

HICKORY CREEK OIL COMPANY

CORE ANALYSIS REPORT

WELL NO. HCO-124

*W. Klenix 46*

OILFIELD RESEARCH LABORATORIES

536 N. HIGHLAND

CHANUTE, KANSAS



# OILFIELD RESEARCH LABORATORIES

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

March 7, 1980

Hickory Creek Oil Company  
P.O. Box 379  
Parsons, Kansas 67357

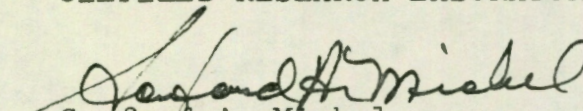
Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from Well No. HCO-124, and submitted to our laboratory on February 15, 1980.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

  
Sanford A. Michel

SAM/tem

- REGISTERED ENGINEERS -

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

## GENERAL INFORMATION & SUMMARY

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,<br/>Feet</u> | <u>Description</u>                   |
|---------------------------------|--------------------------------------|
| 171.0 - 171.6                   | Brown slightly shaly sandstone.      |
| 171.6 - 175.3                   | Light brown very shaly sandstone.    |
| 175.3 - 178.8                   | Brown slightly shaly sandstone.      |
| 178.8 - 180.8                   | Light brown very shaly sandstone.    |
| 180.8 - 181.4                   | Gray sandy shale.                    |
| 181.4 - 183.6                   | Light brown very shaly sandstone.    |
| 183.6 - 185.6                   | Brown shaly sandstone.               |
| 185.6 - 187.7                   | Light brown very shaly sandstone.    |
| 188.0 - 188.6                   | Light brown shaly sandstone.         |
| 188.6 - 195.7                   | Dark brown sandstone.                |
| 195.7 - 198.6                   | Light brown shaly sandstone.         |
| 198.6 - 201.8                   | Gray sandy shale.                    |
| 201.8 - 203.2                   | Dark brown slightly shaly sandstone. |
| 203.2 - 203.8                   | Gray sandy shale.                    |
| 203.8 - 205.2                   | Dark brown sandstone.                |
| 205.2 - 206.0                   | Gray sandy shale.                    |
| 206.0 - 207.4                   | Dark brown slightly shaly sandstone. |

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LABORATORY FLOODING TESTS

The lower portion of the sand in this core responded well, relative to the upper portion of the sand, to laboratory flooding tests, as a total overall recovery of 1,517 barrels of oil per acre was obtained from 15.8 feet of sand. The weighted average percent oil saturation was reduced from 47.4 to 41.2, or represents an average recovery of 6.2 percent. The weighted average effective permeability of the samples is 1.60 millidarcys, while the average initial fluid production pressure is 28.6 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 21 samples tested, 11 produced water and oil. This indicates that approximately 52 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has an erratic permeability profile.

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 4,050 barrels of oil per acre. This is an average recovery of 256 barrels per acre foot from 15.8 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

20.0 / 33.0

Average porosity, percent

20.1 / 19.7

Oil saturation after flooding, percent

41.2 / 41.4

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## RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Hickory Creek Oil Company

Lease

D 46

Well No. HCO-124

3932.7

385.3

890

716.93

| 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          | 171.5       | 19.1                       | <del>28</del>      | 59    | 87    | 415                       | 15.          | 0.6          | 0.6      | 249               | 9.00                     |
| 2          | 172.3       | 13.8                       | 26                 | 63    | 89    | 278                       | 1.3          | 1.4          | 2.0      | 389               | 1.82                     |
| 3          | 173.5       | 12.7                       | 20                 | 77    | 97    | 197                       | Imp.         | 2.0          | 4.0      | 394               | 0.00                     |
| 5          | 175.5       | 18.0                       | 36                 | 61    | 90    | 503                       | 5.4          | 1.7          | 5.7      | 855               | 9.18                     |
| 7          | 177.5       | 18.1                       | 46                 | 37    | 83    | 646                       | 42.          | 1.8          | 7.5      | 1163              | 75.60                    |
| 9          | 179.5       | 15.2                       | 29                 | 46    | 75    | 342                       | 0.73         | 2.0          | 9.5      | 684               | 1.46                     |
| 10         | 181.5       | 14.0                       | 11                 | 78    | 89    | 120                       | Imp.         | 1.0          | 10.5     | 120               | 0.00                     |
| 12         | 183.5       | 19.3                       | 52                 | 30    | 82    | 779                       | 7.5          | 1.2          | 11.7     | 935               | 9.00                     |
| 13         | 184.5       | 17.3                       | 37                 | 40    | 77    | 497                       | 49.          | 1.0          | 12.7     | 497               | 49.00                    |
| 14         | 185.5       | 14.2                       | 38                 | 51    | 89    | 419                       | 15.          | 1.0          | 13.7     | 419               | 15.00                    |
| 16         | 186.9       | 17.4                       | 39                 | 43    | 82    | 527                       | 11.          | 2.1          | 15.8     | 1107              | 23.10                    |
| 17         | 188.5       | <u>18.1</u>                | 47                 | 39    | 86    | 660                       | <u>56.</u>   | 0.6          | 16.4     | 396               | 33.60                    |
| 19         | 190.5       | 20.7                       | 56                 | 22    | 78    | 899                       | 62.          | 2.4          | 18.8     | 2158              | 148.80                   |
| 20         | 191.5       | 20.2                       | 57                 | 27    | 84    | 893                       | 39.          | 1.0          | 19.8     | 893               | 39.00                    |
| 21         | 192.5       | 21.3                       | 60                 | 24    | 84    | 992                       | 60.          | 1.0          | 20.8     | 992               | 60.00                    |
| 22         | 193.5       | 20.9                       | 53                 | 24    | 77    | 859                       | 52.          | 1.0          | 21.8     | 859               | 52.00                    |
| 23         | 194.5       | 21.5                       | <u>49</u>          | 29    | 78    | 817                       | 97.          | <u>1.7</u>   | 23.5     | 1389              | 164.90                   |
| 25         | 196.5       | 19.6                       | <u>38</u>          | 44    | 82    | 578                       | <u>5.0</u>   | <u>2.0</u>   | 25.5     | 1156              | 10.00                    |
| 27         | 202.5       | 19.3                       | 43                 | 33    | 76    | 644                       | 36.          | 1.4          | 26.9     | 902               | 50.40                    |
| 28         | 204.5       | 22.0                       | 40                 | 32    | 72    | 683                       | 101.         | 1.4          | 28.3     | 956               | 141.40                   |
| 29         | 206.5       | 22.6                       | 45                 | 31    | 76    | 789                       | 62.          | 1.4          | 29.7     | 1105              | 86.80                    |

3932.1

235

**Oilfield Research Laboratories**  
**SUMMARY OF PERMEABILITY & SATURATION TESTS**

**TABLE III**

Company Hickory Creek Oil Company Lease - Well No. HCO-124

| Depth Interval,<br>Feet | Feet of Core<br>Analyzed | Average<br>Permeability,<br>Millidarcys | Permeability<br>Capacity<br>Ft. x Md. |
|-------------------------|--------------------------|-----------------------------------------|---------------------------------------|
| 171.0 - 187.7           | 12.8                     | 15.1                                    | 193.16                                |
| 188.0 - 207.4           | 13.9                     | 56.6                                    | 786.90                                |
| 171.0 - 207.4           | 26.7                     | 36.7                                    | 980.06                                |

| Depth Interval,<br>Feet | Feet of Core<br>Analyzed | Average<br>Percent<br>Porosity | Average<br>Percent Oil<br>Saturation | Average<br>Percent Water<br>Saturation | Average<br>Oil Content<br>Bbl./A. Ft. | Total Oil<br>Content<br>Bbls./Acre |
|-------------------------|--------------------------|--------------------------------|--------------------------------------|----------------------------------------|---------------------------------------|------------------------------------|
| 171.0 - 187.7           | 15.8                     | 16.1                           | 33.6                                 | 52.9                                   | 431                                   | 6,812                              |
| 188.0 - 207.4           | 13.9                     | 20.7                           | 48.3                                 | 30.4                                   | 777                                   | 10,806                             |
| 171.0 - 207.4           | 29.7                     | 18.3                           | 40.3                                 | 42.4                                   | 593                                   | 17,618                             |

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## SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

|                                                   |                           |               |               |   |          |         |
|---------------------------------------------------|---------------------------|---------------|---------------|---|----------|---------|
| Company                                           | Hickory Creek Oil Company |               | Lease         | - | Well No. | HCO-124 |
| Depth Interval, Feet                              | 171.0 - 187.7             | 188.0 - 207.4 | 171.0 - 207.4 |   |          |         |
| Feet of Core Analyzed                             | 4.5                       | 11.3          | 15.8          |   |          |         |
| Average Percent Porosity                          | 18.0                      | 20.9          | 20.1          |   |          |         |
| Average Percent Original Oil Saturation           | 40.3                      | 50.2          | 47.4          |   |          |         |
| Average Percent Oil Recovery                      | 5.4                       | 6.5           | 6.2           |   |          |         |
| Average Percent Residual Oil Saturation           | 34.9                      | 43.7          | 41.2          |   |          |         |
| Average Percent Residual Water Saturation         | 58.4                      | 52.2          | 53.9          |   |          |         |
| Average Percent Total Residual Fluid Saturation   | 93.3                      | 95.9          | 95.1          |   |          |         |
| Average Original Oil Content, Bbls./A. Ft.        | 562.                      | 811.          | 741.          |   |          |         |
| Average Oil Recovery, Bbls./A. Ft.                | 75.                       | 104.          | 96.           |   |          |         |
| Average Residual Oil Content, Bbls./A. Ft.        | 487.                      | 707.          | 645.          |   |          |         |
| Total Original Oil Content, Bbls./Acre            | 2,530.                    | 9,169.        | 11,699.       |   |          |         |
| Total Oil Recovery, Bbls./Acre                    | 338.                      | 1,179.        | 1,517.        |   |          |         |
| Total Residual Oil Content, Bbls./Acre            | 2,192.                    | 7,990.        | 10,182.       |   |          |         |
| Average Effective Permeability, Millidarcys       | 0.71                      | 1.95          | 1.60          |   |          |         |
| Average Initial Fluid Production Pressure, p.s.i. | 33.3                      | 26.9          | 28.6          |   |          |         |

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

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## RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Hickory Creek Oil Company Lease - D 46 Well No. HCO-124

| Sample No. | Depth, Feet | Effective Porosity Percent | Original Oil Saturation |              | Oil Recovery |              | 778 Residual Saturation |         |              | Volume of Water Recovered cc* | 17.60 Effective Permeability Millidarcys** | Initial Fluid Production Pressure Lbs./Sq./In. |
|------------|-------------|----------------------------|-------------------------|--------------|--------------|--------------|-------------------------|---------|--------------|-------------------------------|--------------------------------------------|------------------------------------------------|
|            |             |                            | %                       | Bbls./A. Ft. | %            | Bbls./A. Ft. | % Oil                   | % Water | Bbls./A. Ft. |                               |                                            |                                                |
| 1          | 171.5       | 18.6                       | 29                      | 418          | 0            | 0            | 29                      | 61      | 418          | 0                             | Imp.                                       | -                                              |
| 2          | 172.3       | 14.1                       | 26                      | 284          | 0            | 0            | 26                      | 65      | 284          | 0                             | Imp.                                       | -                                              |
| 3          | 173.5       | 13.0                       | 19                      | 192          | 0            | 0            | 19                      | 80      | 192          | 0                             | Imp.                                       | -                                              |
| 5          | 175.5       | 18.2                       | 36                      | 508          | 5            | 71 1.7       | 31                      | 59      | 437          | 10                            | 0.30                                       | 30                                             |
| 7          | 177.5       | 18.0                       | 46                      | 642          | 7            | 98 1.8       | 39                      | 58      | 544          | 55                            | 1.10                                       | 30                                             |
| 9          | 179.5       | 15.7                       | 27                      | 329          | 0            | 0            | 27                      | 60      | 329          | 0                             | Imp.                                       | -                                              |
| 10         | 181.5       | 14.3                       | 11                      | 122          | 0            | 0            | 11                      | 78      | 122          | 0                             | Imp.                                       | -                                              |
| 12         | 183.5       | 19.1                       | 51                      | 756          | 0            | 0            | 51                      | 39      | 756          | 0                             | Imp.                                       | -                                              |
| 13         | 184.5       | 17.8                       | 37                      | 511          | 3            | 41 1.0       | 34                      | 58      | 470          | 38                            | 0.70                                       | 40                                             |
| 14         | 185.5       | 14.6                       | 37                      | 419          | 0            | 0            | 37                      | 55      | 419          | 0                             | Imp.                                       | -                                              |
| 16         | 186.9       | 17.7                       | 38                      | 522          | 0            | 0            | 38                      | 50      | 522          | 0                             | Imp.                                       | -                                              |
| 17         | 188.5       | 17.6                       | 49                      | 669          | 0            | 0            | 49                      | 42      | 669          | 0                             | Imp.                                       | -                                              |
| 19         | 190.5       | 20.3                       | 56                      | 882          | 9            | 142 2.4      | 47                      | 51      | 740          | 76                            | 1.00                                       | 35                                             |
| 20         | 191.5       | 20.2                       | 57                      | 893          | 9            | 141 1.0      | 48                      | 47      | 752          | 32                            | 0.50                                       | 40                                             |
| 21         | 192.5       | 21.0                       | 60                      | 978          | 15           | 244 1.0      | 45                      | 53      | 734          | 111                           | 2.50                                       | 25                                             |
| 22         | 193.5       | 20.7                       | 53                      | 851          | 9            | 145 1.0      | 44                      | 50      | 706          | 80                            | 1.00                                       | 25                                             |
| 23         | 194.5       | 21.4                       | 49                      | 814          | 6            | 100 1.7      | 43                      | 48      | 714          | 306                           | 3.20                                       | 25                                             |
| 25         | 196.5       | 19.5                       | 38                      | 575          | 0            | 0 1.6        | 38                      | 50      | 575          | 0                             | Imp.                                       | -                                              |
| 27         | 202.5       | 19.1                       | 43                      | 637          | 2            | 30 1.0       | 41                      | 54      | 607          | 170                           | 2.10                                       | 20                                             |
| 28         | 204.5       | 22.0                       | 40                      | 683          | 2            | 34           | 38                      | 55      | 649          | 179                           | 2.30                                       | 25                                             |
| 29         | 206.5       | 22.5                       | 45                      | 785          | 2            | 35           | 43                      | 52      | 750          | 254                           | 2.90                                       | 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.