OILFIELD RESEARCH LABORATORIES
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Chanute, Kansas

July 20, 1965

Larry Moore Ranch
Box "A"
Mound Valley, Kansas

Attn: Mr. Ralph Helms

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the McDole Lease, Well No. 6-A, Labette County, Kansas, and submitted to our laboratory on July 14, 1965.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

BRP:rf

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# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company Larry Moore Ranch Lease McDole Well No. 6-A

Location NE

Section 27 Twp. 32S Rge. 18E County Labette State Kansas

| | Squirrel | B'ville |
|---|---|---|
| Name of Sand | | |
| Top of Core | 631.5 | 725.0 |
| Bottom of Core | 634.2 | 748.0 |
| Top of Sand (Analyzed) | 631.5 | 725.0 |
| Bottom of Sand (Analyzed) | 634.2 | 748.0 |
| Total Feet of Permeable Sand | 2.0 | 21.6 |
| Total Feet of Floodable Sand | | 7.0 |

Distribution of Permeable Sand:

| Permeability Range Millidarcys | Feet | Cum. Ft. |
|---|---|---|
| 3 - 20 | 6.6 | 6.6 |
| 20 - 50 | 5.0 | 11.6 |
| 50 - 100 | 5.0 | 16.6 |
| 100 - 300 | 2.0 | 18.6 |
| 300 & above | 3.0 | 21.6 |

| | | |
|---|---|---|
| Average Permeability Millidarcys | 7.4 | 136.6 |
| Average Percent Porosity | 27.3 | 21.4 |
| Average Percent Oil Saturation | | 20.0 |
| Average Percent Water Saturation | | 63.2 |
| Average Oil Content, Bbls./A. Ft. | | 332. |
| Total Oil Content, Bbls./Acre | | 7,649. |
| Average Percent Oil Recovery by Laboratory Flooding Tests | | 8.0 |
| Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. | | 140. |
| Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre | | 977. |
| Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary) | | 2,100. |
| Packer Setting, Feet | | |
| Viscosity, Centipoises @ | | |
| A. P. I. Gravity, degrees @ 60 °F | | |
| Elevation, Feet | | |

Fresh water mud was used as the circulating fluid while taking these cores. The cores were sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in non-virgin territory. Only the Bartlesville core will be discussed.

## FORMATION CORED

The detailed log of the formation cored is as follows:

| Depth Interval, Feet | Description |
|---|---|

-SQUIRREL SAND-

631.5 - 634.2 - Brown, laminated, shaly sandstone.

-BARTLESVILLE SAND-

725.0 - 731.6 - Brown, laminated, slightly shaly sandstone.

731.6 - 748.0 - Brown sandstone.

Coring was started in the Bartlesville at a depth of 725.0 feet in sandstone and completed at 748.0 feet also in sandstone. This core shows a total of 23.0 feet of sandstone. For the most part, the pay is made up of brown sandstone.

## PERMEABILITY

For the sake of distribution, the core was divided into three sections. The weighted average permeability of the upper, middle and lower sections is 41.8, 249.5 and 191.6 millidarcys respectively; the overall average being 136.6 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 727 millidarcys.

## PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 20.0. The weighted average percent oil saturation of the upper, middle and lower sections is 13.2, 35.6 and 13.1 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 64.8, 48.3 and 80.4 respectively; the overall average being 63.2 (See Table III). This gives an overall weighted average total fluid saturation of 83.2 percent.

The weighted average oil content of the upper, middle and lower sections is 185, 615 and 256 barrels per acre foot respectively; the overall average being 332. The total oil content, as shown by this core, is 7,649 barrels per acre of which 4,295 barrels are in the pay sand section (See Table III).

## LABORATORY FLOODING TESTS

A portion of the sand in this core responded to laboratory flooding tests, as a total recovery of 977 barrels of oil per acre was obtained from 7.0 feet of sand. The weighted average percent oil saturation was reduced from 35.6 to 27.6, or represents an average recovery of 8.0 percent. The weighted average effective permeability of the samples is 13.81 millidarcys, while the average initial fluid production pressure is 12.9 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 23 samples tested, 20 produced water and 7 oil. This indicates that approximately 30 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability to water.

## CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 2,100 barrels of oil per acre or an average of 299 barrels of oil per acre foot from the 7.0 feet of floodable pay sand analyzed in this core. Any primary oil that has already been recovered from the area in the vicinity of this well should be subtracted from the foregoing values. These recovery values were calculated using the following data and assumptions:

| | |
|---|---|
| Original formation volume factor | 1.05 |
| Present formation volume factor | 1.02 |
| Reservoir water saturation, percent | 35.0 |
| Average porosity, percent | 22.2 |
| Oil saturation after flooding, percent | 27.6 |
| Performance factor, percent | 50.0 |
| Net floodable pay sand, feet | 7.0 |

This core shows a pay sand section overlain with a gas sand and underlain with a possible water zone.

## Oilfield Research Laboratories

### RESULTS OF SATURATION & PERMEABILITY TESTS

### TABLE 1-B

Company Larry Moore Ranch Lease McDole Well No. 6-A

| 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. | | |
| | | | | | | -SQUIRREL SAND- | | | | | |
| 0-1 | 632.0 | 25.8 | | | | | 6.1 | | | | |
| 0-2 | 634.0 | 28.8 | | | | | 8.7 | | | | |
| | | | | | | -BARTLESVILLE SAND- | | | | | |
| 1 | 725.1 | 16.5 | 15 | 64 | 79 | 192 | 9.4 | 0.6 | 0.6 | 115 | 5.64 |
| 2 | 726.1 | 17.2 | 19 | 57 | 76 | 254 | 11. | 1.0 | 1.6 | 254 | 11.00 |
| 3 | 727.1 | 19.1 | 11 | 67 | 78 | 163 | 33. | 1.0 | 2.6 | 163 | 33.00 |
| 4 | 728.1 | 18.9 | 12 | 62 | 74 | 176 | 44. | 1.0 | 3.6 | 176 | 44.00 |
| 5 | 729.1 | 16.7 | 12 | 62 | 74 | 156 | 3.5 | 1.0 | 4.6 | 156 | 3.50 |
| 6 | 730.1 | 13.4 | 2 | 87 | 89 | 21 | 12. | 1.0 | 5.6 | 21 | 12.00 |
| 7 | 731.1 | 19.6 | 16 | 59 | 75 | 243 | 39. | 1.0 | 6.6 | 243 | 39.00 |
| 8 | 732.1 | 15.1 | 20 | 66 | 86 | 234 | 68. | 1.0 | 7.6 | 234 | 68.00 |
| 9 | 733.1 | 20.5 | 15 | 61 | 76 | 238 | 67. | 1.0 | 8.6 | 238 | 67.00 |
| 10 | 734.1 | 19.0 | 16 | 59 | 75 | 236 | 84. | 1.0 | 9.6 | 236 | 84.00 |
| 11 | 735.1 | 20.6 | 8 | 68 | 76 | 128 | 77. | 1.0 | 10.6 | 128 | 77.00 |
| 12 | 736.1 | 20.4 | 26 | 51 | 77 | 411 | 26. | 1.0 | 11.6 | 411 | 26.00 |
| 13 | 737.1 | 19.5 | 36 | 43 | 79 | 544 | 62. | 1.0 | 12.6 | 544 | 62.00 |
| 14 | 738.1 | 22.8 | 33 | 38 | 71 | 584 | 133. | 1.0 | 13.6 | 584 | 133.00 |
| 15 | 739.1 | 23.1 | 35 | 51 | 86 | 626 | 259. | 1.0 | 14.6 | 626 | 259.00 |
| 16 | 740.1 | 23.6 | 39 | 49 | 88 | 714 | 24. | 1.0 | 15.6 | 714 | 24.00 |
| 17 | 741.1 | 22.3 | 42 | 51 | 93 | 726 | 561. | 1.0 | 16.6 | 726 | 561.00 |
| 18 | 742.1 | 23.6 | 38 | 51 | 89 | 696 | 679. | 1.0 | 17.6 | 696 | 679.00 |
| 19 | 743.1 | 24.8 | 20 | 61 | 81 | 385 | 727. | 1.0 | 18.6 | 385 | 727.00 |
| 20 | 744.1 | 24.2 | 21 | 70 | 91 | 454 | 18. | 1.0 | 19.6 | 454 | 18.00 |
| 21 | 745.1 | 27.4 | 14 | 84 | 98 | 297 | 12. | 1.0 | 20.6 | 297 | 12.00 |
| 22 | 746.1 | 22.0 | 6 | 92 | 98 | 102 | 8.5 | 1.0 | 21.6 | 102 | 8.50 |
| 23 | 747.1 | 19.1 | 7 | 91 | 98 | 104 | Imp. | 1.4 | 23.0 | 146 | 0.00 |

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**SUMMARY OF PERMEABILITY & SATURATION TESTS**

**TABLE III**

Company Larry Moore Ranch Lease McDole Well No. 6-A

-BARTLESVILLE SAND-

| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. |
|---|---|---|---|
| 725.0 - 735.6 | 10.6 | 41.8 | 444.14 |
| 735.6 - 742.6 | 7.0 | 249.5 | 1,744.00 |
| 742.6 - 748.0 | 4.0 | 191.6 | 765.50 |
| 725.0 - 748.0 | 21.6 | 136.6 | 2,953.64 |

| 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 |
|---|---|---|---|---|---|---|
| 725.0 - 735.6 | 10.6 | 17.9 | 13.2 | 64.8 | 185 | 1,964 |
| 735.6 - 742.6 | 7.0 | 22.2 | 35.6 | 48.3 | 615 | 4,301 |
| 742.6 - 748.0 | 5.4 | 23.2 | 13.1 | 80.4 | 256 | 1,384 |
| 725.0 - 748.0 | 23.0 | 21.4 | 20.0 | 63.2 | 332 | 7,649 |

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### RESULTS OF LABORATORY FLOODING TESTS

### TABLE IV

Company Larry Moore Ranch Lease McDole Well No. 6-A

| 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 | 725.1 | 16.7 | 15 | 195 | 0 | 0 | 15 | 74 | 195 | 18 | 0.444 | 25 |
| 2 | 726.1 | 17.4 | 19 | 256 | 0 | 0 | 19 | 59 | 256 | 0 | Imp. | - |
| 3 | 727.1 | 19.0 | 12 | 177 | 0 | 0 | 12 | 78 | 177 | 50 | 1.20 | 20 |
| 4 | 728.1 | 19.4 | 15 | 226 | 0 | 0 | 15 | 81 | 226 | 235 | 6.60 | 10 |
| 5 | 729.1 | 16.4 | 12 | 152 | 0 | 0 | 12 | 64 | 152 | 0 | Imp. | - |
| 6 | 730.1 | 13.6 | 5 | 527 | 0 | 0 | 5 | 89 | 527 | 9 | 0.300 | 35 |
| 7 | 731.1 | 19.2 | 17 | 253 | 0 | 0 | 17 | 80 | 253 | 55 | 1.50 | 20 |
| 8 | 732.1 | 15.4 | 20 | 239 | 0 | 0 | 20 | 70 | 239 | 134 | 2.20 | 10 |
| 9 | 733.1 | 20.1 | 16 | 250 | 0 | 0 | 16 | 78 | 250 | 40 | 0.888 | 20 |
| 10 | 734.1 | 19.5 | 18 | 272 | 0 | 0 | 18 | 80 | 272 | 365 | 18.00 | 10 |
| 11 | 735.1 | 21.0 | 9 | 147 | 0 | 0 | 9 | 90 | 147 | 415 | 40.30 | 10 |
| 12 | 736.1 | 20.2 | 26 | 407 | 4 | 63 | 22 | 76 | 344 | 231 | 6.00 | 20 |
| 13 | 737.1 | 20.0 | 36 | 558 | 6 | 93 | 30 | 59 | 465 | 190 | 3.40 | 10 |
| 14 | 738.1 | 22.4 | 33 | 573 | 6 | 104 | 27 | 68 | 469 | 46 | 1.90 | 20 |
| 15 | 739.1 | 22.7 | 35 | 616 | 7 | 123 | 28 | 70 | 493 | 305 | 15.00 | 10 |
| 16 | 740.1 | 23.1 | 39 | 699 | 7 | 125 | 32 | 67 | 574 | 216 | 23.00 | 10 |
| 17 | 741.1 | 22.6 | 42 | 736 | 14 | 246 | 28 | 71 | 490 | 400 | 9.76 | 10 |
| 18 | 742.1 | 24.0 | 38 | 706 | 12 | 223 | 26 | 72 | 483 | 296 | 37.60 | 10 |
| 19 | 743.1 | 24.9 | 21 | 405 | 0 | 0 | 21 | 72 | 405 | 268 | 24.40 | 10 |
| 20 | 744.1 | 24.2 | 21 | 394 | 0 | 0 | 21 | 76 | 394 | 20 | 0.600 | 30 |
| 21 | 745.1 | 27.8 | 13 | 280 | 0 | 0 | 13 | 86 | 280 | 14 | 0.400 | 30 |
| 22 | 746.1 | 22.3 | 6 | 108 | 0 | 0 | 6 | 93 | 108 | 42 | 0.888 | 20 |
| 23 | 747.1 | 18.9 | 8 | 117 | 0 | 0 | 8 | 91 | 117 | 0 | Imp. | - |

**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 Larry Moore Ranch Lease McDole Well No. 6-A

| | |
|---|---|
| Depth Interval, Feet | 735.6 - 742.6 |
| Feet of Core Analyzed | 7.0 |
| Average Percent Porosity | 22.2 |
| Average Percent Original Oil Saturation | 35.6 |
| Average Percent Oil Recovery | 8.0 |
| Average Percent Residual Oil Saturation | 27.6 |
| Average Percent Residual Water Saturation | 68.9 |
| Average Percent Total Residual Fluid Saturation | 96.5 |
| Average Original Oil Content, Bbls./A. Ft. | 614. |
| Average Oil Recovery, Bbls./A. Ft. | 140. |
| Average Residual Oil Content, Bbls./A. Ft. | 474. |
| Total Original Oil Content, Bbls./Acre | 4,295. |
| Total Oil Recovery, Bbls./Acre | 977. |
| Total Residual Oil Content, Bbls./Acre | 3,318. |
| Average Effective Permeability, Millidarcys | 13.81 |
| Average Initial Fluid Production Pressure, p.s.i. | 12.9 |

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