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

July 5, 1979

James E. Russell Petroleum, Inc.
P.O. Box 2618
Abilene, Texas 79604

Gentlemen:

Enclosed herewith is the report of the analysis of the rotary core taken from the Alexander Lease, Well No. O-17, Woodson County, Kansas, and submitted to our laboratory on June 20, 1979.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

SAM:km
3 c to Abilene, Texas
2 c to Chanute, Kansas

# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company James E. Russell Petroleum, Inc. Lease Alexander Well No. 0-17

Location 990' EWL & 2,310' SNL SW¼

Section 2 Twp. 24S Rge. 16E County Woodson State Kansas

| | |
|---|---|
| Name of Sand | Squirrel |
| Top of Core | 1022.0 |
| Bottom of Core | 1041.0 |
| Top of Sand | 1030.1 |
| Bottom of Sand | 1039.6 |
| Total Feet of Permeable Sand | 8.4 |
| Total Feet of Floodable Sand | 6.9 |

| Distribution of Permeable Sand: Permeability Range Millidarcys | Feet | Cum. Ft. |
|---|---|---|
| 0 - 20 | 2.8 | 2.8 |
| 20 - 40 | 0.9 | 3.7 |
| 40 - 80 | 3.7 | 7.4 |
| 80 & Above | 1.0 | 8.4 |

| | |
|---|---|
| Average Permeability Millidarcys | 46.2 |
| Average Percent Porosity | 19.5 |
| Average Percent Oil Saturation | 55.5 |
| Average Percent Water Saturation | 18.1 |
| Average Oil Content, Bbls./A. Ft. | 852. |
| Total Oil Content, Bbls./Acre | 7,157. |
| Average Percent Oil Recovery by Laboratory Flooding Tests | 15.2 |
| Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. | 241. |
| Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre | 1,661. |
| Total Calculated Oil Recovery, Bbls./Acre (Primary & Waterflooding) | 2,200. |
| Packer Setting, Feet | |
| Viscosity, Centipoises @ | |
| A. P. I. Gravity, degrees @ 60 °F | |
| Elevation, Feet | |

The core was sampled by a representative of Oilfield Research Laboratories. The drilling fluid consisted of fresh water mud. The core was from a non-virgin area.

## FORMATION CORED

The detailed log of the formation cored is as follows:

| Depth Interval, Feet | Description |
|---|---|
| 1022.0 - 1030.1 | Gray sandy shale. First oil stain at 1030.0. |
| 1030.1 - 1030.6 | Dark brown slightly shaly sandstone. |
| 1030.6 - 1033.7 | Dark brown sandstone. |
| 1033.7 - 1034.1 | Brown and gray laminated sandstone and shale. |
| 1034.1 - 1036.6 | Dark brown sandstone. |
| 1036.6 - 1037.3 | Gray sandy shale. |
| 1037.3 - 1038.8 | Brown and gray laminated sandstone and shale. |
| 1038.8 - 1039.6 | Dark brown slightly shaly sandstone. |
| 1039.6 - 1041.0 | Gray sandy shale. |

## LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,661 barrels of oil per acre was obtained from 6.9 feet of sand. The weighted average percent oil saturation was reduced from 56.7 to 41.5, or represents an average recovery of 15.2 percent. The weighted average effective permeability of the samples is 1.77 millidarcys, while the average initial fluid production pressure is 24.4 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 10 samples tested, 8 produced water and 8 oil. This indicates that approximately 80 percent of the sand represented by these samples is floodable pay sand.

## CALCULATED RECOVERY

It would appear from a study of the data, that efficient primary and waterflood operations in the vicinity of this well should recover approximately 2,200 barrels of oil per acre. This is an average recovery of 319 barrels per acre foot from 6.9 feet of floodable sand analyzed in this core.

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

| | |
|---|---|
| Original formation volume factor | 1.07 |
| Reservoir water saturation, percent | 12.0 |
| Average porosity, percent | 20.2 |
| Oil saturation after flooding, percent | 41.5 |
| Performance factor, percent | 50.0 |
| Net floodable pay sand, feet | 6.9 |

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**RESULTS OF SATURATION & PERMEABILITY TESTS**

**TABLE 1-B**

**Company** James E. Russell Petroleum, Inc. **Lease** Alexander **Well No.** O-17

| 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 | 1030.5 | 17.6 | 52 | 19 | 71 | 710 | 19. | 0.5 | 0.5 | 355 | 9.50 |
| 2 | 1031.5 | 20.6 | 62 | 9 | 71 | 991 | 42. | 1.4 | 1.9 | 1387 | 58.80 |
| 3 | 1032.5 | 18.6 | 58 | 16 | 74 | 837 | 54. | 1.0 | 2.9 | 837 | 54.00 |
| 4 | 1033.5 | 21.9 | 58 | 15 | 73 | 985 | 60. | 0.7 | 3.6 | 690 | 42.00 |
| 5 | 1034.5 | 20.7 | 61 | 18 | 79 | 980 | 27. | 0.9 | 4.5 | 882 | 24.30 |
| 6 | 1035.5 | 20.9 | 54 | 18 | 72 | 876 | 141. | 1.0 | 5.5 | 876 | 141.00 |
| 7 | 1036.5 | 23.4 | 55 | 10 | 65 | 999 | 47. | 0.6 | 6.1 | 599 | 28.20 |
| 8 | 1037.5 | 13.3 | 33 | 54 | 87 | 341 | 19. | 0.7 | 6.8 | 239 | 13.30 |
| 9 | 1038.5 | 18.8 | 65 | 10 | 75 | 948 | 8.5 | 0.8 | 7.6 | 758 | 6.80 |
| 10 | 1039.5 | 18.3 | 47 | 22 | 69 | 667 | 13. | 0.8 | 8.4 | 534 | 10.40 |

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### SUMMARY OF PERMEABILITY & SATURATION TESTS

### TABLE III

Company James E. Russell Petroleum, Inc. Lease Alexander Well No. O-17

| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. |
|---|---|---|---|
| 1030.1 - 1039.6 | 8.4 | 46.2 | 388.30 |

| 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 |
|---|---|---|---|---|---|---|
| 1030.1 - 1039.6 | 8.4 | 19.5 | 55.5 | 18.1 | 852 | 7,157 |

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## RESULTS OF LABORATORY FLOODING TESTS

### TABLE IV

Company James E. Russell Petroleum, Inc. Lease Alexander Well No. O-17

| 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 | 1030.5 | 17.2 | 52 | 694 | 8 | 107 | 44 | 55 | 587 | 1 | 0.07 | 20 |
| 2 | 1031.5 | 20.3 | 62 | 976 | 22 | 346 | 40 | 55 | 630 | 18 | 0.52 | 25 |
| 3 | 1032.5 | 18.8 | 58 | 846 | 18 | 263 | 40 | 52 | 583 | 37 | 0.67 | 20 |
| 4 | 1033.5 | 22.4 | 58 | 1008 | 19 | 330 | 39 | 58 | 678 | 114 | 2.92 | 20 |
| 5 | 1034.5 | 21.1 | 61 | 999 | 20 | 327 | 41 | 52 | 672 | 28 | 7.50 | 20 |
| 6 | 1035.5 | 20.7 | 54 | 867 | 12 | 193 | 42 | 56 | 674 | 48 | 1.27 | 25 |
| 7 | 1036.5 | 23.0 | 55 | 981 | 9 | 161 | 46 | 46 | 820 | 32 | 0.97 | 25 |
| 8 | 1037.5 | 13.2 | 34 | 348 | 0 | 0 | 34 | 53 | 348 | 0 | Imp. | - |
| 9 | 1038.5 | 18.6 | 65 | 938 | 0 | 0 | 65 | 22 | 938 | 0 | Imp. | - |
| 10 | 1039.5 | 18.0 | 47 | 656 | 4 | 56 | 43 | 51 | 600 | 2 | 0.15 | 40 |

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 James E. Russell Petroleum, Inc. Lease Alexander Well No. O-17

| | |
|---|---|
| Depth Interval, Feet | 1030.1 - 1039.6 |
| Feet of Core Analyzed | 6.9 |
| Average Percent Porosity | 20.2 |
| Average Percent Original Oil Saturation | 56.7 |
| Average Percent Oil Recovery | 15.2 |
| Average Percent Residual Oil Saturation | 41.5 |
| Average Percent Residual Water Saturation | 53.4 |
| Average Percent Total Residual Fluid Saturation | 94.9 |
| Average Original Oil Content, Bbls./A. Ft. | 882. |
| Average Oil Recovery, Bbls./A. Ft. | 241. |
| Average Residual Oil Content, Bbls./A. Ft. | 641. |
| Total Original Oil Content, Bbls./Acre | 6,085. |
| Total Oil Recovery, Bbls./Acre | 1,661. |
| Total Residual Oil Content, Bbls./Acre | 4,424. |
| Average Effective Permeability, Millidarcys | 1.77 |
| Average Initial Fluid Production Pressure, p.s.i. | 24.4 |

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