

HICKORY CREEK OIL COMPANY

CORE ANALYSIS REPORT

WELL NO. HCO-55

FLAHARTY #5

OILFIELD RESEARCH LABORATORIES

535 N. HIGHLAND

CHANUTE, KANSAS

HCO #55 CONT.

185.25-185.30

SHALE, GRAY

185.30-189.6

SANDSTONE, FNG TO VFNG,
BROWN TO GRAYISH BROWN, SILTY,
SHALEY, MICACEOUS; INTERLAMIN-
ATED AND INTERBEDDED WITH
SILTY AND SHALEY INTERVALS
FROM MILLIMETER TO 1 INCH
THICKNESSES; MICACEOUS
PARTINGS COMMON; OCCASIONAL
MILLIMETER CARBONACEOUS
LAMINAE; FREE OIL OODING
THROUGHOUT INTERVAL.

END HCO #55 CORE

(FLAHERTY #5)

HCO # 53 CONT

171.02-171.36

SHALE GRAY, w/ MILLIMETER

LAMINAE OF CLOSELY SPACED

NEARLY HORIZONTAL WHITE

MDG SILTSTONE.

171.36-185.25

SANDSTONE, FINE, BROWN (BROWN SUGAR)

SUGAR), MICACEOUS, w/ 1/4" SHALE

FRIBBLE AT 179.85, WITH

CLOSELY SPACED MILLIMETER

CARBONACEOUS LAMINAE FROM

175.45 TO 175.75, w/ BLACK

SANDSTONE (CARBONACEOUS) FROM

183.63 TO 183.72 AND FROM 185.07

TO 185.25, w/ SLIGHTLY SHALEY

INTERVAL FROM 183.72 TO 184.4.

OCCASIONAL CARBONACEOUS SPECKS,

LOCAL MICACEOUS PARTINGS, OZING

FRIBBLE THROUGHOUT INTERVAL.

OCT 26, 1979 - DRK

FLAHERTY # 5

HCO # 55 CORE

170.6-189.6

170.60-170.63

SANDSTONE, FINE, BROWN (BROWN SUGAR)

MICACEOUS, w/ CARBONACEOUS SPECKS,

OZING FREE OIL.

170.63-170.72

SHALE GRAY, w/ MILLIMETER

LAMINAE OF CLOSELY SPACED

NEARLY HORIZONTAL WHITE MDG

SILTSTONE.

170.72-171.02

SANDSTONE, FINE, BROWN,

MICACEOUS, OZING FREE OIL.



OILFIELD RESEARCH LABORATORIES

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

November 15, 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-55, and submitted to our laboratory on October 27, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman
Benjamin R. Pearman

BRP/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-55

Location -

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

| | | |
|------------------------------|-------|--|
| Name of Sand | - | |
| Top of Core | 170.6 | |
| Bottom of Core | 189.6 | |
| Top of Sand | 170.7 | |
| Bottom of Sand | 189.6 | |
| Total Feet of Permeable Sand | 17.6 | |
| Total Feet of Floodable Sand | 13.2 | |

Distribution of Permeable Sand:
Permeability Range
Millidarcys

| | Feet | Cum. Ft. |
|-------------|------|----------|
| 2 - 10 | 5.8 | 5.8 |
| 10 - 50 | 4.5 | 10.3 |
| 50 - 100 | 5.3 | 15.6 |
| 100 & Above | 2.0 | 17.6 |

| | | |
|---|---|------------------------------------|
| Average Permeability Millidarcys | - | 50.7 |
| Average Percent Porosity | - | 19.0 |
| Average Percent Oil Saturation | - | 47.3 |
| Average Percent Water Saturation | - | 34.1 |
| Average Oil Content, Bbls./A. Ft. | - | 706. |
| Total Oil Content, Bbls./Acre | - | 12,406. |
| Average Percent Oil Recovery by Laboratory Flooding Tests | - | 18.1 |
| Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. | - | 290. |
| Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre | - | 3,828. |
| Total Calculated Oil Recovery, Bbls./Acre | - | See "Calculated Recovery" Section. |
| Packer Setting, Feet | - | |
| Viscosity, Centipoises @ | - | |
| A. P. I. Gravity, degrees @ 60 °F | - | |
| Elevation, Feet | - | |

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> |
|---------------------------------|--|
| 170.6 - 170.7 | Gray sandy shale. |
| 170.7 - 170.9 | Brown sandstone. |
| 170.9 - 171.4 | Gray sandy shale. |
| 171.4 - 175.4 | Brown sandstone. |
| 175.4 - 175.8 | Light brown sandstone laminated with thin carbon partings. |
| 175.8 - 178.9 | Brown sandstone. |
| 178.9 - 179.8 | Brown shaly sandstone. |
| 179.8 - 183.7 | Brown slightly shaly sandstone. |
| 183.7 - 184.8 | Light brown sandstone laminated with thin carbon partings. |
| 184.8 - 185.2 | Brown sandstone. |
| 185.2 - 189.0 | Light brown shaly sandstone. |
| 189.0 - 189.6 | Brown shaly sandstone. |

LABORATORY FLOODING TESTS

The upper two-thirds of the sand in this core responded to laboratory flooding tests, as a total recovery of 3,828 barrels of oil per acre was obtained from 13.2 feet of sand. The weighted average percent oil saturation was reduced from 50.4 to 32.3, or represents an average recovery of 18.1 percent. The weighted average effective permeability of the samples is 7.40 millidarcys, while the average initial fluid production

FLAHARTY # 5

OILFIELD RESEARCH LABORATORIES

-3-

pressure is 21.0 pounds per square inch (See Table V).

CALCULATED RECOVERY

A study of the results of the laboratory testing indicates that efficient primary and waterflooding operations in the vicinity of this well should recover approximately 5,090 barrels of oil per acre. This is an average recovery of 385 barrels per acre foot from the 13.2 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 | 15.0 / 28.4 |
| Average porosity, percent | 19.8 / 20.2 |
| Oil saturation after flooding, percent | 32.3 / 31.4 |
| Performance factor, percent | ✓ 50.0 |
| Net floodable pay sand, feet | 13.2 / 11.0 |

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease F - 5

Well No. HCO-55

3599.8

383

687

1052.

| 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 | 170.8 | 20.3 | 42 | 37 | 79 | 661 | 55. | 0.2 | 0.2 | 132 | 11.00 |
| 2 | 171.5 | 22.6 | 40 | 31 | 71 | 701 | 130. | 0.6 | 0.8 | 421 | 78.00 |
| 3 | 172.5 | 22.3 | 57 | 20 | 77 | 986 | 99. | 1.0 | 1.8 | 986 | 99.00 |
| 4 | 173.4 | 21.8 | 56 | 19 | 75 | 947 | 92. | <u>1.0</u> | 2.8 | 947 | 92.00 |
| 5 | 174.4 | 22.0 | 55 | 20 | 75 | 939 | 82. | 1.0 | 3.8 | 939 | 82.00 |
| 6 | 175.3 | 23.1 | 47 | 25 | 72 | 842 | 113. | 0.4 | 4.2 | 337 | 45.20 |
| 7 | 176.3 | 23.3 | 52 | 21 | 73 | 940 | 94. | 1.2 | 5.4 | 1,128 | 112.80 |
| 8 | 177.6 | 19.8 | 60 | 24 | 84 | 922 | 149. | 1.0 | 6.4 | 922 | 149.00 |
| 9 | 178.5 | 14.8 | 60 | 33 | 93 | 689 | 67. | 0.9 | 7.3 | 620 | 60.30 |
| 10 | 179.5 | 14.2 | 51 | 34 | 85 | 562 | 8.2 | 0.9 | 8.2 | 510 | 7.38 |
| 11 | 180.5 | 20.4 | 48 | <u>31</u> | 79 | 760 | 26. | <u>1.2</u> | 9.4 | 912 | 31.20 |
| 12 | 181.5 | 16.6 | 44 | 40 | 84 | 567 | 24. | 1.0 | 10.4 | 567 | 24.00 |
| 13 | 182.5 | 21.2 | 44 | <u>34</u> | 78 | 724 | 50. | 1.0 | 11.4 | 724 | 50.00 |
| 14 | 183.5 | 20.0 | 47 | <u>31</u> | 78 | 729 | 23. | 0.7 | 12.1 | 510 | 16.10 |
| 15 | 184.5 | 15.1 | 41 | 42 | 83 | 480 | 10. | 1.1 | 13.2 | 528 | 11.00 |
| 16 | 185.5 | 16.3 | 38 | 49 | 87 | 481 | 2.7 | 0.8 | 14.0 | 385 | 2.16 |
| 17 | 186.5 | 15.2 | 33 | 58 | 91 | 389 | 2.4 | 1.0 | 15.0 | 389 | 2.40 |
| 18 | 187.5 | 18.3 | 39 | 47 | 86 | 554 | 6.3 | 1.0 | 16.0 | 554 | 6.30 |
| 19 | 188.5 | 17.7 | 44 | 44 | 88 | 604 | 6.4 | 1.0 | 17.0 | 604 | 6.40 |
| 20 | 189.5 | 18.0 | 35 | 47 | 82 | 489 | 12. | 0.6 | 17.6 | 294 | 7.20 |

3599.8

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Hickory Creek Oil Company Lease — Well No. HCO-55

| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. |
|-------------------------|--------------------------|---|---------------------------------------|
| 170.7 - 184.8 | 13.2 | 65.7 | 868.98 |
| 185.2 - 189.6 | 4.4 | 5.6 | 24.46 |
| 170.7 - 189.6 | 17.6 | 50.7 | 893.44 |

| 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 |
|-------------------------|--------------------------|--------------------------------|--------------------------------------|--|---------------------------------------|------------------------------------|
| 170.7 - 184.8 | 13.2 | 19.7 | 50.4 | 29.0 | 770 | 10,183 |
| 185.2 - 189.6 | 4.4 | 17.1 | 38.1 | 49.3 | 506 | 2,226 |
| 170.7 - 189.6 | 17.6 | 19.0 | 47.3 | 34.1 | 706 | 12,409 |

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease F-5 Well No. HCO-55

| Sample No. | Depth, Feet | Effective Porosity Percent | Original Oil Saturation | | Oil Recovery | | 674 Residual Saturation | | | Volume of Water Recovered cc* | 109.42 Effective Permeability Millidarcys** | Initial Fluid Production Pressure Lbs./Sq./In. |
|------------|-------------|----------------------------|-------------------------|--------------|--------------|--------------|-------------------------|---------|--------------|-------------------------------|---|--|
| | | | % | Bbls./A. Ft. | % | Bbls./A. Ft. | % Oil | % Water | Bbls./A. Ft. | | | |
| 1 | 170.8 | 20.2 | 42 | 652 | 10 | 155.2 | 32 | 63 | 497 | 220 | 5.62 | 20 |
| 2 | 171.5 | 22.2 | 40 | 689 | 9 | 155.6 | 31 | 67 | 534 | 247 | 9.00 | 20 |
| 3 | 172.5 | 22.3 | 57 | 986 | 33 | 571.0 | 24 | 75 | 415 | 262 | 10.77 | 10 |
| 4 | 173.4 | 22.2 | 56 | 964 | 30 | 517.0 | 26 | 72 | 447 | 255 | 17.35 | 10 |
| 5 | 174.4 | 22.4 | 55 | 956 | 25 | 434.0 | 30 | 69 | 522 | 225 | 11.24 | 10 |
| 6 | 175.3 | 23.1 | 47 | 842 | 20 | 358.4 | 27 | 70 | 484 | 176 | 12.32 | 10 |
| 7 | 176.3 | 23.6 | 52 | 952 | 21 | 384.2 | 31 | 68 | 568 | 298 | 15.93 | 10 |
| 8 | 177.6 | 20.3 | 60 | 945 | 28 | 441.0 | 32 | 65 | 504 | 248 | 16.49 | 15 |
| 9 | 178.5 | 15.1 | 60 | 703 | 24 | 281.9 | 36 | 61 | 422 | 43 | 1.12 | 20 |
| 10 | 179.5 | 14.0 | 51 | 554 | 5 | 54.9 | 46 | 52 | 500 | 3 | 0.22 | 30 |
| 11 | 180.5 | 20.0 | 48 | 745 | 15 | 233.2 | 33 | 64 | 512 | 206 | 4.95 | 20 |
| 12 | 181.5 | 17.0 | 44 | 580 | 15 | 198.0 | 29 | 65 | 382 | 42 | 1.05 | 30 |
| 13 | 182.5 | 20.8 | 44 | 710 | 13 | 210.0 | 31 | 68 | 500 | 110 | 2.62 | 25 |
| 14 | 183.5 | 19.9 | 47 | 726 | 10 | 154.7 | 37 | 59 | 572 | 12 | 0.22 | 35 |
| 15 | 184.5 | 15.5 | 41 | 493 | 3 | 36.1 | 38 | 59 | 457 | 2 | 0.15 | 50 |
| 16 | 185.5 | 16.5 | 39 | 499 | 0 | 0 | 39 | 52 | 499 | 0 | Imp. | - |
| 17 | 186.5 | 15.2 | 33 | 389 | 0 | 0 | 33 | 62 | 389 | 0 | Imp. | - |
| 18 | 187.5 | 18.0 | 40 | 559 | 0 | 0 | 40 | 50 | 559 | 0 | Imp. | - |
| 19 | 188.5 | 17.8 | 44 | 608 | 0 | 0 | 44 | 46 | 608 | 0 | Imp. | - |
| 20 | 189.5 | 18.5 | 35 | 502 | 0 | 0 | 35 | 57 | 502 | 9 | 0.37 | 50 |
| | | | | | TOTAL | | 13.2 | | | | | |
| | | | | | | | -1.80 | | | | | |
| | | | | | | | 11.4 | | | | | |
| | | | | | | | NO | | | | | |
| | | | | | | | 11.314 | | | | | |

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 <u>Hickory Creek Oil Company</u> | Lease <u>-</u> | Well No. <u>HCO-55</u> |
| Depth Interval, Feet | 170.7 - 184.8 | |
| Feet of Core Analyzed | 13.2 | |
| Average Percent Porosity | 19.8 | |
| Average Percent Original Oil Saturation | 50.4 | |
| Average Percent Oil Recovery | 18.1 | |
| Average Percent Residual Oil Saturation | 32.3 | |
| Average Percent Residual Water Saturation | 65.3 | |
| Average Percent Total Residual Fluid Saturation | 97.6 | |
| Average Original Oil Content, Bbls./A. Ft. | 776. | |
| Average Oil Recovery, Bbls./A. Ft. | 290. | |
| Average Residual Oil Content, Bbls./A. Ft. | 486. | |
| Total Original Oil Content, Bbls./Acre | 10,241. | |
| Total Oil Recovery, Bbls./Acre | 3,828. | |
| Total Residual Oil Content, Bbls./Acre | 6,413. | |
| Average Effective Permeability, Millidarcys | 7.40 | |
| Average Initial Fluid Production Pressure, p.s.i. | 21.0 | |

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