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

December 17, 1981

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 Burke Lease, Well No. W-4, located in Anderson County, Kansas and submitted to our laboratory on December 10, 1981.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Sanford A. Michel

SAM/mkf

3 c to Abilene, Tx.
2 c to Chanute, Ks.

# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company James E. Russell Petroleum, Inc. Lease Burke Well No. W-4

Location 580' EWL & 660' SNL NW¼

Section 26 Twp. 22S Rge. 19E County Anderson State Kansas

| | |
|---|---|
| Elevation, Feet Datum: Mean Sea Level (G. L.) | 1092.7 |
| Name of Sand | SQUIRREL |
| Top of Core | 775.0 |
| Bottom of Core | 795.0 |
| Top of Sand | 776.0 |
| Bottom of Sand | 787.8 |
| Total Feet of Permeable Sand | 6.6 |
| Total Feet of Floodable Sand | 2.6 |

| Distribution of Permeable Sand: Permeability Range Millidarcys | Feet | Cum. Ft. |
|---|---|---|
| 0 - 1 | 3.0 | 3.0 |
| 1 - 2 | 1.6 | 4.6 |
| 2 - 3 | 2.0 | 6.6 |

| | |
|---|---|
| Average Permeability Millidarcys | 1.4 |
| Average Percent Porosity | 13.4 |
| Average Percent Oil Saturation | 37.9 |
| Average Percent Water Saturation | 52.2 |
| Average Oil Content, Bbls./A. Ft. | 401. |
| Total Oil Content, Bbls./Acre | 4,530. |
| Average Percent Oil Recovery by Laboratory Flooding Tests | 9.0 |
| Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. | 100. |
| Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre | 259. |
| Total Calculated Oil Recovery, Bbls./Acre | See "Calculated Recovery" Section |

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

## FORMATION CORED

The detailed log of the formation cored is as follows:

| Depth Interval, Feet | Description |
|---|---|
| 775.0 - 776.0 | Shale, gray. |
| 776.0 - 781.0 | Sandstone, shaly, grayish brown. |
| 781.0 - 781.5 | Shale, gray. |
| 781.5 - 783.8 | Sandstone, shaly, grayish brown. |
| 783.8 - 785.0 | Sandstone and shale, laminated , gray and brown. |
| 785.0 - 787.8 | Sandstone, shaly, grayish brown. |
| 787.8 - 795.0 | Shale, gray. |

## LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 25.9 barrels of oil per acre was obtained from 2.6 feet of sand. The weighted average percent oil saturation was reduced from 49.8 to 40.8, or represents an average recovery of 9.0 percent. The weighted average effective permeability of the samples is 0.13 millidarcys, while the average initial fluid production pressure is 41.7 pounds per square inch (See Table V).

## 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 400 barrels of oil per acre. This is an average recovery of 153 barrels per acre foot from 2.6 feet of floodable sand analyzed in this core.

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

| | |
|---|---|
| Original formation volume factor, estimated | 1.05 |
| Reservoir water saturation, percent, estimated | 25.0 |
| Average porosity, percent | 14.3 |
| Oil saturation after flooding, percent | 40.8 |
| Performance factor, percent, estimated | 45.0 |
| Net floodable sand, feet | 2.6 |

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**RESULTS OF SATURATION & PERMEABILITY TESTS**

**TABLE 1-B**

Company James E. Russell Petroleum, Inc. Lease Burke Well No. W-4

| 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 | 776.3 | 12.3 | 39 | 57 | 96 | 372 | Imp. | 1.0 | 1.0 | 372 | 0.00 |
| 2 | 777.3 | 14.3 | 62 | 29 | 91 | 688 | 1.1 | 1.0 | 2.0 | 688 | 1.10 |
| 3 | 778.8 | 14.1 | 40 | 49 | 89 | 438 | 2.6 | 1.0 | 3.0 | 438 | 2.60 |
| 4 | 779.5 | 11.2 | 43 | 51 | 94 | 374 | Imp. | 1.0 | 4.0 | 374 | 0.00 |
| 5 | 780.7 | 17.9 | 35 | 33 | 68 | 486 | 2.6 | 1.0 | 5.0 | 486 | 2.60 |
| 6 | 781.6 | 14.4 | 46 | 43 | 89 | 514 | 1.5 | 0.6 | 5.6 | 308 | 0.90 |
| 7 | 782.2 | 10.4 | 16 | 80 | 96 | 129 | Imp. | 0.7 | 6.3 | 90 | 0.00 |
| 8 | 783.3 | 12.0 | 33 | 62 | 95 | 307 | Imp. | 1.0 | 7.3 | 307 | 0.00 |
| 9 | 784.5 | 15.5 | 45 | 39 | 84 | 541 | 0.95 | 1.2 | 8.5 | 649 | 1.14 |
| 10 | 785.4 | 12.3 | 47 | 46 | 93 | 448 | 0.39 | 0.8 | 9.3 | 358 | 0.31 |
| 11 | 786.5 | 13.0 | 39 | 53 | 92 | 393 | 0.49 | 1.0 | 10.3 | 393 | 0.49 |
| 12 | 787.5 | 12.4 | 7 | 90 | 97 | 67 | Imp. | 1.0 | 11.3 | 67 | 0.00 |

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

### TABLE III

Company James E. Russell Petroleum, Inc. Lease Burke Well No. W-4

| Depth Interval, Feet | Feet of Core Analyzed | Average Permeability, Millidarcys | Permeability Capacity Ft. x Md. |
|---|---|---|---|
| 776.0 - 782.1 | 3.6 | 2.0 | 7.20 |
| 782.1 - 787.8 | 3.0 | 0.65 | 1.94 |
| 776.0 - 787.8 | 6.6 | 1.4 | 9.14 |

| 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 |
|---|---|---|---|---|---|---|
| 776.0 - 782.1 | 5.6 | 14.0 | 44.0 | 43.7 | 476 | 2,666 |
| 782.1 - 787.8 | 5.7 | 12.8 | 31.9 | 60.5 | 327 | 1,864 |
| 776.0 - 787.8 | 11.3 | 13.4 | 37.9 | 52.2 | 401 | 4,530 |

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## RESULTS OF LABORATORY FLOODING TESTS

### TABLE IV

Company James E. Russell Petroleum, Inc. Lease Burke Well No. W-4

| 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 | 776.3 | 12.7 | 38 | 374 | 0 | 0 | 38 | 58 | 374 | 0 | Imp. | - |
| 2 | 777.3 | 14.3 | 62 | 688 | 12 | 133 | 50 | 43 | 555 | 10 | 0.30 | 40 |
| 3 | 778.8 | 14.2 | 40 | 441 | 9 | 99 | 31 | 62 | 342 | 0 | 0.03 | 40 |
| 4 | 779.5 | 11.4 | 42 | 371 | 0 | 0 | 42 | 52 | 371 | 0 | Imp. | - |
| 5 | 780.7 | 17.4 | 36 | 486 | 0 | 0 | 36 | 38 | 486 | 0 | Imp. | - |
| 6 | 781.6 | 14.5 | 46 | 517 | 4 | 45 | 42 | 59 | 472 | 0 | 0.02 | 45 |
| 7 | 782.2 | 10.3 | 16 | 128 | 0 | 0 | 16 | 80 | 128 | 0 | Imp. | - |
| 8 | 783.3 | 12.3 | 32 | 305 | 0 | 0 | 32 | 63 | 305 | 0 | Imp. | - |
| 9 | 784.5 | 16.0 | 44 | 546 | 0 | 0 | 44 | 42 | 546 | 0 | Imp. | - |
| 10 | 785.4 | 12.4 | 46 | 443 | 0 | 0 | 46 | 47 | 443 | 0 | Imp. | - |
| 11 | 786.5 | 12.7 | 40 | 394 | 0 | 0 | 40 | 53 | 394 | 0 | Imp. | - |
| 12 | 787.5 | 12.5 | 7 | 68 | 0 | 0 | 7 | 90 | 68 | 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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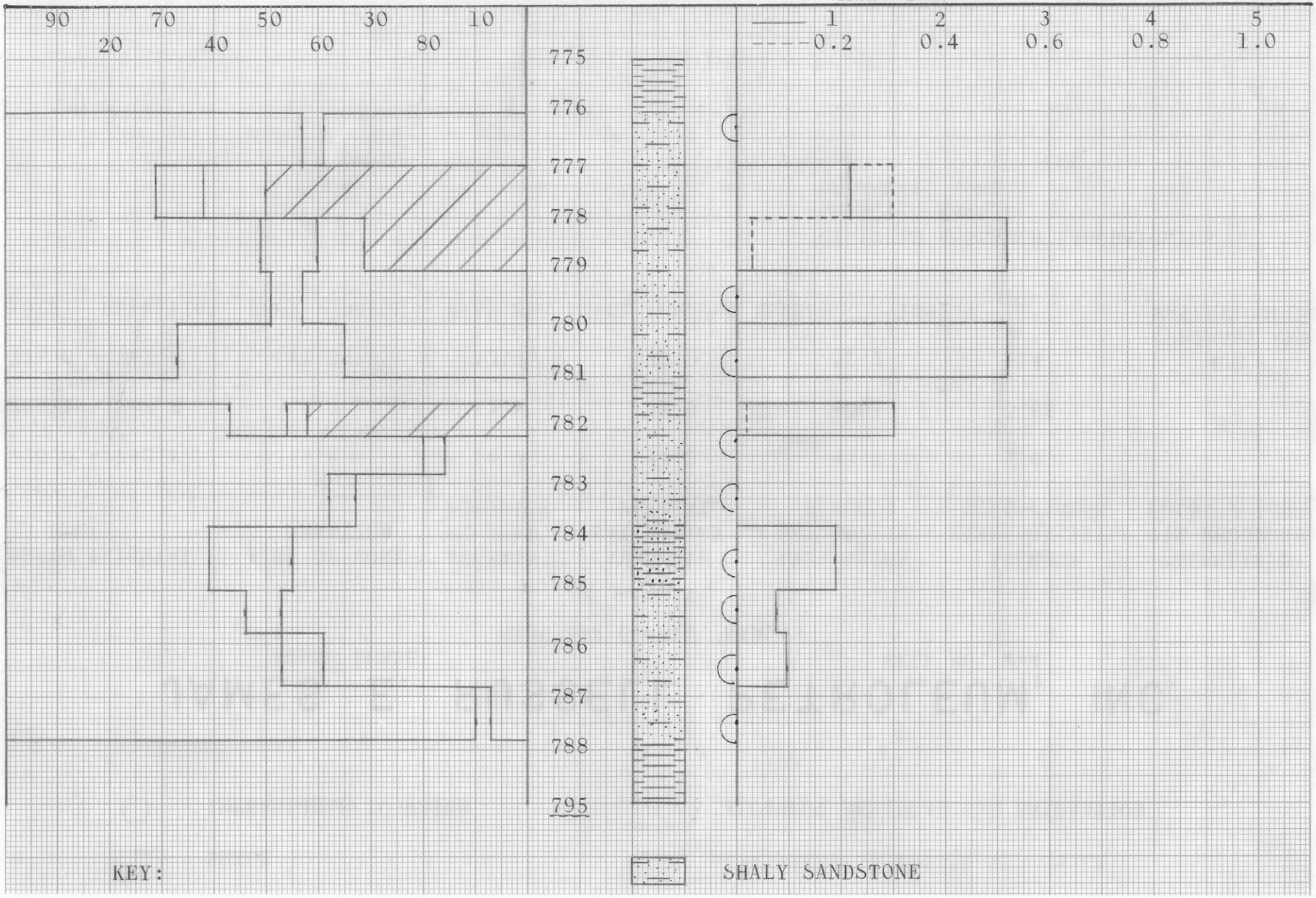
## SUMMARY OF LABORATORY FLOODING TESTS

### TABLE V

Company James E. Russell Petroleum, Inc. Lease Burke Well No. W-4

| | |
|---|---|
| Depth Interval, Feet | 776.0 - 782.1 |
| Feet of Core Analyzed | 2.6 |
| Average Percent Porosity | 14.3 |
| Average Percent Original Oil Saturation | 49.8 |
| Average Percent Oil Recovery | 9.0 |
| Average Percent Residual Oil Saturation | 40.8 |
| Average Percent Residual Water Saturation | 54.0 |
| Average Percent Total Residual Fluid Saturation | 94.8 |
| Average Original Oil Content, Bbls./A. Ft. | 554. |
| Average Oil Recovery, Bbls./A. Ft. | 100. |
| Average Residual Oil Content, Bbls./A. Ft. | 454. |
| Total Original Oil Content, Bbls./Acre | 1,439. |
| Total Oil Recovery, Bbls./Acre | 259. |
| Total Residual Oil Content, Bbls./Acre | 1,180. |
| Average Effective Permeability, Millidarcys | 0.13 |
| Average Initial Fluid Production Pressure, p.s.i. | 41.7 |

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


WATER SAT., PERCENT
OIL SAT., PERCENT
90
70
50
30
10
20
40
60
80
PERMEABILITY, IN MILLIDARCYS
EFFECTIVE PERMEABILITY TO WATER, IN MILLIDARCYS
1
2
3
4
5
0.2
0.4
0.6
0.8
1.0
775
776
777
778
779
780
781
782
783
784
785
786
787
788
795
KEY:
SHALY SANDSTONE

SHALE

LAMINATED SANDSTONE AND SHALE

IMPERMEABLE TO WATER

FLOODPOT RESIDUAL OIL SATURATION

# JAMES E. RUSSELL PETROLEUM, INC.

BURKE LEASE WELL NO. W-4

ANDERSON COUNTY, KANSAS

| DEPTH INTERVAL, FEET | FEET OF CORE ANALYZED | AVERAGE PERCENT POROSITY | AVG. OIL SATURATION PERCENT | AVG. WATER SATURATION PERCENT | AVERAGE PERMEABILITY, MILLIDARCYS | CALCULATED OIL RECOVERY BBLS. / ACRE |
|---|---|---|---|---|---|---|
| 776.0 - 782.1 | 5.6 | 14.0 | 44.0 | 43.7 | 2.0 | |
| 782.1 - 787.8 | 5.7 | 12.8 | 31.9 | 60.5 | 0.65 | |
| 776.0 - 787.8 | 11.3 | 13.4 | 37.9 | 52.2 | 1.4 | 400 (PRIMARY AND WATERFLOODING) |

NOTE: ELEVATION, FEET - DATUM: MEAN SEA LEVEL (GROUND LEVEL) 1092.7

OILFIELD RESEARCH LABORATORIES
CHANUTE, KANSAS
DECEMBER, 1981

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