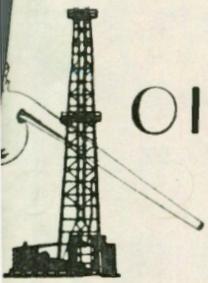
WELL NO. HCO-88

W. Denton 28

OILFIELD RESEARCH LABORATORIES

536 N. HIGHLAND

CHANUTE, KANSAS



OILFIELD RESEARCH LABORATORIES

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

January 15, 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-88, 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

- 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-88

Location -

Section - Twp - Rge - County - State -

Elevation, Feet -

Name of Sand -

Top of Core - 167.0

Bottom of Core - 204.2

Top of Sand - 167.0

Bottom of Sand - 204.2

Total Feet of Permeable Sand - 36.4

Total Feet of Floodable Sand - 21.9

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 20	11.6	11.6
20 - 50	10.8	22.4
50 - 100	6.2	28.6
100 - 200	6.8	35.4
200 - 400	1.0	36.4

Average Permeability Millidarcys - 59.8

Average Percent Porosity - 20.3

Average Percent Oil Saturation - 49.1

Average Percent Water Saturation - 30.4

Average Oil Content, Bbls./A. Ft. - 777.

Total Oil Content, Bbls./Acre - 28,907.

Average Percent Oil Recovery by Laboratory Flooding Tests - 11.3

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - 189.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - 4,146.

Total Calculated Oil Recovery, Bbls./Acre - See "Calculated Recovery" Section.

-2-

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>
167.0 - 169.0	Brown and gray laminated sandstone and shale.
169.0 - 171.8	Brown sandstone.
171.8 - 173.8	Grayish brown very shaly sandstone.
173.8 - 174.5	Brown sandstone.
174.5 - 176.2	Grayish brown slightly shaly sandstone.
176.2 - 179.8	Brown sandstone.
179.8 - 180.9	Grayish brown slightly shaly sandstone.
180.9 - 181.7	Brown sandstone.
181.7 - 183.6	Grayish brown slightly shaly sandstone.
183.6 - 188.2	Dark brown sandstone.
188.2 - 189.1	Black carbonaceous sandstone.
189.1 - 190.7	Grayish brown shaly sandstone.
190.7 - 197.3	Brown sandstone.
197.3 - 198.3	Black carbonaceous sandstone.
198.3 - 204.2	Light brown sandstone.

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 4,146 barrels of oil per acre was obtained from 21.9 feet of sand. The weighted average percent oil saturation was reduced from 53.0 to 41.7, or represents an average recovery of 11.3 percent. The weighted average effective permeability of the samples is 5.00 millidarcys, while the average initial fluid production pressure is 26.4 pounds per square inch (See Table V).

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 7,510 barrels of oil per acre. This is an average recovery of 343 barrels per acre foot from 21.9 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	10.0 / 23.4 ✓
Average porosity, percent	21.5 / 21.1 ✓
Oil saturation after flooding, percent	41.7 / 41.1 ✓
Performance factor, percent, estimated	✓ 45.0
Net floodable sand, feet	21.9 / 17.0 ✓

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - D 28 Well No. HCO-88

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	167.5	16.2	35	58	93	440	3.2	1.0	1.0	440	3.20
2	168.5	17.2	54	31	85	721	4.2	1.0	2.0	721	4.20
3	169.7	19.8	46	25	71	707	22.	1.0	3.0	707	22.00
4	170.3	20.2	54	18	72	846	38.	1.0	4.0	846	38.00
5	171.5	19.6	41	30	71	623	12.	0.8	4.8	498	9.60
6	172.0	12.7	27	70	97	266	0.27	1.2	6.0	319	0.32
7	173.5	16.9	65	33	98	825	Imp.	0.8	6.8	660	0.00
8	174.2	21.5	58	23	81	967	42.	0.7	7.5	677	29.40
9	175.5	15.6	48	48	96	581	10.	1.7	9.2	988	17.00
10	176.5	20.0	42	38	80	652	29.	0.8	10.0	522	23.20
11	177.2	25.2	53	17	70	1036	115.	1.0	11.0	1036	115.00
12	178.5	23.3	56	14	70	1012	130.	1.0	12.0	1012	130.00
13	179.5	22.7	52	18	70	916	78.	0.8	12.8	733	62.40
14	180.5	18.7	50	40	90	725	12.	1.1	13.9	798	13.20
15	181.5	21.4	63	25	88	1046	38.	0.8	14.7	837	30.40
16	182.5	18.5	56	30	86	804	6.3	1.3	16.0	1045	8.19
17	183.5	19.7	72	20	92	1100	15.	0.6	16.6	660	9.00
18	184.7	23.7	57	16	73	1048	61.	1.4	18.0	1467	85.40
19	185.6	24.0	62	12	74	1154	58.	1.0	19.0	1154	58.00
20	186.5	19.9	64	15	79	988	58.	1.0	20.0	988	58.00
21	187.5	22.9	62	12	74	1102	123.	1.2	21.2	1322	147.60
22	188.5	23.5	64	11	65	1167	161.	0.9	22.1	1050	144.90
23	189.5	14.8	19	60	79	218	1.1	0.9	23.0	196	0.99
24	190.4	16.7	37	40	77	479	2.0	0.7	23.7	335	1.40
25	191.5	16.3	80	18	98	1012	19.	1.3	25.0	1316	24.70
26	192.5	21.5	47	25	72	784	76.	1.0	26.0	784	76.00
27	193.5	19.4	49	33	82	738	58.	1.0	27.0	738	58.00
28	194.5	24.5	38	30	68	722	158.	1.0	28.0	722	158.00

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company Lease - Well No. HCO-88

6862.5 752.2 1161 2193.07

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	195.5	24.6	53	26	79	1012	199.	1.0	29.0	1012	199.00
30	196.4	22.5	54	(33)	87	943	46.	1.3	30.3	1226	59.80
31	197.5	25.6	38	43	81	755	305.	1.0	31.3	755	305.00
32	198.5	23.5	42	28	70	766	144.	0.7	32.0	536	100.80
33	199.5	18.4	33	43	76	471	21.	1.0	33.0	471	21.00
34	200.5	17.4	44	48	92	594	38.	1.0	34.0	594	38.00
35	201.5	20.1	36	39	75	561	39.	1.0	35.0	561	39.00
36	202.5	21.2	29	47	76	477	34.	1.0	36.0	477	34.00
37	203.5	22.5	31	44	75	541	37.	1.2	37.2	649	44.40

6862.5 752.2

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease - Well No. HCO-88

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
167.0 - 177.0	9.2	16.8	153.32
177.0 - 197.3	20.3	70.9	1439.98
197.3 - 204.2	6.9	84.4	582.20
167.0 - 204.2	36.4	59.8	2175.50

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
167.0 - 177.0	10.0	17.6	46.5	34.2	643	6,433
177.0 - 197.3	20.3	21.3	54.9	24.5	908	18,431
197.3 - 204.2	6.9	21.2	35.7	42.4	586	4,043
167.0 - 204.2	37.2	20.3	49.1	30.4	777	28,907

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company

Lease D 28

Well No. HCO-88

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	167.5	16.5	35	448	2	26	33	63	422	0	0.01	50
2	168.5	17.2	54	721	0	0	54	42	721	0	Imp.	-
3	169.7	19.6	46	699	13	198	33	59	501	14	0.45	35
4	170.3	20.0	54	838	20	310	34	58	528	35	0.60	20
5	171.5	19.5	41	620	3	45	38	60	575	0	0.01	45
6	172.0	13.0	27	272	0	0	27	55	272	22	0.45	45
7	173.5	16.9	65	852	0	0	65	32	852	0	Imp.	-
8	174.2	21.3	58	958	20	330	38	60	628	0	0.06	25
9	175.5	15.8	48	588	0	0	48	45	588	0	Imp.	-
10	176.5	20.0	42	652	7	109	35	58	543	10	0.30	35
11	177.2	25.0	53	1028	13	252	40	58	776	277	12.33	15
12	178.5	23.8	56	1034	10	185	46	51	849	264	10.87	20
13	179.5	22.5	52	908	3	52	49	47	856	234	8.66	15
14	180.5	19.0	50	737	11	162	39	57	575	39	0.90	20
15	181.5	21.1	63	1031	0	0	63	29	1031	0	Imp.	-
16	182.5	18.1	56	786	14	197	42	55	589	0	0.03	30
17	183.5	19.3	72	1078	27	404	45	53	674	0	0.03	50
18	184.7	23.5	57	1039	10	182	47	50	857	300	5.70	20
19	185.6	24.0	62	1154	19	354	43	55	800	285	5.55	20
20	186.5	19.6	64	973	19	289	45	53	684	47	1.05	25
21	187.5	22.9	62	1101	21	373	41	56	728	346	8.55	15
22	188.5	23.4	64	1162	14	254	50	48	908	268	6.15	25
23	189.5	15.1	19	223	0	0	19	72	223	0	Imp.	-
24	190.4	16.8	37	482	0	0	37	50	482	0	Imp.	-
25	191.5	16.5	80	1024	0	0	80	17	1024	0	Imp.	-
26	192.5	21.5	47	784	2	33	45	52	751	97	2.70	30
27	193.5	19.6	49	745	3	46	46	49	699	60	1.35	30

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.

H₂O
1.15
41.1

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - D 28 Well No. HCO-88

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		1560 Residual Saturation			Volume of Water Recovered cc*	143.10 Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
28	194.5	24.4	38	719	3	57	35	57	662	121	3.00	30
29	195.5	24.6	53	1011	11	210	42	53	801	261	13.92	15
30	196.4	22.8	54	955	6	106	48	45	849	208	19.19	10
31	197.5	25.6	38	755	0	0	38	57	755	288	25.49	10
32	198.5	23.3	42	759	0	0	42	56	759	317	4.95	20
33	199.5	18.8	33	481	0	0	33	53	481	22	0.30	35
34	200.5	17.8	44	608	0	0	44	50	608	47	0.90	35
35	201.5	20.1	36	561	0	0	36	61	561	62	1.05	35
36	202.5	21.2	29	477	0	0	29	69	477	246	3.75	15
37	203.5	22.3	31	536	0	0	31	67	536	307	4.80	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.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company Hickory Creek Oil Company Lease - Well No. HCO-88

Depth Interval, Feet	167.0 - 177.0	177.0 - 197.3	167.0 - 197.3
Feet of Core Analyzed	5.3	16.6	21.9
Average Percent Porosity	19.4	22.1	21.5
Average Percent Original Oil Saturation	46.3	55.3	53.0
Average Percent Oil Recovery	11.3	11.4	11.3
Average Percent Residual Oil Saturation	35.0	43.9	41.7
Average Percent Residual Water Saturation	59.6	52.4	54.2
Average Percent Total Residual Fluid Saturation	94.6	96.3	95.9
Average Original Oil Content, Bbls./A. Ft.	704.	929.	888.
Average Oil Recovery, Bbls./A. Ft.	176.	194.	189.
Average Residual Oil Content, Bbls./A. Ft.	528.	735.	699.
Total Original Oil Content, Bbls./Acre	3,729.	15,716.	19,445.
Total Oil Recovery, Bbls./Acre	933.	3,213.	4,146.
Total Residual Oil Content, Bbls./Acre	2,796.	12,503.	15,299.
Average Effective Permeability, Millidarcys	0.22	6.51	5.00
Average Initial Fluid Production Pressure, p.s.i.	35.0	23.1	26.4

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

Dec 15

Clear coal

J-J

Well #28

HCO# 88

Core # 2 (184-204.1)

(184-204.1)

Sandstone, fine, brown, micaceous

Sand is carbonaceous 188.4-

189.1 containing medium-coarse

grains of feldspar? Shaly sand

interlaminated with carbonaceous

material 189.1-190

Shale rip clasts 192.3-194.5

largest 2" by 3/4"

Coal lamination 196.1 Shale

break 198.7-198.9

Carbonaceous laminations

203.8-204.1

Interval 184-196 zones free
oil. First presence of water

on freshly broken surface 197.4

Interval below 196 appears to
be water wet

End Core # 2

HCO# 88

Dec 14 Clear + cool J-J
Devlin 28 HCO#88
Core #1 (167-184)

(167-184)

Sandstone, fine, brown, micaceous.

Carbonaceous shaly sand (167.0-167.2)

Shaly sand (167.7-168), (168.6-168.9)

At 168.9 to 169.7 Shale inter-

laminated with carbonaceous

material. Shale ripclasts

170.9 largest 1" by 1/2". Shaly

carbonaceous sand 1" thick 171.9.

Shaly carbonaceous laminations

1720-171.

Shale break 172.3-173.2

with a sand streak at 173.1 \approx 1/2"

thick. Shaly sand (173.7-173.8)

(174.5-175.2), (176-176.1) (180-180.1)

+ (180.8 + 180.9).

Entire sand oozes free
oil + gas bubbles. No presence

of water on freshly broken
surfaces at bottom of core.

Pit has good show of oil.

1" core loss each foot 170-176, 2" core loss
176-180.

End Core #1

HCO#88