

OILFIELD RESEARCH LABORATORIES

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

October 13, 1981

Pathfinder Petroleum Corporation
10603 North Penn
Suite 300
Oklahoma City, Oklahoma 73120

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Smith Lease, Well No. L-12, located in Neosho County, Kansas and submitted to our laboratory on September 23, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES


Sanford A. Michel

SAM/kas

5 c to Oklahoma City, Oklahoma

- REGISTERED ENGINEERS -

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

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GENERAL INFORMATION & SUMMARY

Company Pathfinder Petroleum Corporation Lease Smith Well No. L-12

Location _____

Section 36 Twp. 34S Rge. 19E County Neosho State Kansas

Elevation, Feet

Name of Sand

Upper Bartlesville

Top of Core

642.0

Bottom of Core

653.2

Top of Sand

642.0

Bottom of Sand

651.2

Total Feet of Permeable Sand

9.2

Total Feet of Floodable Sand

2.0

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 5

4.3

4.3

5 - 10

2.2

6.5

10 - 20

1.0

7.5

20 - 30

1.7

9.2

Average Permeability Millidarcys

8.6

Average Percent Porosity

16.0

Average Percent Oil Saturation

29.9

Average Percent Water Saturation

44.1

Average Oil Content, Bbls./A. Ft.

388.

Total Oil Content, Bbls./Acre

3,569.

Average Percent Oil Recovery by Laboratory Flooding Tests

5.0

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

63.

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

125.

Total Calculated Oil Recovery, Bbls./Acre

See "Calculated Recovery"
Section

The core was sampled and the samples sealed in plastic bags by a representative of the client. Fresh water mud was used as a drilling fluid.

FORMATION CORED

The detailed log of the formation cored is as follows:

| <u>Depth Interval, Feet</u> | <u>Description</u> |
|---------------------------------|--|
| 642.0 - 644.7 | Light brown sandstone. |
| 644.7 - 647.3 | Grayish light brown shaly sandstone with shale partings. |
| 647.3 - 649.0 | Gray and light brown laminated sandstone and shale. |
| 649.0 - 651.2 | Grayish black slightly carbonaceous shaly sandstone. |
| 651.2 - 653.2 | Gray shale. |

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 125 barrels of oil per acre was obtained from 2.0 feet of sand. The weighted average percent oil saturation was reduced from 38.0 to 33.0, or represents an average recovery of 5.0 percent. The weighted average effective permeability of the samples is 0.19 millidarcys, while the average initial fluid production pressure is 47.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 9 samples tested, 2 produced water and oil, and 2 samples produced water only. This indicates that approximately 22 percent of the sand represented by these samples is floodable pay sand.

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 510 barrels of oil per acre. This is an average recovery of 253 barrels per acre foot from 2.0 feet of floodable sand analyzed in this core.

These recovery values were calculated using the following data and assumptions:

| | |
|--|------|
| Original formation volume factor, estimated | 1.04 |
| Reservoir water saturation, percent, estimated | 25.0 |
| Average porosity, percent | 16.7 |
| Oil saturation after flooding, percent | 33.0 |
| Performance factor, percent, estimated | 50.0 |
| Net floodable sand, feet | 2.0 |

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Pathfinder Petroleum Corporation Lease Smith Well No. L-12

| Sample No. | Depth, Feet | Effective Porosity Percent | Percent Saturation | | | Oil Content Bbbs. / A Ft. | Perm., Mill. | Feet of Sand | | Total Oil Content | Perm. Capacity Ft. X md. |
|------------|-------------|----------------------------|--------------------|-------|-------|---------------------------|--------------|--------------|----------|-------------------|--------------------------|
| | | | Oil | Water | Total | | | Ft. | Cum. Ft. | | |
| 1 | 642.6 | 18.0 | 35 | 28 | 63 | 489 | 13. | 1.0 | 1.0 | 489 | 13.00 |
| 2 | 643.6 | 17.9 | 28 | 34 | 62 | 389 | 28. | 1.0 | 2.0 | 389 | 28.00 |
| 3 | 644.5 | 18.6 | 26 | 38 | 64 | 375 | 23. | 0.7 | 2.7 | 263 | 16.10 |
| 4 | 645.5 | 12.3 | 5 | 60 | 65 | 48 | 1.4 | 1.6 | 4.3 | 77 | 2.26 |
| 5 | 646.5 | 15.1 | 41 | 43 | 84 | 480 | 7.7 | 1.0 | 5.3 | 480 | 7.70 |
| 6 | 647.6 | 15.0 | 22 | 54 | 76 | 256 | 0.92 | 0.7 | 6.0 | 192 | 0.64 |
| 7 | 648.5 | 14.8 | 43 | 35 | 78 | 494 | 1.3 | 1.0 | 7.0 | 494 | 1.30 |
| 8 | 649.4 | 16.5 | 26 | 69 | 95 | 333 | 0.68 | 1.0 | 8.0 | 333 | 0.68 |
| 9 | 650.4 | 18.3 | 50 | 30 | 80 | 710 | 8.0 | 1.2 | 9.2 | 852 | 9.60 |

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

| Company | Lease | Smith | Well No. | L-12 |
|----------------------------------|--------------------------|---|---------------------------------------|------------------------------------|
| Pathfinder Petroleum Corporation | | Smith | | L-12 |
| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. | |
| 642.0 - 651.2 | 9.2 | 8.6 | 79.28 | |
| Depth Interval, Feet | Feet of Core Analyzed | Average Percent Saturation | Average Oil Content Bbl./A. Ft. | Total Oil Content Bbls./Acre |
| 642.0 - 651.2 | 9.2 | 29.9 | 44.1 | 3,569 |
| | 16.0 | 29.9 | 44.1 | 388 |

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

| 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 | 642.6 | 18.1 | 35 | 491 | 3 | 42 | 32 | 35 | 449 | 10 | 0.15 | 50 |
| 2 | 643.6 | 17.9 | 28 | 389 | 0 | 0 | 28 | 44 | 389 | 47 | 0.75 | 30 |
| 3 | 644.5 | 18.7 | 26 | 377 | 0 | 0 | 26 | 47 | 377 | 84 | 1.05 | 30 |
| 4 | 645.5 | 12.2 | 4 | 47 | 0 | 0 | 5 | 66 | 47 | 0 | Imp. | - |
| 5 | 646.5 | 15.2 | 41 | 483 | 7 | 83 | 34 | 56 | 400 | 18 | 0.22 | 45 |
| 6 | 647.6 | 15.3 | 21 | 249 | 0 | 0 | 21 | 56 | 249 | 0 | Imp. | - |
| 7 | 648.5 | 14.6 | 44 | 498 | 0 | 0 | 44 | 35 | 498 | 0 | Imp. | - |
| 8 | 649.4 | 16.7 | 25 | 324 | 0 | 0 | 25 | 71 | 324 | 0 | Imp. | - |
| 9 | 650.4 | 17.9 | 51 | 708 | 0 | 0 | 51 | 31 | 708 | 0 | Imp. | - |

Company Pathfinder Petroleum Corporation
Lease Smith
Well No. L-12

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 Pathfinder Petroleum Corporation Lease Smith Well No. L-12

Depth Interval, Feet 642.0 - 647.3

Feet of Core Analyzed 2.0

Average Percent Porosity 16.7

Average Percent Original Oil Saturation 38.0

Average Percent Oil Recovery 5.0

Average Percent Residual Oil Saturation 33.0

Average Percent Residual Water Saturation 45.5

Average Percent Total Residual Fluid Saturation 78.5

Average Original Oil Content, Bbls./A. Ft. 488.

Average Oil Recovery, Bbls./A. Ft. 63.

Average Residual Oil Content, Bbls./A. Ft. 425.

Total Original Oil Content, Bbls./Acre 974.

Total Oil Recovery, Bbls./Acre 125.

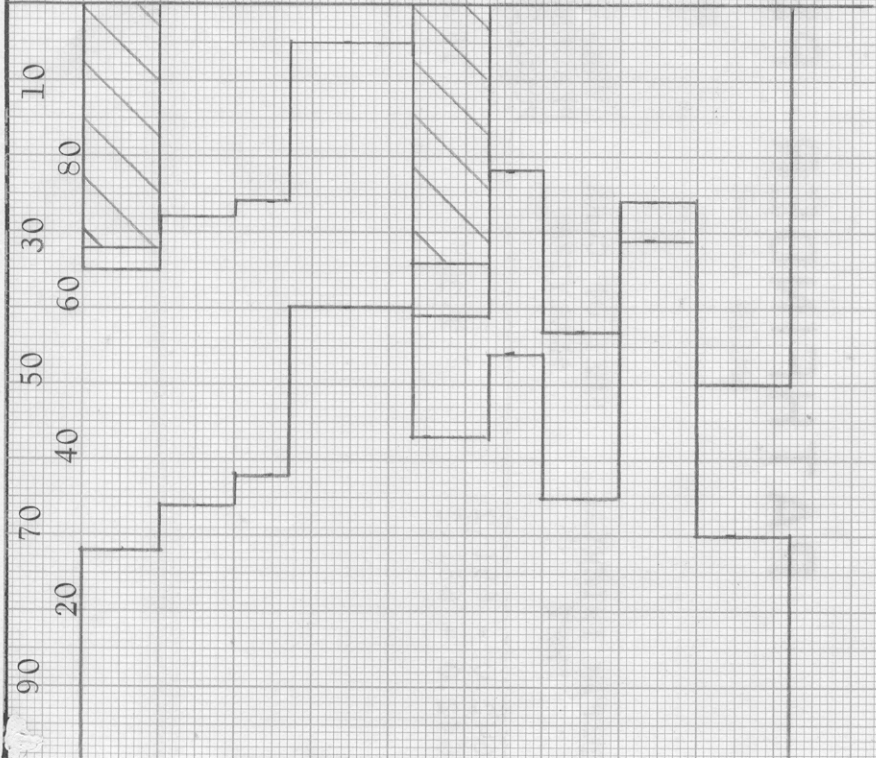
Total Residual Oil Content, Bbls./Acre 849.

Average Effective Permeability, Millidarcys 0.19

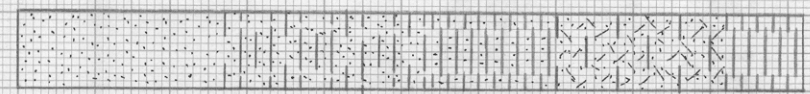
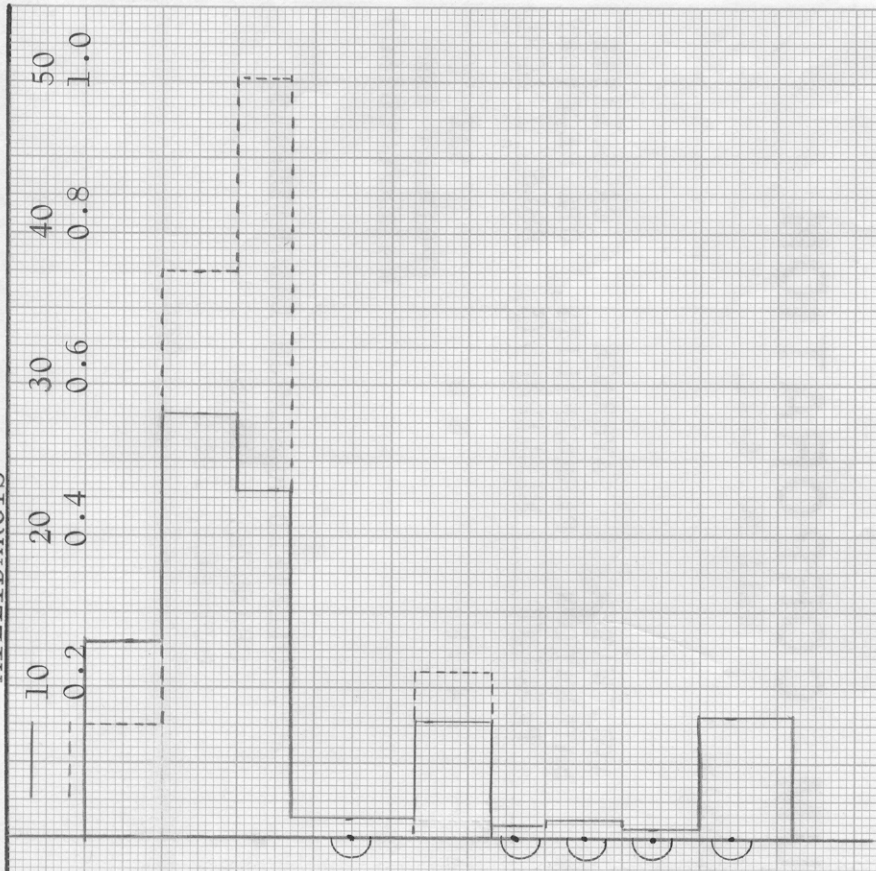
Average Initial Fluid Production Pressure, p.s.i. 47.5

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

WATER SAT., PERCENT → ← OIL SAT., PERCENT



PERMEABILITY, IN MILLIDARCYS
EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS



KEY:
 SHALY SANDSTONE WITH SHALE PARTINGS
 LAMINATED SANDSTONE AND SHALE

KEY:
 SANDSTONE

SHALE FLOODPOT RESIDUAL OIL SATURATION

SHALY CARBONACEOUS SANDSTONE

IMPERMEABLE TO WATER

PATHFINDER PETROLEUM CORPORATION

SMITH LEASE

WELL NO. L-12

NEOSHO COUNTY, KANSAS

| DEPTH INTERVAL, FEET | FEET OF CORE ANALYZED | AVERAGE | | AVG. OIL | | AVG. WATER | | AVERAGE | |
|-------------------------|--------------------------|---------------------|-----------------------|-----------------------|-----------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| | | PERCENT POROSITY | PERCENT SATURATION | SATURATION PERCENT | SATURATION PERCENT | PERMEABILITY, MILLIDARCYS | PERMEABILITY, MILLIDARCYS | OIL RECOVERY BBLs. / ACRE | OIL RECOVERY BBLs. / ACRE |
| 642.0 - 651.2 | 9.2 | 16.0 | 29.9 | 44.1 | 8.6 | 510 | | | |

(PRIMARY AND WATERFLOODING)

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
OCTOBER, 1981

PDC