

WATERFLOOD FEASIBILITY STUDY

LEMON RANCH FIELD

SWOPE LIME RESERVOIR

COMANCHE COUNTY, KANSAS

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June 4, 1981

Mr. Alan Townsend, Operations Manager  
KRM Petroleum Company  
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Re: Waterflood Feasibility Study  
Lemon Ranch Field  
Swope Lime Reservoir  
Comanche Co., Kansas

Dear Alan:

In accord with your request, we have completed a basic reservoir study of the Swope Lime at Lemon Ranch, with primary emphasis on the feasibility of improving oil recovery by water flooding. Our basic conclusion is that Swope reservoir and fluid characteristics are highly favorable to displacement by water injection.

Results of this study are included in the attached report, along with much of the basic support data. The data are organized in seven Appendices which follow the order of discussion in the report, and which are frequently referenced within each section. Economic projections as of June 1, 1981 using escalated prices and costs are included in both the Waterflooding and Primary Performance sections.

We are pleased to work with you in making this study. Please call if we can be of further service.

Very truly yours,

HENDERSON & COMPANY, INC.



H. W. Stack

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## CONCLUSIONS

1. The Swope lime reservoir at Lemon Ranch is a continuous porosity development which averages 5 feet in net thickness over a minimum 560-acre area.
2. The reservoir fluid was slightly undersaturated at an original reservoir pressure of 1,825 psig at the average depth of 4,770 feet (3,000 feet subsea).
3. The reservoir produces by liquid expansion and solution gas drive, supplemented by reinjection of approximately 50% of the produced gas. There is no evidence of a mobile water phase.
4. Original oil-in-place ranges from 1.86 million barrels determined volumetrically to 3.44 million barrels from segmented material balance. Based on performance to date, initial oil-in-place is estimated to be approximately 2.5 million barrels.
5. Primary recovery is projected to be 15.87% of initial oil-in-place under straight depletion drive conditions, and 20.7% with reinjection of half the produced gas. Based on 2.5 million barrels initially in place, these are equivalent recoveries of 396,700 barrels and 517,000 barrels, respectively.
6. Cumulative production to June 1, 1981 is approximately 290,000 barrels, with a current production rate of 330 barrels of oil per day, and average gas injection rate of 800 MCF per day.
7. Waterflooding characteristics, as determined by restored state displacement tests on core samples from the Lemon #3 well, are highly favorable.
8. Waterflood recovery is projected to be 36.9% of initial oil-in-place, with an upside potential of 50%. The 36.9% recovery is equivalent to 921,750 barrels, based on 2.5 million barrels in place.

9. Good injection coverage can be attained without additional infill drilling by the selective conversion of current producing wells. Total cost of the project is currently estimated at \$571,000. Fifty percent of this cost is for artificial lift equipment, which will be required within a year regardless of operating mode.
10. Incremental recovery by water injection over that expected by continued depletion without gas injection is projected to be 478,546 barrels, or 382,837 barrels net to the 100% working interest (80% net revenue interest). Based on current prices escalated at 8% annually, this would provide incremental net income of \$16.855 million undiscounted, or \$10.564 million discounted at 15% annually.

#### RECOMMENDATIONS

1. Begin unitization proceedings immediately.
2. Develop a compatible and sufficient water supply for continuous injection.
3. Convert a well within the configuration suggested in Case 1 and start water injection to evaluate in situ rate and displacement performance (Lemon #9 or Lemon #7).
4. Proceed with full-scale injection unless performance suggests otherwise.

## WATERFLOOD PROJECTIONS

A study of Lemon Ranch logs, cores, fluids, and production performance to date indicates favorable conditions for improving oil recovery from the Swope reservoir by waterflooding. These data are discussed in detail in subsequent sections and the Appendices of this report.

The Swope porosity interval appears to be continuous over a minimum 560-acre area, as shown on the isoporosity-thickness map in Exhibit I-1 in Appendix I. Reservoir limits are well defined on the west and south by a loss of porosity development. There could be further extensions to the east and north, but it's not likely these would prove to be very significant. Average net thickness is 5 feet, with average porosity and water saturation values estimated to be 15% each. Absolute permeabilities range up to 300 millidarcies, averaging approximately 43 millidarcies in a horizontal plane, and 26 millidarcies when measured vertically.

The reservoir produces by depletion drive, supplemented by reinjection of part of the solution gas. There is no evidence of water influx, nor of any mobile water within the reservoir.

Restored state water displacement tests run on selected core samples from Lemon #3 indicate excellent recovery characteristics by water displacement. These data are discussed further under Reservoir Characteristics, and in Appendix V.

Effective permeability to water ranged from 37% of absolute in the tighter samples, to 54%, with residual oil saturations ranging from 20.5% to 33% of pore volume. Laboratory recoveries averaged 67% of oil-in-place at 100% conformance and to a 99.9% water cut. Recovery prior to water breakthrough ranged from 25% to 42% of oil-in-place. While these magnitudes of recovery are achievable only under laboratory conditions, they do suggest that conditions are

favorable for efficiently building an oil bank by water displacement, with the upside possibility of recovering 50% of the oil-in-place. A more realistic recovery by waterflooding would be in the range of 35% to 40%.

Volumetric conformance is dependent to a large extent on the mobility ratio, or mobility of displacing phase (water) to displaced phase (oil). Mobility of each phase is further defined as the ratio of effective permeability to viscosity. Lower mobility ratios provide more efficient oil-banking conditions and better recoveries before water breaks through the oil bank. Higher ratios tend to promote more rapid fingering through the oil bank, promoting premature breakthrough to the producing well and poorer overall recoveries. Mobility ratio in the Swope reservoir at Lemon Ranch is considered highly favorable with an average value of 0.346. This is based on relative permeabilities and viscosities of 45% and 0.65 centipoise for water, and 80% and 0.4 centipoise for oil.

A series of waterflood projections were made using the Garrett computer program, considering the reservoir as a single layer because of the relatively thin and uniform porosity development. The Garrett program is essentially a steady-state model in which the reservoir can be described as a series of layers of varying permeabilities, with the areal configuration defined as segments of a recognizable pattern, i.e., line drive, five-spot, nine-spot, etc. As water is injected into the layers, the respective fluid fronts assume different positions as a function of permeability, porosity, and displaceable fluid saturations. Areal sweep versus water cut data is input on the basis of available correlations for a given injection pattern. Copies of these correlations for line drive and nine-spot patterns are included as Exhibits I-8 and I-9. If multiple layers are described, then the individual layer performance projections are composited into a total pattern projection. As is the case with most reservoir models, analysis of the results in a relative sense is often more important than the

absolute rate and recovery numbers. It's therefore necessary to scale the theoretical results to a more realistic projection expected in the field.

With the current 40-acre development spacing, it should not be necessary to drill additional wells to develop the water injection patterns required to achieve good reservoir coverage. The two configurations shown on Exhibits I-2 and I-3 of Appendix I provided little difference in ultimate recovery, and both provide sufficient injection to production capacity balance. Case 1 would require conversion of Lemon #6, #7, and #9 to water injection wells, along with Rhodes #1. Injection into Lemon 11, the currently shut-in high GOR well, is also a possibility. Lemon #7 and #9 are both current gas injection wells. While there is always some concern about possible channelling in a previous gas injector, this effect should be minimized by a rapid redistribution of fluids away from the wellbore as water is injected. The alternative of displacing towards a gas injection well would result in resaturation of a previously displaced volume, and probable loss of otherwise recoverable oil.

The configuration in Case 2 provides completely enclosed patterns and a higher injector to producer ratio than does Case 1. However, the slightly higher theoretical recoveries resulting from a little better areal coverage would probably be offset by displacing oil toward the gas injection wells, as previously discussed.

Case 1, or a variation thereof, is considered to be the more optimum. In view of the good production performance of Lemon #6, it might be advisable to convert Lemon #5 to injection and leave #6 a producer.

While indications from the core studies indicate good water injection characteristics, actual injectivities cannot be accurately predicted without a field test. In lieu of this, the curves shown on Exhibit I-4 of Appendix I

represent theoretical steady-state injectivities as a function of pressure for a series of permeabilities, and provide a basis for plant design and performance predictions.

Response and subsequent performance to water injection as shown on the graph of Exhibit I-5, Appendix I is generally projected on the basis of results of the Garrett model predictions. Water and oil relative permeability data used were based on the Lemon #3 core work, as discussed subsequently under Reservoir Characteristics and in Appendix V.

Total recovery under the schedule projected is 921,747 barrels, equivalent to 36.9% of the 2.5 million barrels estimated to be in place originally. This amounts to 478,546 barrels over that estimated to be recoverable under continued operation without additional gas or water injection.

An economic projection was made on the basis of starting water injection on September 1, 1981, using the production schedule of Exhibit I-5, and the cost schedule tabulated in Exhibit I-6 of Appendix I. Gas currently being injected was assumed to be sold after June 1, 1981 at an average Btu adjusted price of \$3.60 per MCF. The starting oil price was \$38 per barrel. Oil and gas prices were escalated at a yearly rate of 8% until oil reached \$75 per barrel (9 years) with both prices held constant thereafter. Operating costs were also escalated at 8% yearly for 9 years. Windfall profits taxes were calculated at the rate of 30% on oil revenues exceeding base price levels of \$18 per barrel (\$20 per barrel for stripper) limited to 90% of net income. These base price levels were also escalated at 8% annually with phase-out of the tax assumed in 1989.

Results of this projection are summarized below, along with the results of the projection under continuation of the current operation with gas injection discontinued after June 1, 1981.

|                               | <u>Water Injection</u><br><u>At 9/1/81</u> | <u>No Water</u><br><u>Injection</u> | <u>Difference</u> |
|-------------------------------|--------------------------------------------|-------------------------------------|-------------------|
| Gross Oil Reserves (Bbls)     | 631,747                                    | 153,201                             | 478,546           |
| Net Oil to 100% WI (80% NRI)  | 505,398                                    | 122,561                             | 382,837           |
| Net Gas Sales (MCF)           | 949,208                                    | 349,459                             | 599,749           |
| Net Revenue                   | \$23,739,810                               | \$5,679,481                         | \$18,060,329      |
| Net Operating Costs           | \$ 1,902,396                               | \$ 968,214                          | \$ 934,182        |
| Net Investment                | \$ 571,000                                 | \$ 300,000                          | \$ 271,000        |
| Net Income (Undiscounted)     | \$21,266,418                               | \$4,411,267                         | \$16,855,151      |
| Net Income (Discounted @ 15%) | \$14,220,401                               | \$3,656,226                         | \$10,564,175      |

Yearly detail of the waterflood projection is shown in Exhibit I-7 of Appendix I, and the projection without waterflooding in Exhibit III-11 of Appendix III.

#### OIL-IN-PLACE

Original oil-in-place in the Swope reservoir at Lemon Ranch was calculated both volumetrically and by the material balance approach. Plots, tables, and graphs associated with these determinations are included in Appendix II.

Exhibit II-1 shows the iso-porosity x net thickness map based on the log and core data of Appendix V. Area within the current limits defined on this map is approximately 560 acres. Based on the pore volume mapped, coupled with an estimated average initial water saturation of 15% and initial formation volume factor of 1.49 RB/STB, initial oil-in-place is calculated to be 1.86 million stock tank barrels.

Material balance considerations relate pressure-dependent changes in reservoir fluid characteristics to actual fluid withdrawal volumes and resultant pressure changes in the reservoir to calculate original fluid volumes in place. Since rather large changes in certain characteristics can occur with small changes in pressure, it should be recognized that results from material balance calculations are sensitive to the actual production and average reservoir pressure measurements and can therefore be subject to considerable error. Appendix II



shows the basic data and results of the Lemon Ranch material balance approach. Fluid properties shown in Exhibit II-2 are based on the Lemon #3 fluid analysis detailed in Appendix VI.

The Garrett computer program uses the method of Havlena and Odeh in which the apparent oil-in-place is calculated for each survey point for which performance data are given. A dimensionless influx-pressure term is then evaluated for each point, and a least squares straight line fitted to these points. Oil-in-place is then determined as the intercept of the apparent oil-in-place axis.

Net volumes of oil, gas (produced minus injected), and water were estimated for each well through the field-wide bottom hole pressure survey date of July 8, 1980. These production data were then coupled with the July 1980 pressures shown in Exhibit II-3 of Appendix II, and the segmented material balance was run. Results are shown tabulated in Exhibit II-4, with apparent original oil volumes indicated to be associated with each well's drainage area. Total oil in place from this computation is 3.45 million barrels.

An apparent anomaly is noted at one well, Lemon #5, which accounts for 1.292 million barrels, or 37.5% of the total. This is because of the relatively low pressure loss (1,825 psi to 1,659 psi) with the estimated production of 9,800 barrels of oil. Subsequent production tests of the Lemon #5 well suggest that previous allocations to this well may have been too high, and the actual production somewhat lower. This would result in a redistribution of the well volumes shown, and possibly in a lower total volume.

In addition to the more detailed segmented approach, single point material balance calculations were made using the same total field withdrawal schedule, and assuming a series of average reservoir pressures ranging from 1,200 psi to 1,600 psi. These data are plotted in Exhibit II-5, and detailed in Exhibit II-6.

The sensitivity to actual pressure is dramatically indicated on this plot, with oil-in-place numbers ranging from 785,000 barrels to 5.76 million barrels over the 400 psi average pressure range. Nevertheless, this approach does provide a good supplement to the volumetric determination, which in combination, gives a better overall feel for the actual reservoir volume.

Relating the volumetrically determined 1.86 million barrels in place to the above graph in Exhibit II-5 indicates an average July 1980 pressure of 1,430 psi. Reference to the pressure history graph of Exhibit IV-1 in Appendix IV indicates this to be on the low side, although the average should be heavily weighted by the large withdrawals from Lemon #6 and Rhodes #2.

Accounting for the results indicated in the more detailed segmented calculation, coupled with the volumetric determination, original oil-in-place in the Swope at Lemon Ranch is estimated to be 2.5 million barrels.

#### PRIMARY PERFORMANCE

Since its discovery in December of 1978, the Swope reservoir at Lemon Ranch field has been developed with 14 completed wells, and the limits further defined by four dry holes. Lemon #11 was completed with an extremely high gas-oil ratio, and has remained shut in as an observation well. A development map is shown in Exhibit III-1 of Appendix III.

Approximately 50% of the produced gas has been reinjected into the reservoir since July 1979, in general accord with the schedule shown in Exhibit III-2 of Appendix III. The original gas injectors were Lemon #2X and Lemon #7, with an approximate 20%-80% split between the two wells. Injection was started into Lemon #9 in August 1980 after Lemon #2X would no longer take gas. Injection is under compression at about 1,650 psi.

Production is gauged by lease (Lemon and Rhodes), with allocation to wells based on periodic well tests. These data are tabulated in Exhibit III-3. A plot of total field production and gas injection by month is shown in Exhibit I-5. Similar plots for the Lemon and Rhodes leases are shown in Exhibits III-4 and III-5.

Cumulative production from the Swope reservoir at Lemon Ranch has totalled approximately 290,000 stock tank barrels of oil through May 1981, with a current average rate of 330 barrels per day from ten active producing wells. Total gas reinjected has been approximately 300 million standard cubic feet, with a current average injection rate of 800 MCF per day.

Depletion of the Swope reservoir by solution gas drive was predicted under two conditions using the Tarner method as modified by Tracy, and as programmed by Garrett. The first case assumed no gas injection, and the second was with reinjection of 50% of produced gas. Reservoir fluid properties were as shown in Appendix VI (Lemon #6 fluid analyses), and gas-oil relative permeability data as in Appendix V, Exhibit V-3, page 3 (Lemon #3 restored state analysis).

Results of these predictions are plotted on Exhibit III-7, and projected in Exhibits III-8 and III-9. These results are summarized as follows:

|                          | <u>Projected Recovery</u> |                |
|--------------------------|---------------------------|----------------|
|                          | <u>% Oil-in-Place</u>     | <u>Barrels</u> |
| Without gas injection    | 15.87                     | 396,700        |
| With 50% gas reinjection | 20.70                     | 517,425        |

Barrel recoveries shown are based on 2.5 million barrels of oil-in-place, as previously discussed, with depletion to an abandonment pressure of 100 psi.

Economic projections as of June 1, 1981 were made on the basis of (a) continued reinjection of 50% of the produced gas, and (b) termination of gas injection at June 1, 1981, with the gas formerly injected being delivered to a

sales line at a Btu-adjusted price of \$3.60 per MCF. There are no gas sales in the former case. As in the waterflood projection described previously, oil and gas prices were escalated at 8% annually to a limit of \$75 per barrel (from \$38 per barrel over 9 years), and windfall profits taxes calculated at a 30% tax rate. The \$300,000 investment in each case represents artificial lift equipment which will probably be required in 1982 regardless of the mode of operation.

Yearly detail for these projections are included in Exhibits III-10 and III-11, with comparative results summarized as follows:

|                               | Case (a)<br>Continued<br>Gas Injection | Case (b)<br>Gas Injection<br>Terminated<br>6/1/81 | Difference |
|-------------------------------|----------------------------------------|---------------------------------------------------|------------|
| Gross Oil Reserves (Bbls)     | 227,000                                | 153,201                                           | 73,799     |
| Net Oil to 100% WI (80% NRI)  | 181,600                                | 122,561                                           | 59,039     |
| Net Gas Sales (MCF)           | 0                                      | 349,459                                           | (349,459)  |
| Net Revenue                   | \$6,504,880                            | \$5,679,481                                       | \$825,399  |
| Net Operating Costs           | \$1,040,500                            | \$ 968,214                                        | \$ 72,286  |
| Net Investment                | \$ 300,000                             | \$ 300,000                                        | 0          |
| Net Income (Undiscounted)     | \$5,164,380                            | \$4,411,267                                       | \$753,113  |
| Net Income (Discounted @ 15%) | \$4,098,355                            | \$3,656,226                                       | \$442,129  |

#### PRESSURE DATA

A graphical representation of the bottom hole pressure history at Lemon Ranch is depicted in IV-1 of Appendix IV. Bottom hole pressures are plotted in the month they were measured, along with cumulative oil produced from the Swope reservoir. Cumulative volumes by well were also estimated from the allocations and noted opposite the well on pressure tests taken after the initial measurement.

Several points are noted from this history:

1. Initial bottom hole pressure in the Swope reservoir was 1,825 psig

at a subsea datum of 3,000 feet, as extrapolated from drill stem test measurements on Lemon #1 in January 1978. This is a gradient of 0.383 per foot of depth.

2. The next series of points through Rhodes #4 in February 1980 show pressures at each of the new locations in the reservoir as initially drill stem tested to average approximately 1,730 psig, or 5.2% less than the original Lemon #1 pressure. The obvious exceptions are noted as Rhodes #1 and Lemon #8, which indicated a high drawdown to approximately 1,500 psig, and Lemon #11 which was at the original level of 1,820 psig. There is some question as to whether some of the lower pressures were fully stabilized. Nevertheless, it does appear that a relatively high degree of pressure loss occurred at Rhodes #1 and Lemon #8 after the withdrawal of approximately 20,000 stock tank barrels from the reservoir.
3. Gas injection was started into Lemon #2X and Lemon #7 in July 1979. The effect of this injection was undoubtedly responsible for some of the higher initial pressure levels noted on wells drilled subsequent to this.
4. A series of bottom hole pressures measured in July 1979 show varying degrees of pressure loss in the wells tested. These ranged from 140 psi in Lemon #11, which has been shut in since completion, to 755 psi at Rhodes #2, which has produced an estimated 22,000 stock tank barrels of oil.
5. The most recent measurements are bottom hole buildup tests run in Rhodes #3 in October 1980, and in Lemon #5 in January 1981. Rhodes #3 recorded 792 psig after 72 hours, and was extrapolated by a Horner

plot to a  $P^*$  of 1,118 psig (Exhibits IV-4 and IV-4a of Appendix IV).

Lemon #5 recorded 875 psig after 24 hours, and had a  $P^*$  Horner extrapolation to 1,634 psig (Exhibits IV-5 and IV-5a).

Also included in Appendix IV are the following:

- a. Tabulation of initial drill stem test data (Exhibit IV-2).
- b. Tabulation of bottom hole pressures taken in July 1980, and estimated cumulative oil volumes produced through July 1980 (Exhibit IV-3).
- c. Pressure buildup analyses and Horner plots from initial drill stem tests on Lemon #1, Lemon #8, and Rhodes #1 (Exhibits IV-6 and IV-6a, IV-7 and IV-7a, and IV-8 and IV-8a).

#### RESERVOIR AND FLOW CHARACTERISTICS

The reservoir rock at Lemon Ranch field is the relatively thin Swope limestone development occurring at an average depth of 4,770 feet within the Pennsylvanian Lansing-Kansas City formation. The reservoir, as currently defined by well control, appears to be continuous over at least a 560-acre area, with net thickness ranging up to 8 feet. Average characteristics as defined by logs and cores are as follows:

|                             | <u>Logs</u> | <u>Cores</u> |
|-----------------------------|-------------|--------------|
| • Net thickness             | 5 feet      | 4.5 feet     |
| • Porosity                  | 15.3%       | 17.4%        |
| • Water Saturation          | 14.5%       | 23.5%        |
| • Permeability (horizontal) | -           | 42.5 Md.     |
| • Permeability (vertical)   | -           | 25.9 Md.     |

Log porosity calculations are based on density measurements using a grain density of 2.73 grams/cc, and water saturations based on induction resistivities using a formation water resistivity at 125 degrees Fahrenheit of 0.044 ohm-meters and a cementation factor of 2.0. Log data are summarized in Appendix V, Exhibit V-1, along with copies of the density logs.

Core values are based on standard analyses performed on whole core sections. Some limited vertical fracturing was noted in three of the wells (Lemon #2X, Lemon #11, and Rhodes #3). Core data are summarized in Appendix V, Exhibit V-2, along with copies of each coregraph and standard analysis. Exhibit V-3 of Appendix V shows the general relationship between core porosities and water saturations, with permeabilities shown in parentheses beside each point.

A restored-state core analysis was performed on three selected samples taken from Lemon #3 in order to further evaluate flow and displacement characteristics under both gas and water injection.

After extracting all fluids and salt and measuring porosities and air permeabilities, each core plug was saturated with a 91,000 ppm sodium chloride brine. Residual water saturations were then established by centrifuging the samples, and the voided pore space resaturated with a 20 centipoise mineral oil. This permitted measurements of permeability to oil at residual water saturation. Gas-oil relative permeability and displacement characteristics were determined by injecting humidified nitrogen and measuring incremental volumes of oil and gas produced versus time. Results of these tests are shown on pages 2 through 10 of Core Laboratories, Inc.'s report in Exhibit V-4. These results indicate relatively good displacement efficiencies by gas for the 78 Md. and 63 Md. samples, with poorer efficiency in the 8.7 Md. rock.

Pages 11 through 19 of the Core Laboratories' report detail results of the water displacement tests. These were obtained from the same core samples after gas injection. The samples were resaturated with a 1.02 cp. oil, evacuated of all gas, and then dynamically displaced with the oil in order to measure effective permeabilities to oil at residual water saturations. These oil permeabilities ranged from 54% of absolute in the 8.7 Md. sample with the highest residual water saturation of 37.5%, to 95.2% of absolute in the 63 Md. sample with



with residual water of 16.8% of pore volume. The cores were then displaced with a 1.74 cp., 91,000 ppm salt water so as to yield a displaced to displacing viscosity ratio of approximately 0.6. Displacement by water was continued to a 99.9% water cut, permitting the measurement of relative permeabilities to water and fluid recoveries as a function of time and injected volumes.

These tests indicate excellent displacement efficiencies by water, reducing the oil saturations to residual values of 20.5% in the 8.7 Md. sample, and 32.9% in the 78 Md. sample, while recovering 62.4% of 71.0% of the oil-in-place. These recovery values imply 100% conformance, achievable only under laboratory conditions. This can in no way be duplicated in the field, but does nevertheless indicate favorable conditions for water displacement. The water cut curves on pages 17 through 19 of Core Laboratories' report in Appendix V indicates 34.3% to 42% of the total recoverable oil produced prior to water breakthrough for the 78 Md. and 63 Md. samples, reducing to 25.6% for the 8.7 Md. sample.

#### RESERVOIR FLUID CHARACTERISTICS

Results of a reservoir fluid analysis made by Core Laboratories, Inc. on a subsurface sample taken from Lemon Ranch #6 on May 29, 1979, are included in Exhibit VI-1 of Appendix VI. These data indicate the oil in the Swope reservoir at Lemon Ranch to be slightly undersaturated initially, with a bubble point pressure of 1,695 psig at 125 degrees Fahrenheit. Initial reservoir pressure at the #6 well was measured at 1,762 psig at a depth of 4,777 feet (3,011 feet subsea). Solution gas at the bubble point was 845 standard cubic feet per barrel, and formation volume factor was 1.49 reservoir barrels per stock tank barrel. Residual oil gravity is 43.2 degrees API. Oil viscosity in the reservoir ranged from 0.389 centipoises initially to 0.666 centipoises at 150 psi.



These data were assumed to represent the average fluid characteristics in the Swope reservoir, and were used in all material balance and performance predictions included in this report. A tabulation of the basic data is shown in Exhibit VI-2 of Appendix VI.

#### WELL COMPLETIONS

Basic Swope completion data are tabulated and summarized for each well in Appendix VII. Wells are completed with 4-1/2" casing cemented through the Swope Lime, perforated with 2 to 4 jet shots per foot of pay, and tubed with 2-3/8" upset tubing set on a packer above the perforations. The perforations are broken down and treated with 2,000 gallons to 5,000 gallons of acid and potentialized as flowing wells. Seating nipples are installed in all tubing strings to facilitate later pumping installations. Initial flowing potentials ranged from 2 to 216 barrels of oil per day.

APPENDIX VII

EXHIBIT VII-1

Lemon Ranch Field  
Swope Completion Intervals  
and Initial Potentials

| Well      | Perforations |      | Initial Potential |       | Comments                            |
|-----------|--------------|------|-------------------|-------|-------------------------------------|
|           | Interval     | Feet | BOPD              | SCFB  |                                     |
| Lemon #1  | 4754-4762    | 8    | 100               | 1350  | Miss. Perfs                         |
| Lemon #2X | 4755-4760    | 5    | 50                | 1200  | Swope Gas Injection.<br>Miss. Perfs |
| Lemon #3  | 4768-4778    | 10   | 170               | 640   |                                     |
| Lemon #5  | 4782-4787    | 5    | 150               | 800   |                                     |
| Lemon #6  | 4778-4788    | 10   | 180               | 800   |                                     |
| Lemon #7  | 4788-4794    | 6    | 84                | -     | Swope Gas Injection.<br>Miss. Perfs |
| Lemon #8  | 4776-4782    | 6    | 115               | 1000  | Miss. Perfs                         |
| Lemon #9  | 4766-4771    | 5    | 216               | -     | Swope Gas Injection.                |
| Lemon #10 | 4773-4778    | 5    | 192               | -     |                                     |
| Lemon #11 | 4757-4764    | 7    | 2                 | 46000 |                                     |
| Rhodes #1 | 4763-4767    | 4    | 48                | 1000  |                                     |
| Rhodes #2 | 4754-4763    | 9    | 100               | 1000  |                                     |
| Rhodes #3 | 4770-4778    | 8    | 156               | 1000  |                                     |
| Rhodes #4 | 4766-4771    | 5    | 172               | -     |                                     |

APPENDIX VII

EXHIBIT VII-2

Lemon Ranch Field Wells  
Swope Lime Completion Data

Lemon #1 Perfs 4754-62 w/4 JSPF

Acidized w/500 gals - MCA - IPIP - 1250 psi @ 1/2 BPM  
BDP = 800 psi @ 1 BPM ISIP - 450 psi 5" SIP - Vac  
Kicked well off flowing 40 BO/1 hr.

Acidized w/1500 gals 15% CRA w/20 ball sealers  
IPIP - 500 psi @ 1/2 BPM to 1000 psi @ 4 BPM w/balls on perfs  
ISIP - 1200 psi  
Well kicked off flowing @ 180-200 BOPD  
Initial production - 100 BOPD on 10/64" choke w/FTP-390 psi  
and GOR-1350 CFB

Lemon #2X 4755-60 w/2 JSPF

Acidized w/2000 gals 15% HCl NE acid w/8 B.S.  
BDP - 1350 IPIP - 14.0 ATP - 1350 ATR - 3.75  
ISIP - 1400 2" SIP - 375 1-1/2 hr SIP - 200  
Swabbed load. No flow.

Acidized 3000 gals 15% HCl NE Acid @ 3 BPM  
IPIP - 1000 ATP - 800 ATR - 3 BPM  
Flowing 2 BOPH on 10/64  
Initial production - 50 BOPD, 10/64 FTP - 250 GOR - 1200

Lemon #3 4768-78 - 2 JSPF

Acidized w/2000 gals 15% HCl NE acid  
IPIP - 1900 @ 1 BPM → 800 @ 3 BPM  
ISIP - 500 5" SIP 200 15" = Vac  
Well kicked off flowing  
Initial production - 170 BOPD 10/64 FTP - 300 GOR - 641 (?)

Lemon #5 4782-87 w/2 JSPF

Acidized w/1500 gals 15% HCl NE acid w/15 B.S.  
BDP - 2000 IPIP - 1500 @ 1.5 BPM → 1300  
ISIP - 1400 20" SITP - 250  
Well kicked off flowing - 6 BOPH in heads.

Reperfed 4782-87  
Acidized w/1000 gals 15% HCl NE acid  
BDP-1900 IPIP-1500 ATP-1300 → 1400 ATR-3  
ISIP-1400 25" = vac  
Initial production - flowing - 150 BOPD 10/64"  
FTP-325 GOR-800

Lemon #6 4778-88 w/4 JSPF

Acidized w/2000 gals 15% HCl NE BDP - 1600 IPIP-1400 ATP-1000  
ATR-3 BPM ISIP-200 3" vac.  
Well kicked off flowing - Initial production-180 BOPD 10/64 FTP-410  
GOR-800

Lemon #7 4788-94 w/2 JSPF

Acidized w/5000 gals 15% HCl NE acid  
BDP-1000 ATP-1800 ATR-4.5 ISIP-450 40" vac  
Well kicked off flowing - Initial production-84 BOPD 10/64, FTP-620

Lemon #8 4776-82

Acidized w/5000 gals 15% HCL NE BDP-1800 psi ISIP-650  
45" SIP-450  
Well kicked off flowing - Initial production-115 BO 10/64"  
FTP-340 Est. 115 M/D GOR-1000

Lemon #9 4766-71 w/2 SPF

Acidized w/5000 gals 15% HCl NE acid. Press to 1825 w/balls.  
ATP-1750 ATR-5 BPM ISIP-450 1 hr SITP-45  
Well kicked off flowing  
Initial production 9 BOPH - 216 BOPD 10/64" FTP400

Lemon #10 4773-78 w/2 JSPF

Acidized w/5000 gals 15% HCl NE Treated w/4-3/4 BPM ISIP-950  
15" vac  
Well kicked off flowing  
Initial production - 192 BOPD 10/64"  
320# FTP. Subsequently tested at 40 BOPD on 10/64" w/350 psi  
w/GOR est. @ 875 CFB.

Lemon #11 4757-64 w/2 JSPF

Acidized w/5000 gals 15% HCl NE acid w/12 B.S.  
BDP-1900 ATP-1600 @ 5 BPM inc. to 2100 w/balls on perms  
ISIP-450 6" vac.  
Well kicked off flowing  
Initial production - 2 BOPD, 920 MCF/D gas 10/64" FTP-1250

Rhodes #1 4763-67 w/4 JSPF

Acidized - 5000 gals 15% HCl NE acid ATP-1400 ATR-3 BPM  
ISIP-500 1 hr-200  
Initial production - 2 BOPD - 50 BOPD 8/64 FTP-390 GOR-1000

Rhodes #2 4754-63 w/2 JSPF

Acidized - 2000 gals 15% HCl NE acid ATP-900 ATR-4.5 BPM  
ISIP - vac  
Initial production - 100 BOPD 10/64 560# GOR 1000

Rhodes #3 4770-78 w/2 JSPF

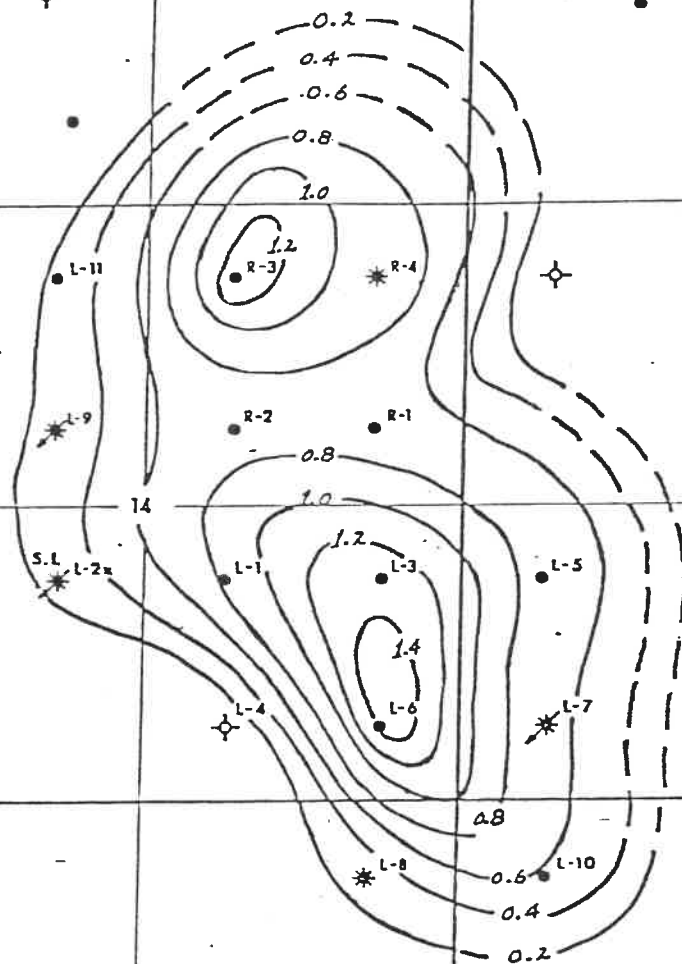
Acidized - 5000 gals 15% HCl NE acid  
ATP-1700 ATR 4.5 B/M ISIP-400 6" - vac  
Initial production - 156 BOPD GOR-1000 480#

Rhodes #4 4766-71 w/2 JSPF

Acidized - 5000 gals 15% HCl NE acid  
ATP-1300 → 1500 (w/balls) ATR-4 BPM  
ISIP-300# 5" - vac  
Initial production - 172 BOPD 12/64 FTP 400#

R 20 W

T  
34  
N



HENDERSON COMPANY, INC.

LEMON RANCH FIELD  
Comanche Co., Kansas

EXHIBIT I-1  
ISO - Porosity x Thickness Map

Based on Log Data

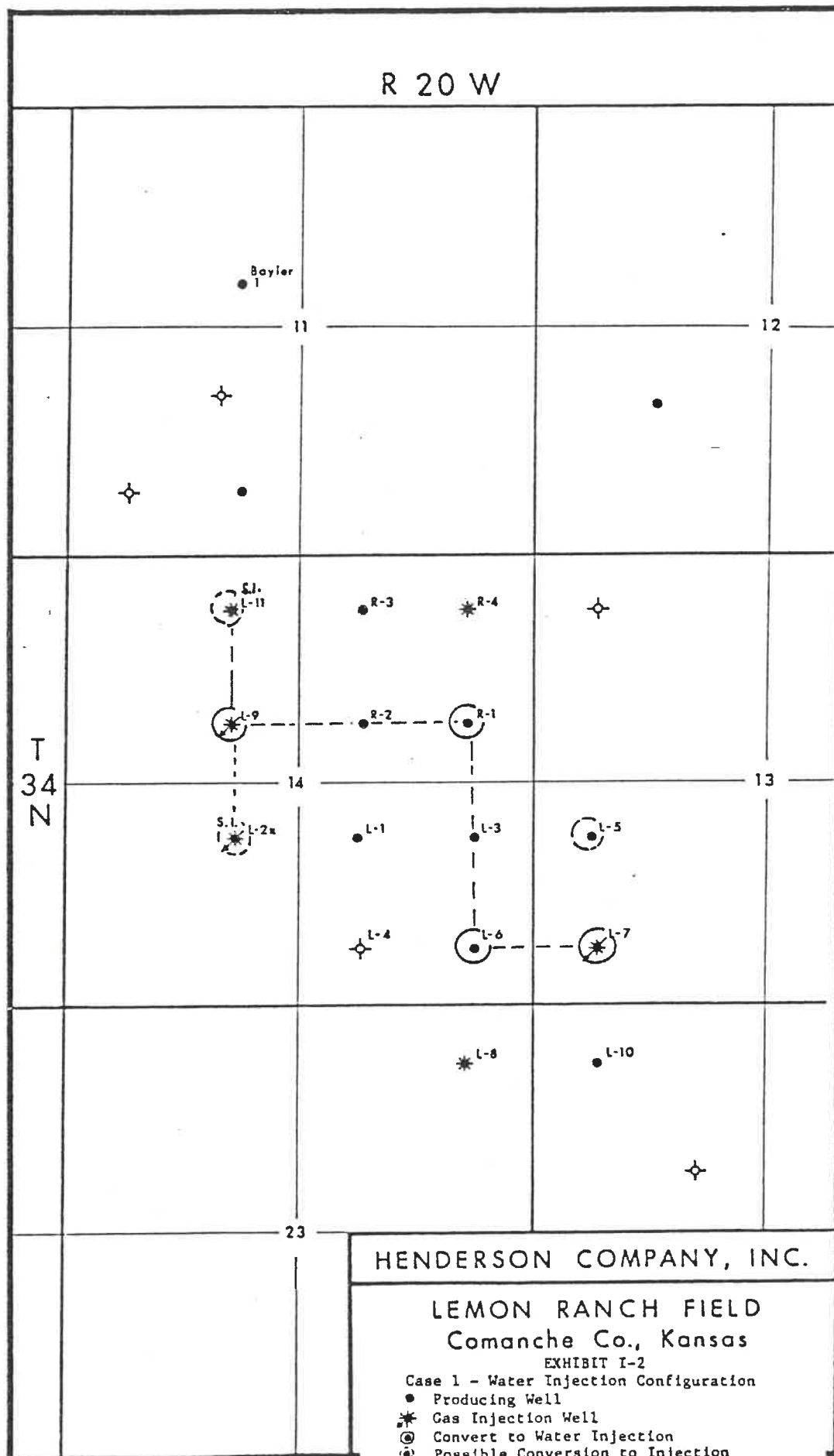






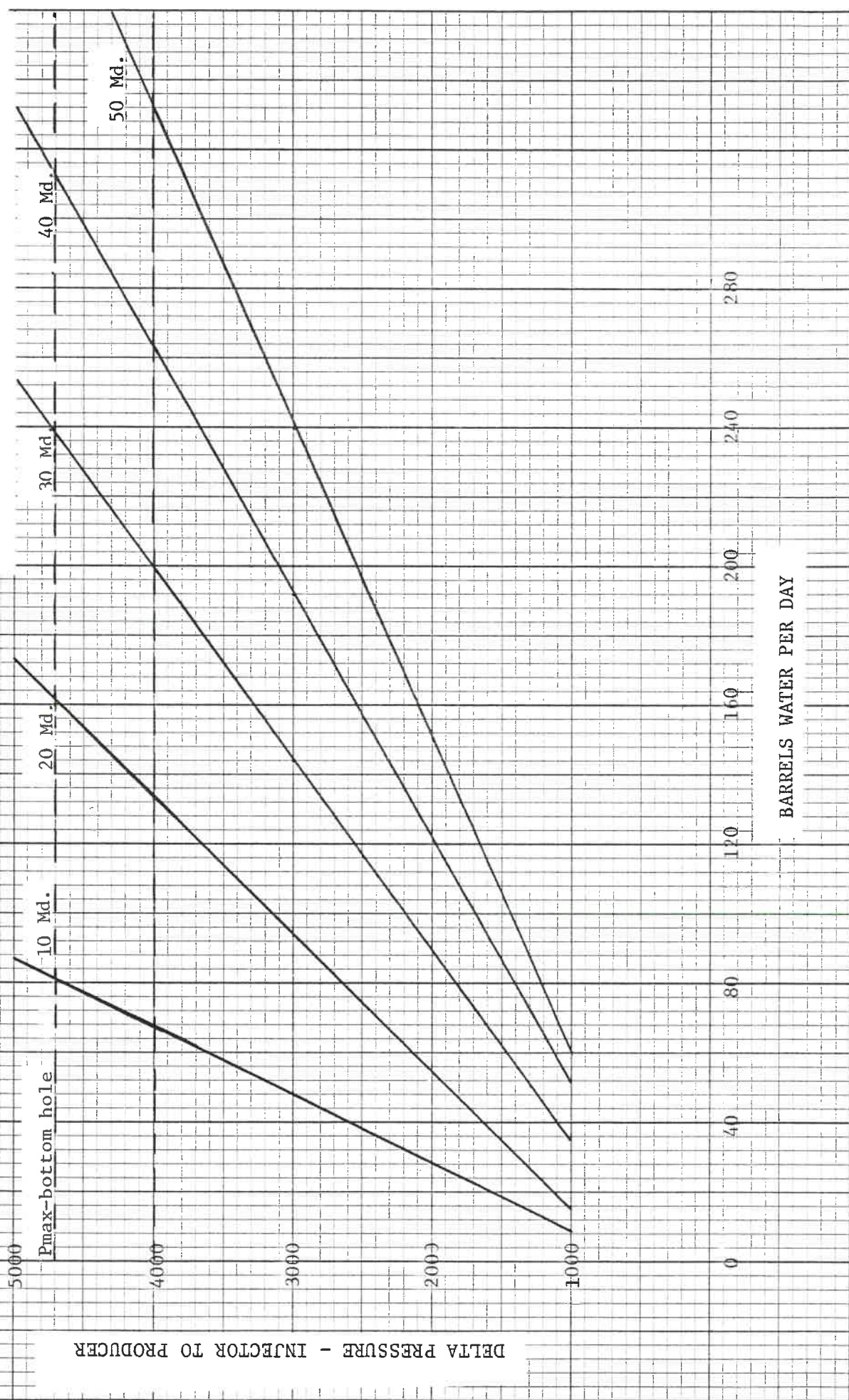
EXHIBIT I-4

Theoretical Water Injectivity After Fillup

$h = 5$  feet,  $K_{rw} = 45\%$

Max. Bottomhole Pressure = 4,700 psi (1 psi/foot)

Max. Surface Pressure = 2,640 psi



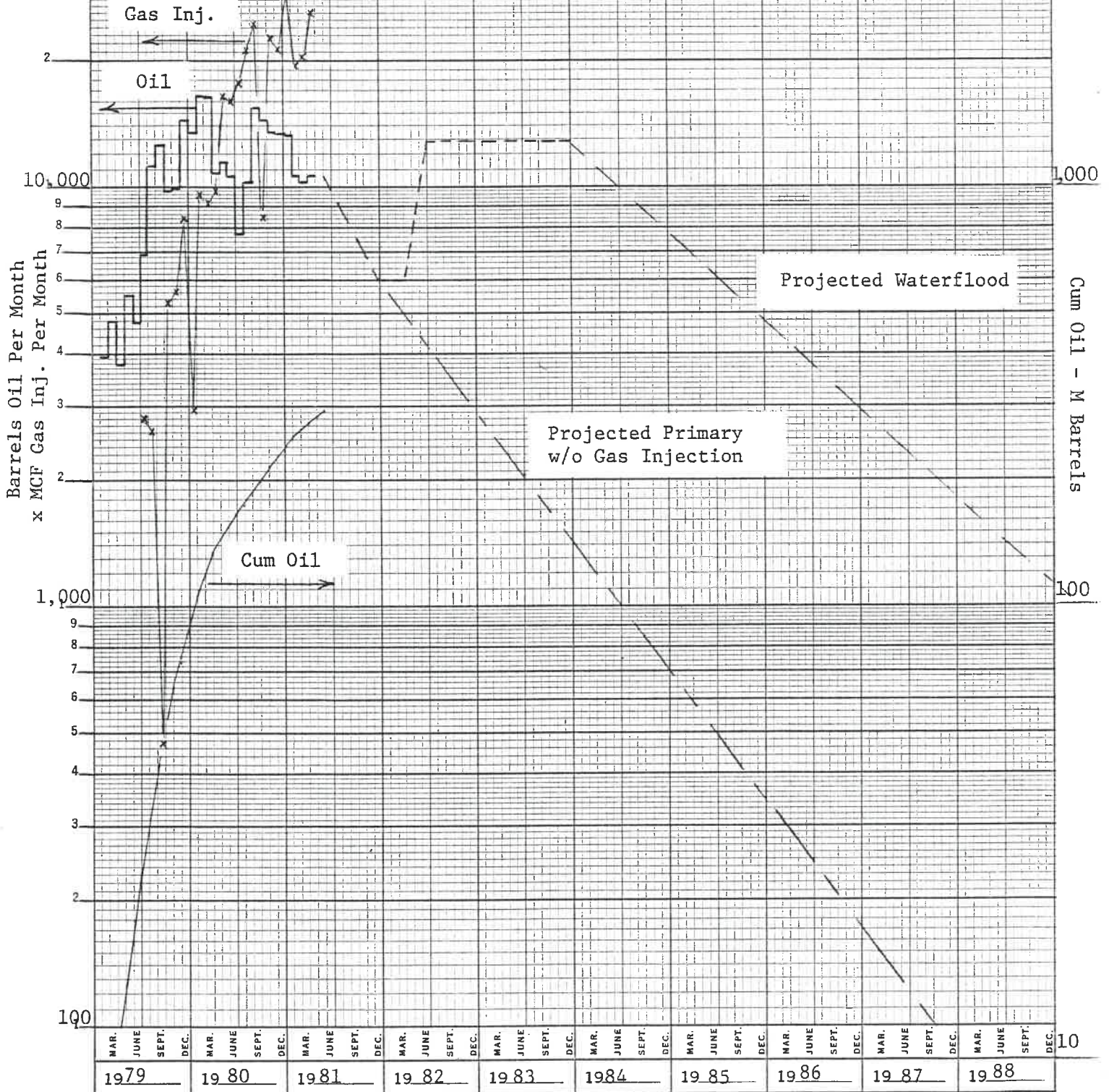


100,000

APPENDIX I

EXHIBIT I-5

Lemon Ranch Field  
Actual and Projected  
Production Schedule



APPENDIX I

EXHIBIT I-6

Lemon Ranch Waterflood

Summary of Estimated Costs

|                                            |                         |
|--------------------------------------------|-------------------------|
| Injection Plant                            | \$ 50,000               |
| Changes to Tank Batteries                  | 27,100                  |
| Water System:                              |                         |
| A. Water Well                              | 15,000                  |
| B. Water Tank Dirt Work, etc.              | 8,000                   |
| Distribution System                        | 50,000                  |
| Well Conversions                           | 18,000                  |
| Pumping Units (Rods, Pumps, Motors, Units) | <u>327,500</u>          |
|                                            | Subtotal 495,600        |
| Contingencies @ 15%                        | <u>75,000</u>           |
|                                            | Total <u>\$ 570,000</u> |

LEMON RANCH FIELD  
SWOPE LIME RESERVOIR  
COMANCHE CO. KANSAS

APPENDIX I

EXHIBIT I-7

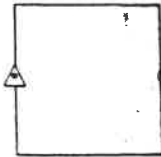
RESERVES AND ECONOMICS  
AS OF DATE : 6/ 1/1981

WATERFLOOD PREDICTION  
ESCALATED PRICES AND COSTS

| -END-<br>MO-YR     | GROSS OIL<br>PRODUCTION | GROSS GAS<br>PRODUCTION | OIL TO NET<br>INTEREST | GAS TO NET<br>INTEREST | REVENUE TO<br>INTEREST | NET<br>INVESTMENT | NET OPER<br>EXPENSES | NET INCOME<br>BEFORE FIT | CUMULATIVE<br>NET INCOME | CUM DISC<br>NET INCOME | 15.00 PCT |
|--------------------|-------------------------|-------------------------|------------------------|------------------------|------------------------|-------------------|----------------------|--------------------------|--------------------------|------------------------|-----------|
| ----               | ---MB---                | ---MMF---               | ---MB---               | ---MMF---              | ---M\$---              | ---M\$---         | ---M\$---            | ---M\$---                | ---M\$---                | ---M\$---              | ---M\$--- |
| 12-81              | 55.253                  | 97.650                  | 44.202                 | 78.120                 | 1700.703               | 571.000           | 84.000               | 1045.703                 | 1045.703                 | 1008.922               |           |
| 12-82              | 123.022                 | 326.550                 | 98.418                 | 261.240                | 4304.989               | 0.000             | 150.720              | 4154.269                 | 5199.972                 | 4543.851               |           |
| 12-83              | 155.125                 | 345.906                 | 124.100                | 276.725                | 5644.513               | 0.000             | 162.778              | 5481.735                 | 10681.707                | 8559.065               |           |
| 12-84              | 121.565                 | 201.794                 | 97.252                 | 161.435                | 4531.514               | 0.000             | 175.799              | 4355.715                 | 15037.422                | 11305.408              |           |
| 12-85              | 73.300                  | 98.841                  | 58.640                 | 79.073                 | 2864.259               | 0.000             | 189.864              | 2674.395                 | 17711.818                | 12756.936              |           |
| 12-86              | 44.423                  | 52.833                  | 35.538                 | 42.266                 | 1845.754               | 0.000             | 205.053              | 1640.701                 | 19352.520                | 13523.474              |           |
| 12-87              | 27.056                  | 29.815                  | 21.845                 | 23.852                 | 1206.506               | 0.000             | 221.457              | 985.049                  | 20337.570                | 13919.831              |           |
| 12-88              | 16.559                  | 17.419                  | 13.247                 | 13.935                 | 805.302                | 0.000             | 239.174              | 566.128                  | 20903.698                | 14115.618              |           |
| 12-89              | 10.183                  | 10.411                  | 8.147                  | 8.329                  | 533.288                | 0.000             | 258.308              | 274.980                  | 21178.678                | 14197.562              |           |
| 12-90              | 5.261                   | 5.291                   | 4.209                  | 4.233                  | 302.982                | 0.000             | 215.243              | 87.739                   | 21266.418                | 14220.401              |           |
| S TOT              | 631.747                 | 1186.510                | 505.398                | 949.208                | 23739.810              | 571.000           | 1902.396             | 21266.418                | 21266.418                | 14220.401              |           |
| AFTER              | 0.000                   | 0.000                   | 0.000                  | 0.000                  | 0.000                  | 0.000             | 0.000                | 0.000                    | 21266.418                | 14220.401              |           |
| TOTAL              | 631.747                 | 1186.510                | 505.398                | 949.208                | 23739.810              | 571.000           | 1902.396             | 21266.418                | 21266.418                | 14220.401              |           |
| CUM.               | 290.000                 | 290.000                 |                        | NET OIL REVENUE        | 19748.972              |                   | 5 PCT                | 18460.590                | 40 PCT                   | 8227.750               |           |
|                    |                         |                         |                        | NET GAS REVENUE        | 3990.840               |                   | 10 PCT               | 16145.619                | 50 PCT                   | 6835.927               |           |
| ULT.               | 921.747                 | 1476.510                |                        | NET PROD REVENUE       | -0.002                 |                   | 15 PCT               | 14220.401                | 60 PCT                   | 5768.012               |           |
|                    |                         |                         |                        |                        |                        |                   | 20 PCT               | 12605.897                | 80 PCT                   | 4270.524               |           |
|                    |                         |                         |                        |                        |                        |                   | 30 PCT               | 10080.016                | 100 PCT                  | 3300.609               |           |
| CUM NET INC/INV(1) | 37.244                  |                         |                        | CUM NET PW/INV(1)      | 24.904                 |                   |                      |                          |                          |                        |           |
| GROSS WELLS        | 10.                     |                         |                        | LIFE (YEARS)           | 9.38                   |                   |                      |                          |                          |                        |           |
| MONTH IN 1ST YEAR  | 7.                      |                         |                        | RATE OF RETURN,PCT     | 100.00                 |                   |                      |                          |                          |                        |           |
| INITIAL W.I., PCT  | 100.0000                |                         |                        | INITIAL N.I., PCT      | 80.0000                |                   |                      |                          |                          |                        |           |

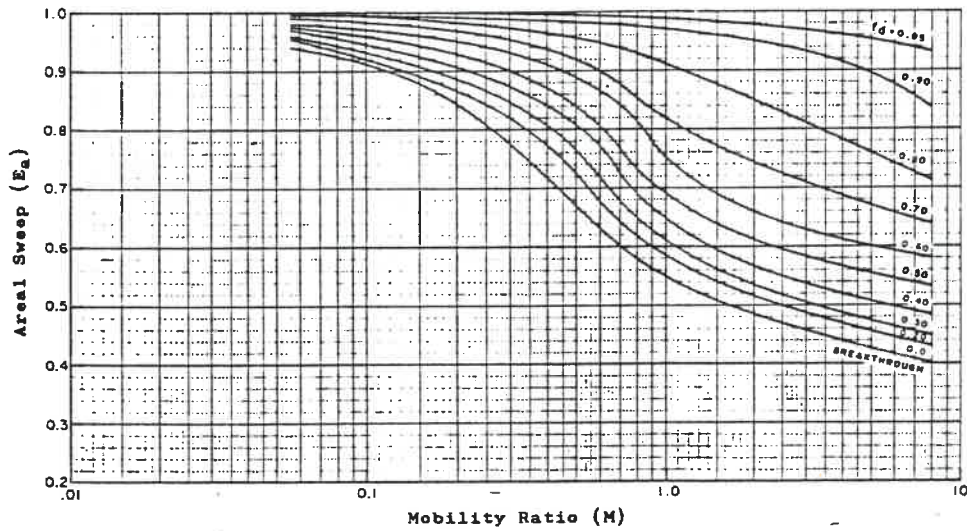
NOLOSS

APPENDIX I  
EXHIBIT I-8



LINE-DRIVE CORRELATION  
FOR DIRECT-LINE  
SQUARE PATTERN

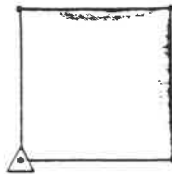
(after Dyes, Caudle and Erickson<sup>5</sup>)





# APPENDIX I

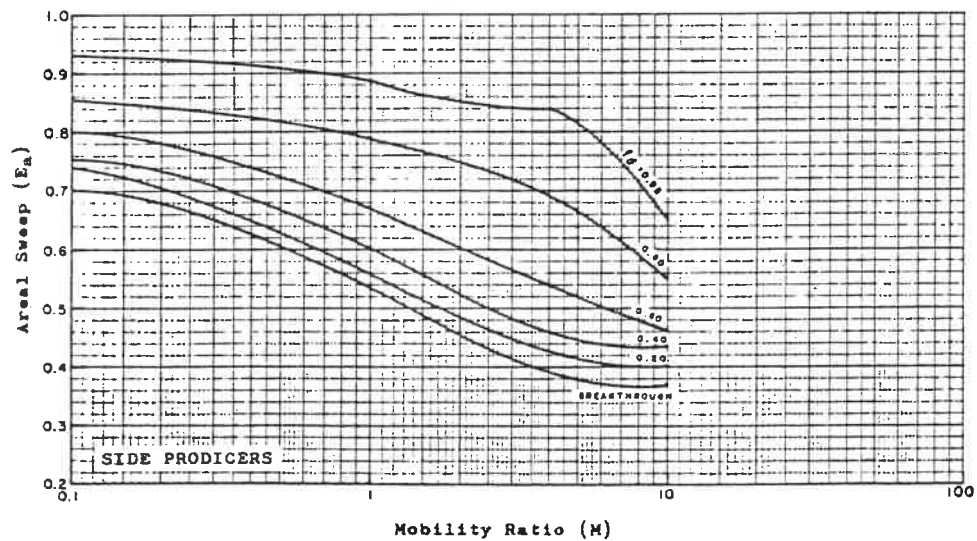
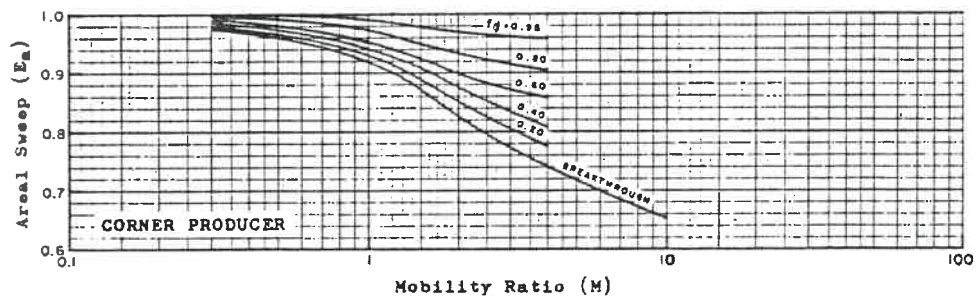
## EXHIBIT I-9

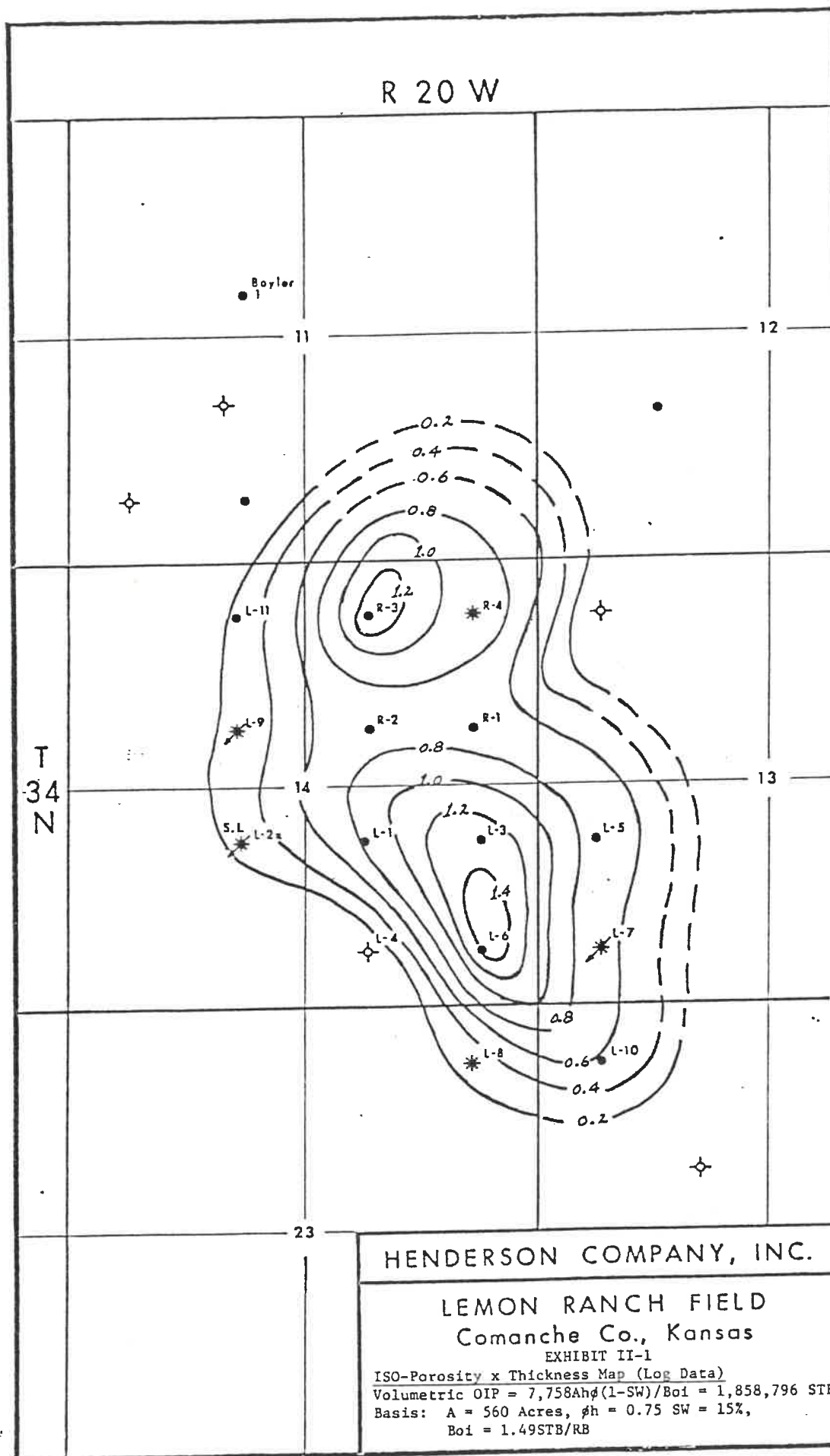


### NINE-SPOT CORRELATION

$$\text{FOR } q_c / q_s = 1.0$$

(after Kimbler, Caudle and Cooper<sup>3</sup>)





KRM-LEMON RANCH FIELD  
SWOPE LIME RESERVOIR  
COMANCHE CO, KANSAS

APPENDIX II

EXHIBIT II-2

R E S E R V O I R F L U I D S T A B L E

| PRESSURE<br>PSIG---- | DIFFERENTIAL DATA |                    | FLASH          |                    | FLASH              |                  | GAS             |                    | Z |  |
|----------------------|-------------------|--------------------|----------------|--------------------|--------------------|------------------|-----------------|--------------------|---|--|
|                      | FVF<br>V/B----    | GAS SOL<br>F/B---- | FVF<br>V/B---- | GAS SOL<br>F/B---- | GAS SOL<br>F/B---- | GRAVITY<br>----- | FACTOR<br>----- | GAS FVF<br>B/MCF-- |   |  |
| 50.                  | 1.1200            | 110.               | 1.1200         | 110.               | 0.000              | 1.0000           | 45.6056         |                    |   |  |
| 100.                 | 1.1900            | 205.               | 1.1900         | 205.               | 0.000              | 0.9950           | 25.5879         |                    |   |  |
| 150.                 | 1.2270            | 259.               | 1.2270         | 259.               | 0.000              | 0.9770           | 17.4952         |                    |   |  |
| 200.                 | 1.2550            | 320.               | 1.2550         | 320.               | 0.000              | 0.9590           | 13.1727         |                    |   |  |
| 300.                 | 1.2640            | 331.               | 1.2640         | 331.               | 0.000              | 0.9350           | 8.7613          |                    |   |  |
| 600.                 | 1.3170            | 446.               | 1.3170         | 446.               | 0.000              | 0.8980           | 4.3076          |                    |   |  |
| 900.                 | 1.3650            | 555.               | 1.3650         | 555.               | 0.000              | 0.8680           | 2.7980          |                    |   |  |
| 1200.                | 1.4120            | 663.               | 1.4120         | 663.               | 0.000              | 0.8440           | 2.0487          |                    |   |  |
| 1400.                | 1.4420            | 733.               | 1.4420         | 733.               | 0.000              | 0.8330           | 1.7361          |                    |   |  |
| 1695.                | 1.4900            | 845.               | 1.4900         | 845.               | 0.000              | 0.8150           | 1.4055          |                    |   |  |

N - MSTB 0.000  
G/N RATIO - CF/B 000.000  
G - MMCF 0.000  
BW - RVB/STB 1.0100  
SEP. CF/STB 000.  
RESVR TEMP - F 125.  
NITROGEN - PCT 00.00  
HYD. SULF. - PCT 00.000

SAT PSI 1695.  
SCW - PCT 15  
GAS CAP PSI 0.  
CW - V/MMV/PSI 2.500  
CD - V/MMV/PSI 13.900  
CF - V/MMV/PSI 4.000  
CARB. DIOX. - PCT 00.00



APPENDIX II

EXHIBIT II-3

Lemon Ranch Field  
Pressure and Gas - Oil Ratio Data  
July 8, 1980

| <u>Well No.</u> | <u>Estimated<br/>Test Date</u> | <u>Estimated<br/>Bbls Oil/Day</u> | <u>Estimated<br/>MCF Gas/Day</u> | <u>GOR-CF/B</u> | <u>SITP-PSI</u> | <u>SIBHP-PSI</u>    | <u>Survey<br/>Date</u> | <u>Estimated<br/>Cumulative<br/>Bbls Oil</u> |
|-----------------|--------------------------------|-----------------------------------|----------------------------------|-----------------|-----------------|---------------------|------------------------|----------------------------------------------|
| Lemon #1        | 6/15/80                        | 62                                | 91                               | 1,468           | 1,020           |                     | 7/8/80                 | 30,500                                       |
| Lemon #3        | 6/15/80                        | 54                                | 102                              | 1,594           | 1,250           | -                   | 7/8/80                 | 20,600                                       |
| Lemon #5        | 6/15/80                        | 94                                | 180                              | 1,915           | 800             | 1,659               | 7/8/80                 | 9,800                                        |
| Lemon #5        | 1/26/81                        | 11                                | 30                               | 2,727           | -               | 1,634 <sup>1/</sup> | 1/27/81                |                                              |
| Lemon #6        | 3/15/80                        | 90                                | 150                              | 1,667           | 1,200           | 1,446               | 7/8/80                 | 26,100                                       |
| Lemon #8        | 6/15/80                        | 80                                | 80                               | 1,000           | 1,450           | -                   | 7/8/80                 | 6,900                                        |
| Lemon #9        | 6/15/80                        | 25                                | 60                               | 2,400           | 400             | 1,619               | 7/8/80                 | 1,000                                        |
| Lemon #10       | 6/15/80                        | 82                                | 100                              | 1,220           | 800             | 1,586               | 7/8/80                 | 13,400                                       |
| Lemon #11       | 6/15/80                        | 20                                | 984                              | 49,200          | 1,500           | 1,686               | 7/8/80                 | 0                                            |
| Rhodes #1       | 3/15/80                        | 25                                | 50                               | 2,000           | 680             | -                   | 7/8/80                 | 22,300                                       |
| Rhodes #2       | 5/30/80                        | 80                                | 395                              | 4,938           | 1,200           | 1,069               | 7/8/80                 | 23,100                                       |
| Rhodes #3       | 6/15/80                        | 81                                | 135                              | 1,667           | 800             | -                   | 7/8/80                 | 8,500                                        |
| Rhodes #3       | 10/23/80                       | 75                                | 150                              | 2,000           | 454             | 1,118 <sup>2/</sup> | 10/24/80               | 15,600                                       |
| Rhodes #4       | 7/1/80                         | 132                               | 132                              | 1,000           | 1,500           | -                   | 7/8/80                 | 2,300                                        |

Notes: <sup>1/</sup> Extrapolated to p\*. Measured 875 psi max./24 hours.  
<sup>2/</sup> Extrapolated to p\*. Measured 792 psi max./72 hours.

APPENDIX II

EXHIBIT II-4

KRM-Lemon Ranch Field  
Swope Lime Reservoir  
Comanche County, Kansas

MATERIAL BALANCE RESULTS  
Survey Date: 7/8/80

| Well No.  | Original<br>Pressure | Current<br>Pressure | Cumulative Production |             |               | Oil-in-Place<br>Original<br>MSTB |
|-----------|----------------------|---------------------|-----------------------|-------------|---------------|----------------------------------|
|           |                      |                     | Oil<br>MSTB           | Gas<br>MMCF | Water<br>MSTB |                                  |
| Lemon #1  | 1825                 | 1000                | 30.5                  | 36.0        | 0             | 163                              |
| Lemon #2* | 1825                 | 1600                | 0.6                   | -17.0       | 0             | 21                               |
| Lemon #3  | 1825                 | 1200                | 20.6                  | 26.0        | 0             | 180                              |
| Lemon #5  | 1825                 | 1659                | 9.8                   | 14.0        | 0             | 1292                             |
| Lemon #6  | 1825                 | 1446                | 26.1                  | 30.0        | 0             | 448                              |
| Lemon #7* | 1825                 | 1600                | 3.0                   | -85.0       | 0             | 103                              |
| Lemon #8  | 1825                 | 1590                | 6.9                   | 6.0         | 0             | 228                              |
| Lemon #9  | 1825                 | 1619                | 1.0                   | 1.0         | 0             | 51                               |
| Lemon #10 | 1825                 | 1586                | 13.4                  | 13.0        | 0             | 468                              |
| Lemon #11 | 1825                 | 1686                | 0.0                   | 0.0         | 0             | 0                                |
| Rhodes #1 | 1825                 | 1050                | 22.3                  | 30.0        | 0             | 150                              |
| Rhodes #2 | 1825                 | 1069                | 23.1                  | 35.0        | 0             | 182                              |
| Rhodes #3 | 1825                 | 1400                | 8.5                   | 0.0         | 0             | 80                               |
| Rhodes #4 | 1825                 | 1600                | 2.3                   | 2.0         | 0             | 84                               |
| CAP       | 0                    | 0                   | 0.0                   | 0.0         | 0             |                                  |
| TOTALS    |                      |                     | 168.1                 | 91.0        | 0             | 3447                             |

Original Gas Cap Vol. = 0. MMSCF  
Total Water Influx Vol. = 0. MBBLS

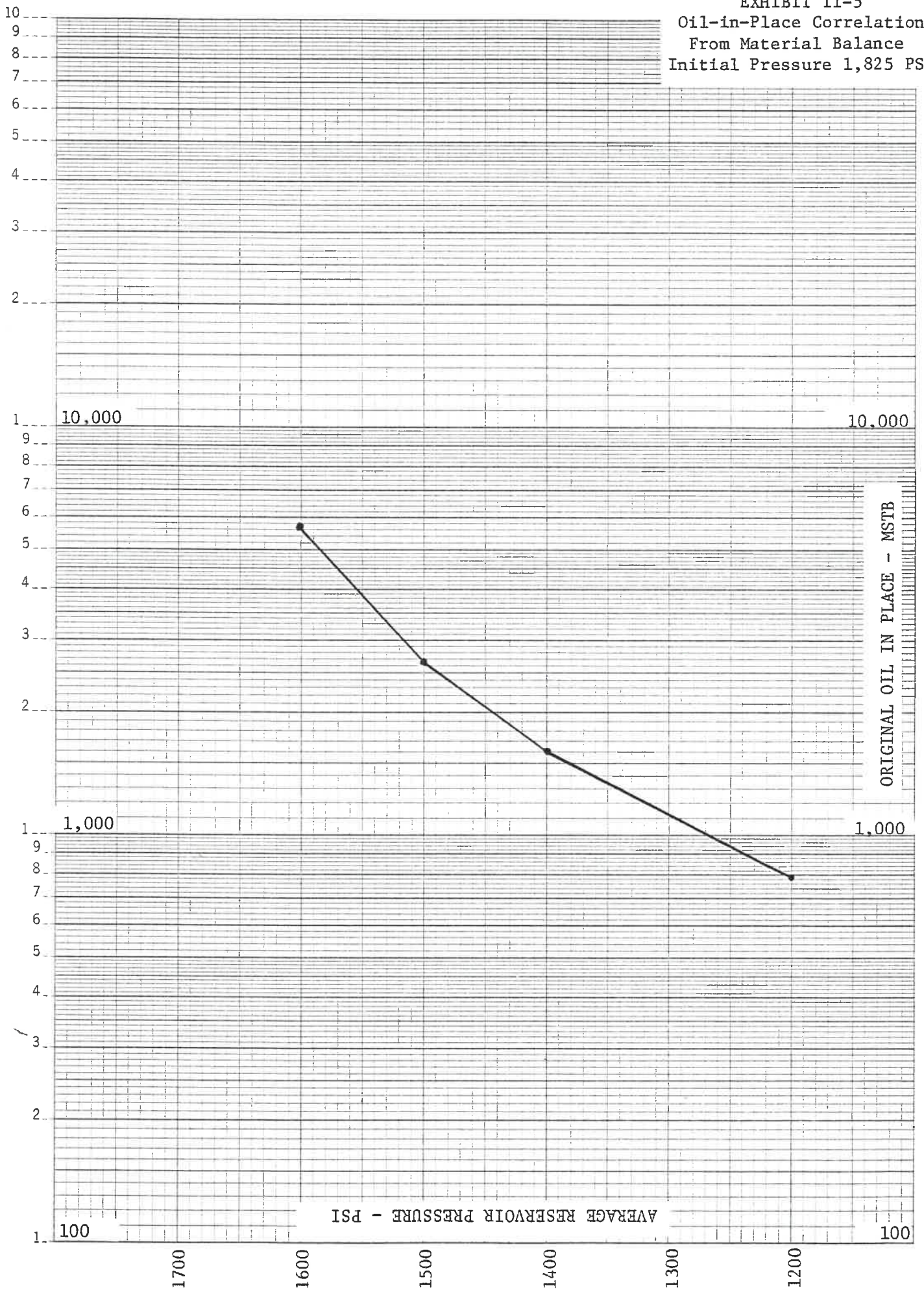
\* Gas Injection Well

APPENDIX II  
EXHIBIT II-5

Oil-in-Place Correlation  
From Material Balance  
Initial Pressure 1,825 PSI

46 5490

KE SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS  
KEUFFEL & ESSER CO. MADE IN U.S.A.



APPENDIX II

EXHIBIT II-6

KRM-Lemon Ranch Field  
Swope Lime Reservoir  
Comanche County, Kansas

MATERIAL BALANCE RESULTS  
Survey Date: 7/8/80

| <u>Case No.</u> | <u>Original<br/>Pressure</u> | <u>Assumed<br/>Current<br/>Pressure</u> | <u>Cumulative Production</u> |                     |                       | <u>Oil-in-Place<br/>Original<br/>MSTB</u> |
|-----------------|------------------------------|-----------------------------------------|------------------------------|---------------------|-----------------------|-------------------------------------------|
|                 |                              |                                         | <u>Oil<br/>MSTB</u>          | <u>Gas<br/>MMCF</u> | <u>Water<br/>MSTB</u> |                                           |
| 1               | 1825                         | 1200                                    | 168                          | 91                  | 0                     | 785                                       |
| 2               | 1825                         | 1400                                    | 168                          | 91                  | 0                     | 1590                                      |
| 3               | 1825                         | 1500                                    | 168                          | 91                  | 0                     | 2645                                      |
| 4               | 1825                         | 1600                                    | 168                          | 91                  | 0                     | 5759                                      |

APPENDIX III

EXHIBIT III-2

PRODUCED GAS METERED FOR RE-INJECTION  
LEMON RANCH FIELD

| <u>1979</u> | <u>Leman Ranch</u> |            | <u>Rhodes</u> |            | <u>Total</u> |            |
|-------------|--------------------|------------|---------------|------------|--------------|------------|
|             | <u>MCF</u>         |            | <u>MCF</u>    |            | <u>MCF</u>   |            |
|             | <u>Month</u>       | <u>Cum</u> | <u>Month</u>  | <u>Cum</u> | <u>Month</u> | <u>Cum</u> |
| July (1,2)  | 1,549              | 1,549      | 1,263         | 1,263      | 2,812        | 2,812      |
| August      | 1,675              | 3,227      | 944           | 2,207      | 2,622        | 5,434      |
| September   | 280                | 3,507      | 192           | 2,399      | 472          | 5,906      |
| October     | 2,521              | 6,028      | 2,764         | 5,163      | 5,285        | 11,191     |
| November    | 2,850              | 8,878      | 2,802         | 7,965      | 5,652        | 16,843     |
| December    | 5,094              | 13,972     | 3,338         | 11,303     | 8,432        | 25,275     |
| <u>1980</u> |                    |            |               |            |              |            |
| January     | 5,876              | 19,848     | 2,076         | 13,379     | 2,952        | 28,227     |
| February    | 6,113              | 25,961     | 3,491         | 16,890     | 9,604        | 38,731     |
| March       | 7,244              | 33,205     | 1,923         | 18,793     | 9,167        | 46,998     |
| April       | 7,643              | 40,845     | 2,212         | 21,005     | 9,855        | 56,853     |
| May         | 11,603             | 52,451     | 4,677         | 25,682     | 16,280       | 73,133     |
| June        | 12,246             | 64,697     | 3,831         | 29,513     | 16,077       | 89,210     |
| July        | 13,676             | 78,373     | 4,138         | 33,651     | 17,074       | 107,024    |
| August (3)  | 14,526             | 92,899     | 6,688         | 40,339     | 21,214       | 128,235    |
| September   | 15,760             | 108,659    | 8,955         | 49,294     | 24,715       | 152,953    |
| October     | 5,444              | 114,103    | 3,049         | 52,343     | 8,493        | 161,446    |
| November    | 14,499             | 128,602    | 8,324         | 60,667     | 22,823       | 184,269    |
| December    | 14,849             | 143,451    | 6,470         | 67,137     | 21,319       | 205,588    |
| <u>1981</u> |                    |            |               |            |              |            |
| January     | 20,365             | 163,816    | 8,711         | 75,848     | 29,076       | 234,664    |
| February    | 14,978             | 178,794    | 4,694         | 80,542     | 19,672       | 254,336    |
| March       | 14,063             | 192,857    | 6,065         | 86,607     | 20,128       | 274,464    |
| April       | 14,653             | 207,510    | 12,282        | 98,889     | 26,938       | 301,402    |

Notes:

- (1) Injection at average wellhead pressure of 1,650 psi.
- (2) Gas injection into Leman #2X and #7.
- (3) Leman #2X shut in. Gas injection started in Leman #9.

## APPENDIX III

## EXHIBIT III-3

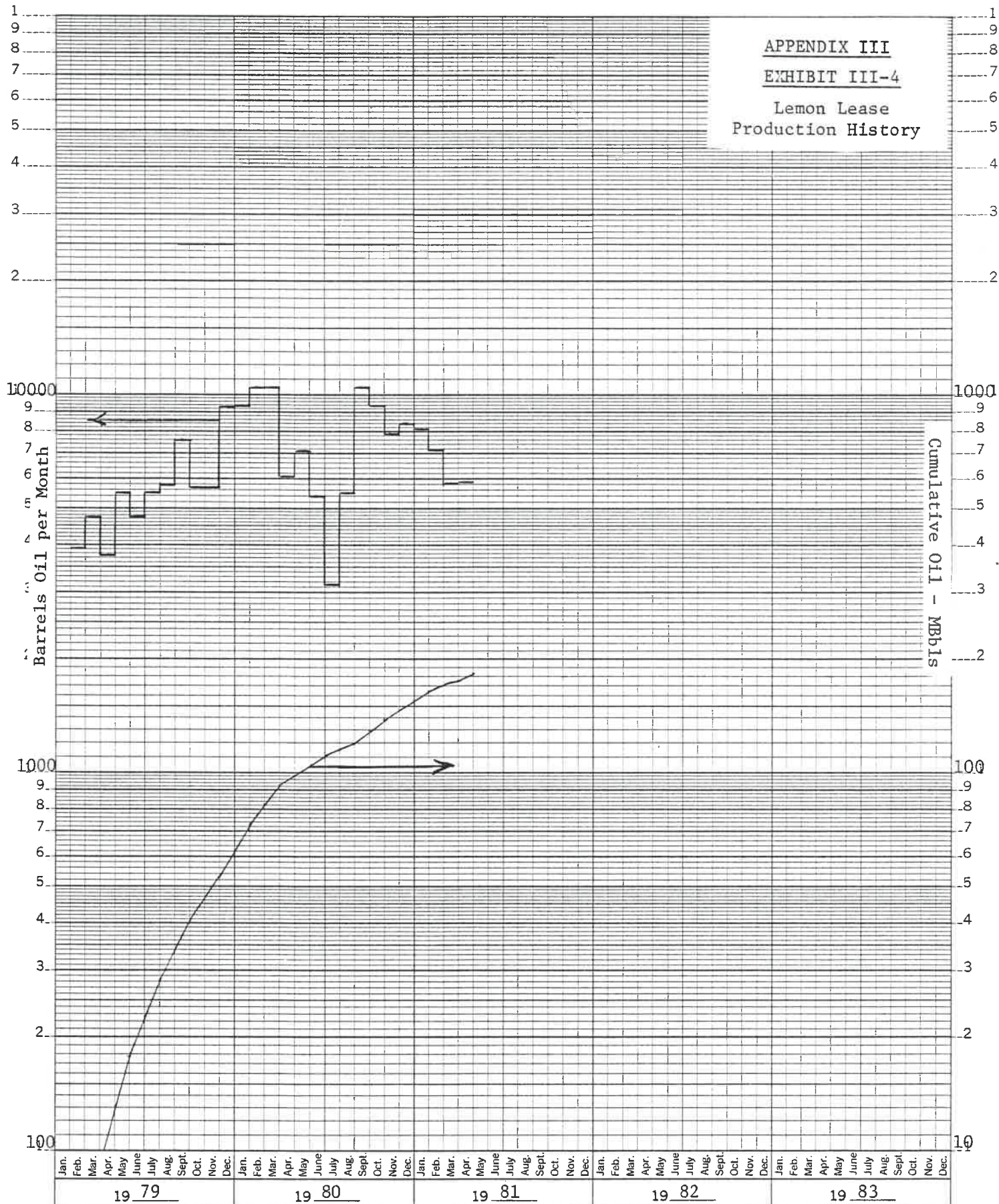
OIL PRODUCTION HISTORY  
LEMON RANCH FIELD

| 1979        | Leman Ranch |         |         | Rhodes |         |         | Total  |         |         |
|-------------|-------------|---------|---------|--------|---------|---------|--------|---------|---------|
|             | Active      | Barrels |         | Active | Barrels |         | Active | Barrels |         |
|             | Wells       | Month   | Cum     | Wells  | Month   | Cum     | Wells  | Month   | Cum     |
| February    | 1           | 3,960   | 3,960   | -      | -       | -       | 1      | 3,960   | 3,960   |
| March       | 1           | 4,784   | 8,744   | -      | -       | -       | 1      | 4,784   | 8,744   |
| April       | 2           | 3,757   | 12,501  | -      | -       | -       | 2      | 3,757   | 12,501  |
| May         | 5           | 5,454   | 17,955  | -      | -       | -       | 5      | 5,454   | 17,955  |
| June        | 5           | 4,706   | 22,661  | -      | -       | -       | 5      | 4,706   | 22,661  |
| July        | 5           | 5,480   | 28,141  | 2      | 1,394   | 1,394   | 7      | 6,874   | 29,535  |
| August      | 6           | 5,790   | 33,931  | 2      | 5,398   | 6,792   | 8      | 11,188  | 40,653  |
| September   | 6           | 7,584   | 41,515  | 2      | 4,934   | 11,726  | 8      | 12,518  | 53,171  |
| October     | 7           | 5,704   | 47,219  | 2      | 4,067   | 15,793  | 9      | 9,771   | 62,942  |
| November    | 4           | 5,730   | 52,949  | 2      | 4,238   | 20,031  | 6      | 9,968   | 72,910  |
| December    | 7           | 9,247   | 62,196  | 2      | 4,913   | 24,944  | 9      | 14,160  | 87,070  |
| <u>1980</u> |             |         |         |        |         |         |        |         |         |
| January     | 6           | 9,416   | 71,612  | 2      | 4,032   | 28,976  | 8      | 13,448  | 100,518 |
| February    | 4           | 10,410  | 82,022  | 3      | 6,022   | 34,998  | 7      | 16,432  | 116,950 |
| March       | 7           | 10,384  | 92,406  | 3      | 6,069   | 41,067  | 10     | 16,453  | 133,403 |
| April       | 4           | 6,120   | 98,526  | 3      | 4,659   | 45,726  | 7      | 10,779  | 144,182 |
| May         | 6           | 7,102   | 105,628 | 3      | 4,339   | 50,065  | 9      | 11,441  | 155,623 |
| June        | 4           | 5,443   | 111,071 | 4      | 5,083   | 55,148  | 8      | 10,526  | 166,149 |
| July        | 3           | 3,190   | 114,261 | 2      | 4,542   | 59,690  | 5      | 7,732   | 173,887 |
| August      | 4           | 5,546   | 119,807 | 2      | 4,467   | 64,157  | 6      | 10,013  | 183,891 |
| September   | 7           | 10,350  | 130,157 | 2      | 4,835   | 68,992  | 9      | 15,185  | 199,079 |
| October     | 6           | 9,366   | 139,523 | 3      | 5,103   | 74,095  | 9      | 14,469  | 213,548 |
| November    | 6           | 7,978   | 147,501 | 2      | 5,388   | 79,483  | 8      | 13,366  | 226,914 |
| December    | 6           | 8,430   | 155,931 | 3      | 4,845   | 84,328  | 9      | 13,275  | 240,189 |
| <u>1981</u> |             |         |         |        |         |         |        |         |         |
| January     | 6           | 8,148   | 164,079 | 3      | 4,946   | 89,274  | 9      | 13,094  | 253,283 |
| February    | 6           | 7,136   | 171,215 | 4      | 3,347   | 92,621  | 10     | 10,483  | 263,766 |
| March       | 6           | 5,808   | 177,023 | 4      | 4,238   | 96,859  | 10     | 10,046  | 273,812 |
| April       | 6           | 5,945   | 182,968 | 4      | 4,576   | 101,435 | 10     | 10,521  | 284,333 |



46 6690

APPENDIX III  
EXHIBIT III-4  
Lemon Lease  
Production History





APPENDIX III  
EXHIBIT III-5  
Rhodes Lease  
Production History

10000

1000

Cumulative Oil - MBbls

1000

100

100

10

|       |      |      |      |     |      |      |      |       |      |      |      |       |      |      |      |     |      |      |      |       |      |      |      |       |      |      |      |     |      |      |      |       |      |      |      |       |      |      |      |     |      |      |      |       |      |      |      |       |  |  |  |  |  |  |  |  |  |  |  |
|-------|------|------|------|-----|------|------|------|-------|------|------|------|-------|------|------|------|-----|------|------|------|-------|------|------|------|-------|------|------|------|-----|------|------|------|-------|------|------|------|-------|------|------|------|-----|------|------|------|-------|------|------|------|-------|--|--|--|--|--|--|--|--|--|--|--|
| Jan.  | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan.  | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan.  | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan.  | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |       |  |  |  |  |  |  |  |  |  |  |  |
| 19 79 |      |      |      |     |      |      |      |       |      |      |      | 19 80 |      |      |      |     |      |      |      |       |      |      |      | 19 81 |      |      |      |     |      |      |      |       |      |      |      | 19 82 |      |      |      |     |      |      |      |       |      |      |      | 19 83 |  |  |  |  |  |  |  |  |  |  |  |

KRM-LEMON RANCH FIELD  
SWOPE LIME RESERVOIR  
COMANCHE CO, KANSAS

APPENDIX III

EXHIBIT III-6

R E S E R V O I R F L U I D S T A B L E

| PRESSURE<br>PSIG---- | DIFFERENTIAL DATA |                    | FLASH         |                    | FLASH              |                  | GAS             |                    | Z |  |
|----------------------|-------------------|--------------------|---------------|--------------------|--------------------|------------------|-----------------|--------------------|---|--|
|                      | FVF<br>V/B---     | GAS SOL<br>F/B---- | FVF<br>V/B--- | GAS SOL<br>F/B---- | GAS SOL<br>F/B---- | GRAVITY<br>----- | FACTOR<br>----- | GAS FVF<br>B/MCF-- |   |  |
| 50.                  | 1.1200            | 110.               | 1.1200        | 110.               | 0.000              | 1.0000           | 45.6056         |                    |   |  |
| 100.                 | 1.1900            | 205.               | 1.1900        | 205.               | 0.000              | 0.9950           | 25.5879         |                    |   |  |
| 150.                 | 1.2270            | 259.               | 1.2270        | 259.               | 0.000              | 0.9770           | 17.4952         |                    |   |  |
| 200.                 | 1.2550            | 320.               | 1.2550        | 320.               | 0.000              | 0.9590           | 13.1727         |                    |   |  |
| 300.                 | 1.2640            | 331.               | 1.2640        | 331.               | 0.000              | 0.9350           | 8.7613          |                    |   |  |
| 600.                 | 1.3170            | 446.               | 1.3170        | 446.               | 0.000              | 0.8980           | 4.3076          |                    |   |  |
| 900.                 | 1.3650            | 555.               | 1.3650        | 555.               | 0.000              | 0.8680           | 2.7980          |                    |   |  |
| 1200.                | 1.4120            | 663.               | 1.4120        | 663.               | 0.000              | 0.8440           | 2.0487          |                    |   |  |
| 1400.                | 1.4420            | 733.               | 1.4420        | 733.               | 0.000              | 0.8330           | 1.7361          |                    |   |  |
| 1695.                | 1.4900            | 845.               | 1.4900        | 845.               | 0.000              | 0.8150           | 1.4055          |                    |   |  |

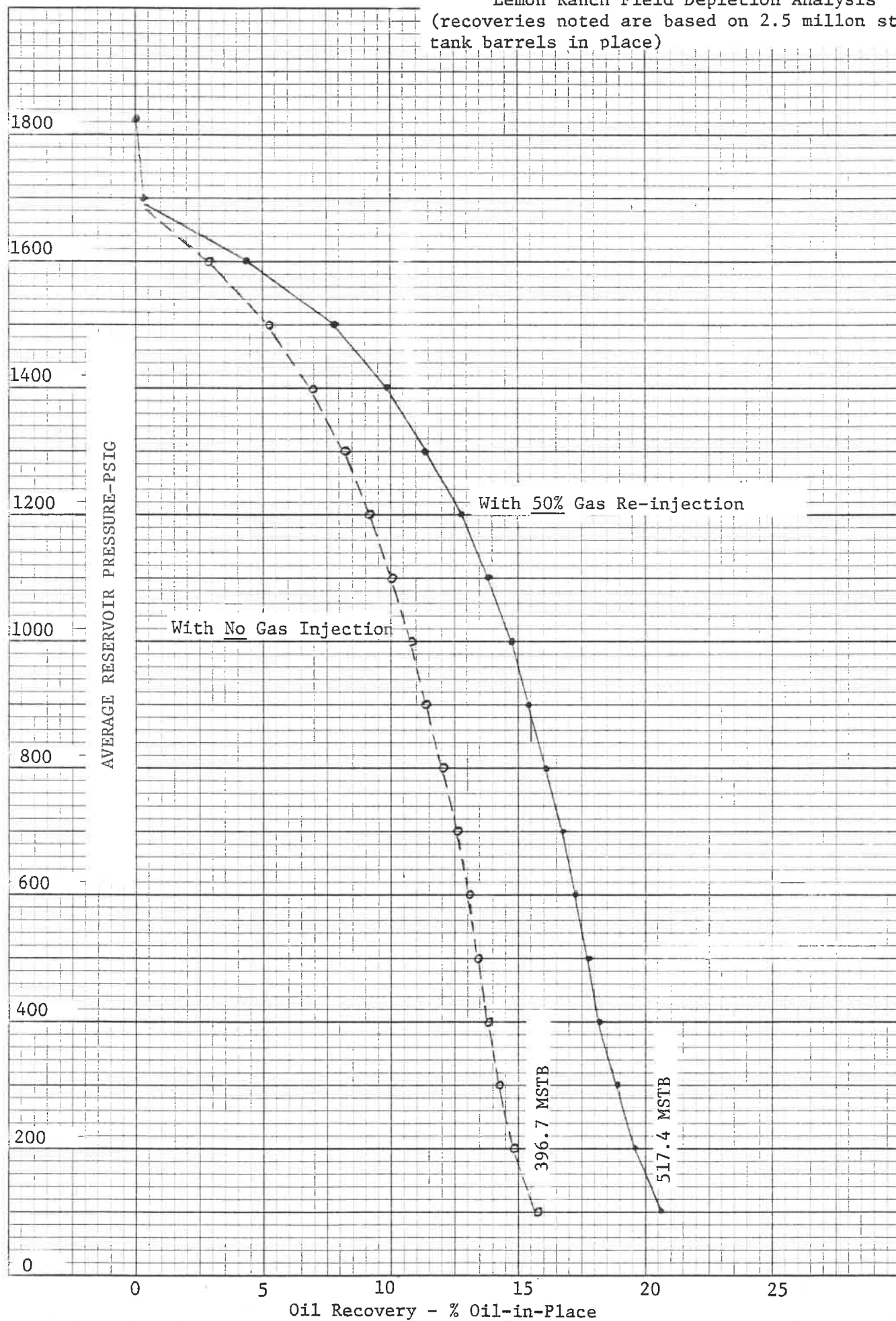
N - MSTB 0.000  
G/N RATIO - CF/B 000.000  
G - MMCF 0.000  
BW - RVB/STB 1.0100  
SEP. CF/STB 000.  
RESVR TEMP - F 125.  
NITROGEN - PCT 00.00  
HYD. SULF. - PCT 00.000

SAT PSI 1695.  
SCW - PCT 15  
GAS CAP PSI 0.  
CW - V/MMV/PSI 2.500  
CD - V/MMV/PSI 13.900  
CF - V/MMV/PSI 4.000  
CARB. DIOX. - PCT 00.00



APPENDIX III  
EXHIBIT III-7

Lemon Ranch Field Depletion Analysis  
(recoveries noted are based on 2.5 million stock  
tank barrels in place)



46 0780

10 X 10 TO THE INCH • 7 X 10 INCHES  
KEUFFEL & ESSER CO. MADE IN U.S.A.

APPENDIX III

LEMON RANCH RECOVERY ANALYSIS  
WITH 50% GAS INJECTION  
SWOPE LS-COMANCHE CO, KS

EXHIBIT III-8

INTERNAL GAS DRIVE  
PRESSURE - PRODUCTION PERFORMANCE  
DISPERSED DISPLACEMENT

| PRESSURE<br>PSIG | RECOVERY<br>FACTOR % | OIL PROD<br>MSTB | CUM OIL<br>MSTB | CUM GAS--MMSCF<br>TOTAL | GOR<br>SCF/STB | GAS SAT<br>% PV |
|------------------|----------------------|------------------|-----------------|-------------------------|----------------|-----------------|
| -----            | -----                | -----            | -----           | -----                   | -----          | -----           |
| 1825.            | 0.000                | 0.00             | 0.0             | 0.0                     | 0.0            | 845.            |
| 1800.            | 0.048                | 1.19             | 1.2             | 1.0                     | 1.0            | 820.            |
| 1700.            | 0.238                | 4.75             | 5.9             | 4.9                     | 4.9            | 820.            |
| 1695.            | 0.247                | 0.24             | 6.2             | 5.1                     | 5.1            | 820.            |
| 1600.            | 4.401                | 103.84           | 110.0           | 110.0                   | 56.2           | 1010.           |
| 1500.            | 7.703                | 82.53            | 192.6           | 247.5                   | 123.9          | 1666.           |
| 1400.            | 9.848                | 53.63            | 246.2           | 400.8                   | 199.9          | 2860.           |
| 1300.            | 11.446               | 39.95            | 286.1           | 565.2                   | 281.6          | 4114.           |
| 1200.            | 12.709               | 31.55            | 317.7           | 732.5                   | 364.9          | 5303.           |
| 1100.            | 13.840               | 28.27            | 346.0           | 926.1                   | 461.3          | 6846.           |
| 1000.            | 14.718               | 21.95            | 367.9           | 1115.1                  | 555.6          | 8611.           |
| 900.             | 15.416               | 17.44            | 385.4           | 1299.2                  | 647.4          | 10557.          |
| 800.             | 16.125               | 17.74            | 403.1           | 1521.3                  | 758.2          | 12519.          |
| 700.             | 16.708               | 14.57            | 417.7           | 1727.2                  | 861.0          | 14135.          |
| 600.             | 17.213               | 12.61            | 430.3           | 1921.5                  | 958.0          | 15404.          |
| 500.             | 17.811               | 14.96            | 445.2           | 2159.8                  | 1076.9         | 15933.          |
| 400.             | 18.336               | 13.12            | 458.3           | 2372.1                  | 1182.9         | 16187.          |
| 300.             | 18.930               | 14.86            | 473.2           | 2608.6                  | 1301.0         | 15920.          |
| 200.             | 19.696               | 19.16            | 492.4           | 2881.3                  | 1437.1         | 14228.          |
| 100.             | 20.697               | 25.00            | 517.4           | 3284.9                  | 1638.6         | 16141.          |

INITIAL OIL-IN-PLACE (MB) = 2499.8  
INITIAL GAS-IN-PLACE, MMF 2112.3

APPENDIX III

LEMON RANCH RECOVERY ANALYSIS  
WITH NO GAS INJECTION  
SWOPE LS-COMANCHE CO, KS

EXHIBIT III-9

I N T E R N A L   G A S   D R I V E  
P R E S S U R E   -   P R O D U C T I O N   P E R F O R M A N C E  
D I S P E R S E D   D I S P L A C E M E N T

| PRESSURE<br>PSIG | RECOVERY<br>FACTOR % | OIL PROD<br>MSTB | CUM OIL<br>MSTB | CUM GAS--MMSCF<br>TOTAL | NET    | GOR<br>SCF/STB | GAS SAT<br>% PV |
|------------------|----------------------|------------------|-----------------|-------------------------|--------|----------------|-----------------|
| -----            | -----                | -----            | -----           | -----                   | -----  | -----          | -----           |
| 1825.            | 0.000                | 0.00             | 0.0             | 0.0                     | 0.0    | 845.           | 0.0             |
| 1800.            | 0.048                | 1.19             | 1.2             | 1.0                     | 1.0    | 820.           | 0.0             |
| 1700.            | 0.238                | 4.75             | 5.9             | 4.9                     | 4.9    | 820.           | 0.0             |
| 1695.            | 0.247                | 0.24             | 6.2             | 5.1                     | 5.1    | 820.           | 0.0             |
| 1600.            | 2.942                | 67.37            | 73.5            | 61.3                    | 61.3   | 834.           | 3.1             |
| 1500.            | 5.340                | 59.94            | 133.5           | 130.1                   | 130.1  | 1148.          | 6.1             |
| 1400.            | 7.011                | 41.78            | 175.3           | 205.5                   | 205.5  | 1806.          | 8.3             |
| 1300.            | 8.237                | 30.63            | 205.9           | 284.8                   | 284.8  | 2590.          | 10.1            |
| 1200.            | 9.190                | 23.83            | 229.7           | 366.0                   | 366.0  | 3408.          | 11.7            |
| 1100.            | 10.084               | 22.35            | 252.1           | 458.8                   | 458.8  | 4150.          | 13.2            |
| 1000.            | 10.829               | 18.62            | 270.7           | 550.5                   | 550.5  | 4925.          | 14.6            |
| 900.             | 11.443               | 15.36            | 286.0           | 640.8                   | 640.8  | 5879.          | 15.9            |
| 800.             | 12.071               | 15.70            | 301.7           | 747.7                   | 747.7  | 6810.          | 17.2            |
| 700.             | 12.589               | 12.93            | 314.7           | 848.4                   | 848.4  | 7787.          | 18.4            |
| 600.             | 13.017               | 10.72            | 325.4           | 944.6                   | 944.6  | 8973.          | 19.5            |
| 500.             | 13.489               | 11.78            | 337.2           | 1060.5                  | 1060.5 | 9838.          | 20.7            |
| 400.             | 13.898               | 10.23            | 347.4           | 1165.7                  | 1165.7 | 10284.         | 21.9            |
| 300.             | 14.361               | 11.57            | 359.0           | 1282.1                  | 1282.1 | 10060.         | 23.1            |
| 200.             | 14.970               | 15.24            | 374.2           | 1417.6                  | 1417.6 | 8891.          | 24.0            |
| 100.             | 15.868               | 22.44            | 396.7           | 1622.6                  | 1622.6 | 9135.          | 27.7            |

INITIAL OIL-IN-PLACE (MB) = 2499.8

INITIAL GAS-IN-PLACE, MMF 2112.3

LEMON RANCH FIELD  
 SHOPE LIME RESERVOIR  
 COMANCHE CO. KANSAS

APPENDIX III  
 EXHIBIT III-10

RESERVES AND ECONOMICS  
 AS OF DATE : 6/ 1/1981

CONTINUED GAS INJECTION  
 ESCALATED PRICES AND COSTS

| -END-<br>MO-YR     | GROSS OIL<br>PRODUCTION<br>-----MB----- | GROSS GAS<br>PRODUCTION<br>-----MMF----- | OIL TO NET<br>INTEREST<br>-----MB----- | GAS TO NET<br>INTEREST<br>-----MMF----- | REVENUE TO<br>INTEREST<br>-----M\$----- | NET<br>INVESTMENT<br>-----M\$----- | NET OPER<br>EXPENSES<br>-----M\$----- | NET INCOME<br>BEFORE FIT<br>-----M\$----- | CUMULATIVE<br>NET INCOME<br>-----M\$----- | 15.00 PCT<br>CUM DISC<br>NET INCOME<br>-----M\$----- |
|--------------------|-----------------------------------------|------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|------------------------------------|---------------------------------------|-------------------------------------------|-------------------------------------------|------------------------------------------------------|
|                    |                                         |                                          |                                        |                                         |                                         |                                    |                                       |                                           |                                           |                                                      |
| 12-81              | 60.777                                  | 133.373                                  | 48.622                                 | 106.698                                 | 1561.583                                | 0.000                              | 84.000                                | 1477.583                                  | 1477.583                                  | 1414.830                                             |
| 12-82              | 70.225                                  | 188.229                                  | 56.180                                 | 150.584                                 | 1892.805                                | 300.000                            | 150.720                               | 1442.185                                  | 2919.768                                  | 2634.482                                             |
| 12-83              | 42.470                                  | 135.206                                  | 33.976                                 | 108.164                                 | 1236.361                                | 0.000                              | 162.778                               | 1073.583                                  | 3993.351                                  | 3420.851                                             |
| 12-84              | 25.814                                  | 91.209                                   | 20.651                                 | 72.968                                  | 814.924                                 | 0.000                              | 175.799                               | 639.125                                   | 4632.476                                  | 3823.829                                             |
| 12-85              | 15.767                                  | 59.361                                   | 12.613                                 | 47.488                                  | 545.716                                 | 0.000                              | 189.864                               | 355.852                                   | 4988.328                                  | 4016.968                                             |
| 12-86              | 9.676                                   | 37.876                                   | 7.741                                  | 30.301                                  | 361.692                                 | 0.000                              | 205.053                               | 156.639                                   | 5144.967                                  | 4090.150                                             |
| 12-87              | 2.271                                   | 9.052                                    | 1.817                                  | 7.242                                   | 91.699                                  | 0.000                              | 72.286                                | 19.413                                    | 5164.380                                  | 4098.355                                             |
| 12-88              |                                         |                                          |                                        |                                         |                                         |                                    |                                       |                                           |                                           |                                                      |
| 12-89              |                                         |                                          |                                        |                                         |                                         |                                    |                                       |                                           |                                           |                                                      |
| 12-90              |                                         |                                          |                                        |                                         |                                         |                                    |                                       |                                           |                                           |                                                      |
| S TOT              | 227.000                                 | 654.306                                  | 181.600                                | 523.445                                 | 6504.880                                | 300.000                            | 1040.500                              | 5164.380                                  | 5164.380                                  | 4098.355                                             |
| AFTER              | 0.000                                   | 0.000                                    | 0.000                                  | 0.000                                   | 0.000                                   | 0.000                              | 0.000                                 | 0.000                                     | 5164.380                                  | 4098.355                                             |
| TOTAL              | 227.000                                 | 654.306                                  | 181.600                                | 523.445                                 | 6504.880                                | 300.000                            | 1040.500                              | 5164.380                                  | 5164.380                                  | 4098.355                                             |
| CUM.               | 290.000                                 | 290.000                                  |                                        | NET OIL REVENUE                         | 6504.880                                |                                    | 5 PCT                                 | 4761.429                                  | 40 PCT                                    | 2996.560                                             |
| ULT.               | 517.000                                 | 944.306                                  |                                        | NET GAS REVENUE                         | 0.000                                   |                                    | 10 PCT                                | 4408.569                                  | 50 PCT                                    | 2697.500                                             |
|                    |                                         |                                          |                                        | NET PROD REVENUE                        | 0.000                                   |                                    | 15 PCT                                | 4098.355                                  | 60 PCT                                    | 2450.921                                             |
|                    |                                         |                                          |                                        |                                         |                                         |                                    | 20 PCT                                | 3824.329                                  | 80 PCT                                    | 2070.706                                             |
|                    |                                         |                                          |                                        |                                         |                                         |                                    | 30 PCT                                | 3364.477                                  | 100 PCT                                   | 1793.163                                             |
| CUM NET INC/INV(1) | 0.000                                   |                                          |                                        | CUM NET PW/INV(1)                       | 0.000                                   |                                    |                                       |                                           |                                           |                                                      |
| GROSS WELLS        | 10.                                     |                                          |                                        | LIFE (YEARS)                            | 5.91                                    |                                    |                                       |                                           |                                           |                                                      |
| MONTH IN 1ST YEAR  | 7.                                      |                                          |                                        | RATE OF RETURN,PCT                      | 100.00                                  |                                    |                                       |                                           |                                           |                                                      |
| INITIAL W.I., PCT  | 100.0000                                |                                          |                                        | INITIAL N.I., PCT                       | 80.0000                                 |                                    |                                       |                                           |                                           |                                                      |



LEMON RANCH FIELD  
SNOPE LIME RESERVOIR  
COMANCHE CO. KANSAS  
ESCALATED PRICES AND COSTS

APPENDIX III

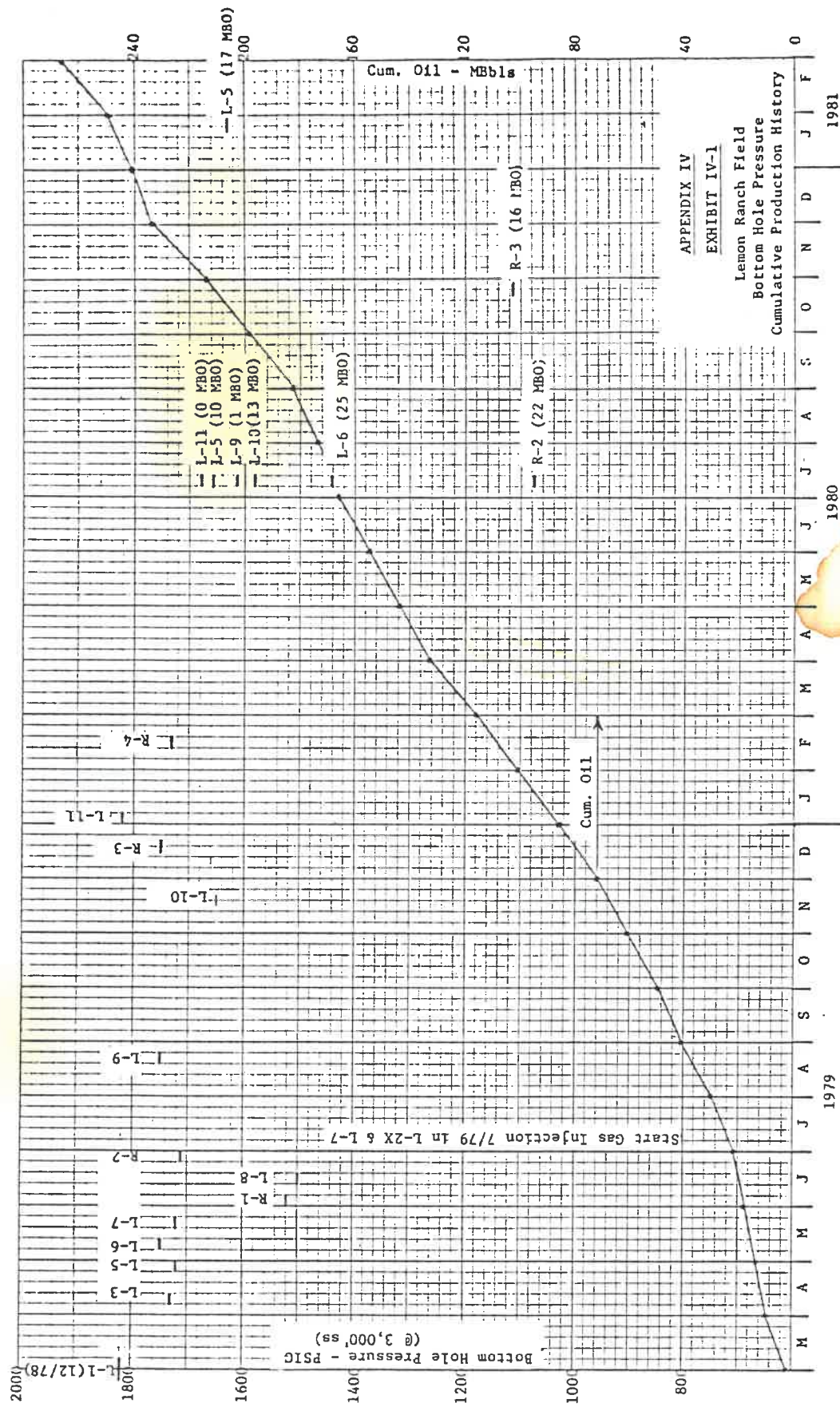
EXHIBIT III-11

RESERVES AND ECONOMICS

DEPLETION WITHOUT GAS  
INJECTION AFTER JUNE 1981

AS OF DATE : 6/ 1/1981

| -END-<br>MO-YR     | GROSS OIL                   |                             | GAS OIL TO NET           |                           | GAS TO NET                |                           | REVENUE TO NET              |                           | NET OPER NET INCOME         |                             | CUMULATIVE CUM DISC         |                                          |
|--------------------|-----------------------------|-----------------------------|--------------------------|---------------------------|---------------------------|---------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------------------------|
|                    | PRODUCTION<br>-----M\$----- | PRODUCTION<br>-----MMF----- | INTEREST<br>-----MB----- | INTEREST<br>-----MMF----- | INTEREST<br>-----M\$----- | INTEREST<br>-----M\$----- | INVESTMENT<br>-----M\$----- | EXPENSES<br>-----M\$----- | BEFORE FIT<br>-----M\$----- | NET INCOME<br>-----M\$----- | NET INCOME<br>-----M\$----- | 15.00 PCT<br>NET INCOME<br>-----M\$----- |
| 12-81              | 54.274                      | 122.319                     | 43.419                   | 97.955                    | 1746.575                  | 0.000                     | 84.000                      | 1662.575                  | 1662.575                    | 1591.965                    |                             |                                          |
| 12-82              | 48.960                      | 138.487                     | 39.168                   | 110.790                   | 1736.787                  | 300.000                   | 150.720                     | 1286.067                  | 2948.642                    | 2678.775                    |                             |                                          |
| 12-83              | 24.058                      | 79.913                      | 19.247                   | 63.930                    | 962.162                   | 0.000                     | 162.778                     | 799.384                   | 3748.026                    | 3264.301                    |                             |                                          |
| 12-84              | 13.175                      | 47.499                      | 10.540                   | 37.999                    | 589.199                   | 0.000                     | 175.799                     | 413.400                   | 4161.426                    | 3524.955                    |                             |                                          |
| 12-85              | 7.812                       | 29.484                      | 6.249                    | 23.596                    | 382.381                   | 0.000                     | 189.864                     | 192.517                   | 4353.943                    | 3629.444                    |                             |                                          |
| 12-86              | 4.922                       | 19.112                      | 3.938                    | 15.289                    | 262.377                   | 0.000                     | 205.053                     | 57.324                    | 4411.267                    | 3656.226                    |                             |                                          |
| 12-87              |                             |                             |                          |                           |                           |                           |                             |                           |                             |                             |                             |                                          |
| 12-88              |                             |                             |                          |                           |                           |                           |                             |                           |                             |                             |                             |                                          |
| 12-89              |                             |                             |                          |                           |                           |                           |                             |                           |                             |                             |                             |                                          |
| 12-90              |                             |                             |                          |                           |                           |                           |                             |                           |                             |                             |                             |                                          |
| S TOT              | 153.201                     | 436.824                     | 122.561                  | 349.459                   | 5679.481                  | 300.000                   | 968.214                     | 4411.267                  | 4411.267                    | 3656.226                    |                             |                                          |
| AFTER              | 0.000                       | 0.000                       | 0.000                    | 0.000                     | 0.000                     | 0.000                     | 0.000                       | 0.000                     | 4411.267                    | 3656.226                    |                             |                                          |
| TOTAL              | 153.201                     | 436.824                     | 122.561                  | 349.459                   | 5679.481                  | 300.000                   | 968.214                     | 4411.267                  | 4411.267                    | 3656.226                    |                             |                                          |
| CUM.               | 290.000                     | 290.000                     |                          | NET OIL REVENUE           | 4292.203                  |                           | 5 PCT                       | 4130.428                  | 40 PCT                      | 2825.780                    |                             |                                          |
|                    |                             |                             |                          | NET GAS REVENUE           | 1387.278                  |                           | 10 PCT                      | 3880.094                  | 50 PCT                      | 2588.511                    |                             |                                          |
| ULT.               | 443.201                     | 726.824                     |                          | NET PROD REVENUE          | 0.000                     |                           | 15 PCT                      | 3656.226                  | 60 PCT                      | 2388.091                    |                             |                                          |
|                    |                             |                             |                          |                           |                           |                           | 20 PCT                      | 3455.203                  | 80 PCT                      | 2069.212                    |                             |                                          |
|                    |                             |                             |                          |                           |                           |                           | 30 PCT                      | 3110.048                  | 100 PCT                     | 1827.638                    |                             |                                          |
| CUM NET INC/INV(1) | 0.000                       |                             |                          | CUM NET PW/INV(1)         | 0.000                     |                           |                             |                           |                             |                             |                             |                                          |
| GROSS WELLS        | 10.                         |                             |                          | LIFE (YEARS)              | 5.58                      |                           |                             |                           |                             |                             |                             |                                          |
| MONTH IN 1ST YEAR  | 7.                          |                             |                          | RATE OF RETURN,PCT        | 100.00                    |                           |                             |                           |                             |                             |                             |                                          |
| INITIAL W.I., PCT  | 100.0000                    |                             |                          | INITIAL N.I., PCT         | 80.0000                   |                           |                             |                           |                             |                             |                             |                                          |



APPENDIX IV

EXHIBIT IV-2

Lemon Ranch Drill Stem Test Data

| Well      | ISIP     | FSIP | IFP     | FFP     | P* AT -3000' | Initial Flow                | Final Flow            | Recovery                                            | Date     |
|-----------|----------|------|---------|---------|--------------|-----------------------------|-----------------------|-----------------------------------------------------|----------|
| Lemon #1  | 1758     | 1773 | 205-206 | 349-461 | 1825         | 152 MCF/D                   | 87 MCF/D              | 180' Gassy mud<br>1985' Gassy muddy oil             | 12/1/78  |
| Lemon #2  | Plugging | 813  | -       | 245-129 | -            | Weak to light blow          |                       | 220' SOGCM                                          | 3/24/79  |
| Lemon #3  | 1739     | -    | 85-92   | -       | 1735         | Strong blow                 | GTS 6"                | 240' CO 20' Frothy oil                              | 4/7/79   |
| Lemon #5  | 1668     | 1705 | 58-63   | 86-139  | -            | 48 M/D                      | 48 M/D                | 500' CGO 100' Muddy oil                             | 4/28/79  |
| Lemon #6  | 1733     | -    | 180-252 | -       | -            | 200 M/D                     | -                     | 1140' Gassy oil                                     | 5/8/79   |
| Lemon #7  | 1502     | 1695 | 68-50   | 74-77   | -            | Strong blow                 | GTS 35 min            | 30' OGCM 60 HOGCM 60 MO                             | 5/19/79  |
| Lemon #8  | 1219     | 1498 | 29-43   | 64-67   | -            | Weak blow inc. to good blow |                       | 165' SLOGCM 60' HOGCM 3720' CIP                     | 6/2/79   |
| Lemon #9  | 1571     | 1739 | 83-45   | 83-17   | -            | NCTS                        | 17 MCF/D              | 35' SLOC                                            | 8/23/79  |
| Lemon #10 | 1633     | 1566 | 55-75   | 55-144  | -            | GTS 27"                     | 11 MCF                | 60' SOGCM 120' HOGCM<br>120' Gassy oil              | 11/18/79 |
| Lemon #11 | 1822     | 1823 | 169-173 | 158-160 | 1823         | GTS 6" 280 M/D              | 353 M/D               | 70' M 600' MW 60' SOCM 60' OCC<br>Foamy muddy water | 1/4/80   |
| Rhodes #1 | 471      | 1495 | 37-34   | 50-50   | -            | Strong blow                 |                       | 60' M 60' SOCM                                      | 6/16/79  |
| Rhodes #2 | 1689     | 1693 | 258-457 | 538-554 | 1707         | 411 MCF/D                   | 332 M/D<br>Flowed oil | 300' Gassy oil                                      | 6/21/79  |
| Rhodes #3 | 1714     | -    | 148-150 | -       | -            | 130 M/D                     |                       | 140' HOGCM 430' HG Froggy oil                       | 12/18/79 |
| Rhodes #4 | 1731     | 1735 | 185-110 | 156-237 | 1732         | 130 M/D                     | 101 M/D               | 630' GFO 120' GCMO                                  | 2/15/80  |

APPENDIX IV

EXHIBIT IV-3

Lemon Ranch Field  
Pressure and Gas - Oil Ratio Data  
July 8, 1980

| <u>Well No.</u> | <u>Estimated<br/>Test Date</u> | <u>Estimated<br/>Bbls Oil/Day</u> | <u>Estimated<br/>MCF Gas/Day</u> | <u>GOR-CP/B</u> | <u>SITP-PSI</u> | <u>SIBHP-PSI</u>    | <u>Survey<br/>Date</u> | <u>Estimated<br/>Cumulative<br/>Bbls Oil</u> |
|-----------------|--------------------------------|-----------------------------------|----------------------------------|-----------------|-----------------|---------------------|------------------------|----------------------------------------------|
| Lemon #1        | 6/15/80                        | 62                                | 91                               | 1,468           | 1,020           |                     | 7/8/80                 | 30,500                                       |
| Lemon #3        | 6/15/80                        | 54                                | 102                              | 1,594           | 1,250           | -                   | 7/8/80                 | 20,600                                       |
| Lemon #5        | 6/15/80                        | 94                                | 180                              | 1,915           | 800             | 1,659               | 7/8/80                 | 9,800                                        |
| Lemon #5        | 1/26/81                        | 11                                | 30                               | 2,727           | -               | 1,634 <sup>1/</sup> | 1/27/81                | 17,000                                       |
| Lemon #6        | 3/15/80                        | 90                                | 150                              | 1,667           | 1,200           | 1,446               | 7/8/80                 | 26,100                                       |
| Lemon #8        | 6/15/80                        | 80                                | 80                               | 1,000           | 1,450           | -                   | 7/8/80                 | 6,900                                        |
| Lemon #9        | 6/15/80                        | 25                                | 60                               | 2,400           | 400             | 1,619               | 7/8/80                 | 1,000                                        |
| Lemon #10       | 6/15/80                        | 82                                | 100                              | 1,220           | 800             | 1,586               | 7/8/80                 | 13,400                                       |
| Lemon #11       | 6/15/80                        | 20                                | 984                              | 49,200          | 1,500           | 1,686               | 7/8/80                 | 0                                            |
| Rhodes #1       | 3/15/80                        | 25                                | 50                               | 2,000           | 680             | -                   | 7/8/80                 | 22,300                                       |
| Rhodes #2       | 5/30/80                        | 80                                | 395                              | 4,938           | 1,200           | 1,069               | 7/8/80                 | 23,100                                       |
| Rhodes #3       | 6/15/80                        | 81                                | 135                              | 1,667           | 800             | -                   | 7/8/80                 | 8,500                                        |
| Rhodes #3       | 10/23/80                       | 75                                | 150                              |                 | 454             | 1,118 <sup>2/</sup> | 10/24/80               | 15,600                                       |
| Rhodes #4       | 7/1/80                         | 132                               | 132                              | 1,000           | 1,500           | -                   | 7/8/80                 | 2,300                                        |

Notes: 1/ Extrapolated to p\*. Measured 875 psi max./24 hours.  
2/ Extrapolated to p\*. Measured 792 psi max./72 hours.

RHODES #3  
 PRESS BUILDUP 10-24-80  
 SWOPE PERFS 4,770-4,778

APPENDIX IV

EXHIBIT IV-4

P R E S S U R E   B U I L D - U P   A N A L Y S I S

| POINTS<br>USED | RADIUS<br>FELT, FT | SLOPE<br>PSI/CYC | K<br>(MDS) | P.I.<br>B/D/PSI | SKIN<br>FACTOR | SKIN<br>DP | COMPL.<br>EFF, % | SIBHP<br>PSIG | AVG. P<br>PSIG |
|----------------|--------------------|------------------|------------|-----------------|----------------|------------|------------------|---------------|----------------|
| 1- 3           | 24.                | 49.9             | 16.7527    | 0.324           | -3.20          | -139.      | 160.1            | 561.          | 736.           |
| 3- 9           | 43.                | 100.5            | 8.1264     | 0.184           | -3.56          | -311.      | 176.4            | 634.          | 912.           |
| 9-24           | 99.                | 172.2            | 4.5841     | 0.124           | -3.96          | -593.      | 197.8            | 790.          | 1111. *        |
| 24-25          | 102.               | 82.3             | 9.6771     | 0.171           | -2.22          | -159.      | 136.3            | 792.          | 944.           |

| POINT | PRESSURE | DP<br>PSI | CORRECTED<br>PRESSURE@ | DT<br>(HOURS) | (T+DT)/DT | CORRECTED<br>(T+DT)/DT@@ | WB STOR<br>LDP/LDT |
|-------|----------|-----------|------------------------|---------------|-----------|--------------------------|--------------------|
| 1     | 537.     | 32.       | 537.                   | 0.500         | 9953.0    | 9953.0                   | 0.0000             |
| 2     | 551.     | 46.       | 551.                   | 1.000         | 4977.0    | 4977.0                   | 0.5236             |
| 3     | 561.     | 56.       | 561.                   | 1.500         | 3318.3    | 3318.3                   | 0.4851             |
| 4     | 571.     | 66.       | 571.                   | 2.000         | 2489.0    | 2489.0                   | 0.5711             |
| 5     | 587.     | 82.       | 587.                   | 3.000         | 1659.7    | 1659.7                   | 0.5353             |
| 6     | 598.     | 93.       | 598.                   | 4.000         | 1245.0    | 1245.0                   | 0.4376             |
| 7     | 610.     | 105.      | 610.                   | 5.000         | 996.2     | 996.2                    | 0.5439             |
| 8     | 620.     | 115.      | 620.                   | 6.000         | 830.3     | 830.3                    | 0.4990             |
| 9     | 634.     | 129.      | 634.                   | 8.000         | 623.0     | 623.0                    | 0.3993             |
| 10    | 649.     | 144.      | 649.                   | 10.000        | 498.6     | 498.6                    | 0.4930             |
| 11    | 660.     | 155.      | 660.                   | 12.000        | 415.7     | 415.7                    | 0.4037             |
| 12    | 671.     | 166.      | 671.                   | 14.000        | 356.4     | 356.4                    | 0.4448             |
| 13    | 680.     | 175.      | 680.                   | 16.000        | 312.0     | 312.0                    | 0.3954             |
| 14    | 689.     | 184.      | 689.                   | 18.000        | 277.4     | 277.4                    | 0.4258             |
| 15    | 697.     | 192.      | 697.                   | 20.000        | 249.8     | 249.8                    | 0.4039             |
| 16    | 711.     | 206.      | 711.                   | 24.000        | 208.3     | 208.3                    | 0.3860             |
| 17    | 723.     | 218.      | 723.                   | 28.000        | 178.7     | 178.7                    | 0.3673             |
| 18    | 734.     | 229.      | 734.                   | 32.000        | 156.5     | 156.5                    | 0.3687             |
| 19    | 742.     | 237.      | 742.                   | 36.000        | 139.2     | 139.2                    | 0.2915             |
| 20    | 751.     | 246.      | 751.                   | 40.000        | 125.4     | 125.4                    | 0.3538             |
| 21    | 760.     | 255.      | 760.                   | 46.000        | 109.2     | 109.2                    | 0.2571             |
| 22    | 773.     | 268.      | 773.                   | 54.000        | 93.1      | 93.1                     | 0.3101             |
| 23    | 785.     | 280.      | 785.                   | 62.000        | 81.3      | 81.3                     | 0.3171             |
| 24    | 790.     | 285.      | 790.                   | 68.000        | 74.2      | 74.2                     | 0.1916             |
| 25    | 792.     | 287.      | 792.                   | 72.000        | 70.1      | 70.1                     | 0.1223             |

@ CORRECTED FOR AFTERFLOW

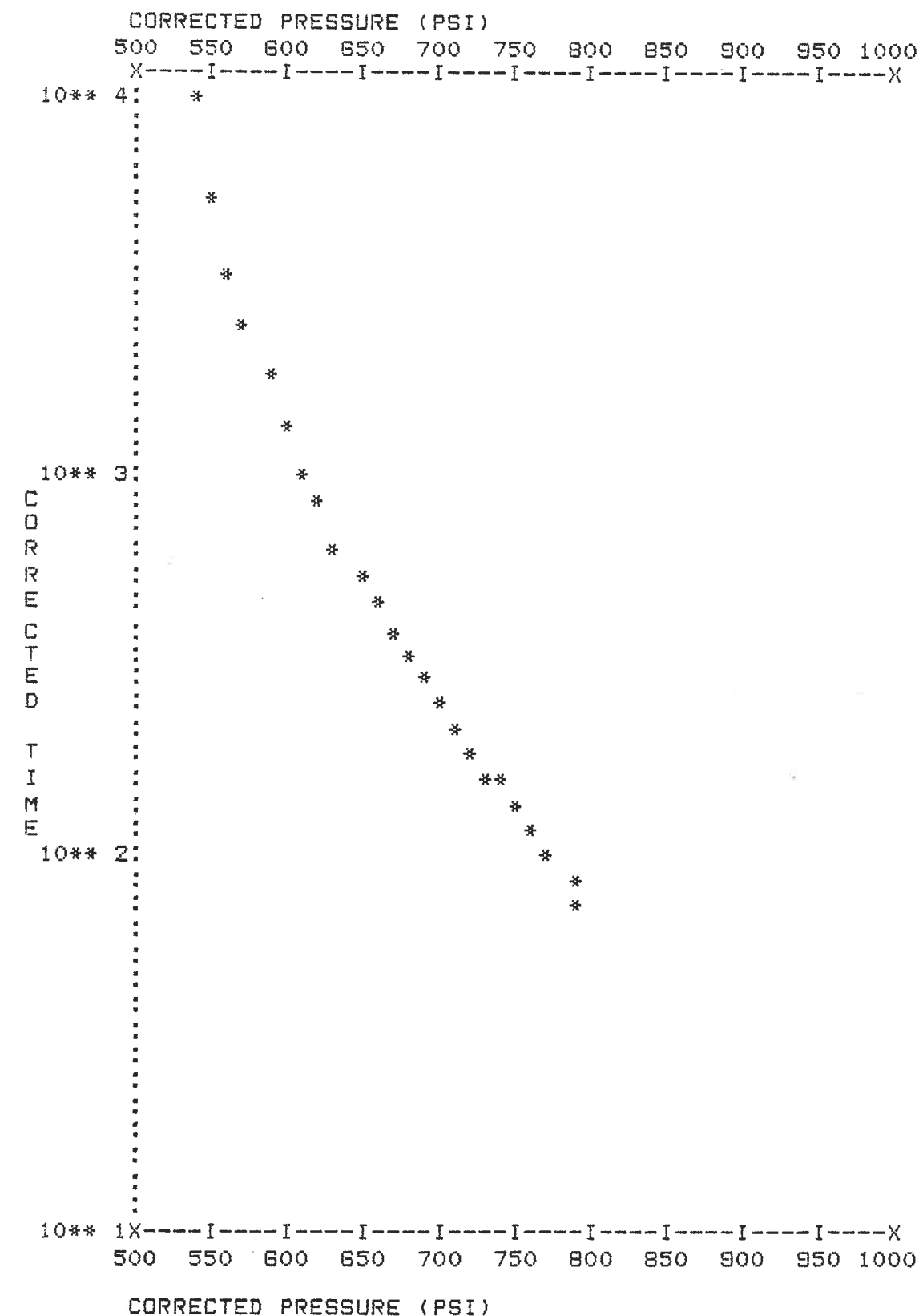
@@ CORRECTED FOR SUPERPOSITION

RHODES #3

APPENDIX IV

PRESS BUILDUP 10-24-80

EXHIBIT IV-4a





LEMON RANCH #5  
PRESS BUILDUP 1-27-81  
SWOPE PERFS 4782-4787

APPENDIX IV

EXHIBIT IV-5

P R E S S U R E   B U I L D - U P   A N A L Y S I S

| POINTS<br>USED | RADIUS<br>FELT, FT | SLOPE<br>PSI/CYC | K<br>(MDS) | P.I.<br>B/D/PSI | SKIN<br>FACTOR | SKIN<br>DP | COMPL.<br>EFF, % | SIBHP<br>PSIG | AVG. P<br>PSIG |
|----------------|--------------------|------------------|------------|-----------------|----------------|------------|------------------|---------------|----------------|
| 1- 2           | 13.                | 12.6             | 16.2127    | 0.143           | -2.97          | -32.       | 142.1            | 625.          | 690.           |
| 2- 3           | 16.                | 26.6             | 7.6112     | 0.074           | -3.18          | -74.       | 149.3            | 633.          | 762.           |
| 3- 6           | 24.                | 59.3             | 3.3472     | 0.036           | -3.30          | -170.      | 155.3            | 669.          | 921.           |
| 6-12           | 32.                | 126.2            | 1.5198     | 0.019           | -3.55          | -390.      | 165.8            | 730.          | 1206.          |
| 12-23          | 51.                | 239.9            | 0.7665     | 0.011           | -3.84          | -801.      | 178.5            | 875.          | 1634. *        |

| POINT | PRESSURE | DP<br>PSI | CORRECTED<br>PRESSURE@ | DT<br>(HOURS) | (T+DT)/DT | CORRECTED<br>(T+DT)/DT@@ | WB STOR<br>LDP/LDT |
|-------|----------|-----------|------------------------|---------------|-----------|--------------------------|--------------------|
| 1     | 620.     | 7.        | 620.                   | 0.100         | 370910.1  | 370910.1                 | 0.0000             |
| 2     | 625.     | 12.       | 625.                   | 0.250         | 148364.6  | 148364.6                 | 0.5882             |
| 3     | 633.     | 20.       | 633.                   | 0.500         | 74182.8   | 74182.8                  | 0.7370             |
| 4     | 649.     | 36.       | 649.                   | 1.000         | 37091.9   | 37091.9                  | 0.8480             |
| 5     | 660.     | 47.       | 660.                   | 1.500         | 24728.3   | 24728.3                  | 0.6576             |
| 6     | 669.     | 56.       | 669.                   | 2.000         | 18546.5   | 18546.5                  | 0.6090             |
| 7     | 681.     | 68.       | 681.                   | 2.500         | 14837.4   | 14837.4                  | 0.8701             |
| 8     | 688.     | 75.       | 688.                   | 3.000         | 12364.6   | 12364.6                  | 0.5374             |
| 9     | 695.     | 82.       | 695.                   | 3.500         | 10598.4   | 10598.4                  | 0.5789             |
| 10    | 703.     | 90.       | 703.                   | 4.000         | 9273.7    | 9273.7                   | 0.6971             |
| 11    | 718.     | 105.      | 718.                   | 5.000         | 7419.2    | 7419.2                   | 0.6908             |
| 12    | 730.     | 117.      | 730.                   | 6.000         | 6182.8    | 6182.8                   | 0.5935             |
| 13    | 744.     | 131.      | 744.                   | 7.000         | 5299.7    | 5299.7                   | 0.7332             |
| 14    | 754.     | 141.      | 754.                   | 8.000         | 4637.4    | 4637.4                   | 0.5509             |
| 15    | 764.     | 151.      | 764.                   | 9.000         | 4122.2    | 4122.2                   | 0.5817             |
| 16    | 774.     | 161.      | 774.                   | 10.000        | 3710.1    | 3710.1                   | 0.6086             |
| 17    | 792.     | 179.      | 792.                   | 12.000        | 3091.9    | 3091.9                   | 0.5813             |
| 18    | 809.     | 196.      | 809.                   | 14.000        | 2650.4    | 2650.4                   | 0.5886             |
| 19    | 825.     | 212.      | 825.                   | 16.000        | 2319.2    | 2319.2                   | 0.5877             |
| 20    | 836.     | 223.      | 836.                   | 18.000        | 2061.6    | 2061.6                   | 0.4295             |
| 21    | 851.     | 238.      | 851.                   | 20.000        | 1855.5    | 1855.5                   | 0.6179             |
| 22    | 862.     | 249.      | 862.                   | 22.000        | 1687.0    | 1687.0                   | 0.4741             |
| 23    | 875.     | 262.      | 875.                   | 24.000        | 1546.5    | 1546.5                   | 0.5849             |

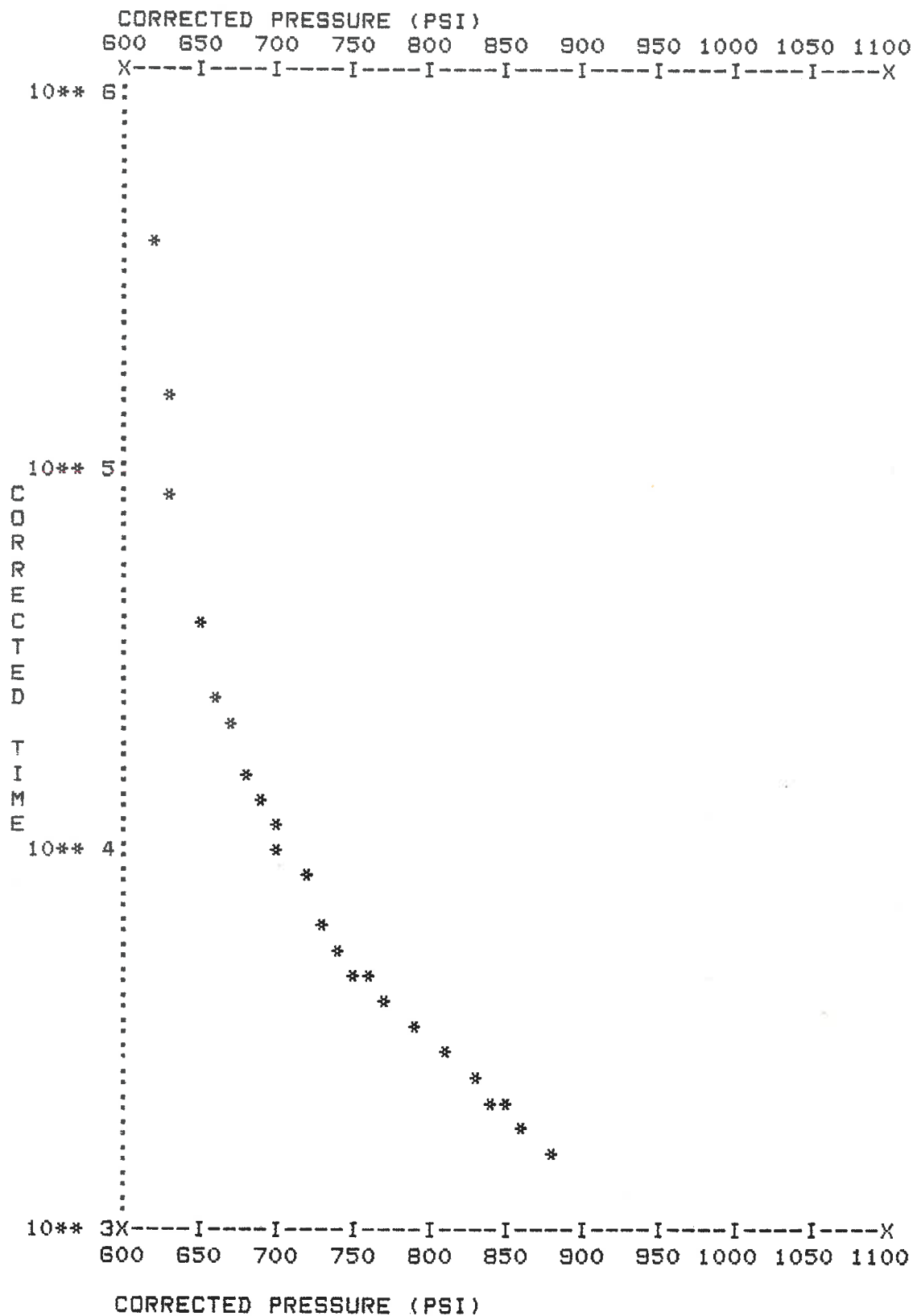
@ CORRECTED FOR AFTERFLOW

@@ CORRECTED FOR SUPERPOSITION

LEMON RANCH #5  
PRESS BUILDUP 1-27-81  
SWOPE PERFS 4782-4787

APPENDIX IV

EXHIBIT IV-5a



LEMON RANCH #1  
INITIAL DST - 12-1-78  
SWOPE LIME

APPENDIX IV

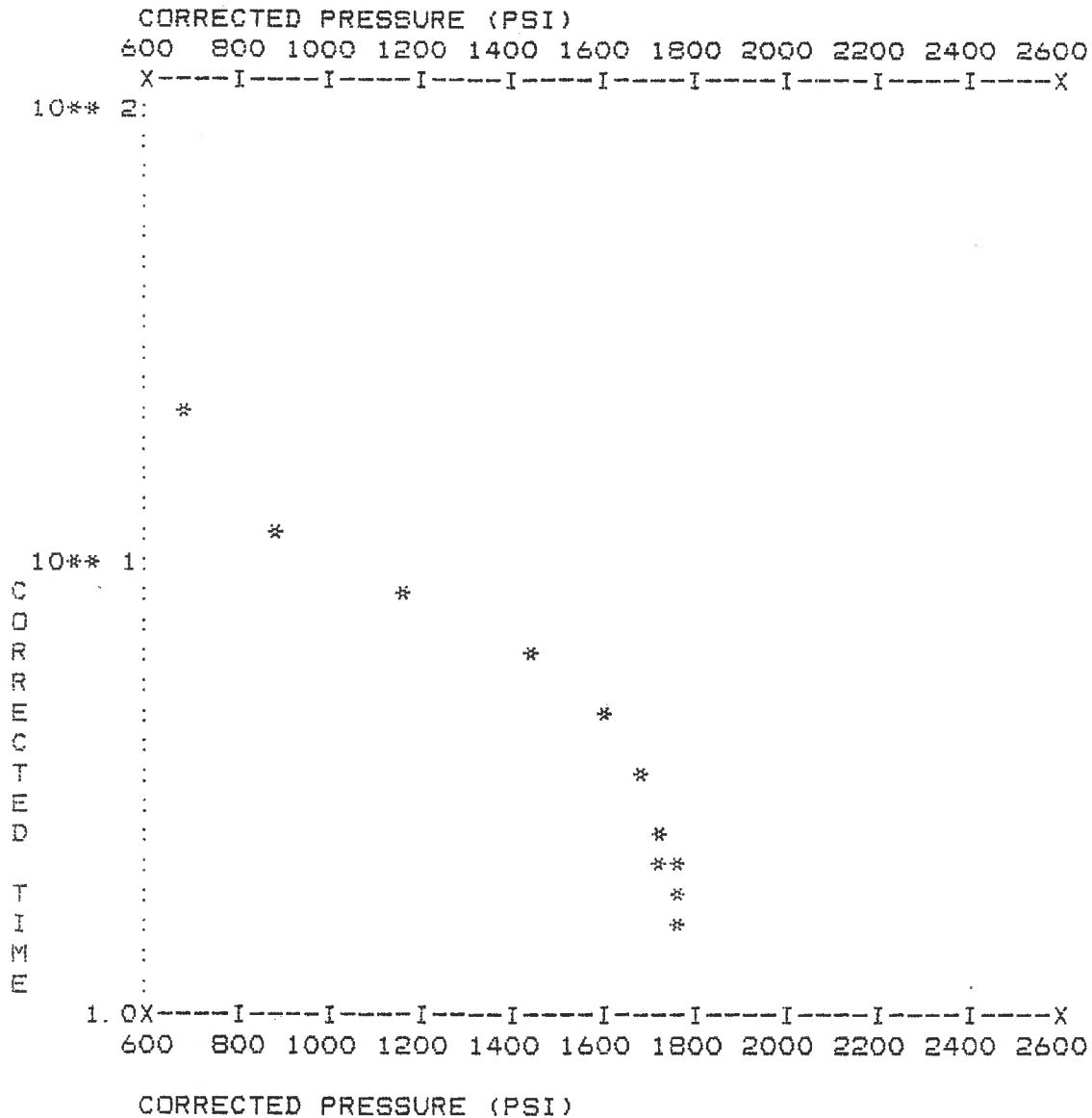
EXHIBIT IV-6

P R E S S U R E   B U I L D - U P   A N A L Y S I S

| POINTS<br>USED | RADIUS<br>FELT, FT | SLOPE<br>PSI/CYC | K<br>(MDS) | P. I.<br>B/D/PSI | COMPL.<br>EFF., % | SIBHP<br>PSIG | AVG. P<br>PSIG |
|----------------|--------------------|------------------|------------|------------------|-------------------|---------------|----------------|
| 1- 2           | 173.               | 634. 0           | 66. 15     | 2. 54            | 355. 5            | 860.          | 1520.          |
| 2- 3           | 185.               | 1920. 2          | 21. 84     | 1. 12            | 437. 0            | 1161.         | 2859.          |
| 3- 4           | 194.               | 2452. 2          | 17. 10     | 0. 94            | 457. 4            | 1422.         | 3330.          |
| 4- 5           | 215.               | 1160. 6          | 36. 13     | 1. 44            | 353. 4            | 1586.         | 2325.          |
| 5- 6           | 264.               | 563. 7           | 74. 40     | 1. 81            | 227. 5            | 1676.         | 1945.          |
| 6- 7           | 323.               | 261. 6           | 160. 33    | 2. 01            | 123. 4            | 1700.         | 1801.          |
| 7- 8           | 337.               | 844. 4           | 49. 67     | 1. 72            | 313. 8            | 1728.         | 2025.          |
| 8-20           | 575.               | 254. 1           | 165. 04    | 1. 98            | 118. 5            | 1773. —       | 1819.          |

LEMON RANCH #1  
INITIAL DST - 12-1-78  
SWOPE LINE

APPENDIX IV  
EXHIBIT IV-6a



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Lemon #2-X COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petroleum, Corp. DATE 3-24-79 FILE NO S-1373  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>NO | DEPTH | PERMEABILITY<br>MILLIDARCYS |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS                                   |
|--------------|-------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|-------------------------------------------|
|              |       | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |                                           |
| 1            | 4764  | x 0.0                       | 0.0      | 6.8           | 33.1                                | 12.9                              | No Perm                | Vertical fracture with<br>oil in fracture |
|              | 65    |                             |          |               |                                     |                                   |                        |                                           |
| 2            | 4765  | x 0.0                       | 0.0      | 6.7           | 37.9                                | 9.4                               | No Perm                |                                           |
|              | 66    |                             |          |               |                                     |                                   |                        |                                           |
| 3            | 4766  | x 0.0                       | 0.0      | 7.3           | 39.2                                | 10.7                              | No Perm                |                                           |
|              | 67    |                             |          |               |                                     |                                   |                        |                                           |
| Net          | 0'    | 0.0                         | 0.0      | 6.9           | 36.7                                | 11.0                              |                        |                                           |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 3-24-79  
WELL Lenon #2-X ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas CR \_\_\_\_\_ RB \_\_\_\_\_

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PERMEABILITY MILLIDARCYS  $\bigcirc \longrightarrow$

CONNATE WATER % SATURATION  $\bigcirc \longrightarrow$

30 20 10 0

0 70 60 50 40

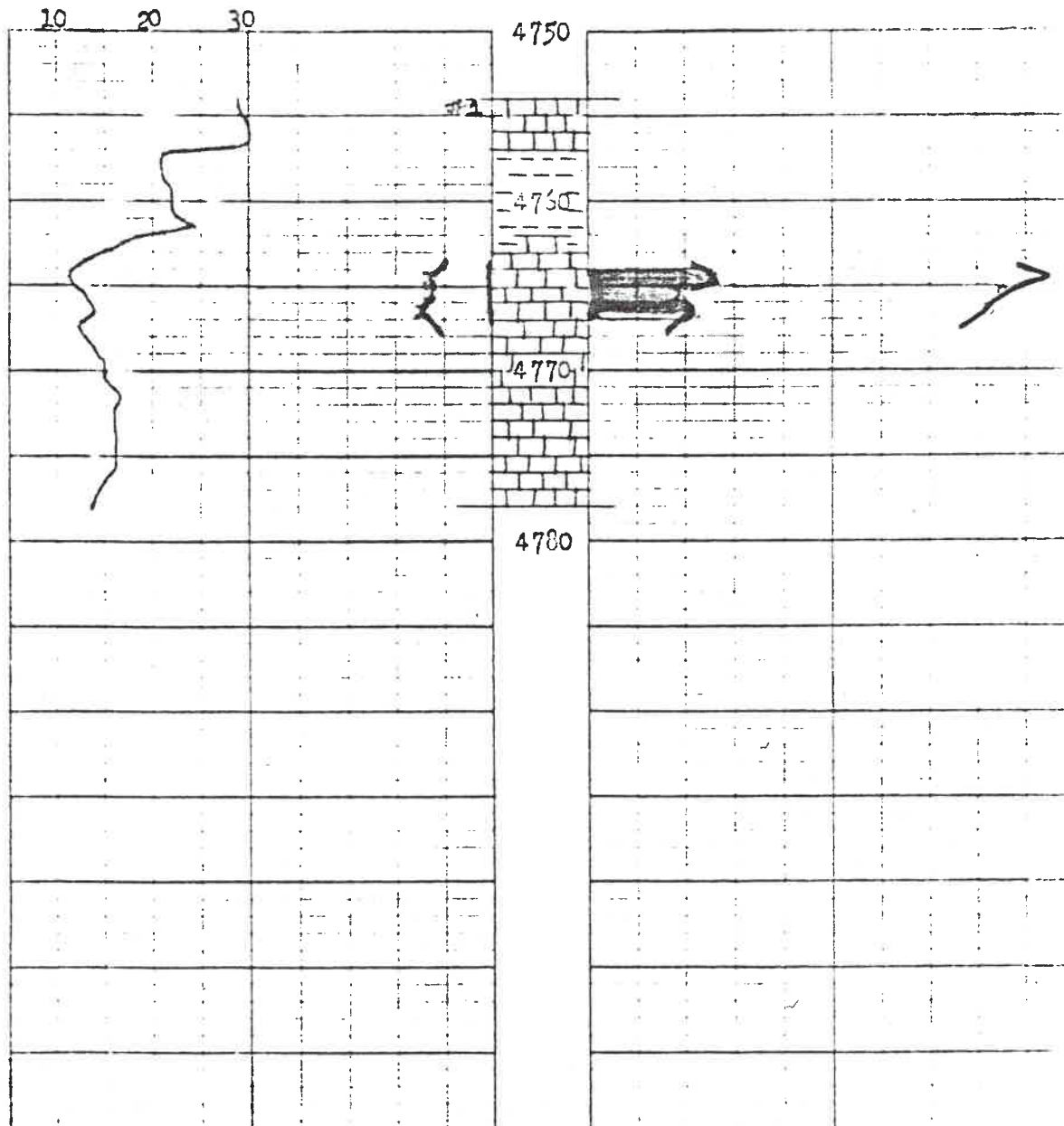
POROSITY-%  $\times \longrightarrow \times$

OIL % PORE SATURATION  $\times \longrightarrow \times$

CORING TIME 20 10 0

0 10 20

MIN/FT





# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA KANSAS 67208

WELL Lemon #5 COUNTY Commanche STATE Kansas  
COMPANY K.R.M. Petr. Corp. DATE 4-28-79 FILE NO. S-1383  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>NO. | DEPTH      | PERMEABILITY<br>MILLIDARCYs |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS             |
|---------------|------------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------------------|
|               |            | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |                     |
| 1             | 4784<br>85 | 77.8                        | 38.5     | 26.5          | 14.5                                | 7.6                               | Oil *                  | *High Gas-Oil Ratio |
| 2             | 4785<br>86 | x 0.0                       | 0.0      | 1.2           | 21.8                                | 2.6                               | No Perm                |                     |
| 3             | 4786<br>87 | 36.6                        | 10.1     | 24.4          | 16.2                                | 7.1                               | Oil *                  |                     |
| 4             | 4787<br>88 | 32.2                        | 13.2     | 25.5          | 13.7                                | 10.0                              | Oil *                  |                     |
| Net           | 3'         | 48.9                        | 20.6     | 25.5          | 14.8                                | 8.2                               |                        |                     |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPAN K.R.M. Petroleum Corp. DATE 4-28-79  
WELL Lemon #5 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCY'S  $\circ \leftarrow$

200 150 100 50 0

CONNATE WATER % SATURATION  $\circ \leftarrow$

0 50 40 30 20

POROSITY-%  $X \leftarrow X$

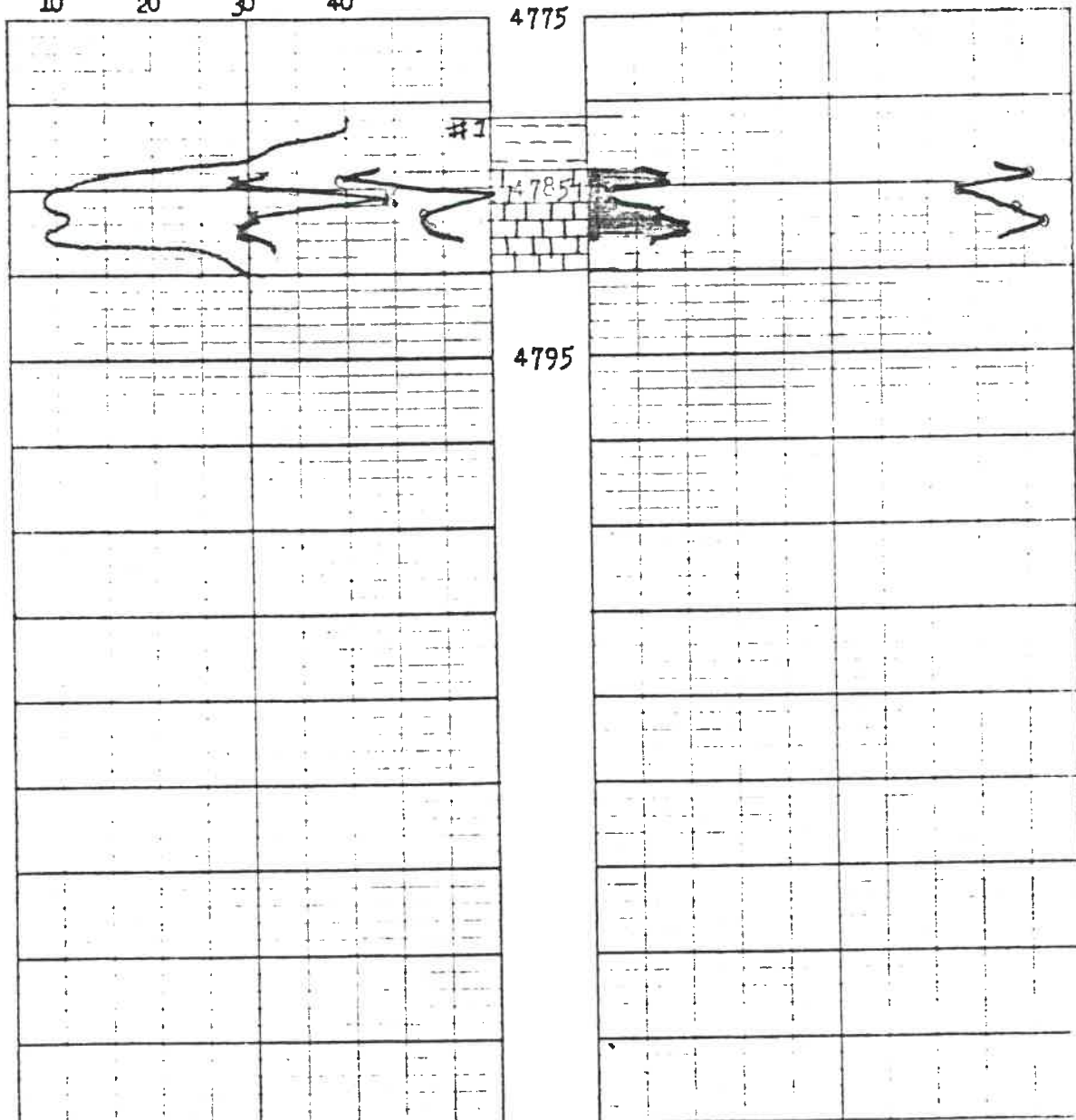
OIL % PORE SATURATION  $X \leftarrow X$

CORING TIME 20 10 0

0 10 20

MIN/FT

10 20 30 40



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Lemon #6 COUNTY Comanche STATE Kansas  
COMPANY K.R.M Petr. Corp. DATE 5-8-79 FILE NO. S-1386  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>No. | DEPTH | PERMEABILITY<br>MILLIDARCYS |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS |
|---------------|-------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------|
|               |       | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |         |
| 1             | 4781  | 10.1                        | 1.0      | 29.7          | 30.0                                | 2.7                               | Gas                    |         |
|               | 82    |                             |          |               |                                     |                                   |                        |         |
| 2             | 4782  | 8.0                         | 4.2      | 20.7          | 28.4                                | 9.1                               | Oil                    |         |
|               | 83    |                             |          |               |                                     |                                   |                        |         |
| 3             | 4783  | 5.8                         | 2.1      | 22.8          | 27.1                                | 11.5                              | Oil                    |         |
|               | 84    |                             |          |               |                                     |                                   |                        |         |
| 4             | 4784  | 22.5                        | 7.4      | 16.5          | 40.2                                | 17.0                              | Oil                    |         |
|               | 85    |                             |          |               |                                     |                                   |                        |         |
| 5             | 4785  | 130                         | 57.0     | 23.2          | 19.3                                | 8.7                               | Oil                    |         |
|               | 86    |                             |          |               |                                     |                                   |                        |         |
| 6             | 4786  | 130                         | 120      | 19.2          | 21.1                                | 8.1                               | Oil                    |         |
|               | 87    |                             |          |               |                                     |                                   |                        |         |
| 7             | 4787  | 26.7                        | 32.2     | 17.8          | 24.8                                | 11.0                              | Oil                    |         |
|               | 88    |                             |          |               |                                     |                                   |                        |         |
| 8             | 4788  | x 0.0                       | 0.0      | 12.0          | 19.8                                | 11.0                              | No Perm                |         |
|               | 89    |                             |          |               |                                     |                                   |                        |         |
| 9             | 4789  | 280                         | 280      | 19.7          | 18.6                                | 11.2                              | Oil                    |         |
|               | 90    |                             |          |               |                                     |                                   |                        |         |
| 10            | 4790  | x 0.0                       | 0.0      | 12.4          | 23.2                                | 11.6                              | No Perm                |         |
|               | 91    |                             |          |               |                                     |                                   |                        |         |
| 11            | 4791  | x 0.0                       | 0.0      | 6.9           | 29.9                                | 5.7                               | No Perm                |         |
|               | 92    |                             |          |               |                                     |                                   |                        |         |
| Net           | 8'    | 76.6                        | 63.0     | 21.2          | 26.2                                | 9.9                               |                        |         |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 5-8-79  
WELL Lemon #6 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCYS  $\bigcirc \rightarrow \bigcirc$

400 200 100 50 0

POROSITY-%  $X \rightarrow X$

CORING TIME 20 10 0

MIN/FT

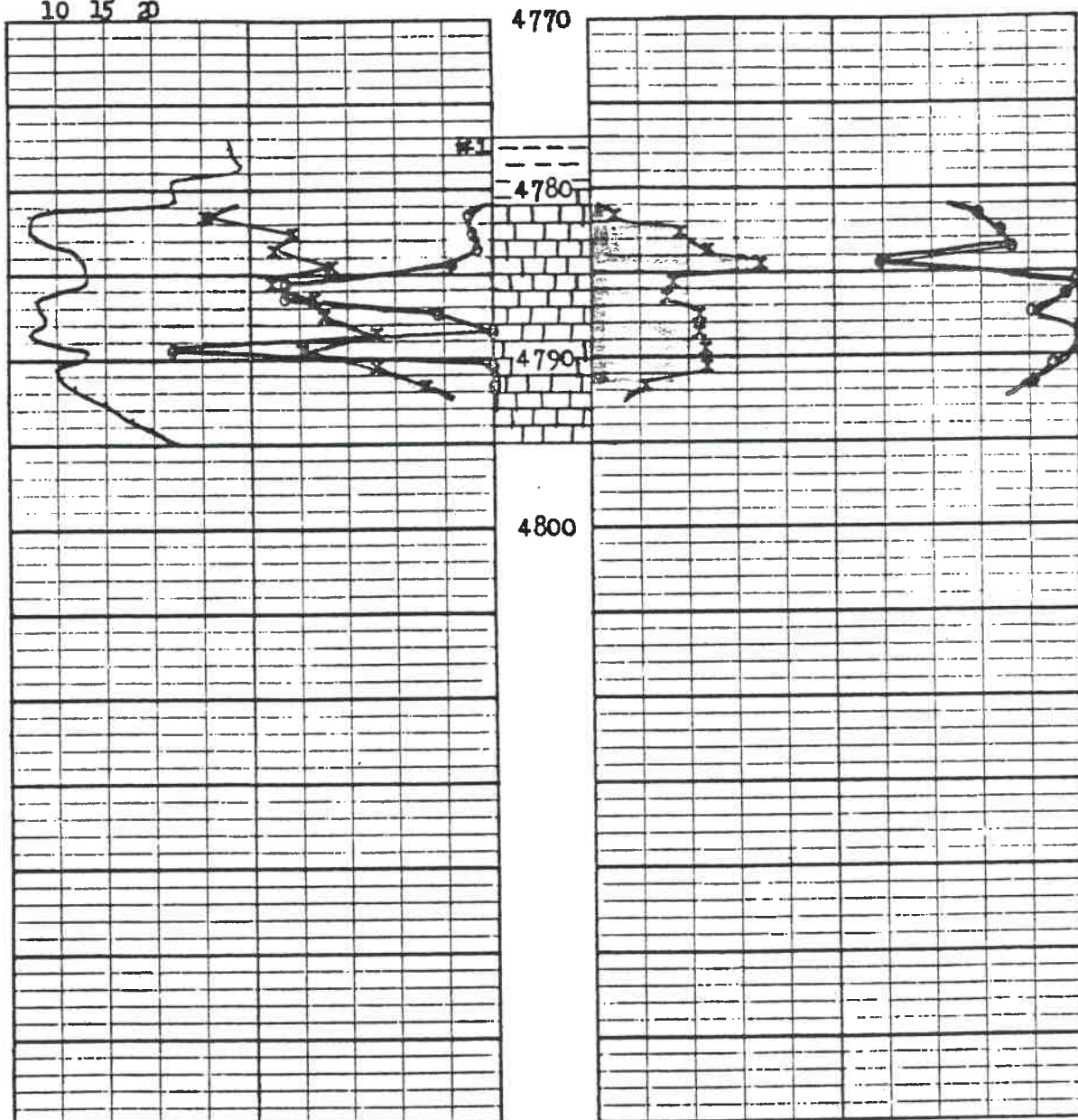
10 15 20

CONNATE WATER % SATURATION

0 60 50 40 30  $\bigcirc \rightarrow \bigcirc$

OIL % PORE SATURATION  $X \rightarrow X$

0 10 20 30



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Lemon #7 COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petroleum Corp. DATE 5-18-79 FILE NO. S-1388  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>NO | DEPTH      | PERMEABILITY<br>MILLIDARCY |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS |
|--------------|------------|----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------|
|              |            | HORIZONTAL                 | VERTICAL |               |                                     |                                   |                        |         |
| 1            | 4793<br>94 | 1.0                        | 0.0      | 7.6           | 34.1                                | 1.7                               | No Perm                |         |
| 2            | 4794<br>95 | X 0.0                      | 0.0      | 10.8          | 57.9                                | 2.4                               | No Perm                |         |
| 3            | 4795<br>96 | X 0.0                      | 0.0      | 22.4          | 33.9                                | 1.0                               | No Perm                |         |
| 4            | 4796<br>97 | X 0.0                      | 0.0      | 23.9          | 25.5                                | 2.2                               | No Perm                |         |
| 5            | 4797<br>98 | 1.0                        | 0.0      | 21.7          | 31.0                                | 1.6                               | No Perm                |         |
| Net          | 2'         | 1.0                        | 0.0      | 14.8          | 32.1                                | 1.7                               |                        |         |

# Kansas Cores

## PETROLEUM-RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 5-18-79  
WELL Lemon #7 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCYS  $\bigcirc \longrightarrow \bigcirc$

30 20 10 0

POROSITY--%  $X \longrightarrow X$

CORING TIME

20 10 0

MIN/FT

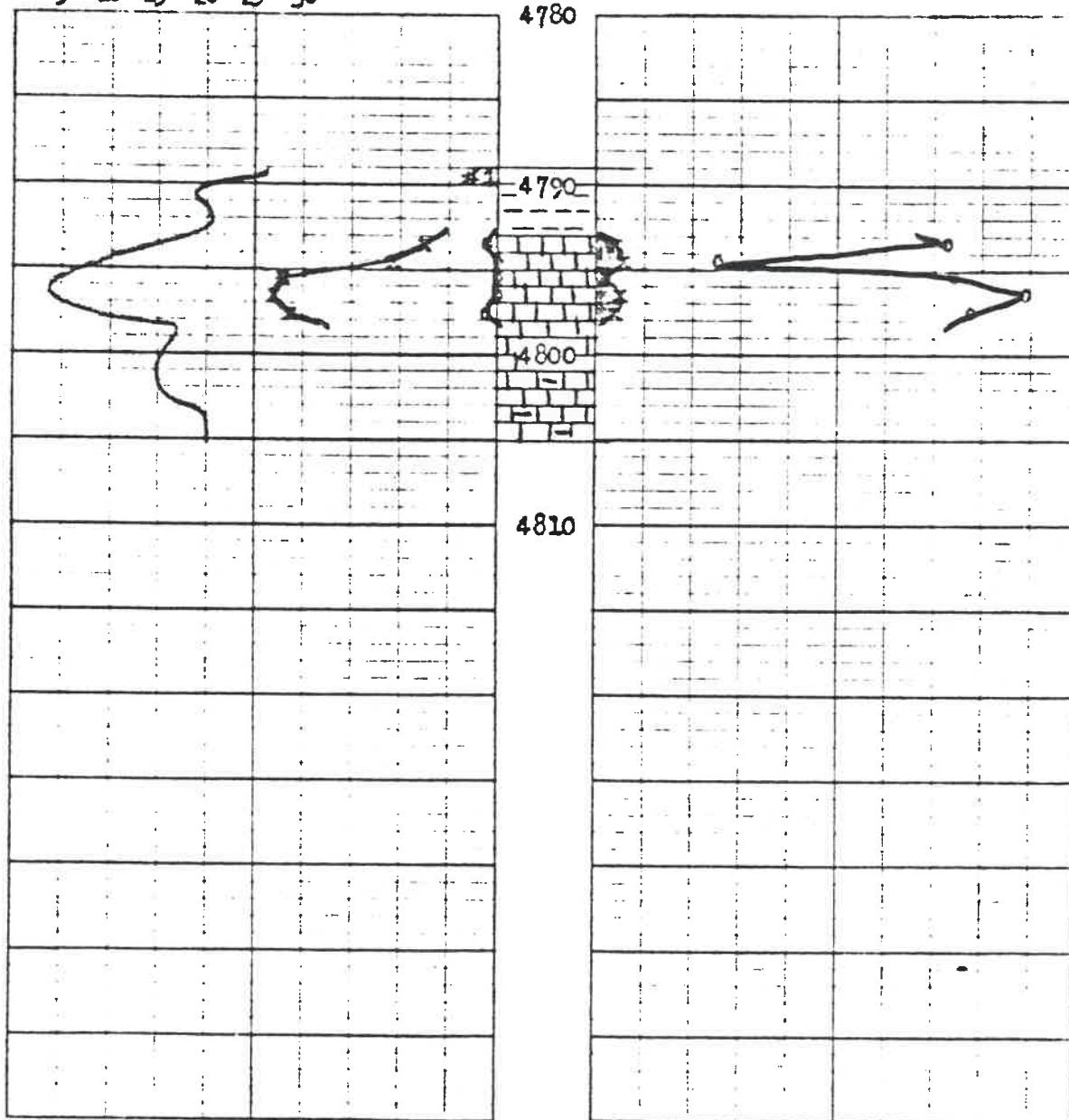
5 10 15 20 25 30

CONNATE WATER % SATURATION

0 60 50 40 30  $\bigcirc \longrightarrow \bigcirc$

OIL % PORE SATURATION  $X \longrightarrow X$

10 20





# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Lemon #8 COUNTY Commanche STATE Kansas  
COMPANY K.R.M. Petroleum Corp. DATE 6-2-79 FILE NO. S-1391  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>No. | DEPTH | PERMEABILITY<br>MILLIDARCYS |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS |
|---------------|-------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------|
|               |       | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |         |
| 1             | 4776  | X 0.0                       | 0.0      | 7.8           | 36.7                                | 2.3                               | No Perm                |         |
|               | 77    |                             |          |               |                                     |                                   |                        |         |
| 2             | 4777  | 0.8                         | 0.0      | 7.9           | 29.7                                | 9.0                               | Oil                    |         |
|               | 78    |                             |          |               |                                     |                                   |                        |         |
| 3             | 4778  | 1.2                         | 0.2      | 7.8           | 21.2                                | 5.1                               | Oil                    |         |
|               | 79    |                             |          |               |                                     |                                   |                        |         |
| 4             | 4779  | 12.1                        | 4.6      | 15.1          | 23.4                                | 8.1                               | Oil                    |         |
|               | 80    |                             |          |               |                                     |                                   |                        |         |
| 5             | 4780  | X 0.0                       | 0.0      | 6.1           | 50.0                                | 14.6                              | No Perm                |         |
|               | 81    |                             |          |               |                                     |                                   |                        |         |
| 6             | 4781  | 1.0                         | 0.0      | 8.6           | 36.9                                | 10.6                              | Oil                    |         |
|               | 82    |                             |          |               |                                     |                                   |                        |         |
| 7             | 4782  | X 0.0                       | 0.0      | 7.4           | 40.5                                | 4.7                               | No Perm                |         |
|               | 83    |                             |          |               |                                     |                                   |                        |         |
| 8             | 4783  | X 0.0                       | 0.0      | 9.6           | 48.9                                | 1.2                               | No Perm                |         |
|               | 84    |                             |          |               |                                     |                                   |                        |         |
| Net           |       | 3.8                         | 1.2      | 9.9           | 27.8                                | 8.2                               |                        |         |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY **K.R.M. Petroleum Corporation**

DATE **6-2-79**

WELL **Lemon #8**

ANALYST **IS**

FIELD

ELEVATION

COUNTY **Commanche** STATE **Kansas**

OR                      LB                     

Estimates and interpretations are based on material brought to Kansas Cores by the client, and such data and interpretations are those of the company which the client represents. Kansas Cores makes no warranty and makes no guarantee for the interpretation and specifications of the data. Our opinion and conclusions are placed at the discretion of the operator.

PERMEABILITY MILLIDARCS  $\text{D} \rightarrow \text{O}$

CONNATE WATER % SATURATION

15 10 5 0

0 60 50 40 30

POROSITY %  $\times \rightarrow \times$

OIL % PORE SATURATION  $\times \rightarrow \times$

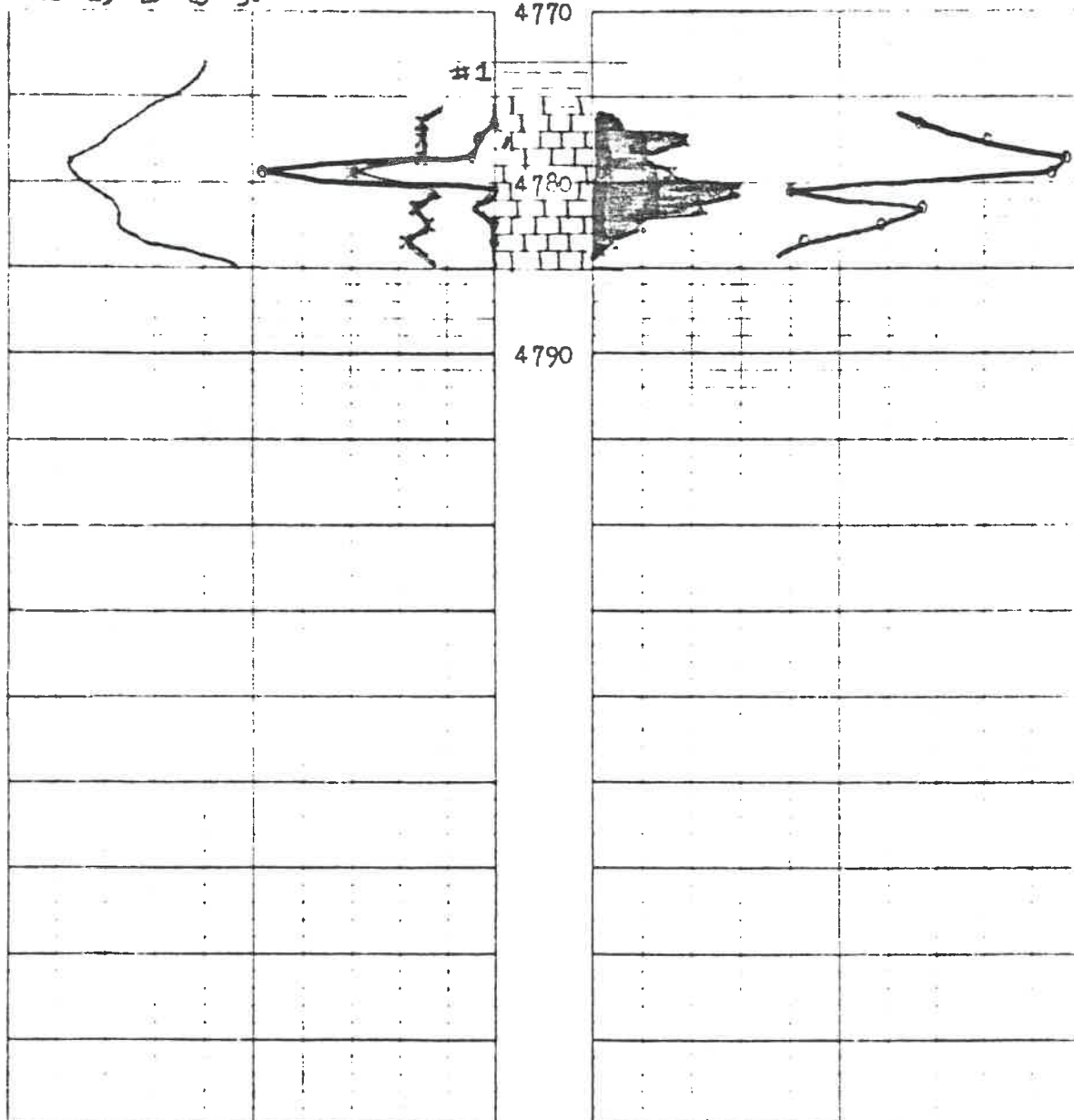
CORING TIME

20 10 0

10 20

MIN/FT

10 15 20 25 30



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL **Lemon #9** COUNTY **Comanche** STATE **Kansas**  
COMPANY **K.R.M. Petroleum Corp.** DATE **8-23-79** FILE NO. **S-1406**  
FIELD TYPE CORES **Diamond** ANALYST **IS**

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>No.   | DEPTH | PERMEABILITY<br>MILLIDARCYs |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS |
|-----------------|-------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------|
|                 |       | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |         |
| 1 68 4774<br>75 |       | X 0.0                       | 0.0      | 15.5          | 25.0                                | 10.3                              | No Perm                |         |
| 2 69 4775<br>76 |       | 1.0                         | 0.8      | 16.9          | 18.5                                | 9.2                               | No Perm                |         |
| 3 72 4776<br>77 |       | X 0.0                       | 0.0      | 7.0           | 45.9                                | 13.4                              | No Perm                |         |
| 4 71 4777<br>78 |       | X 0.0                       | 0.0      | 11.1          | 28.8                                | 3.3                               | No Perm                |         |
| Net             | 1'    | 1.0                         | 0.8      | 16.9          | 18.5                                | 9.2                               |                        |         |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 8-23-79  
WELL Lemon #9 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCY'S  $\bigcirc \longrightarrow$

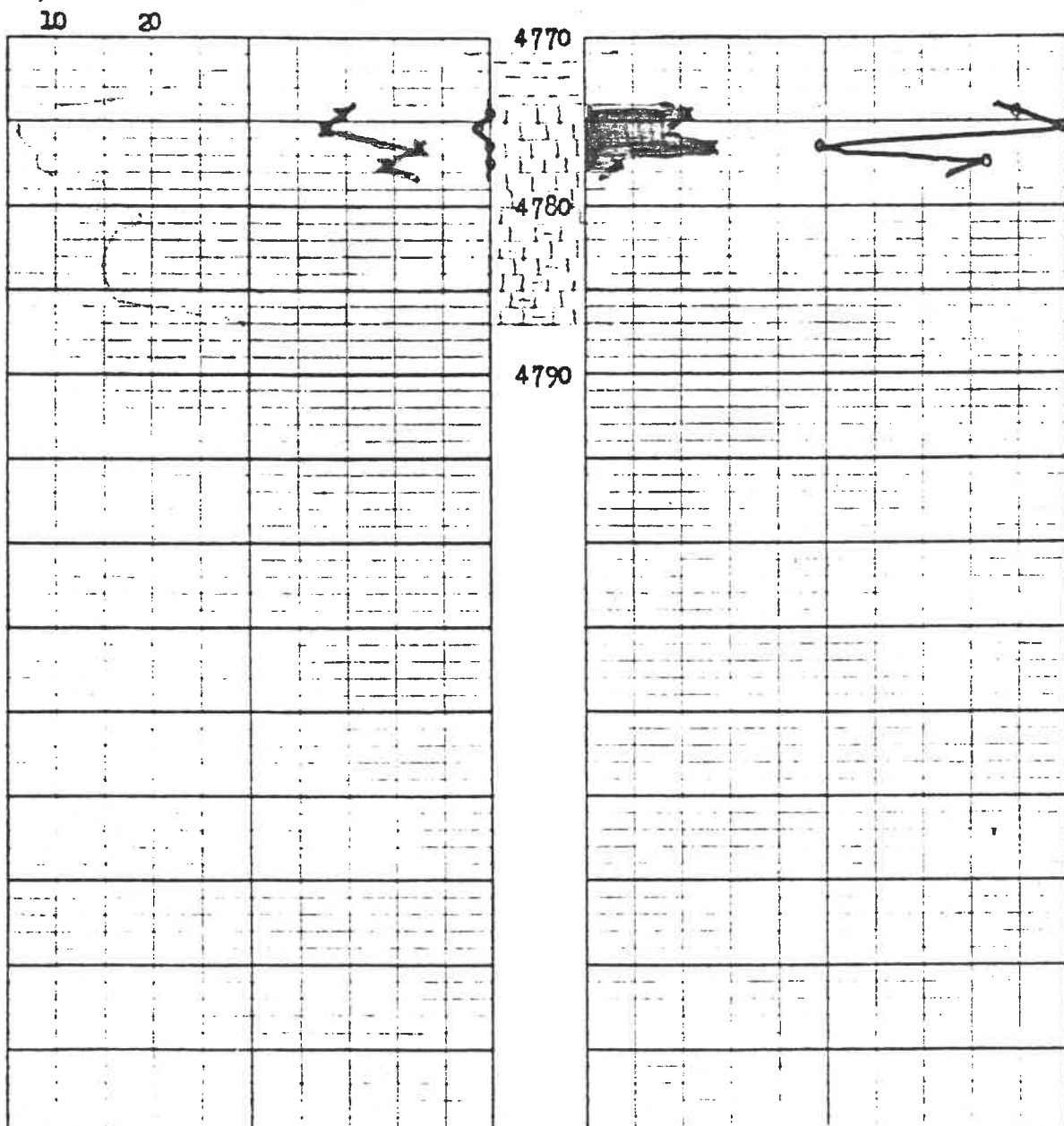
CONNATE WATER % SATURATION  $\bigcirc \longrightarrow$

POROSITY-%  $\times \longrightarrow \times$

OIL % PORE SATURATION  $\times \longrightarrow \times$

CORING TIME

MIN/FT



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Lemon #10 COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petroleum Corp. DATE 11-18-79 FILE NO. S-1415  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>No. | DEPTH | PERMEABILITY<br>MILLIDARCYS |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS                                                                                           |
|---------------|-------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------------------------------------------|
|               |       | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |                                                                                                   |
| 1 73          | 4770  | 23.0                        | 21.6     | 21.6          | 17.4                                | 3.8                               |                        | The low oil percentages indicate mainly gas with some oil will be produced from this entire zone. |
|               | 71    |                             |          |               |                                     |                                   |                        |                                                                                                   |
| 2 74          | 4771  | 2.0                         | 2.1      | 25.0          | 18.2                                | 6.8                               |                        |                                                                                                   |
|               | 72    |                             |          |               |                                     |                                   |                        |                                                                                                   |
| 3 75          | 4772  | 3.0                         | 2.4      | 28.5          | 13.4                                | 2.6                               |                        |                                                                                                   |
|               | 73    |                             |          |               |                                     |                                   |                        |                                                                                                   |
| 4 76          | 4773  | 2.1                         | 0.8      | 14.8          | 34.1                                | 17.0                              |                        |                                                                                                   |
|               | 74    |                             |          |               |                                     |                                   |                        |                                                                                                   |
| 5 77          | 4774  | X 0.0                       | 0.0      | 6.7           | 47.6                                | 4.2                               |                        |                                                                                                   |
|               | 75    |                             |          |               |                                     |                                   |                        |                                                                                                   |
| Net           | 4'    | 7.5                         | 6.7      | 22.5          | 20.8                                | 7.6                               |                        |                                                                                                   |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp.

DATE 11-18-79

WELL Lenon #10

ANALYST IS

FIELD

ELEVATION

COUNTY Comanche

STATE Kansas

GR KB

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PERMEABILITY MILLIDARCY'S 0 →

CONNATE WATER % SATURATION

30 20 10 0

0 60 50 40 30

POROSITY % X →

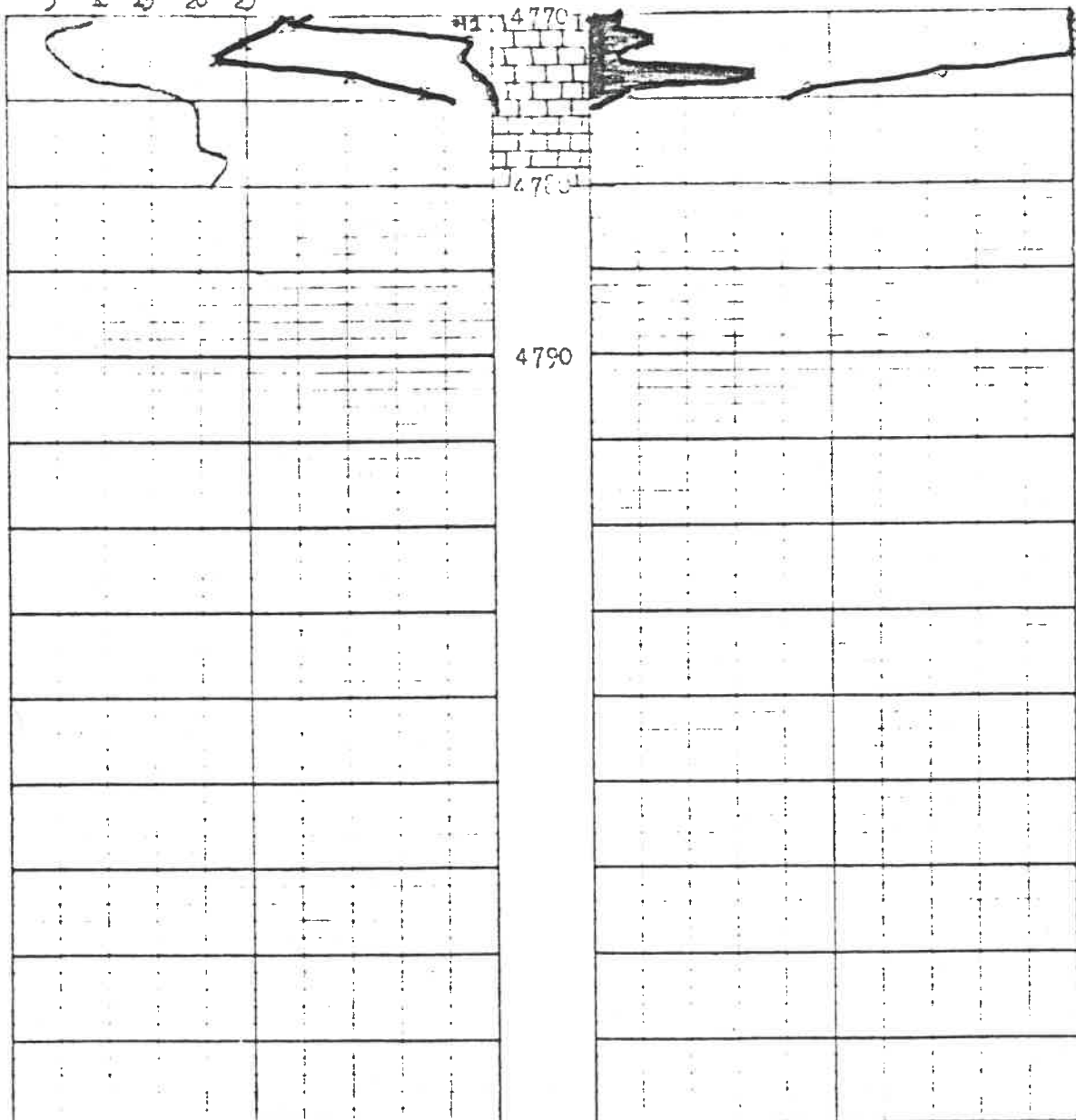
OIL % PORE SATURATION X →

DRILLING TIME 20 10 0

0 10 20

MIN/FT

5 10 15 20 25





# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Lemon #11 COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petroleum Corp. DATE 1-3-80 FILE NO S-1429  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>No.   | DEPTH | PERMEABILITY<br>MILLIDARCYs |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS                                          |
|-----------------|-------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|--------------------------------------------------|
|                 |       | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |                                                  |
| 1 38 4760<br>61 |       | 43.8                        | 3.2      | 15.8          | 26.5                                | 14.0                              | Oil                    |                                                  |
| 2 39 4761<br>62 |       | 125                         | 62.7     | 15.6          | 32.6                                | 13.6                              | Oil                    |                                                  |
| 3 40 4762<br>63 |       | 1.0                         | 0.8      | 14.4          | 17.5                                | 4.7                               | Oil                    | Slight vertical fracture<br>with oil in fracture |
| 4 41 4764<br>65 |       | 4.6                         | 3.0      | 14.4          | 30.3                                | 11.7                              | Oil                    |                                                  |
| 5 42 4765<br>66 |       | 2.1                         | 0.0      | 12.2          | 23.0                                | 21.1                              | Oil                    |                                                  |
| 6 43 4766<br>67 |       | X 0.0                       | 0.0      | 7.7           | 31.8                                | 17.5                              | No Perm                |                                                  |
| Net             | 6'    | 35.3                        | 11.6     | 10.4          | 21.7                                | 10.9                              |                        |                                                  |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 1-3-80  
WELL Lemon #11 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCYS  $\bigcirc \text{---} \bigcirc$

200 100 50 25 0

POROSITY-%  $\times \text{---} \times$

CORING TIME

20 10 0

MIN/FT

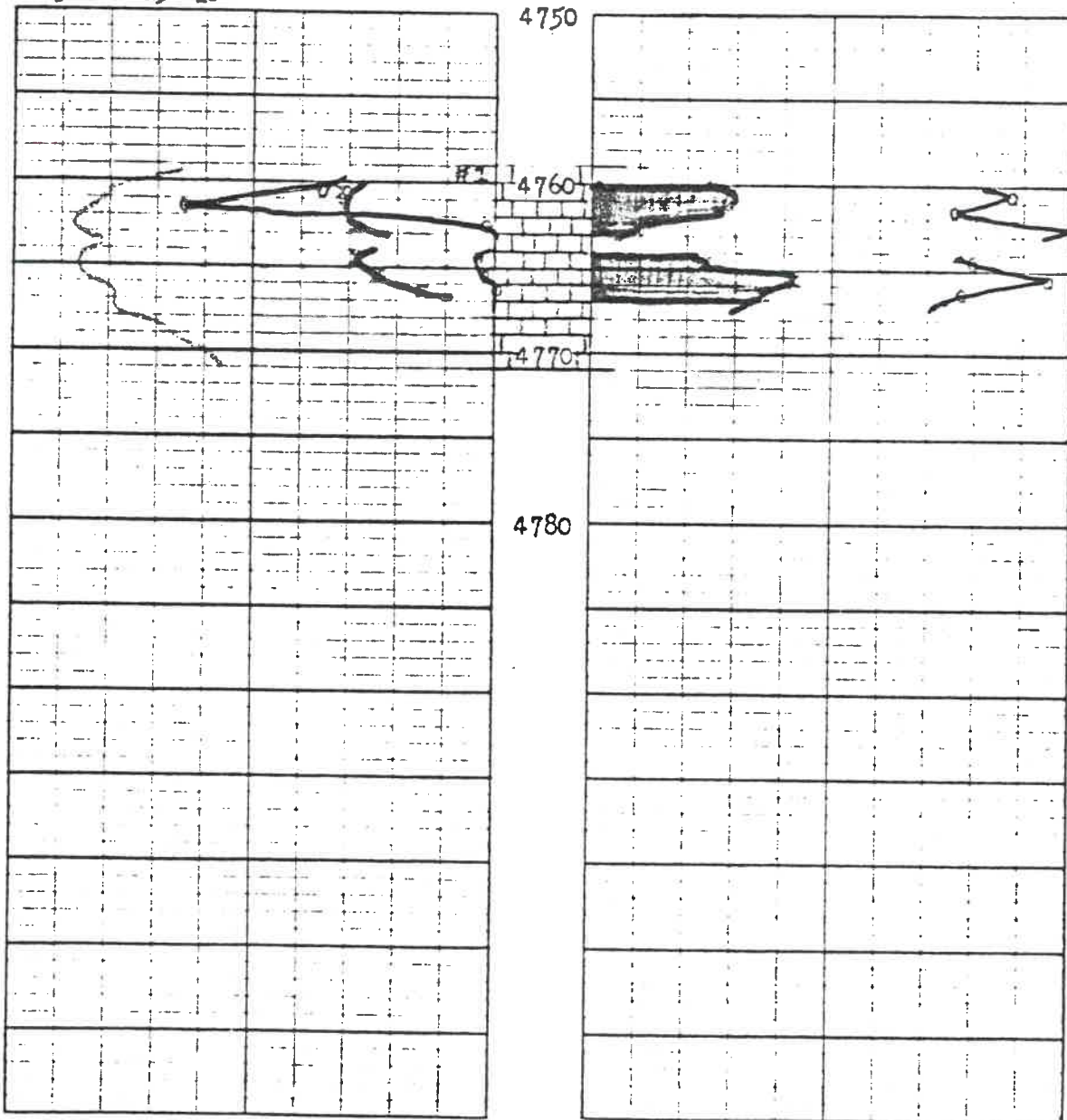
5 10 15 20

CONNATE WATER % SATURATION

0 60 50 40 30  $\bigcirc \text{---} \bigcirc$

OIL % PORE SATURATION  $\times \text{---} \times$

10 20 30



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Rhoades #1 COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petroleum Corp. DATE 6-15-79 FILE NO. S-1392  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE<br>No | DEPTH      | PERMEABILITY<br>MILLIDARCYS |          | POROSITY<br>% | SATURATION<br>WATER % PORE<br>SPACE | SATURATION<br>OIL % PORE<br>SPACE | PROBABLE<br>PRODUCTION | REMARKS |
|--------------|------------|-----------------------------|----------|---------------|-------------------------------------|-----------------------------------|------------------------|---------|
|              |            | HORIZONTAL                  | VERTICAL |               |                                     |                                   |                        |         |
| 1            | 4766<br>67 | X 0.0                       | 0.0      | 11.1          | 31.0                                | 9.1                               | No Perm                |         |
| 2            | 4767<br>68 | 22.1                        | 9.8      | 16.1          | 19.3                                | 9.0                               | Oil                    |         |
| 3            | 4768<br>69 | 4.6                         | 4.6      | 14.2          | 18.2                                | 13.7                              | Oil                    |         |
| 4            | 4769<br>70 | X 0.0                       | 0.0      | 9.6           | 27.3                                | 12.5                              | No Perm                |         |
| Net          | 2'         | 13.4                        | 7.2      | 15.1          | 18.8                                | 11.4                              |                        |         |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY **K.R.M. Petroleum Corp.**

DATE **6-15-79**

WELL **Rhoades #1**

ANALYST **IS**

FIELD

ELEVATION

COUNTY **Comanche**

STATE **Kansas**

OR \_\_\_\_\_

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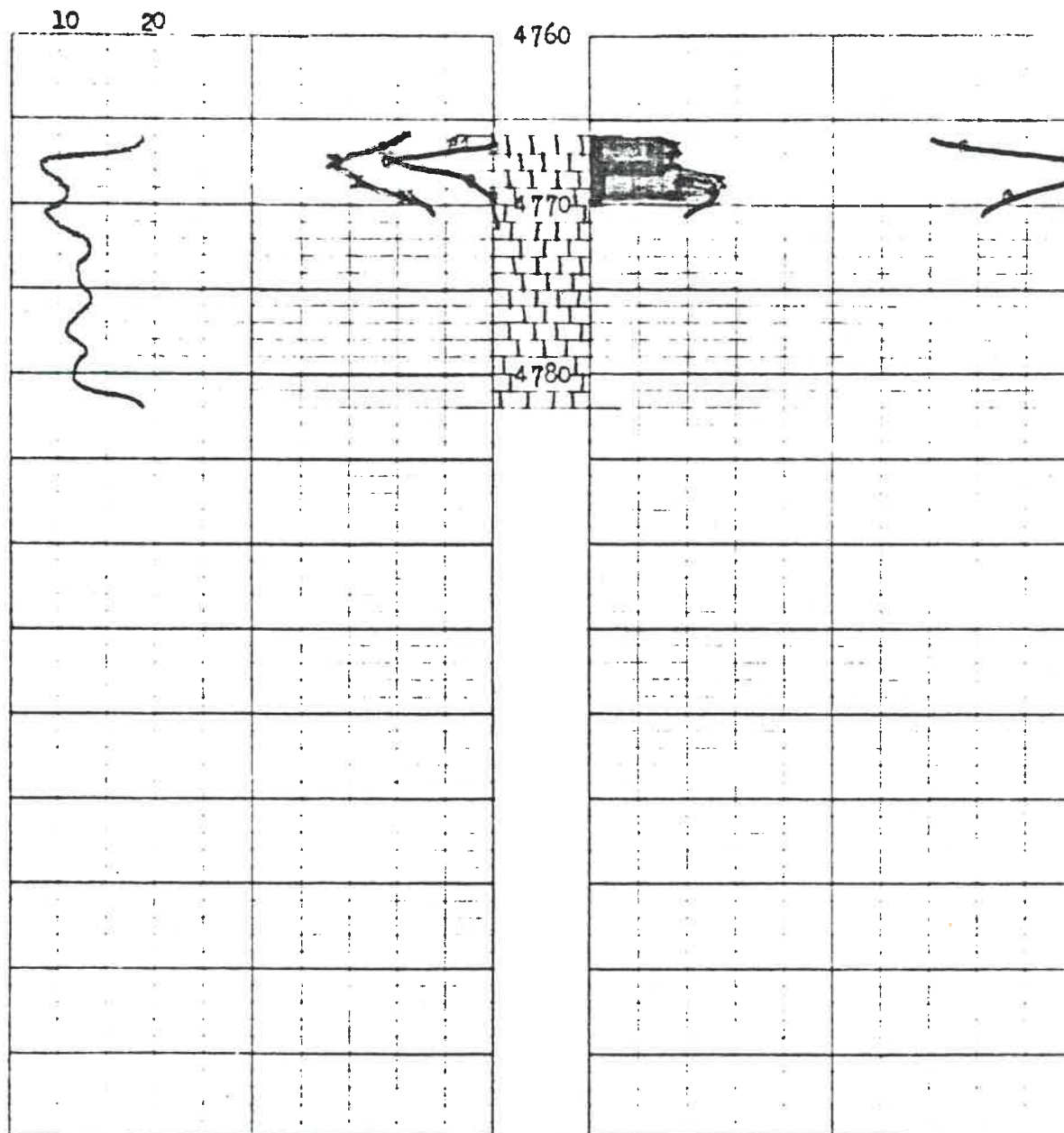
PERMEABILITY MILLIDARCY'S 

CONNATE WATER % SATURATION 

60 40 20 0  
POROSITY %   
CORING TIME 20 10 0

0 60 50 40 30  
OIL % PORE SATURATION   
10 20

MIN/FT



# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Rhoades #2 COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petroleum Corp. DATE 6-27-79 FILE NO. 8-1398  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE NO | DEPTH | PERMEABILITY MILLIDARCYs |          | POROSITY % | SATURATION WATER % PORE SPACE | SATURATION OIL % PORE SPACE | PROBABLE PRODUCTION | REMARKS |
|-----------|-------|--------------------------|----------|------------|-------------------------------|-----------------------------|---------------------|---------|
|           |       | HORIZONTAL               | VERTICAL |            |                               |                             |                     |         |
| 1         | 4755  | 21.3                     | 13.6     | 29.9       | 15.0                          | 1.7                         | Gas                 |         |
|           | 56    |                          |          |            |                               |                             |                     |         |
| 2         | 4756  | 140                      | 130      | 22.1       | 21.6                          | 10.1                        | Oil                 |         |
|           | 57    |                          |          |            |                               |                             |                     |         |
| 3         | 4757  | 110                      | 55.2     | 19.3       | 23.8                          | 10.4                        | Oil                 |         |
|           | 58    |                          |          |            |                               |                             |                     |         |
| 4         | 4758  | 300                      | 125      | 22.0       | 19.3                          | 13.2                        | Oil                 |         |
|           | 59    |                          |          |            |                               |                             |                     |         |
| 5         | 4759  | 2.1                      | 0.0      | 16.1       | 24.3                          | 10.6                        | Oil                 |         |
|           | 60    |                          |          |            |                               |                             |                     |         |
| 6         | 4760  | 51.6                     | 32.8     | 16.5       | 28.2                          | 9.8                         | Oil                 |         |
|           | 61    |                          |          |            |                               |                             |                     |         |
| 7         | 4761  | 48.2                     | 39.6     | 16.8       | 25.4                          | 7.6                         | Oil                 |         |
|           | 62    |                          |          |            |                               |                             |                     |         |
| 8         | 4762  | 56.1                     | 31.2     | 15.2       | 24.9                          | 6.3                         | Oil                 |         |
|           | 63    |                          |          |            |                               |                             |                     |         |
| 9         | 4763  | 32.6                     | 18.9     | 13.6       | 23.5                          | 8.6                         | Oil                 |         |
|           | 64    |                          |          |            |                               |                             |                     |         |
| 10        | 4764  | X 0.0                    | 0.0      | 10.3       | 36.2                          | 5.1                         | No Perm             |         |
|           | 65    |                          |          |            |                               |                             |                     |         |
| Net       | 9'    | 84.7                     | 49.6     | 19.1       | 22.9                          | 8.7                         |                     |         |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 6-27-79  
WELL Rhoades #2 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCYS  $\bigcirc \rightarrow \bigcirc$

300 200 100 0

POROSITY-%  $X \rightarrow X$

CORING TIME

20 10 0

MIN/FT

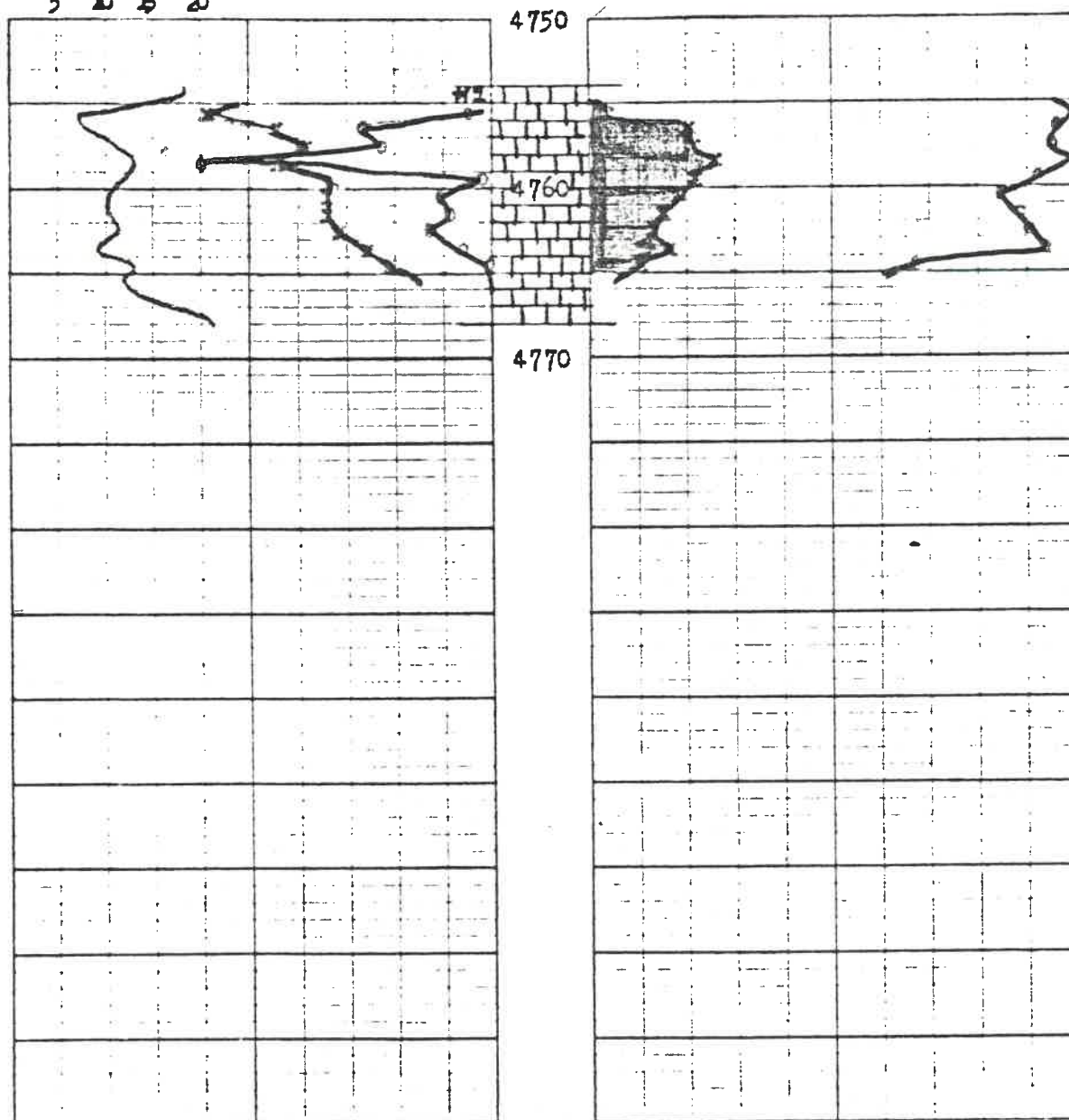
5 10 15 20

CONNATE WATER % SATURATION

0 60 50 40  $\bigcirc \rightarrow \bigcirc$  30

OIL % PORE SATURATION  $X \rightarrow X$

10 20 30





# Kansas Cores

PETROLEUM RESERVOIR ENGINEERING  
WICHITA, KANSAS 67208

WELL Rhoads #3 COUNTY Comanche STATE Kansas  
COMPANY K.R.M. Petr. Corp. DATE 12-18-79 FILE NO S-1425  
FIELD \_\_\_\_\_ TYPE CORES Diamond ANALYST IS

## ANALYSIS DATA AND INTERPRETATIONS

| SAMPLE NO        | DEPTH | PERMEABILITY MILLIDARCYs |          | DENSITY | SATURATION WATER % PORE SPACE | SATURATION OIL % PORE SPACE | PROBABLE PRODUCTION | REMARKS            |
|------------------|-------|--------------------------|----------|---------|-------------------------------|-----------------------------|---------------------|--------------------|
|                  |       | HORIZONTAL               | VERTICAL |         |                               |                             |                     |                    |
| 1 72 4770<br>71  |       | X 0.0                    | 0.0      | 10.8    | 33.6                          | 7.8                         | No Perm             |                    |
| 2 73 4771<br>72  |       | 2.4                      | 1.2      | 14.6    | 26.9                          | 10.0                        | Oil                 |                    |
| 3 74 4772<br>73  |       | 2.2                      | 0.8      | 19.9    | 32.0                          | 12.9                        | Oil                 |                    |
| 4 75 4773<br>74  |       | 67.9                     | 55.2     | 23.2    | 21.7                          | 14.8                        | Oil                 |                    |
| 5 74 4774<br>75  |       | 22.1                     | 7.4      | 17.8    | 19.3                          | 16.9                        | Oil                 |                    |
| 6 77 4775<br>76  |       | X 0.0                    | 0.0      | 5.8     | 34.9                          | 4.7                         | No Perm             |                    |
| 7 78 4776<br>77  |       | 2.9                      | 1.8      | 11.2    | 26.6                          | 9.2                         | Oil                 |                    |
| 8 79 4777<br>78  |       | 4.7                      | 3.0      | 11.7    | 25.3                          | 13.8                        | Oil                 | Vertical fractures |
| 9 80 4778<br>79  |       | X 0.0                    | 0.0      | 9.7     | 27.2                          | 12.4                        | No Perm             | Vertical fractures |
| 10 81 4779<br>80 |       | X 0.0                    | 0.0      | 8.6     | 30.6                          | 8.8                         | No Perm             | Vertical fractures |
| 11 82 4780<br>81 |       | X 0.0                    | 0.0      | 8.5     | 47.1                          | 2.9                         | No Perm             |                    |
| Net              | 6'    | 17.0                     | 6.0      | 16.4    | 25.3                          | 12.9                        |                     |                    |

# Kansas Cores

## PETROLEUM RESERVOIR ENGINEERING WICHITA, KANSAS

COMPANY K.R.M. Petroleum Corp. DATE 12-18-79  
WELL Rhoads #3 ANALYST IS  
FIELD \_\_\_\_\_ ELEVATION \_\_\_\_\_  
COUNTY Comanche STATE Kansas GR \_\_\_\_\_ KB \_\_\_\_\_

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PERMEABILITY MILLIDARCYS  $\bigcirc \longrightarrow$

80 60 40 20 0

CONNATE WATER % SATURATION

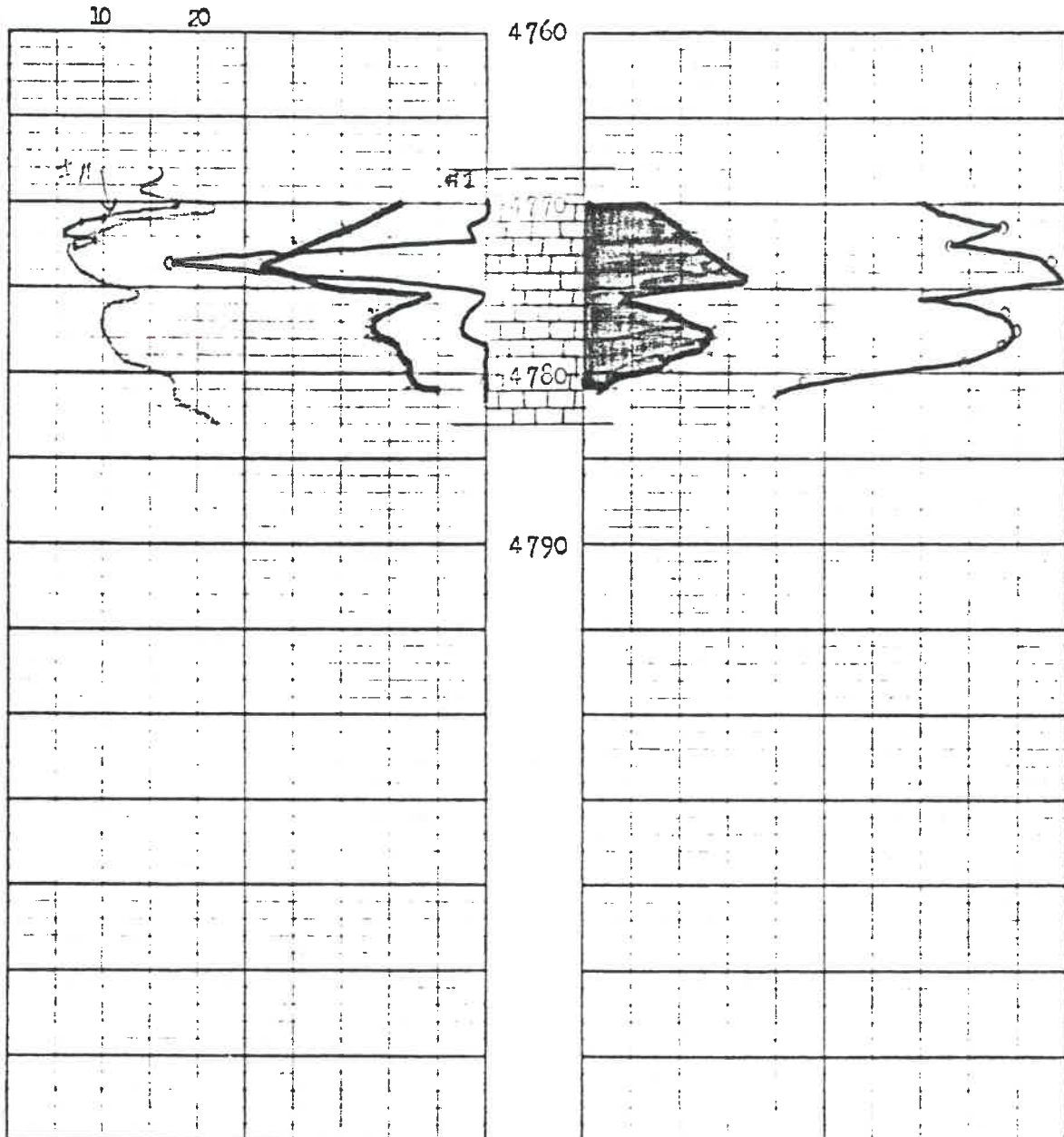
0 60 50 40 30  $\bigcirc \longrightarrow$

POROSITY-%  $\times \longrightarrow$

CORING TIME 20 10 0

OIL % PORE SATURATION  $\times \longrightarrow$   
10 20

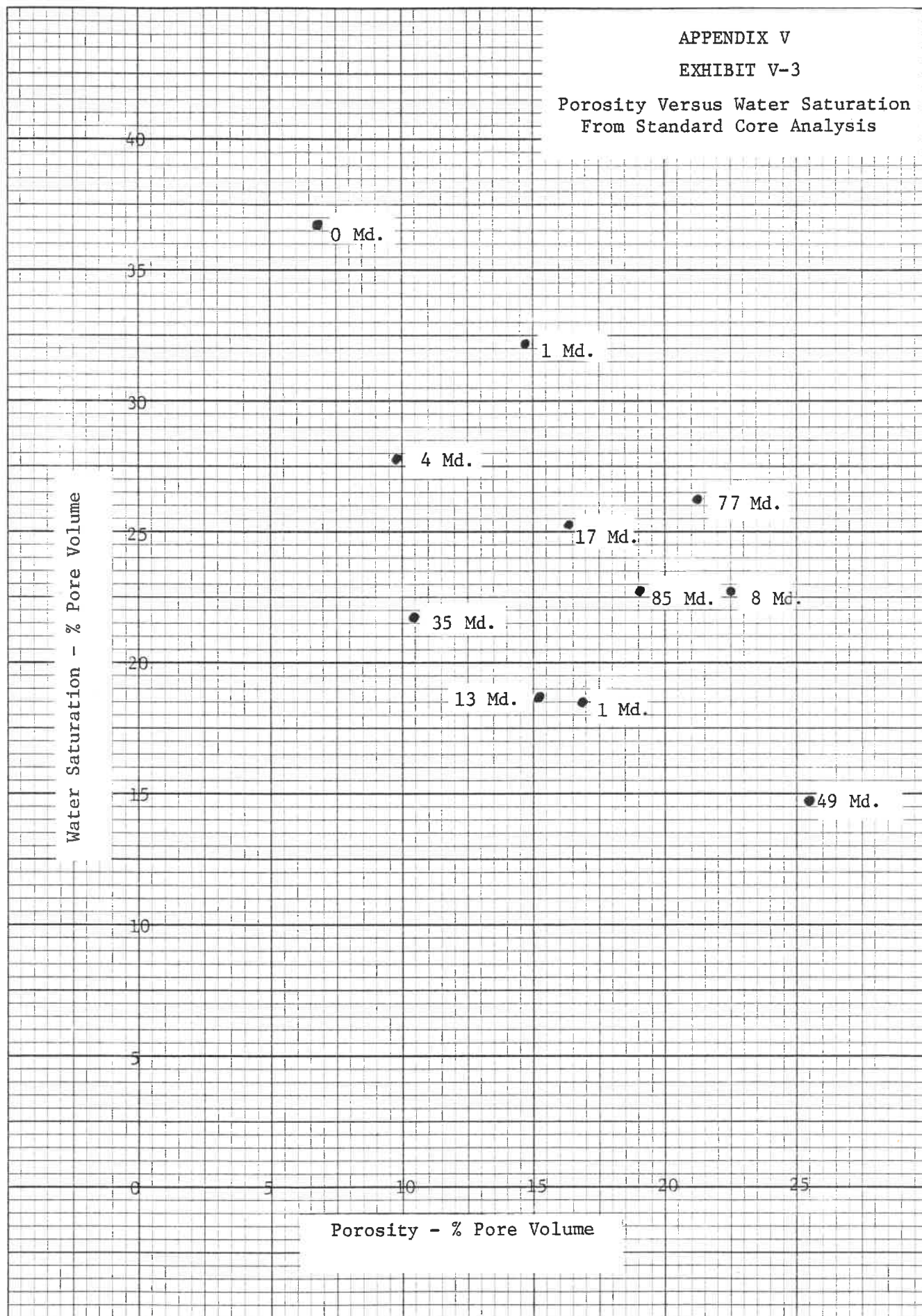
MIN/FT



APPENDIX V

EXHIBIT V-3

Porosity Versus Water Saturation  
From Standard Core Analysis



CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS, TEXAS 75247

APPENDIX V

EXHIBIT V-3

Special Core Analysis Study  
for

KRM PETROLEUM CORPORATION

G. C. Lemon No. 3 Well  
Comanche County, Kansas

CORE LABORATORIES, INC.

*Petroleum Reservoir Engineering*

DALLAS, TEXAS 75247

October 1, 1979

KRM Petroleum Corporation  
Guaranty Bank Building  
817 Seventeenth Street  
Denver, Colorado 80202

Attention: Mr. J. C. Simmons

Subject: Special Core Analysis Study  
G. C. Lemon No. 3 Well  
Kansas City-Lansing Formation  
Comanche County, Kansas  
File Number: SCAL-79164-S

Gentlemen:

In a telephone conversation on April 16, 1979, between J. C. Simmons and a representative of Core Laboratories, Inc., a special core analysis test program was discussed which would evaluate flow characteristics of the reservoir in question. In a letter dated May 2, 1979, J. C. Simmons requested Core Laboratories, Inc., to perform three each of the following: (1) Unsteady-State Gas-Oil Relative Permeability Tests, and (2) Unsteady-State Waterflood Susceptibility Tests on carbonate core plugs. Presented in this report are the results of the requested analyses. The core plugs used in this study are lithologically described and identified as to sample number and depth interval on Page 1.

Five full-diameter well core segments, each representing a different depth interval between the depths 4779 feet and 4784 feet, were submitted for use in this study. One core plug, 1-1/2 inches in diameter, was obtained from each well core segment using a diamond core bit with water as the bit coolant and lubricant. Each core plug was extracted of hydrocarbons with alternate injections of toluene and acetone, leached of salt with methyl alcohol, and then dried. Air permeabilities and Boyle's law porosities were determined on the cleaned and dried core plugs. Based on the results of the air permeability and porosity determinations, three core plugs were selected for further testing. The three selected core plugs were evacuated and pressure saturated with a brine containing 91,000 ppm sodium chloride.

Initial (pseudo-connate) water saturations were established in the three brine-saturated core plugs utilizing a centrifugal technique and an air-brine system. The pore space voided by this method was resaturated with a refined mineral oil having a viscosity of approximately 20 centipoise. Effective permeabilities to oil were determined in the presence of the initial water saturations. The oil present in each core plug was dynamically displaced by humidified nitrogen



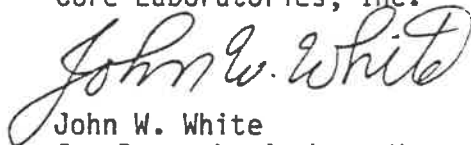
gas and incremental volumes of oil and gas production were measured as a function of time. Gas-oil relative permeability characteristics were calculated from the production data and these results are presented on Pages 2 through 4 and in graphical form on Pages 5 through 10. An examination of the test results reveals that the oil displacement efficiency by gas is within the range considered average for Samples 2 and 4, and slightly below average for Sample 5 as compared to carbonates in general.

Upon completion of the gas-oil relative permeability tests, each core plug was submerged under a laboratory oil having a viscosity of 1.02 centipoise and evacuated a short period of time to remove any gas saturation which may have been present. Each core plug was then mounted in a hydraulic-type core holder and all mobile fluids present within each core plug were dynamically displaced with the 1.02 centipoise oil. Effective permeabilities to oil were then determined in the presence of the initial water saturations which ranged from 12.5 to 37.5 percent pore space, and averaged 22.3 percent pore space. The 91,000 ppm sodium chloride brine containing sufficient calcium sulfate to increase the viscosity to 1.74 centipoise was used as the displacing phase for the waterflood tests. The fluids used in the waterflood tests were selected so as to yield an oil-water viscosity ratio equal to the oil-water viscosity ratio present in the reservoir. The oil remaining in the core plugs at terminal conditions of water floodout (99.9 percent water cut) ranged from 20.5 to 32.9 percent pore space and averaged 25.8 percent pore space. These data are summarized on Page 11, presented in tabular form on Pages 12 through 14, and in graphical form on Pages 15 through 17.

It was a pleasure working with and for KRM Petroleum Corporation on this study. Should you have any questions pertaining to these test results or if we can be of further assistance, please do not hesitate to contact us.

Very truly yours,

Core Laboratories, Inc.



John W. White  
for Duane L. Archer, Manager  
Special Core Analysis

JWW:fm  
10 cc. - Addressee



CORE LABORATORIES, INC.  
*Petroleum Reservoir Engineering*  
DALLAS, TEXAS 75247

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File SCAL-79164-S

Company KRM Petroleum Corp. Formation Kansas City - Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas

Identification and Description of Samples

| <u>Sample<br/>Number</u> | <u>Depth, feet</u> | <u>Lithological Description</u>      |
|--------------------------|--------------------|--------------------------------------|
| 2                        | 4780               | Ls, brn, fnly xln, dns, many pp vugs |
| 4                        | 4782               | Ls, brn fnly xln, dns, many pp vugs  |
| 5                        | 4783               | Ls, brn, med xln, dns, many pp vugs  |

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 File SCAL-79164-S

Gas-Oil Relative Permeability Data

Sample Number 2 Initial Water Saturation,  
 Percent Pore Space 12.5  
 Air Permeability, md 78 Porosity, Percent 27.0  
 Oil Permeability at  
 Initial Water Saturation, md 67

| <u>Gas Saturation,<br/>Percent Pore Space</u> | <u>Gas-Oil Relative<br/>Permeability Ratio</u> | <u>Relative Permeability<br/>to Gas,* Fraction</u> | <u>Relative Permeability<br/>to Oil,* Fraction</u> |
|-----------------------------------------------|------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
| 0.0                                           | 0.000                                          | 0.0000                                             | 1.000                                              |
| 6.5                                           | 0.014                                          | 0.0076                                             | 0.565                                              |
| 8.3                                           | 0.031                                          | 0.014                                              | 0.469                                              |
| 9.7                                           | 0.048                                          | 0.020                                              | 0.417                                              |
| 10.9                                          | 0.069                                          | 0.026                                              | 0.374                                              |
| 12.0                                          | 0.096                                          | 0.032                                              | 0.332                                              |
| 13.1                                          | 0.130                                          | 0.038                                              | 0.292                                              |
| 14.0                                          | 0.168                                          | 0.044                                              | 0.264                                              |
| 15.0                                          | 0.220                                          | 0.056                                              | 0.256                                              |
| 16.7                                          | 0.255                                          | 0.064                                              | 0.210                                              |
| 21.0                                          | 0.704                                          | 0.102                                              | 0.145                                              |
| 24.4                                          | 1.35                                           | 0.130                                              | 0.096                                              |
| 27.7                                          | 2.49                                           | 0.164                                              | 0.066                                              |
| 32.0                                          | 5.49                                           | 0.199                                              | 0.036                                              |
| 35.2                                          | 10.3                                           | 0.236                                              | 0.023                                              |
| 37.9                                          | 17.2                                           | 0.270                                              | 0.016                                              |
| 40.0                                          | 27.3                                           | 0.295                                              | 0.011                                              |
| 40.7                                          | 31.7                                           | 0.316                                              | 0.010                                              |
| 42.0                                          | 43.9                                           | 0.324                                              | 0.0074                                             |

\*Relative to oil permeability.

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Page 3 of 19  
 File SCAL-79164-S

Gas-Oil Relative Permeability Data

Sample Number 4 Initial Water Saturation,  
 Percent Pore Space 16.8  
 Air Permeability, md 63 Porosity, Percent 22.0  
 Oil Permeability at  
 Initial Water Saturation, md 56

| <u>Gas Saturation,<br/>Percent Pore Space</u> | <u>Gas-Oil Relative<br/>Permeability Ratio</u> | <u>Relative Permeability<br/>to Gas,* Fraction</u> | <u>Relative Permeability<br/>to Oil,* Fraction</u> |
|-----------------------------------------------|------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
| 0.0                                           | 0.000                                          | 0.000                                              | 1.000                                              |
| 6.5                                           | 0.048                                          | 0.025                                              | 0.519                                              |
| 8.2                                           | 0.074                                          | 0.033                                              | 0.447                                              |
| 9.7                                           | 0.103                                          | 0.041                                              | 0.397                                              |
| 11.0                                          | 0.136                                          | 0.049                                              | 0.357                                              |
| 12.2                                          | 0.174                                          | 0.056                                              | 0.321                                              |
| 13.4                                          | 0.219                                          | 0.063                                              | 0.287                                              |
| 14.5                                          | 0.271                                          | 0.069                                              | 0.256                                              |
| 15.4                                          | 0.329                                          | 0.076                                              | 0.231                                              |
| 16.9                                          | 0.437                                          | 0.088                                              | 0.202                                              |
| 20.2                                          | 0.800                                          | 0.120                                              | 0.150                                              |
| 24.3                                          | 1.62                                           | 0.159                                              | 0.098                                              |
| 28.7                                          | 3.51                                           | 0.203                                              | 0.058                                              |
| 32.3                                          | 6.65                                           | 0.249                                              | 0.037                                              |
| 36.3                                          | 14.7                                           | 0.298                                              | 0.020                                              |
| 40.2                                          | 34.9                                           | 0.356                                              | 0.010                                              |
| 42.1                                          | 57.1                                           | 0.393                                              | 0.0069                                             |
| 43.4                                          | 83.9                                           | 0.420                                              | 0.0050                                             |

\*Relative to oil permeability.

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File SCAL-79164-S

Gas-Oil Relative Permeability Data

Sample Number 5  
Air Permeability, md 8.7  
Oil Permeability at  
Initial Water Saturation, md 3.9

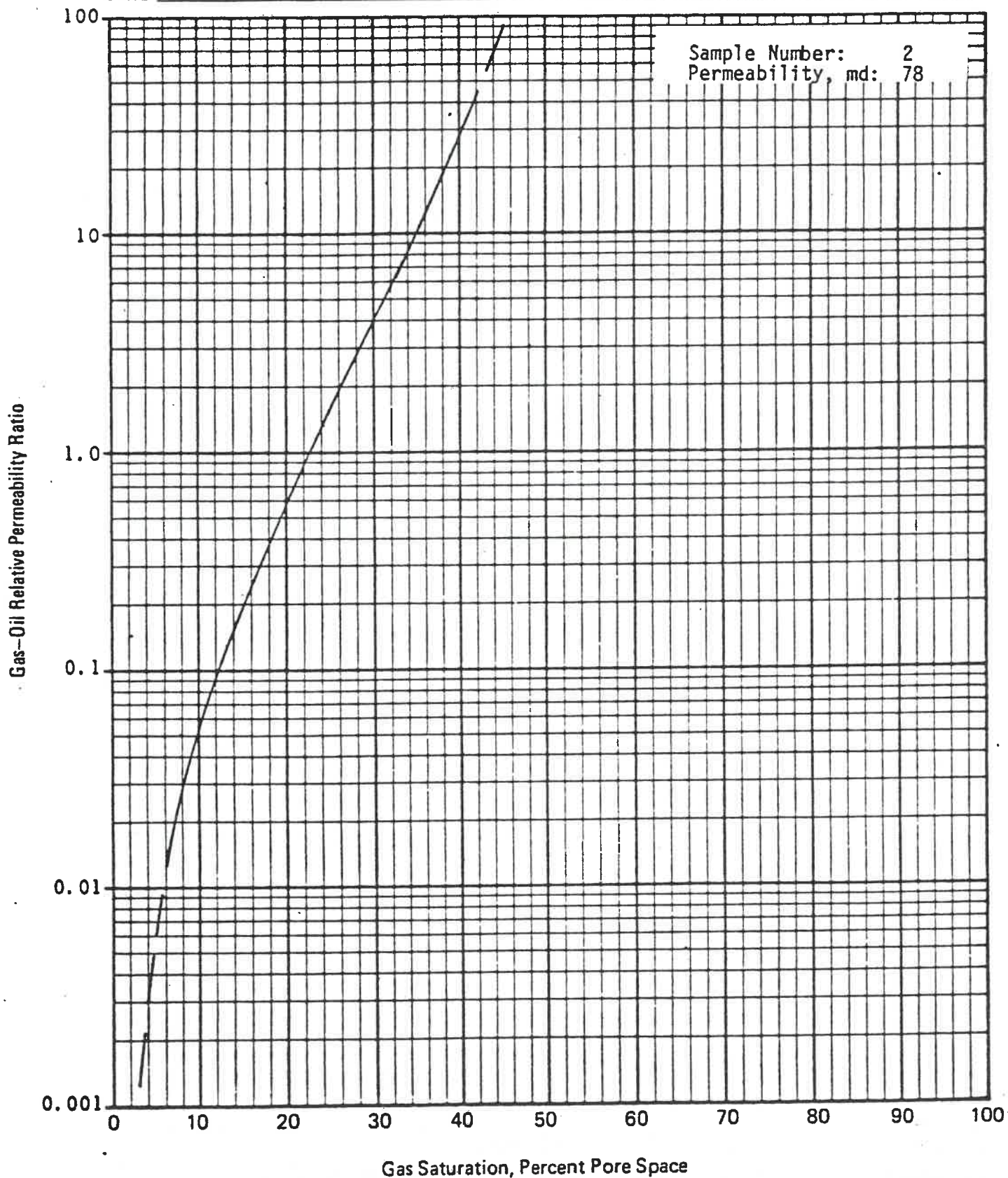
Initial Water Saturation,  
Percent Pore Space 37.5  
Porosity, Percent 22.8

| <u>Gas Saturation,<br/>Percent Pore Space</u> | <u>Gas-Oil Relative<br/>Permeability Ratio</u> | <u>Relative Permeability<br/>to Gas,* Fraction</u> | <u>Relative Permeability<br/>to Oil,* Fraction</u> |
|-----------------------------------------------|------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
| 0.0                                           | 0.000                                          | 0.000                                              | 1.000                                              |
| 3.0                                           | 0.060                                          | 0.049                                              | 0.819                                              |
| 4.1                                           | 0.090                                          | 0.060                                              | 0.664                                              |
| 5.1                                           | 0.125                                          | 0.070                                              | 0.555                                              |
| 5.9                                           | 0.166                                          | 0.078                                              | 0.472                                              |
| 6.6                                           | 0.208                                          | 0.086                                              | 0.414                                              |
| 7.2                                           | 0.250                                          | 0.094                                              | 0.374                                              |
| 7.6                                           | 0.287                                          | 0.100                                              | 0.350                                              |
| 8.0                                           | 0.318                                          | 0.107                                              | 0.335                                              |
| 8.3                                           | 0.350                                          | 0.112                                              | 0.321                                              |
| 8.8                                           | 0.393                                          | 0.118                                              | 0.299                                              |
| 10.4                                          | 0.589                                          | 0.140                                              | 0.238                                              |
| 13.7                                          | 1.27                                           | 0.181                                              | 0.143                                              |
| 16.3                                          | 2.33                                           | 0.210                                              | 0.090                                              |
| 19.0                                          | 4.68                                           | 0.245                                              | 0.052                                              |
| 22.0                                          | 10.4                                           | 0.285                                              | 0.027                                              |
| 23.7                                          | 17.4                                           | 0.310                                              | 0.018                                              |
| 24.7                                          | 24.2                                           | 0.329                                              | 0.014                                              |
| 25.3                                          | 30.5                                           | 0.343                                              | 0.011                                              |
| 25.9                                          | 37.2                                           | 0.354                                              | 0.0095                                             |

\*Relative to oil permeability.

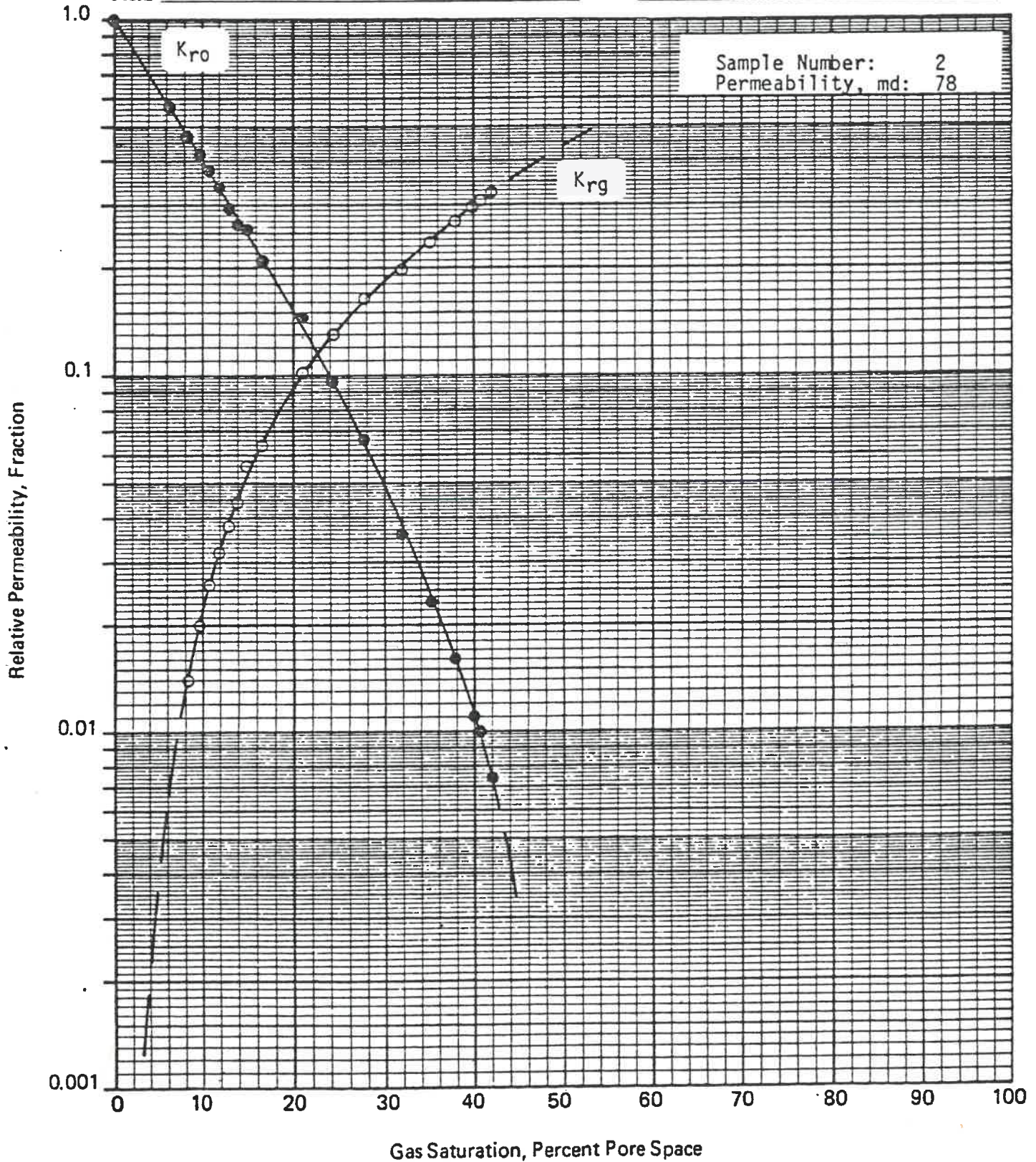
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Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas



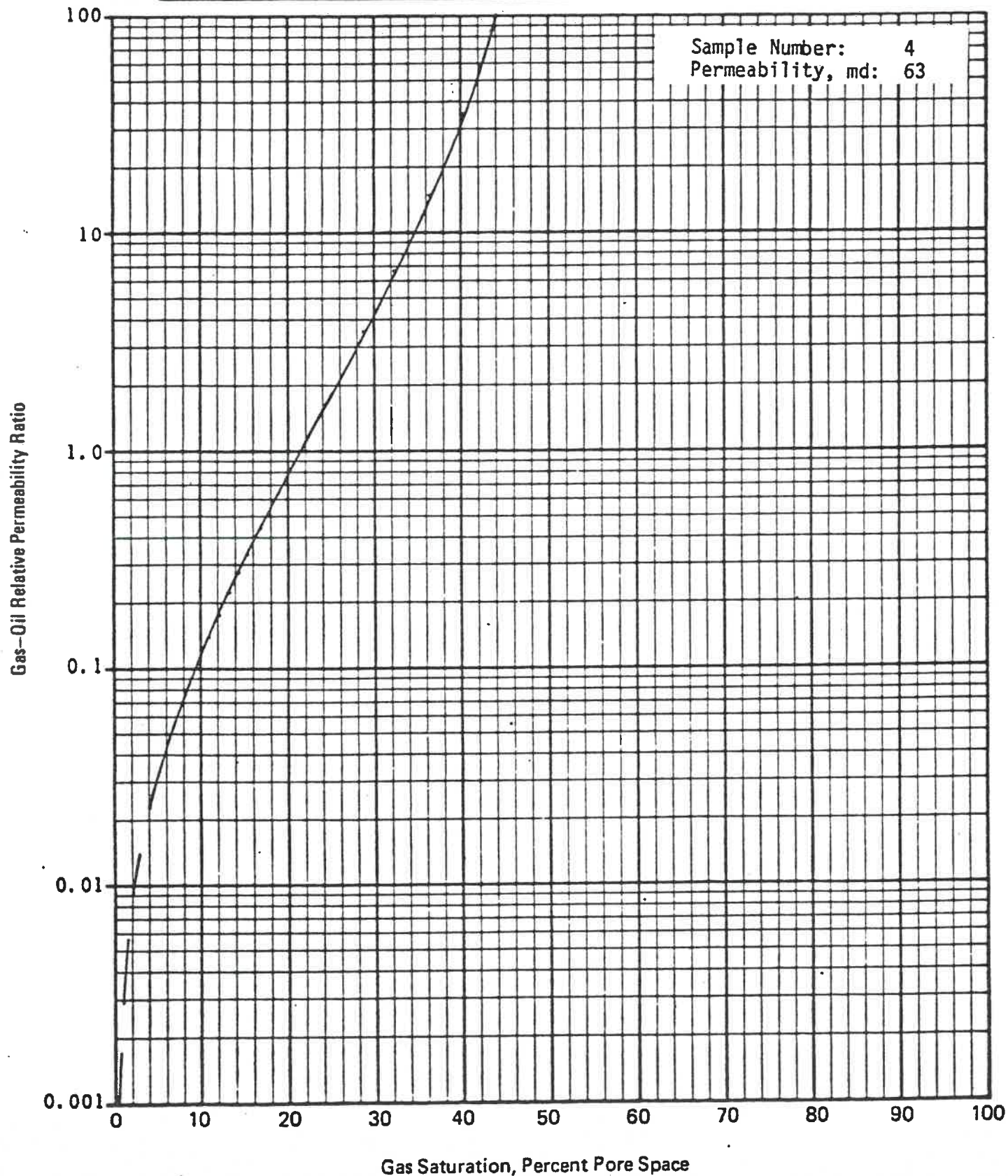


Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas



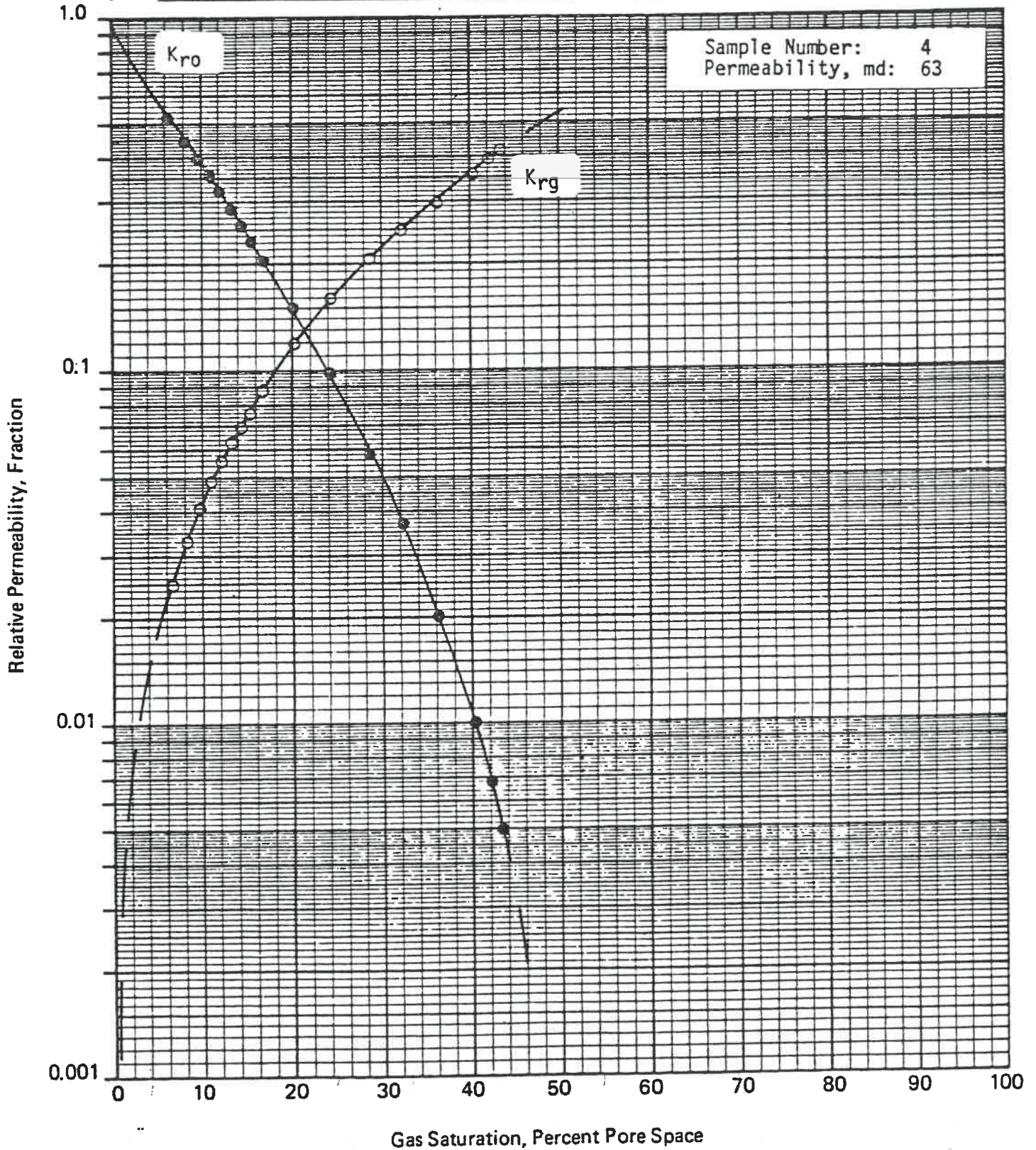


Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas





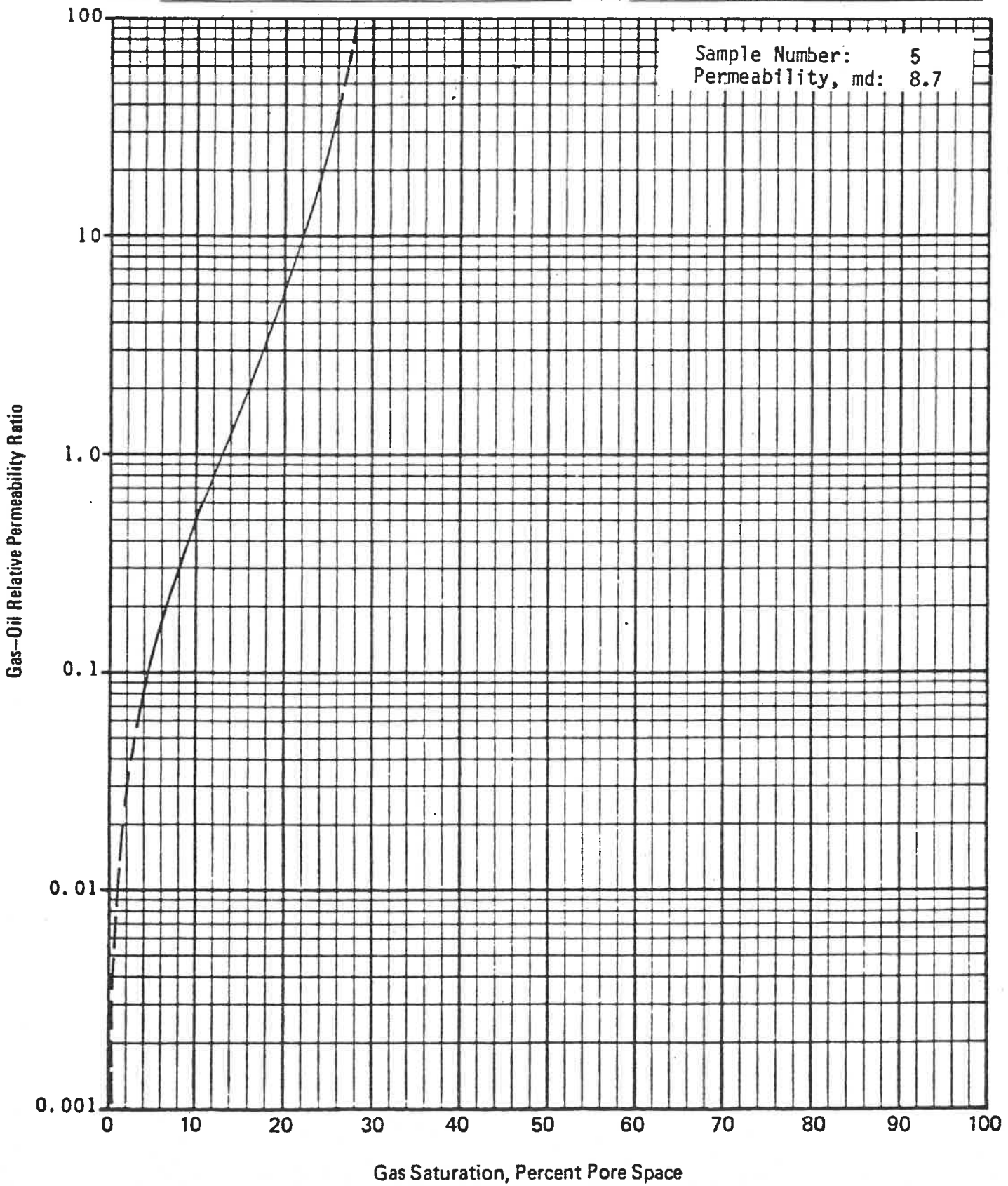
Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas





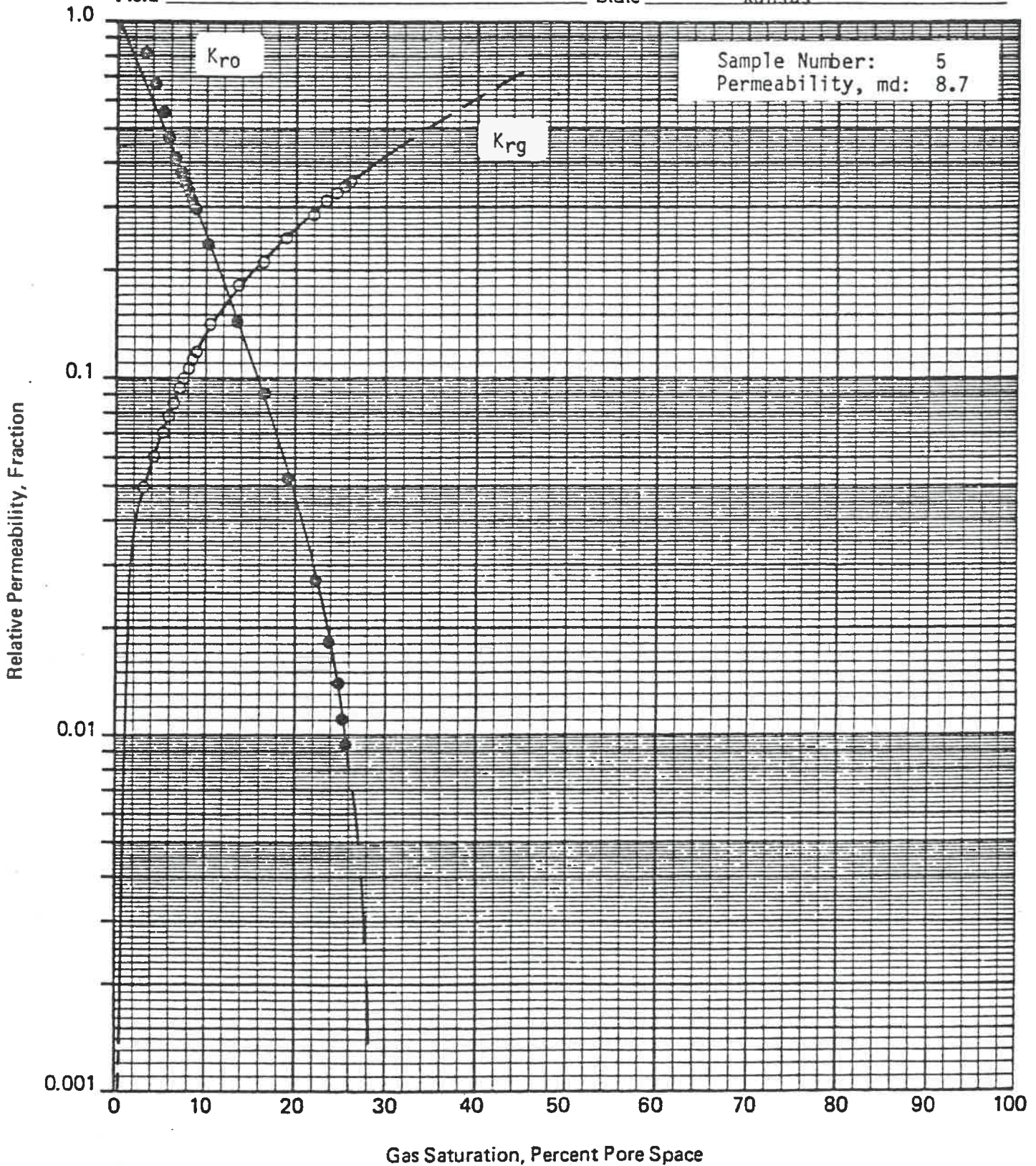
Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas

Sample Number: 5  
Permeability, md: 8.7





Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas



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*Petroleum Reservoir Engineering*

DALLAS, TEXAS 75247

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File SCAL-79164-S

## Summary of Waterflood Test Results

| Sample Number | Depth, feet | Air Permeability, Millidarcies | Initial Conditions                   |                                | Terminal Conditions                |                                  |                                                |
|---------------|-------------|--------------------------------|--------------------------------------|--------------------------------|------------------------------------|----------------------------------|------------------------------------------------|
|               |             |                                | Water Saturation, Percent Pore Space | Oil Permeability, Millidarcies | Oil Saturation, Percent Pore Space | Water Permeability, Millidarcies | Oil Recovered, Percent Pore Space Oil in Place |
| 2             | 4780        | 78                             | 12.5                                 | 48 (61.5% Ka)                  | 32.9                               | 42 (53.8% Ka)                    | 54.6 62.4                                      |
| 4             | 4782        | 63                             | 16.8                                 | 60 (95.2% Ka)                  | 24.1                               | 34 (54% Ka)                      | 59.1 71.0                                      |
| 5             | 4783        | 8.7                            | 37.5                                 | 4.7 (54% Ka)                   | 20.5                               | 3.2 (36.8% Ka)                   | 42.0 67.2                                      |

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Waterflood Susceptibility Data

|                                                    |           |                                     |             |
|----------------------------------------------------|-----------|-------------------------------------|-------------|
| Sample Number                                      | <u>2</u>  | Initial Water, Percent Pore Space   | <u>12.5</u> |
| Permeability to Air, md                            | <u>78</u> | Porosity, Percent                   | <u>27.0</u> |
| Permeability to Oil with Initial Water Present, md | <u>48</u> | Flooding Pressure Differential, psi | <u>25</u>   |

| Water Input,<br>Pore Volumes | Cumulative Oil<br>Recovery, Percent<br>Pore Space | Average Oil<br>Recovery, * Percent<br>Pore Space | Average<br>Water Cut, **<br>Percent |
|------------------------------|---------------------------------------------------|--------------------------------------------------|-------------------------------------|
| 0.295                        | 29.5                                              | 30.9                                             | 34.9                                |
| 0.338                        | 32.3                                              | 32.8                                             | 68.2                                |
| 0.370                        | 33.3                                              | 33.7                                             | 83.0                                |
| 0.414                        | 34.1                                              | 34.6                                             | 85.6                                |
| 0.493                        | 35.2                                              | 35.8                                             | 90.3                                |
| 0.621                        | 36.4                                              | 37.0                                             | 92.6                                |
| 0.768                        | 37.5                                              | 38.1                                             | 94.2                                |
| 0.972                        | 38.7                                              | 39.3                                             | 95.6                                |
| 1.24                         | 39.9                                              | 40.4                                             | 96.6                                |
| 1.53                         | 40.9                                              | 41.5                                             | 97.8                                |
| 2.09                         | 42.1                                              | 42.7                                             | 98.2                                |
| 2.69                         | 43.2                                              | 44.0                                             | 98.7                                |
| 3.93                         | 44.8                                              | 45.4                                             | 99.1                                |
| 5.20                         | 45.9                                              | 46.8                                             | 99.2                                |
| 7.64                         | 47.8                                              | 48.3                                             | 99.6                                |
| 10.1                         | 48.8                                              | 49.6                                             | 99.7                                |
| 15.2                         | 50.4                                              | 50.9                                             | 99.8                                |
| 20.1                         | 51.4                                              | 52.2                                             | 99.8                                |
| 29.7                         | 52.9                                              |                                                  |                                     |

\*Calculated for mid-point of incremental throughput

\*\*Calculated from incremental throughput volumes

\*\*\*Breakthrough recovery



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*Petroleum Reservoir Engineering*  
 DALLAS, TEXAS 75247

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 File SCAL-79164-S

Waterflood Susceptibility Data

|                                                    |               |                                            |                               |
|----------------------------------------------------|---------------|--------------------------------------------|-------------------------------|
| Sample Number                                      | 2 (continued) | Initial Water, Percent Pore Space          | 12.5                          |
| Permeability to Air, md                            | 78            | Porosity, Percent                          | 27.0                          |
| Permeability to Oil with Initial Water Present, md | 48            | Flooding Pressure Differential, psi        | 25                            |
| Water Input, Pore Volumes                          |               | Average Oil Recovery, * Percent Pore Space | Average Water Cut, ** Percent |
| 34.4                                               | 53.5          | 53.2                                       | 99.9                          |
| 39.3                                               | 54.1          | 53.8                                       | 99.9                          |
| 44.0                                               | 54.4          | 54.2                                       | 99.9                          |
| 48.9                                               | 54.6          | 54.5                                       | 99.9                          |

\*Calculated for mid-point of incremental throughput  
 \*\*Calculated from incremental throughput volumes  
 \*\*\*Breakthrough recovery

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Waterflood Susceptibility Data

|                                                    |    |                                     |      |
|----------------------------------------------------|----|-------------------------------------|------|
| Sample Number                                      | 4  | Initial Water, Percent Pore Space   | 16.8 |
| Permeability to Air, md                            | 63 | Porosity, Percent                   | 22.0 |
| Permeability to Oil with Initial Water Present, md | 60 | Flooding Pressure Differential, psi | 15   |

| Water Input,<br>Pore Volumes | Cumulative Oil<br>Recovery, Percent<br>Pore Space | Average Oil<br>Recovery, * Percent<br>Pore Space | Average<br>Water Cut, **<br>Percent |
|------------------------------|---------------------------------------------------|--------------------------------------------------|-------------------------------------|
| 0.350                        | 35.0                                              | 35.7                                             | 70.7                                |
| 0.402                        | 36.5                                              | 37.4                                             | 81.2                                |
| 0.494                        | 38.2                                              | 39.1                                             | 87.2                                |
| 0.630                        | 40.0                                              | 40.8                                             | 91.8                                |
| 0.824                        | 41.6                                              | 42.4                                             | 94.4                                |
| 1.11                         | 43.2                                              | 43.9                                             | 95.7                                |
| 1.46                         | 44.7                                              | 45.5                                             | 97.9                                |
| 2.25                         | 46.4                                              | 47.4                                             | 97.8                                |
| 3.18                         | 48.4                                              | 49.5                                             | 98.8                                |
| 5.01                         | 50.6                                              | 51.3                                             | 99.3                                |
| 6.84                         | 51.9                                              | 52.5                                             | 99.3                                |
| 8.63                         | 53.2                                              | 53.8                                             | 99.6                                |
| 12.2                         | 54.4                                              | 54.9                                             | 99.7                                |
| 15.7                         | 55.3                                              | 55.8                                             | 99.9                                |
| 22.5                         | 56.3                                              | 56.8                                             | 99.9                                |
| 29.7                         | 57.3                                              | 57.7                                             | 99.9                                |
| 36.5                         | 58.2                                              | 58.4                                             | 99.9                                |
| 43.3                         | 58.6                                              | 58.8                                             | 99.9                                |
| 50.0                         | 58.9                                              | 59.0                                             | 99.9                                |
| 56.7                         | 59.1                                              |                                                  |                                     |

\*Calculated for mid-point of incremental throughput

\*\*Calculated from incremental throughput volumes

\*\*\*Breakthrough recovery

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File SCAL-79164-S

Waterflood Susceptibility Data

Sample Number 5  
Permeability to Air, md 8.7  
Permeability to Oil with Initial Water Present, md 4.7  
Initial Water, Percent Pore Space 37.5  
Porosity, Percent 22.8  
Flooding Pressure Differential, psi 350

| Water Input,<br>Pore Volumes | Cumulative Oil<br>Recovery, Percent<br>Pore Space | Average Oil<br>Recovery, * Percent<br>Pore Space | Average<br>Water Cut, **<br>Percent |
|------------------------------|---------------------------------------------------|--------------------------------------------------|-------------------------------------|
| 0.159                        | 15.9***                                           |                                                  |                                     |
| 0.217                        | 18.7                                              | 17.3                                             | 52.0                                |
| 0.284                        | 20.8                                              | 19.8                                             | 67.9                                |
| 0.383                        | 22.8                                              | 21.8                                             | 80.0                                |
| 0.506                        | 24.4                                              | 23.6                                             | 87.1                                |
| 0.657                        | 25.8                                              | 25.1                                             | 90.5                                |
| 0.860                        | 27.2                                              | 26.5                                             | 93.5                                |
| 1.12                         | 28.3                                              | 27.7                                             | 95.7                                |
| 1.44                         | 29.5                                              | 28.9                                             | 96.3                                |
| 1.81                         | 30.4                                              | 30.0                                             | 97.3                                |
| 2.23                         | 31.3                                              | 30.9                                             | 97.9                                |
| 2.66                         | 32.0                                              | 31.7                                             | 98.4                                |
| 3.50                         | 33.0                                              | 32.5                                             | 98.8                                |
| 4.44                         | 33.8                                              | 33.4                                             | 99.1                                |
| 5.49                         | 34.6                                              | 34.2                                             | 99.2                                |
| 7.38                         | 35.9                                              | 35.3                                             | 99.3                                |
| 9.41                         | 36.9                                              | 36.4                                             | 99.5                                |
| 11.6                         | 37.7                                              | 37.3                                             | 99.6                                |
| 13.8                         | 38.4                                              | 38.0                                             | 99.7                                |

\*Calculated for mid-point of incremental throughput

\*\*Calculated from incremental throughput volumes

\*\*\*Breakthrough recovery

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Waterflood Susceptibility Data

|                                                    |               |                                     |      |
|----------------------------------------------------|---------------|-------------------------------------|------|
| Sample Number                                      | 5 (continued) | Initial Water, Percent Pore Space   | 37.5 |
| Permeability to Air, md                            | 8.7           | Porosity, Percent                   | 22.8 |
| Permeability to Oil with Initial Water Present, md | 4.7           | Flooding Pressure Differential, psi | 350  |

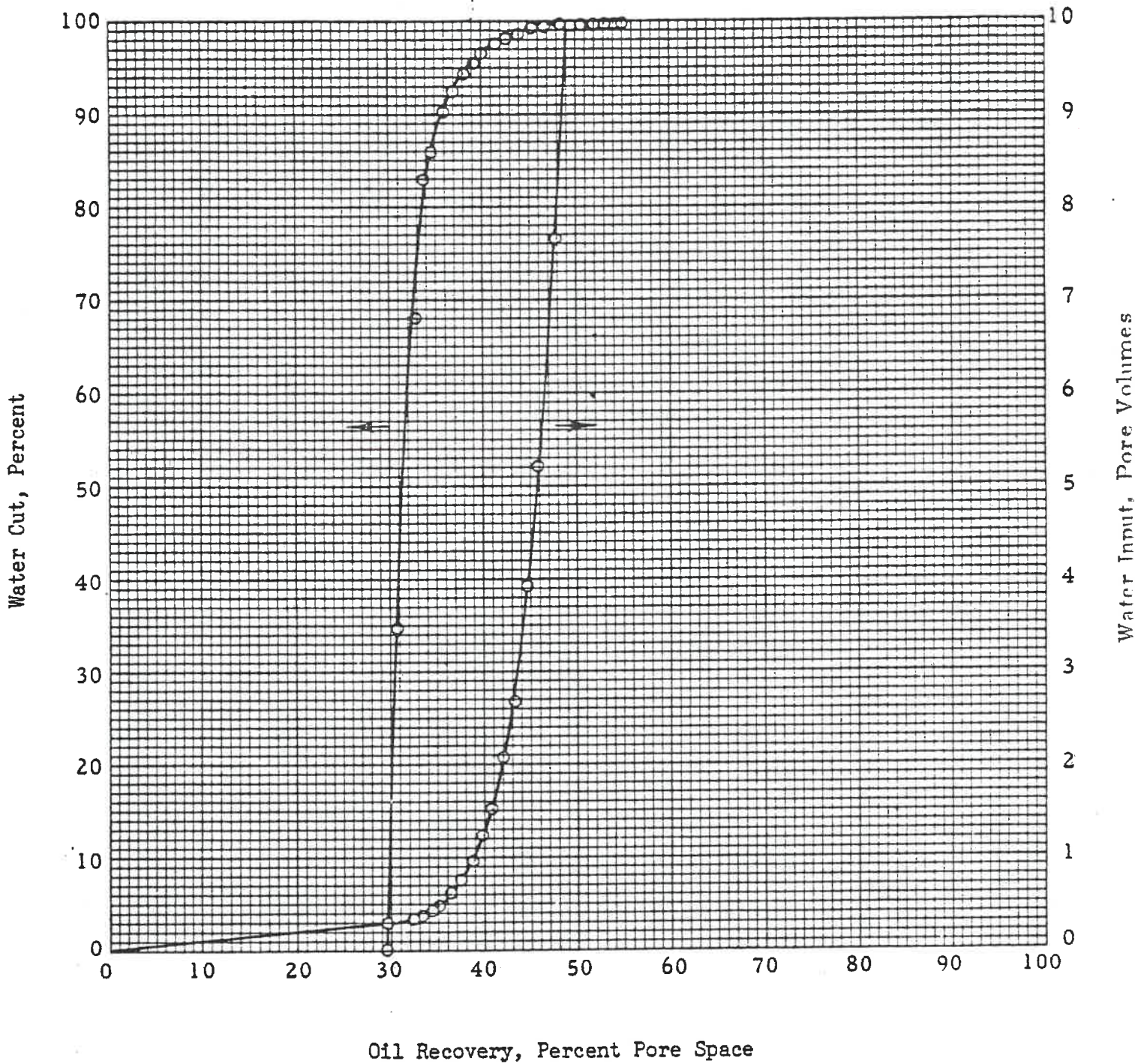
| Water Input,<br>Pore Volumes | Cumulative Oil<br>Recovery, Percent<br>Pore Space | Average Oil<br>Recovery, * Percent<br>Pore Space | Average<br>Water Cut, **<br>Percent |
|------------------------------|---------------------------------------------------|--------------------------------------------------|-------------------------------------|
| 17.8                         | 39.3***                                           | 38.8                                             | 99.8                                |
| 21.9                         | 39.9                                              | 39.6                                             | 99.8                                |
| 26.1                         | 40.4                                              | 40.1                                             | 99.9                                |
| 34.1                         | 41.1                                              | 40.7                                             | 99.9                                |
| 41.9                         | 41.6                                              | 41.3                                             | 99.9                                |
| 49.6                         | 42.0                                              | 41.8                                             | 99.9                                |

\*Calculated for mid-point of incremental throughput  
\*\*Calculated from incremental throughput volumes  
\*\*\*Breakthrough recovery



Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas

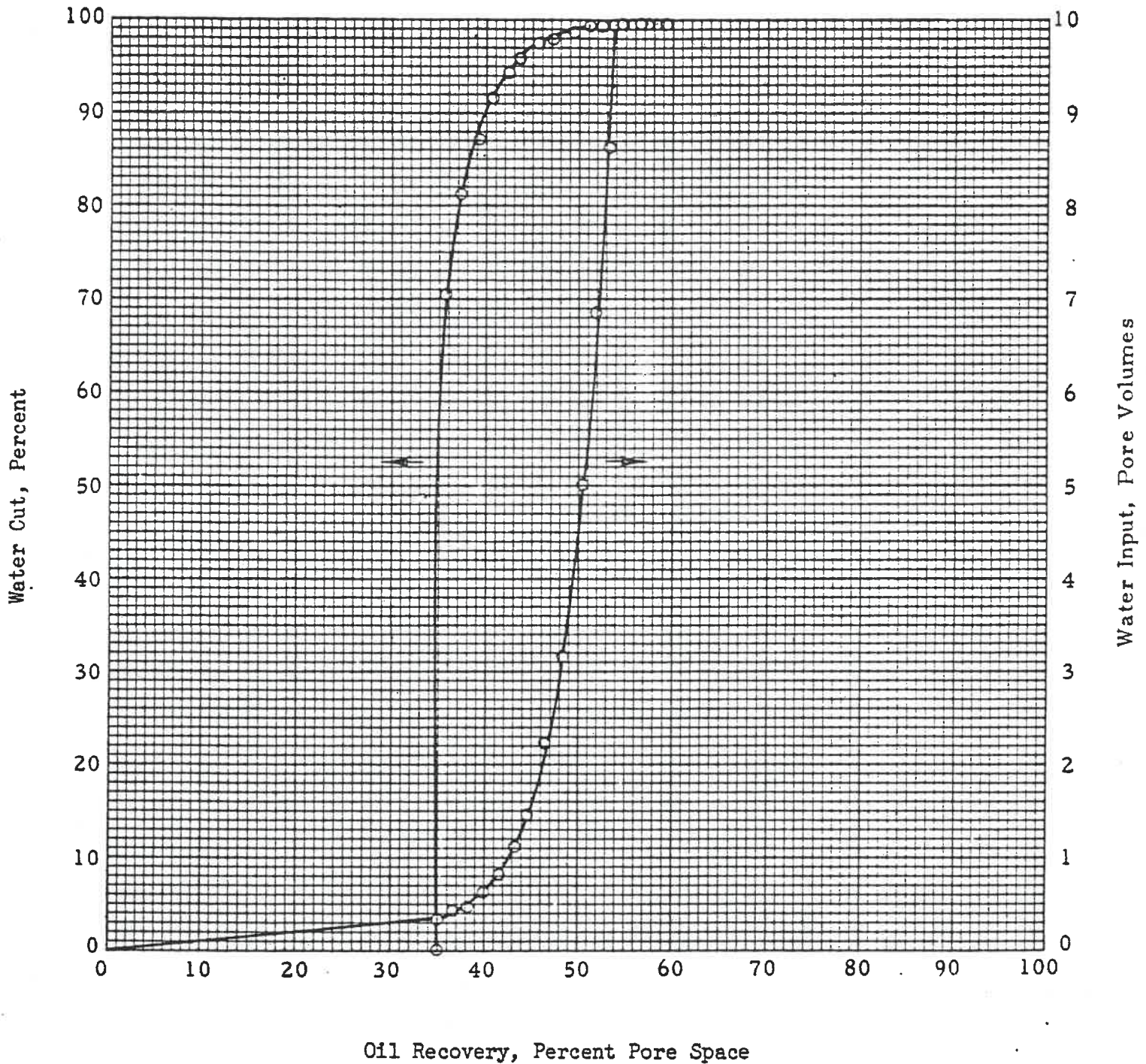
Sample Number: 2  
Permeability, md: 78





Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas

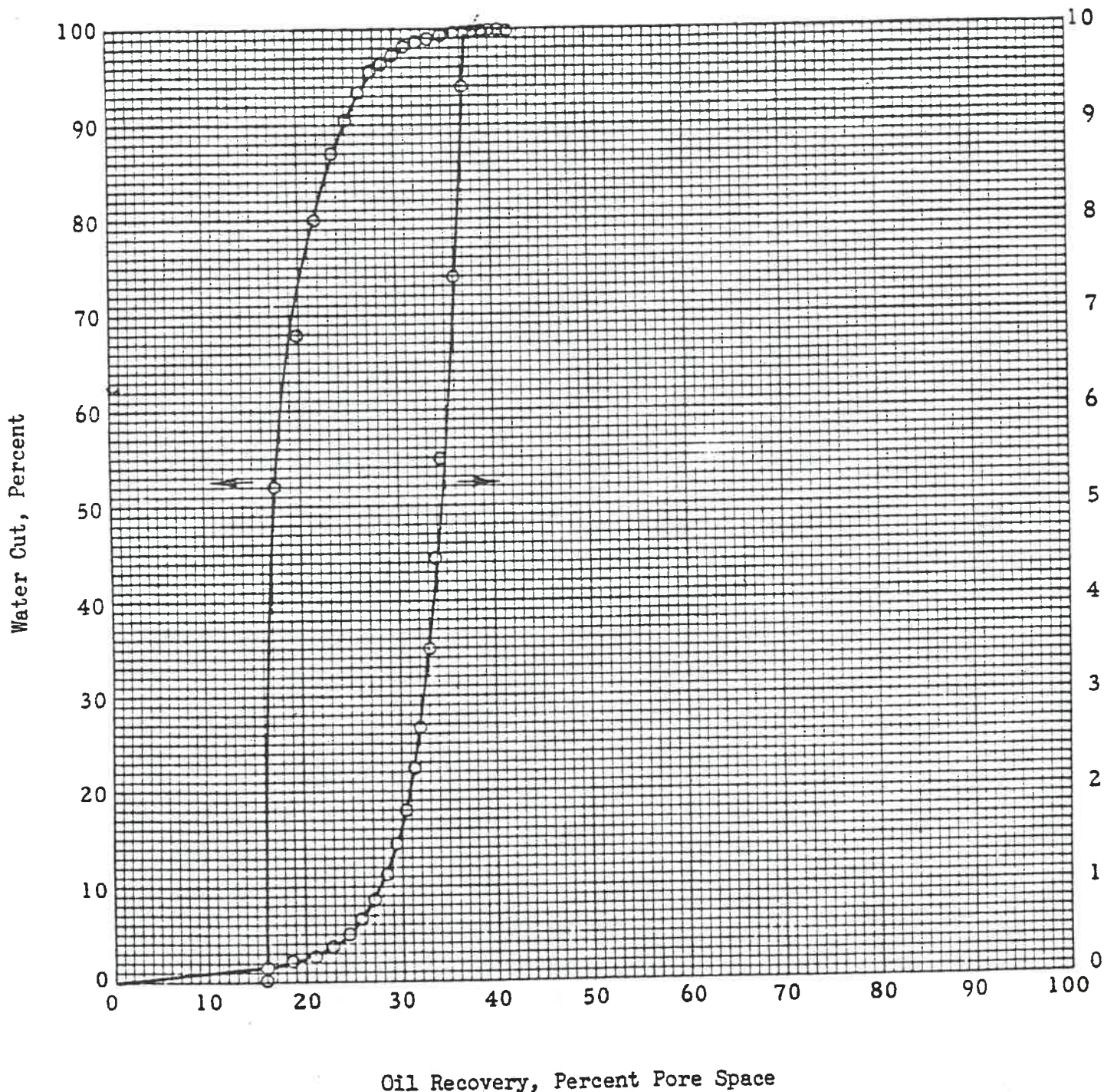
Sample Number: 4  
Permeability, md: 63





Company KRM Petroleum Corporation Formation Kansas City-Lansing  
Well G. C. Lemon No. 3 County Comanche  
Field \_\_\_\_\_ State Kansas

Sample Number: 5  
Permeability, md: 8.7



APPENDIX VI

KRM-LEMON RANCH FIELD  
SWOPE LIME RESERVOIR  
COMANCHE CO, KANSAS

EXHIBIT VI-1

R E S E R V O I R   F L U I D S   T A B L E

| PRESSURE<br>PSIG---- | DIFFERENTIAL DATA |                     | FLASH          |                     | FLASH               |                  | GAS             | Z | GAS FVF<br>B/MCF-- |
|----------------------|-------------------|---------------------|----------------|---------------------|---------------------|------------------|-----------------|---|--------------------|
|                      | FVF<br>V/B----    | GAS SOL<br>F/B----- | FVF<br>V/B---- | GAS SOL<br>F/B----- | GAS SOL<br>F/B----- | GRAVITY<br>----- | FACTOR<br>----- |   |                    |
| 50.                  | 1.1200            | 110.                | 1.1200         | 110.                | 0.000               | 1.0000           | 45.6056         |   |                    |
| 100.                 | 1.1900            | 205.                | 1.1900         | 205.                | 0.000               | 0.9950           | 25.5879         |   |                    |
| 150.                 | 1.2270            | 259.                | 1.2270         | 259.                | 0.000               | 0.9770           | 17.4952         |   |                    |
| 200.                 | 1.2550            | 320.                | 1.2550         | 320.                | 0.000               | 0.9590           | 13.1727         |   |                    |
| 300.                 | 1.2640            | 331.                | 1.2640         | 331.                | 0.000               | 0.9350           | 8.7613          |   |                    |
| 600.                 | 1.3170            | 446.                | 1.3170         | 446.                | 0.000               | 0.8980           | 4.3076          |   |                    |
| 900.                 | 1.3650            | 555.                | 1.3650         | 555.                | 0.000               | 0.8680           | 2.7980          |   |                    |
| 1200.                | 1.4120            | 663.                | 1.4120         | 663.                | 0.000               | 0.8440           | 2.0487          |   |                    |
| 1400.                | 1.4420            | 733.                | 1.4420         | 733.                | 0.000               | 0.8330           | 1.7361          |   |                    |
| 1695.                | 1.4900            | 845.                | 1.4900         | 845.                | 0.000               | 0.8150           | 1.4055          |   |                    |

N - MSTB                      0.000  
G/N RATIO - CF/B        000.000  
G - MMCF                    0.000  
BW - RVB/STB            1.0100  
SEP. CF/STB                000.  
RESVR TEMP - F            125.  
NITROGEN - PCT            00.00  
HYD. SULF. - PCT        00.000

SAT PSI                      1695.  
SCW - PCT                    15  
GAS CAP PSI                0.  
CW - V/MMV/PSI            2.500  
CD - V/MMV/PSI            13.900  
CF - V/MMV/PSI            4.000  
CARB. DIOX. - PCT        00.00

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**DALLAS, TEXAS**

APPENDIX VI

Exhibit VI-2

Reservoir Fluid Study  
for  
K.R.M. PETROLEUM CORPORATION

G.C. Lemon No. 6 Well  
Lemon Ranch Pool Field  
Comanche County, Kansas

**CORE LABORATORIES, INC.**  
*Petroleum Reservoir Engineering*  
**DALLAS, TEXAS 75207**  
June 22, 1979

**RESERVOIR FLUID DIVISION**

K.R.M. Petroleum Corporation  
817 17th Street  
Suite 820  
Denver, Colorado 80202

Attention: Mr. Jerry C. Simmons

Subject: Reservoir Fluid Study  
G.C. Lemon No. 6 Well  
Lemon Ranch Pool Field  
Comanche County, Kansas  
Our File Number: RFL 79352

Gentlemen:

Duplicate subsurface fluid samples were collected from the subject well by a representative of Tefteller, Inc. on May 21, 1979. These samples were submitted to our Dallas laboratory for use in a reservoir fluid study. Presented to you in the following report are the results of this study.

As a quality check, the room temperature saturation pressure of each subsurface sample was initially determined. At 72°F., the two subsurface samples were found to have bubble point pressures of 1473 psig and 1475 psig. These values were considered to be in excellent agreement with one another and the sample having the higher room temperature saturation pressure was selected for use in the reservoir fluid study.

The hydrocarbon composition of the reservoir fluid was measured by low temperature fractional distillation. The results of this distillation in terms of both mol percent and weight percent are presented on page two.

A portion of the subsurface fluid was initially subjected to constant composition expansion at the reservoir temperature of 125°F. During this expansion, a bubble point pressure of 1695 psig was determined. The results of the pressure-volume measurements at the reservoir temperature are presented on page four.

During differential pressure depletion at the reservoir temperature, the fluid liberated a total of 845 cubic feet of gas at 14.65 psia and 60°F. per barrel of residual oil at 60°F. The relative oil volume associated with this test was 1.490 barrels of saturated fluid per barrel of residual oil. In addition, the



oil density and the properties of the evolved gases were measured at each point during the depletion. A summary of the differential pressure depletion data may be found on page five.

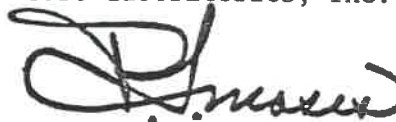
Viscosity measurements were then performed on the reservoir fluid at 125°F. in a rolling ball viscosimeter. The viscosity of the fluid was found to vary from a minimum of 0.388 centipoise at the saturation pressure to a maximum of 1.390 centipoises at atmospheric pressure.

Four single-stage separator tests were then performed at 70°F. to determine the effect of separator pressure upon gas/oil ratio, stock tank oil gravity, formation volume factor and separator gas composition. The results of the four separator tests are tabulated on page seven and the associated chromatographic analyses of the separator gas samples may be found on page eight. The separator data indicates that optimum separation should occur near 90 psig at 70°F. and near optimum separation should occur over pressures ranging from 60 psig to 100 psig.

It has been our pleasure to perform this reservoir fluid study for K.R.M. Petroleum Corporation. Should you have any questions or if we may be of further assistance in any matter, please feel free to call upon us.

Very truly yours,

Core Laboratories, Inc.

A handwritten signature in dark ink, appearing to read "P. L. Moses", written in a cursive style.

P. L. Moses, Manager  
Reservoir Fluid Analysis

PLM:JF:bt  
7 cc: Addressee

**CORE LABORATORIES, INC.**  
*Petroleum Reservoir Engineering*  
**DALLAS, TEXAS**

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File RFL 79352

Company K.R.M. Petroleum Corp. Date Sampled May 21, 1979  
Well G.C. Lemon No. 6 County Comanche  
Field Lemon Ranch Pool State Kansas

**FORMATION CHARACTERISTICS**

Formation Name Lansing Kansas City  
Date First Well Completed                     , 19        
Original Reservoir Pressure (Lemon No. 3) 1762 PSIG @ 4777 Ft.  
Original Produced Gas-Oil Ratio 640 SCF/Bbl  
Production Rate 160 Bbl/Day  
Separator Pressure and Temperature 10 PSIG. 80 °F.  
Oil Gravity at 60° F. 47 °API  
Datum 3011 Ft. Subsea  
Original Gas Cap None

**WELL CHARACTERISTICS**

Elevation 1766 KB Ft.  
Total Depth 4802 PB Ft.  
Producing Interval 4778-4788 Ft.  
Tubing Size and Depth 2-3/8 In. to 4770 Ft.  
Productivity Index                      Bbl/D/PSI @            Bbl/Day  
Last Reservoir Pressure 1768 PSIG @ 4783 Ft.  
Date May 21, 1979  
Reservoir Temperature 125 °F. @ 4783 Ft.  
Status of Well Shut in  
Pressure Gauge Amerada  
Normal Production Rate                      Bbl/Day  
Gas-Oil Ratio                      SCF/Bbl  
Separator Pressure and Temperature                      PSIG,            °F.  
Base Pressure                      PSIA  
Well Making Water                      % Cut.

**SAMPLING CONDITIONS**

Sampled at 4683 Ft.  
Status of Well Shut in  
Gas-Oil Ratio                      SCF/Bbl  
Separator Pressure and Temperature                      PSIG,            °F.  
Tubing Pressure 535 PSIG  
Casing Pressure Nil PSIG  
Sampled by Tefteller, Inc.  
Type Sampler                     

REMARKS:

## CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

Page 2 of 11File RFL 79352Company K.R.M. Petroleum Corp. Formation Lansing Kansas CityWell G.C. Lemon No. 6 County ComancheField Lemon Ranch Pool State KansasHYDROCARBON ANALYSIS OF Reservoir Fluid SAMPLE

| COMPONENT        | MOL<br>PER CENT | WEIGHT<br>PER CENT | DENSITY @ 60° F.<br>GRAMS PER CUBIC<br>CENTIMETER | ° API<br>@ 60° F. | MOLECULAR<br>WEIGHT |
|------------------|-----------------|--------------------|---------------------------------------------------|-------------------|---------------------|
| Hydrogen Sulfide | Nil             | Nil                |                                                   |                   |                     |
| Carbon Dioxide   | 1.01            | 0.50               |                                                   |                   |                     |
| Nitrogen         | 1.29            | 0.41               |                                                   |                   |                     |
| Methane          | 29.53           | 5.35               |                                                   |                   |                     |
| Ethane           | 6.07            | 2.06               |                                                   |                   |                     |
| Propane          | 10.30           | 5.13               |                                                   |                   |                     |
| iso-Butane       | 2.26            | 1.48               |                                                   |                   |                     |
| n-Butane         | 6.57            | 4.31               |                                                   |                   |                     |
| iso-Pentane      | 2.38            | 1.94               |                                                   |                   |                     |
| n-Pentane        | 2.05            | 1.67               |                                                   |                   |                     |
| Hexanes          | 4.16            | 4.03               |                                                   |                   |                     |
| Heptanes plus    | 34.38           | 73.12              | 0.8326                                            | 38.3              | 188                 |
|                  | 100.00          | 100.00             |                                                   |                   |                     |

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Petroleum Reservoir Engineering  
DALLAS, TEXAS

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File RFL 79352  
Well G.C. Lemon No. 6

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 1695 PSIG @ 125 °F.
2. Specific volume at saturation pressure: ft <sup>3</sup>/lb 0.02348 @ 125 °F.
3. Thermal expansion of saturated oil @ 5000 PSI =  $\frac{V @ 125 \text{ °F}}{V @ 70 \text{ °F}} = \underline{1.03347}$
4. Compressibility of saturated oil @ reservoir temperature: Vol/Vol/PSI:  

From 5000 PSI to 3500 PSI =  $9.61 \times 10^{-6}$   
From 3500 PSI to 2500 PSI =  $11.43 \times 10^{-6}$   
From 2500 PSI to 1695 PSI =  $13.91 \times 10^{-6}$

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File RFL 79352

Well G.C. Lemon No. 6

Pressure-Volume Relations at 125 °F.

| <u>Pressure</u><br><u>PSIG</u> | <u>Relative</u><br><u>Volume (1)</u> | <u>Y</u><br><u>Function (2)</u> |
|--------------------------------|--------------------------------------|---------------------------------|
| 5000                           | 0.9634                               |                                 |
| 4500                           | 0.9678                               |                                 |
| 4000                           | 0.9725                               |                                 |
| 3500                           | 0.9775                               |                                 |
| 3000                           | 0.9829                               |                                 |
| 2500                           | 0.9888                               |                                 |
| 2000                           | 0.9955                               |                                 |
| 1900                           | 0.9969                               |                                 |
| 1800                           | 0.9984                               |                                 |
| 1700                           | 0.9999                               |                                 |
| 1695                           | 1.0000                               |                                 |
| 1685                           | 1.0033                               |                                 |
| 1675                           | 1.0054                               |                                 |
| 1652                           | 1.0104                               |                                 |
| 1590                           | 1.0273                               |                                 |
| 1525                           | 1.0474                               | 2.329                           |
| 1438                           | 1.0781                               | 2.260                           |
| 1339                           | 1.1192                               | 2.207                           |
| 1219                           | 1.1808                               | 2.134                           |
| 1095                           | 1.2631                               | 2.055                           |
| 959                            | 1.3866                               | 1.955                           |
| 828                            | 1.5515                               | 1.867                           |
| 690                            | 1.8093                               | 1.761                           |
| 550                            | 2.2210                               | 1.660                           |
| 427                            | 2.8406                               | 1.559                           |
| 311                            | 3.8688                               | 1.480                           |

(1) Relative Volume:  $V/V_{sat}$  is barrels at indicated pressure per barrel at saturation pressure.

(2) Y Function =  $\frac{(P_{sat}-P)}{(P_{abs})(V/V_{sat}-1)}$

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**DALLAS, TEXAS**

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 File RFL 79352  
 Well G.C. Lemon No. 6

Differential Vaporization at 125 °F.

| Pressure<br>PSIG | Solution<br>Gas/Oil<br>Ratio(1) | Relative<br>Oil<br>Volume(2) | Relative<br>Total<br>Volume(3) | Oil<br>Density<br>gm/cc | Deviation<br>Factor<br>Z | Gas Formation<br>Volume<br>Factor(4) | Incremental<br>Gas<br>Gravity |
|------------------|---------------------------------|------------------------------|--------------------------------|-------------------------|--------------------------|--------------------------------------|-------------------------------|
| 1695             | 845                             | 1.490                        | 1.490                          | 0.6823                  |                          |                                      |                               |
| 1400             | 733                             | 1.442                        | 1.634                          | 0.6921                  | 0.833                    | 0.00970                              | 0.751                         |
| 1200             | 663                             | 1.412                        | 1.781                          | 0.6989                  | 0.844                    | 0.01145                              | 0.745                         |
| 900              | 555                             | 1.365                        | 2.170                          | 0.7100                  | 0.868                    | 0.01563                              | 0.746                         |
| 600              | 446                             | 1.317                        | 3.024                          | 0.7224                  | 0.898                    | 0.02407                              | 0.773                         |
| 300              | 331                             | 1.264                        | 5.738                          | 0.7359                  | 0.935                    | 0.04892                              | 0.841                         |
| 150              | 259                             | 1.227                        | 11.216                         | 0.7454                  | 0.959                    | 0.09579                              | 0.996                         |
| 0                | 0                               | 1.033                        |                                | 0.7829                  |                          |                                      | 1.874                         |
|                  |                                 | at 60°F. = 1.000             |                                |                         |                          |                                      |                               |

Gravity of residual oil = 43.2°API at 60°F.

- (1) Cubic feet of gas at 14.65 psia and 60°F. per barrel of residual oil at 60°F.
- (2) Barrels of oil at indicated pressure and temperature per barrel of residual oil at 60°F.
- (3) Barrels of oil plus liberated gas at indicated pressure and temperature per barrel of residual oil at 60°F.
- (4) Cubic feet of gas at indicated pressure and temperature per cubic foot at 14.65 psia and 60°F.

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Petroleum Reservoir Engineering  
DALLAS, TEXAS 75207

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File RFL 79352

Well G.C. Lemon No. 6

Viscosity Data at 125 °F.

| <u>Pressure</u><br><u>PSIG</u> | <u>Oil Viscosity</u><br><u>Centipoise</u> | <u>Calculated</u><br><u>Gas Viscosity</u><br><u>Centipoise</u> | <u>Oil/Gas</u><br><u>Viscosity</u><br><u>Ratio</u> |
|--------------------------------|-------------------------------------------|----------------------------------------------------------------|----------------------------------------------------|
| 5000                           | 0.464                                     |                                                                |                                                    |
| 4000                           | 0.441                                     |                                                                |                                                    |
| 3000                           | 0.418                                     |                                                                |                                                    |
| 2000                           | 0.395                                     |                                                                |                                                    |
| 1750                           | 0.389                                     |                                                                |                                                    |
| 1695                           | 0.388                                     |                                                                |                                                    |
| 1400                           | 0.416                                     | 0.0149                                                         | 27.9                                               |
| 1200                           | 0.438                                     | 0.0142                                                         | 30.8                                               |
| 900                            | 0.475                                     | 0.0132                                                         | 36.0                                               |
| 600                            | 0.525                                     | 0.0123                                                         | 42.7                                               |
| 300                            | 0.600                                     | 0.0114                                                         | 52.6                                               |
| 150                            | 0.666                                     | 0.0106                                                         | 62.8                                               |
| 0                              | 1.390                                     | 0.0079                                                         | 175.9                                              |

**CORE LABORATORIES, INC.**  
*Petroleum Reservoir Engineering*  
**DALLAS, TEXAS**

Page 7 of 11

File RFL 79352

Well G.C. Lemon No. 6

**SEPARATOR TESTS OF** Reservoir Fluid **SAMPLE**

| SEPARATOR<br>PRESSURE.<br>PSI GAUGE | SEPARATOR<br>TEMPERATURE.<br>° F. | GAS/OIL RATIO<br>(1) | GAS/OIL RATIO<br>(2) | STOCK TANK<br>GRAVITY.<br>° API @ 60° F. | FORMATION<br>VOLUME<br>FACTOR<br>(3) | SEPARATOR<br>VOLUME<br>FACTOR<br>(4) | SPECIFIC<br>GRAVITY OF<br>FLASHED GAS |
|-------------------------------------|-----------------------------------|----------------------|----------------------|------------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|
| 15<br>to<br>0                       | 70<br>70                          | 787<br>21            | 801<br>21            |                                          |                                      | 1.018                                | 0.988*                                |
|                                     |                                   |                      |                      | 43.8                                     | 1.443                                | 1.005                                | 1.342                                 |
| 40<br>to<br>0                       | 70<br>70                          | 677<br>58            | 705<br>58            |                                          |                                      | 1.041                                | 0.916*                                |
|                                     |                                   |                      |                      | 45.2                                     | 1.405                                | 1.005                                | 1.471                                 |
| 60<br>to<br>0                       | 70<br>70                          | 624<br>86            | 660<br>86            |                                          |                                      | 1.058                                | 0.875*                                |
|                                     |                                   |                      |                      | 45.6                                     | 1.394                                | 1.005                                | 1.491                                 |
| 100<br>to<br>0                      | 70<br>70                          | 560<br>130           | 608<br>131           |                                          |                                      | 1.086                                | 0.824*                                |
|                                     |                                   |                      |                      | 45.8                                     | 1.390                                | 1.005                                | 1.483                                 |

\*Collected and analyzed for hydrocarbons, in the laboratory.

- (1) Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.65 PSI absolute per barrel of oil @ indicated pressure and temperature.
- (2) Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.65 PSI absolute per barrel of stock tank oil @ 60° F.
- (3) Formation Volume Factor is barrels of saturated oil @ 1695 PSI gauge and 125 ° F. per barrel of stock tank oil @ 60° F.
- (4) Separator Volume Factor is barrels of oil @ indicated pressure and temperature per barrel of stock tank oil @ 60° F.

These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitability of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

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*Petroleum Reservoir Engineering*  
**DALLAS, TEXAS**

Page 8 of 11  
 File RFL 79352  
 Well G.C. Lemon No. 6

Hydrocarbon Analyses of Separator Gas Samples

| Separator Conditions: |  | 15          | PSIG and 70 °F. | 40          | PSIG and 70 °F. | 60          | PSIG and 70 °F. | 100         | PSIG and 70 °F. |
|-----------------------|--|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| Component             |  | Mol Percent | GPM             | Mol Percent | GPM             | Mol Percent | GPM             | Mol Percent | GPM             |
| Hydrogen Sulfide      |  | Nil         |                 | Nil         |                 | Nil         |                 | Nil         |                 |
| Carbon Dioxide        |  | 1.92        |                 | 2.05        |                 | 2.12        |                 | 2.18        |                 |
| Nitrogen              |  | 2.57        |                 | 2.84        |                 | 3.01        |                 | 3.27        |                 |
| Methane               |  | 56.47       |                 | 61.12       |                 | 63.83       |                 | 67.95       |                 |
| Ethane                |  | 10.81       | 2.874           | 11.15       | 2.965           | 11.13       | 2.960           | 10.73       | 2.853           |
| Propane               |  | 16.27       | 4.451           | 14.64       | 4.006           | 13.31       | 3.642           | 11.07       | 3.029           |
| iso-Butane            |  | 2.26        | 0.735           | 1.73        | 0.563           | 1.44        | 0.468           | 1.08        | 0.351           |
| n-Butane              |  | 6.47        | 2.028           | 4.58        | 1.435           | 3.71        | 1.163           | 2.71        | 0.849           |
| iso-Pentane           |  | 1.23        | 0.448           | 0.75        | 0.273           | 0.58        | 0.211           | 0.40        | 0.146           |
| n-Pentane             |  | 1.16        | 0.418           | 0.68        | 0.245           | 0.52        | 0.187           | 0.36        | 0.130           |
| Hexanes               |  | 0.52        | 0.211           | 0.29        | 0.118           | 0.22        | 0.089           | 0.16        | 0.065           |
| Heptanes plus         |  | 0.32        | 0.144           | 0.17        | 0.077           | 0.13        | 0.059           | 0.09        | 0.041           |
|                       |  | 100.00      | 11.309          | 100.00      | 9.682           | 100.00      | 8.779           | 100.00      | 7.464           |

Calculated gas gravity(Air=1.000): 0.988

0.916

0.875

Calculated gross heating value  
 (BTU per cubic foot of dry gas  
 at 14.65 psia and 60°F.):

1589

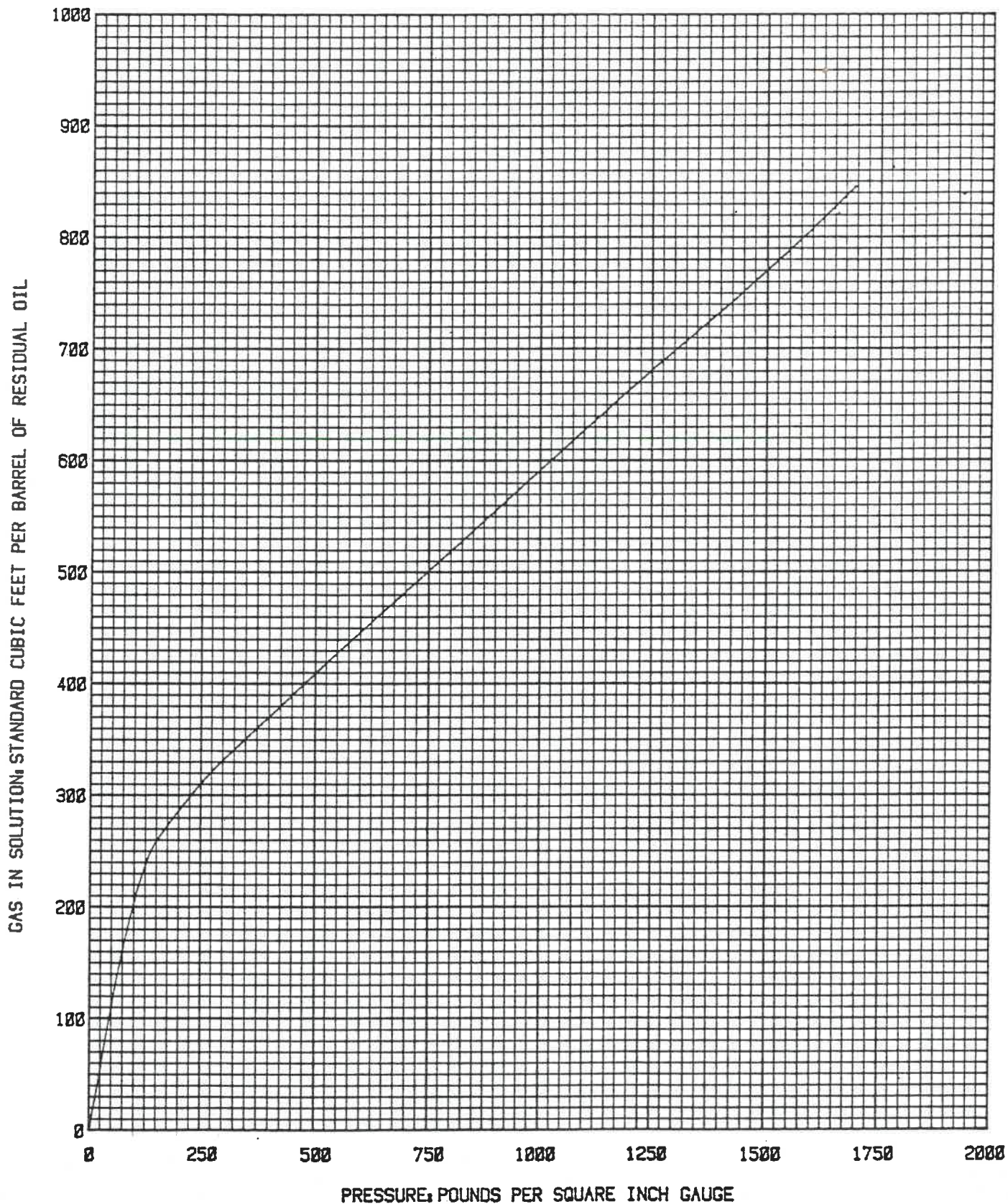
1465

1317



DIFFERENTIAL VAPORIZATION OF RESERVOIR FLUID AT 125 °F.

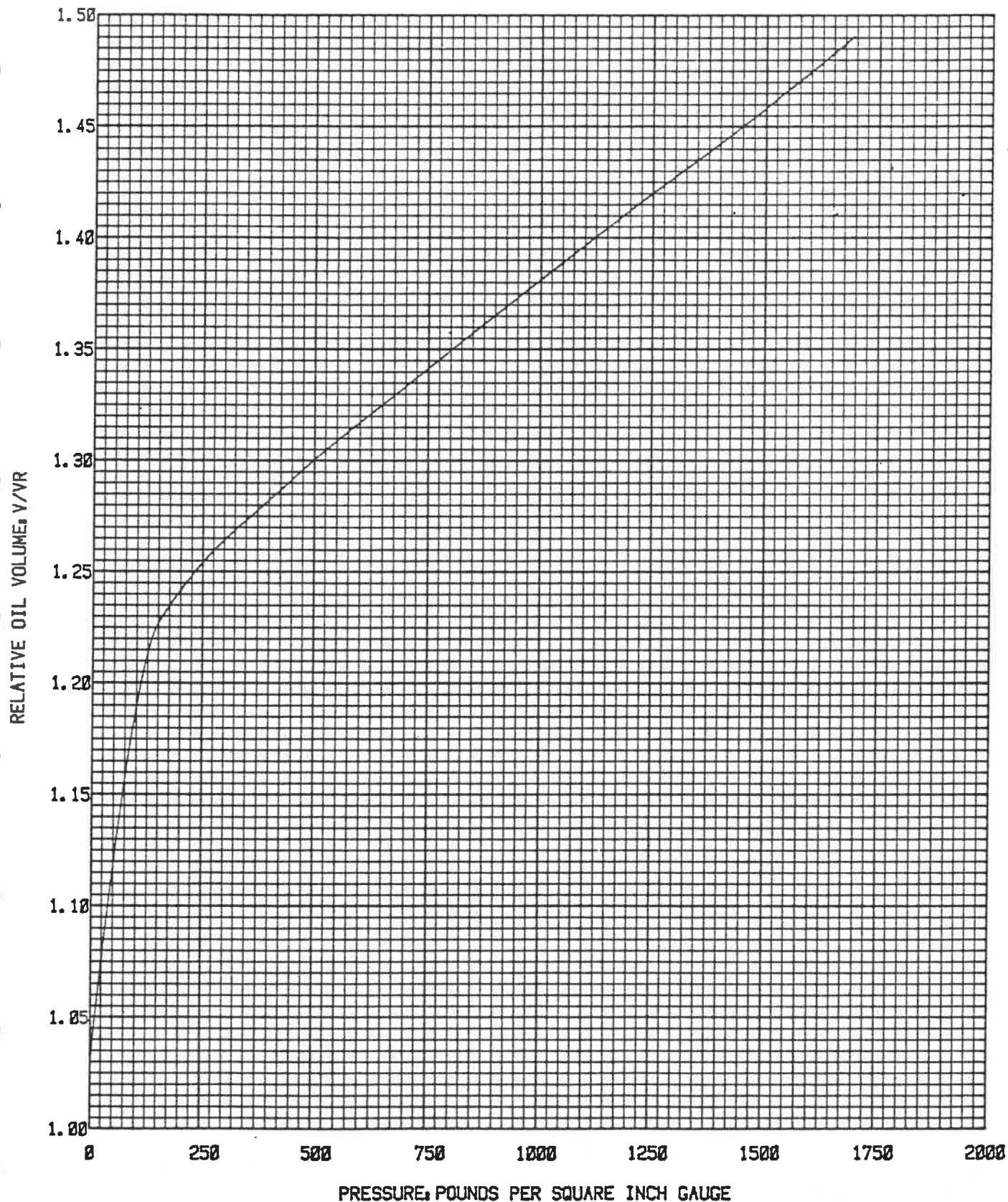
|         |                        |           |                     |
|---------|------------------------|-----------|---------------------|
| Company | K.R.M. PETROLEUM CORP. | Formation | LANSING KANSAS CITY |
| Well    | G.C. LEMON NO. 6       | County    | COMANCHE            |
| Field   | LEMON RANCH POOL       | State     | KANSAS              |





DIFFERENTIAL VAPORIZATION OF RESERVOIR FLUID AT 125 °F.

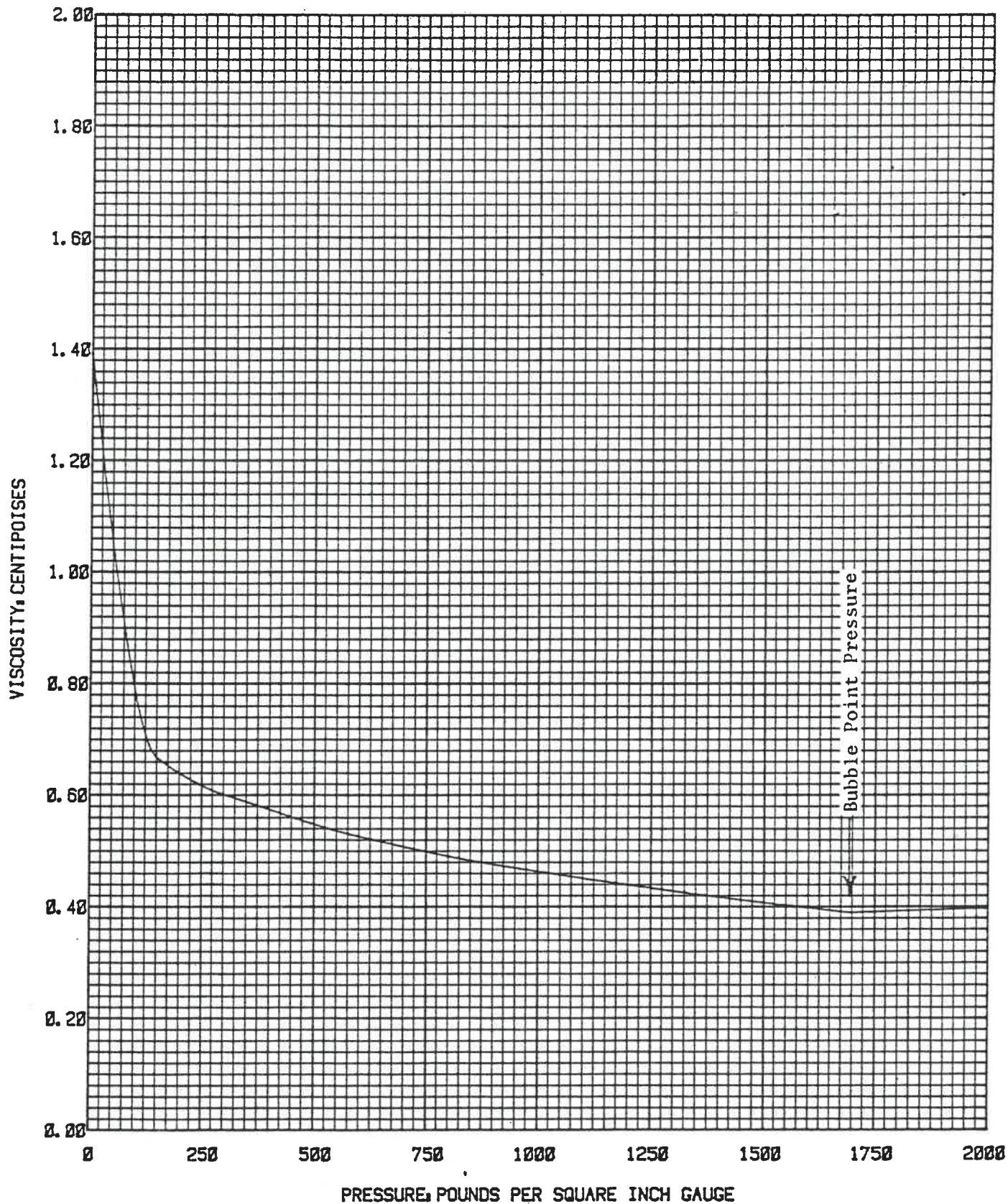
|         |                        |           |                     |
|---------|------------------------|-----------|---------------------|
| Company | K.R.M. PETROLEUM CORP. | Formation | LANSING KANSAS CITY |
| Well    | G.C. LEMON NO. 6       | County    | COMANCHE            |
| Field   | LEMON RANCH POOL       | State     | KANSAS              |





VISCOSITY OF RESERVOIR FLUID AT 125 °F.

|         |                        |           |                     |
|---------|------------------------|-----------|---------------------|
| Company | K.R.M. PETROLEUM CORP. | Formation | LANSING KANSAS CITY |
| Well    | G.C. LEMON NO. 6       | County    | COMANCHE            |
| Field   | LEMON RANCH POOL       | State     | KANSAS              |



APPENDIX V

EXHIBIT V-1

Lemon Ranch Log Data

| <u>Well</u>            | <u>Net Feet - %</u> | <u>Porosity - %<br/>(Density Log)<sup>1/</sup></u> | <u>Water<br/>Saturation - %<sup>2/</sup></u> |
|------------------------|---------------------|----------------------------------------------------|----------------------------------------------|
| Lemon #1               | 6                   | 14.0                                               | 15.0                                         |
| Lemon #2X              | 4                   | 6.0                                                | 45.0                                         |
| Lemon #3               | 6                   | 22.0                                               | 9.0                                          |
| Lemon #5               | 6                   | 12.0                                               | 13.0                                         |
| Lemon #6               | 8                   | 17.5                                               | 10.5                                         |
| Lemon #7               | 4                   | 16.0                                               | 15.0                                         |
| Lemon #8               | 3                   | 11.0                                               | 16.0                                         |
| Lemon #9               | 2                   | 16.0                                               | 16.0                                         |
| Lemon #10              | 4                   | 15.0                                               | 16.0                                         |
| Lemon #11              | 4                   | 7.0                                                | 30.0                                         |
| Rhodes #1              | 6                   | 10.0                                               | 21.0                                         |
| Rhodes #2              | 5                   | 12.0                                               | 12.0                                         |
| Rhodes #3              | 6                   | 21.0                                               | 12.0                                         |
| Rhodes #4              | 4                   | 22.0                                               | 10.0                                         |
| Average                |                     |                                                    |                                              |
| 13 Wells <sup>3/</sup> | 5                   | 15.3                                               | 14.5                                         |

Notes

1/ Based on grain density of 2.73 g/cc.

2/ Based on formation water resistivity of 0.044 ohm-meters and cementation factor of 2.

3/ Average does not include Lemon #2X.







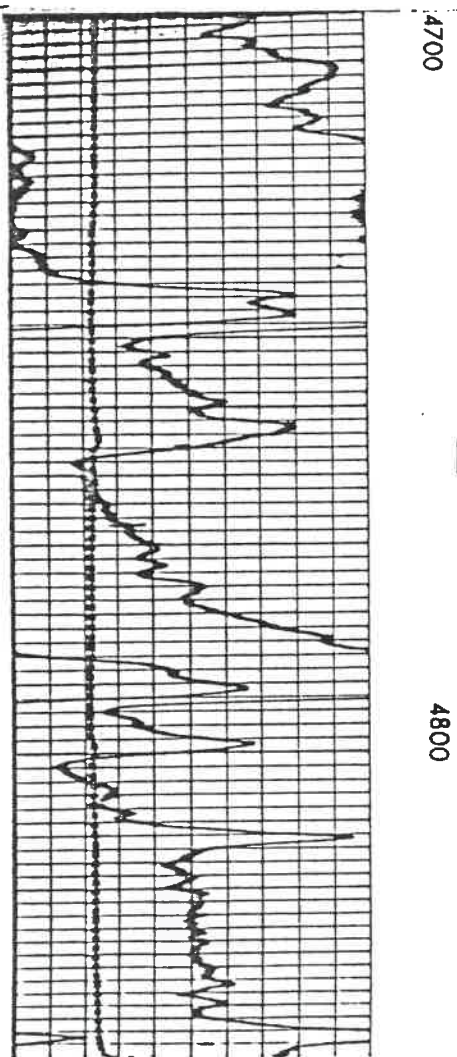
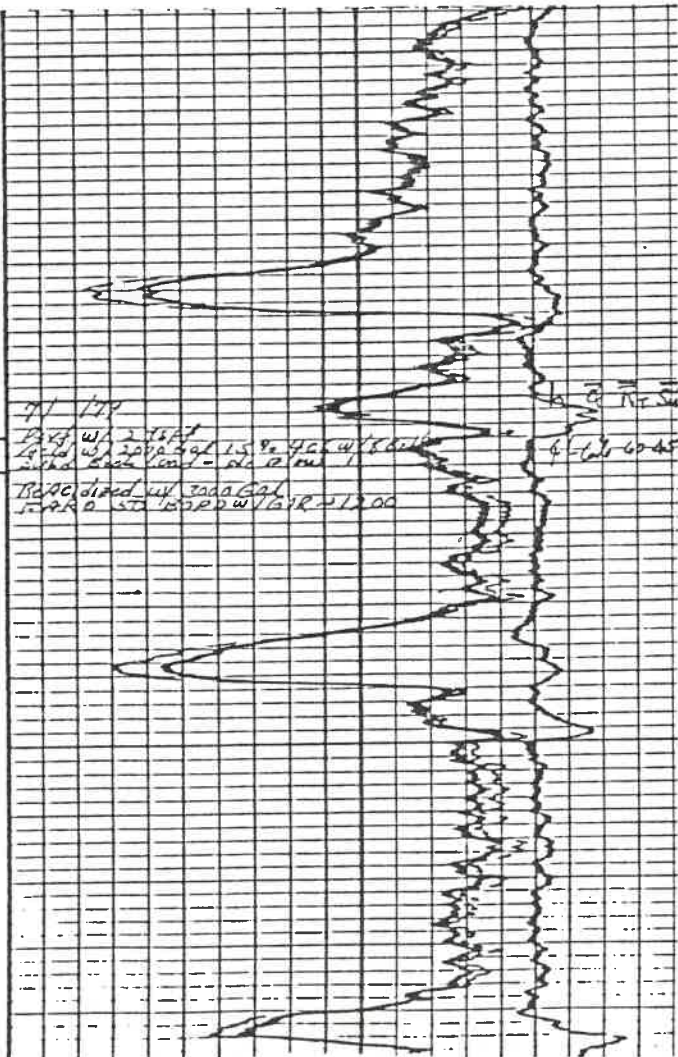
# COMPENSATED DENSITY LOG

COMPANY FIELD PRINT  
WELL Thank You  
FIELD \_\_\_\_\_ State \_\_\_\_\_  
County \_\_\_\_\_  
Sec 14 Twp 34S Rge 20E  
WELL LEMON #2-X  
FIELD \_\_\_\_\_  
COUNTY COMANCHE STATE KANSAS  
Location NE-SW  
Other Services:  
R-GRD-SUN  
BOTTOM-GAMMA  
MSG-FF-AVL

Permanent Datum Ground Level Elev 1754'  
Log Measured From 12 Ft Above Perm. Datum  
Drilling Measured From KB Elev: KB 1766'  
DF NA  
GL 1754'

Date 3-28-79  
Run No. ONE C.M.S. DENSITY  
Type Log GAMMA  
Depth - Driller 5303  
Depth - Well 5280  
Bottom Logged Interval 5280  
Top Logged Interval 3850  
Type Fluid in Hole 12.8 Mud  
Salinity PPM Cl 22,000  
Density 8.8  
Level FULL  
Max. Rec Temp. deg F 123.28 ED  
Operating Rig time 1 1/2 HR  
Recorded By J. McLEOD  
Witnessed by MR. LANDERS

| BORE-HOLE RECORD |        |      |      | CASING RECORD |      |      |     |
|------------------|--------|------|------|---------------|------|------|-----|
| RUN              | BL     | From | To   | Size          | Wgt. | From | To  |
| 1                | 12 1/4 | 000  | 654  | 8 3/4         |      |      |     |
| 2                | 3 1/4  | 654  | 5303 |               |      |      | 654 |







4700

ONE MINUTE INTERVAL MARKER

GAMMA RAY

CALPER

4800

Porosity

DENSITY

C-27-79

Rd 10  
w/ 3500

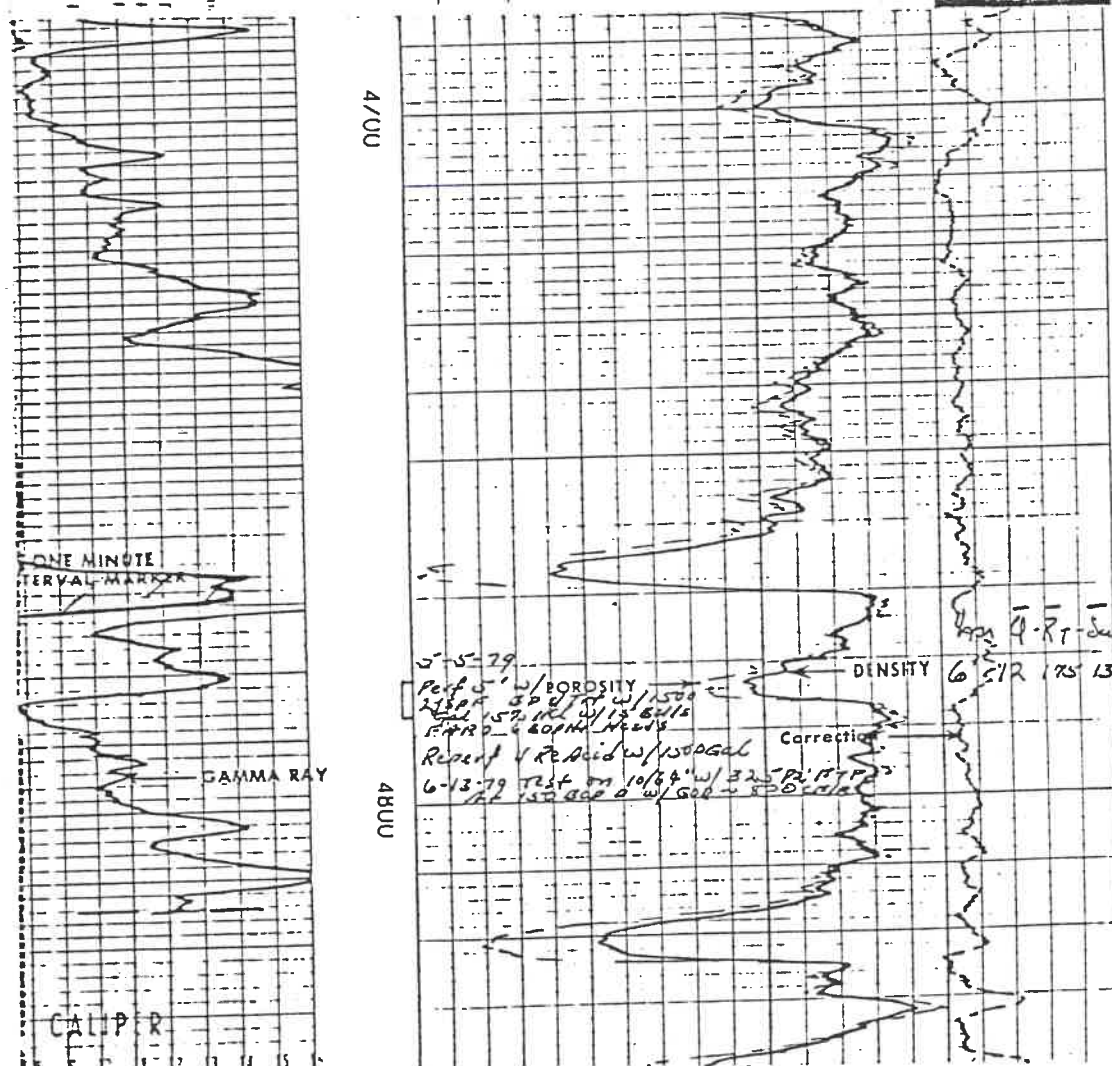
Rd 100 w/ 25000

1500/1000

15-20 TEST on 10/100 w/ 2500 STOPPED

Rd 100 1500 w/ 2500 STOPPED 13.600

Correction 6.1 120

[illegible]





# COMPENSATED DENSITY LOG

COMPANY F. E. M. PETROLEUM CORPORATION  
WELL LENON #6  
FIELD \_\_\_\_\_  
County COMANCHE State KANSAS

COMPANY K. R. M. PETROLEUM CORPORATION  
WELL LENON #6  
FIELD \_\_\_\_\_  
COUNTY COMANCHE STATE KANSAS  
Location \_\_\_\_\_  
Other Services. GAMMA-GIRO-SWN

Sec 14 Twp 34S Rge 20W

Permanent Datum GROUND LEVEL Elev. 1754'  
Log Measured From KELLY BUSHING 12 Ft. Above Perm Datum  
During Measured From KELLY BUSHING

Date 5-9-79 Run No. ONE

Type Log GAMMA-GAMMA  
Depth - Driller 4850'  
Depth - Well 4816'

Bottom Logged Interval 4845'  
Top Logged Interval 3500'  
Type Fluid in Hole DRILLING MUD

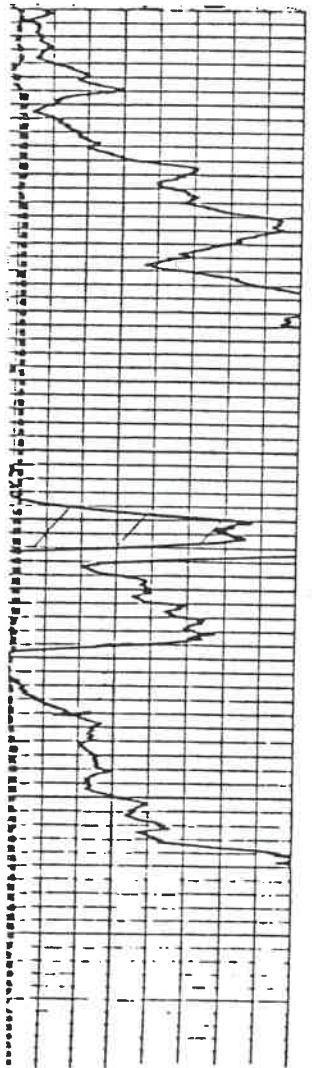
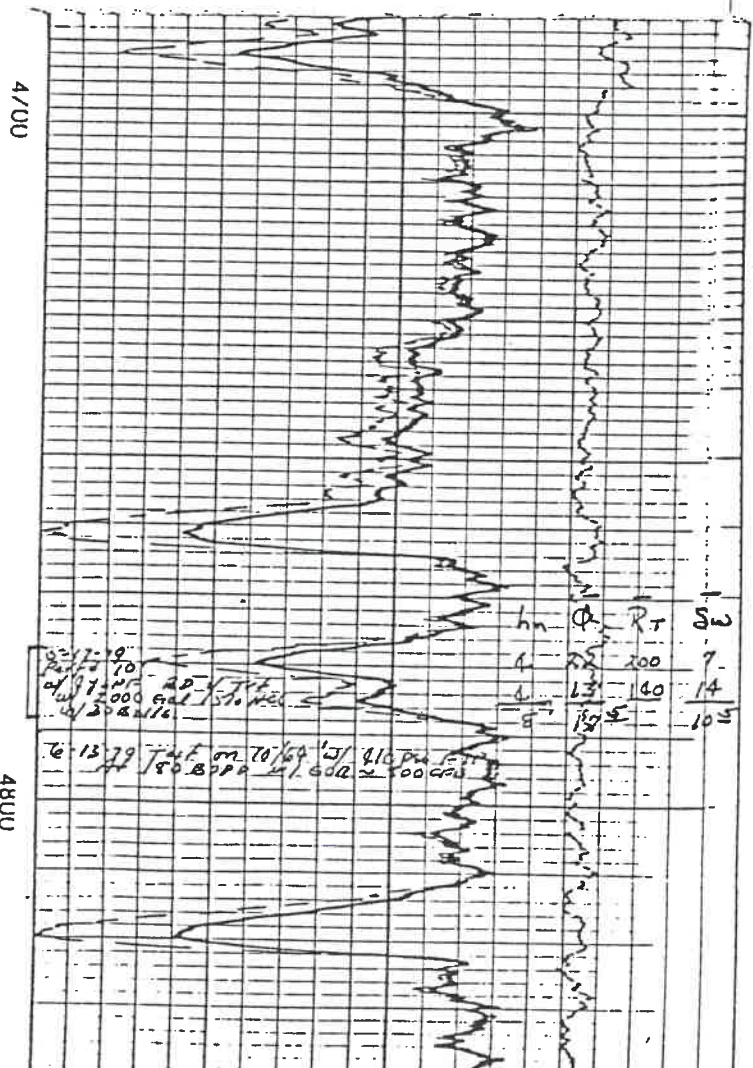
Sam. PPM Cl \_\_\_\_\_  
Density 9.3

Level 40' BELOW G.L.  
Mud temp. deg F 118

Operating Airline \_\_\_\_\_  
Run in by M.R. J. MORROW

Witnessed by M.R. J. MORROW

| MUD LOG RECORD |    | CASING RECORD |      |
|----------------|----|---------------|------|
| Run No.        | 11 | From          | To   |
| 11             | 0  | 11            | 781' |
| 12             | 0  | 12            | 781' |

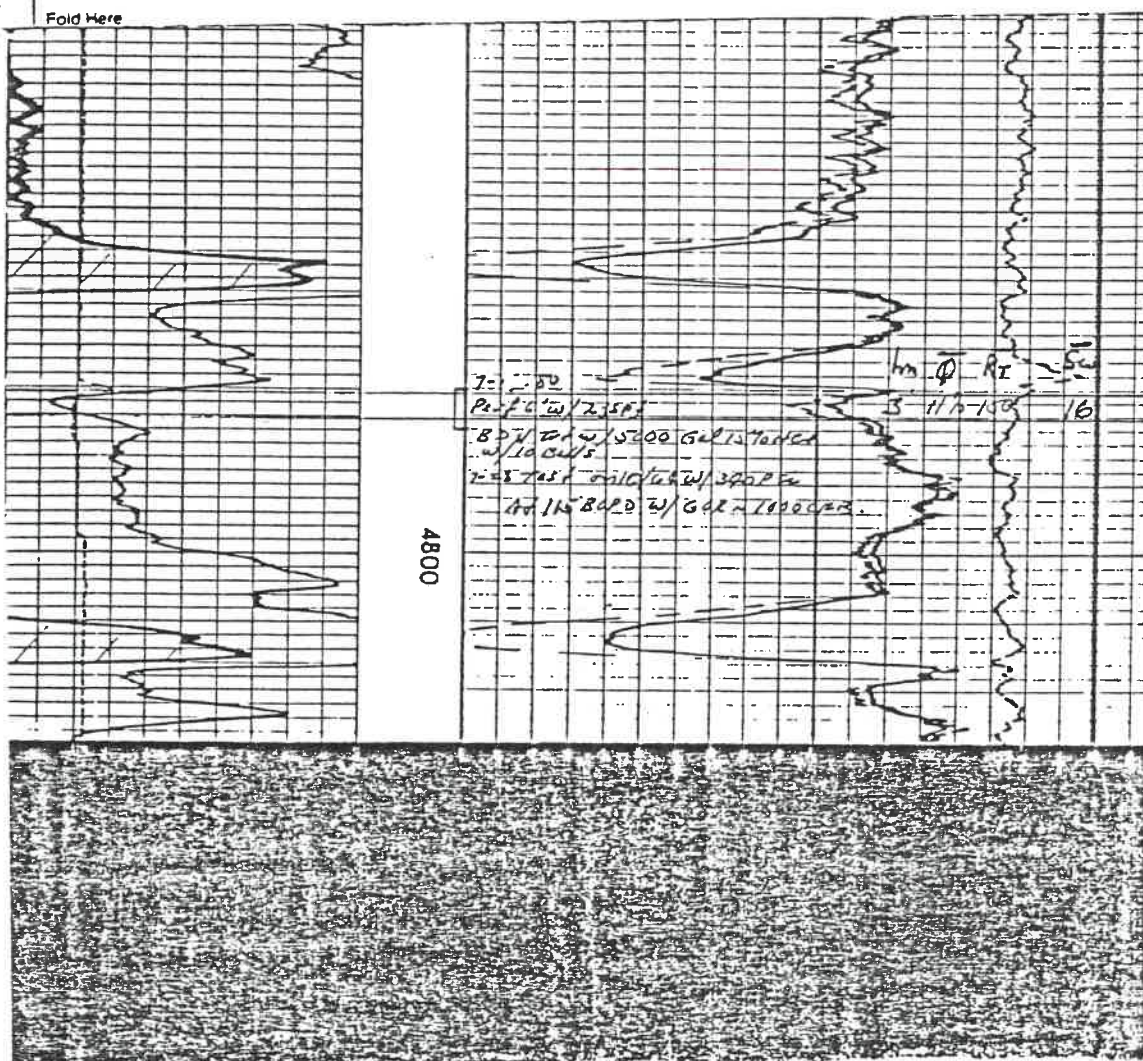








|                 |     |                           |          |
|-----------------|-----|---------------------------|----------|
| COMPANY         |     | KRM PETROLEUM CORPORATION |          |
| WELL            |     | LEMON #B                  |          |
| FIELD           |     | COMANCHE                  |          |
| County          |     | State                     |          |
| Sec             | 23  | Twp                       | 34S      |
| Age             | 20W |                           |          |
| Location        |     | COUNTY                    | COMANCHE |
|                 |     | STATE                     | KANSAS   |
| Other Services: |     | KANSAS                    |          |
| GAMMA-GRD-SWN   |     |                           |          |

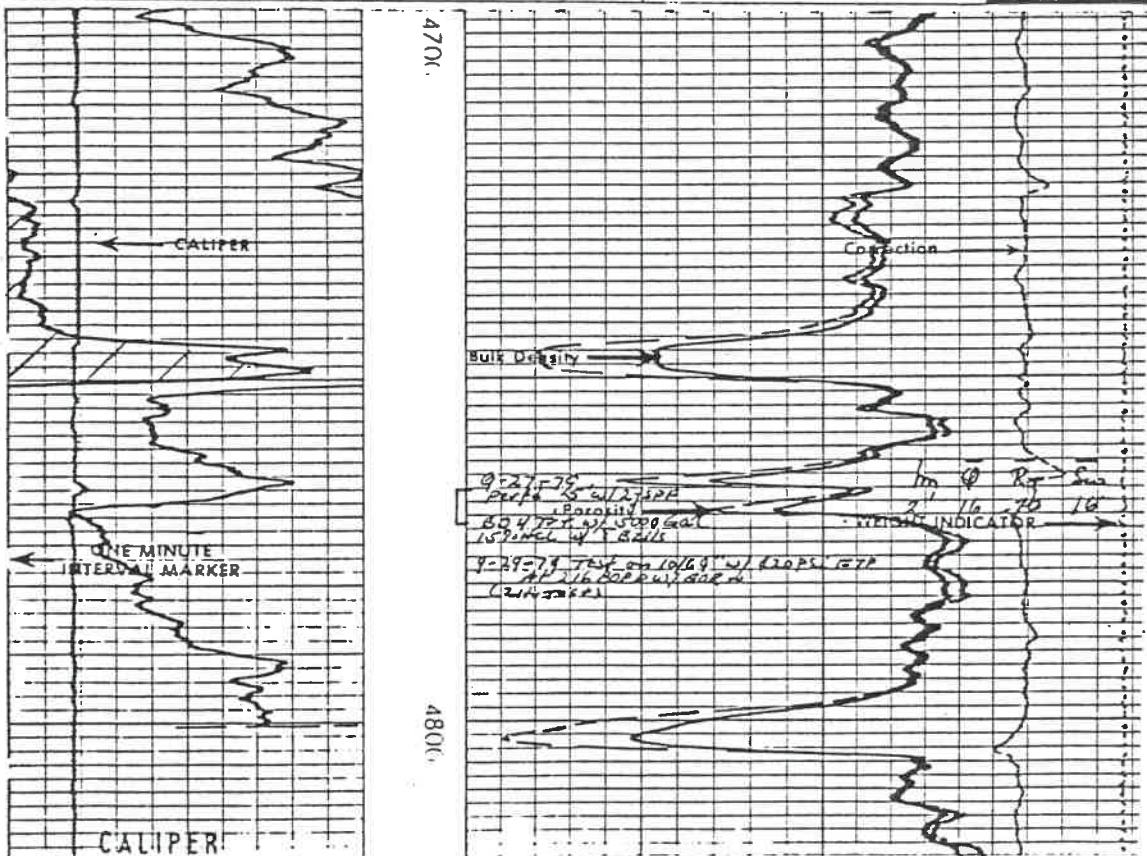
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# COMPENSATED DENSITY GAMMA CALIPER LOG

|                                             |                                    |                                                                |  |
|---------------------------------------------|------------------------------------|----------------------------------------------------------------|--|
| COMPANY <u>KRM PETROLEUM CORPORATION</u>    |                                    | WELL <u>LEMON #9</u>                                           |  |
| FIELD <u>LEMON RANCH</u>                    |                                    | COUNTY <u>COMANCHE</u> STATE <u>KANSAS</u>                     |  |
| Sec <u>14</u> Twp <u>34S</u> Rge <u>20W</u> |                                    | Elev. <u>1759'</u>                                             |  |
| Permanent Datum <u>GROUND LEVEL</u>         |                                    | Log Measured From <u>KELLY BUSHING</u> 12 ft Above Perm. Datum |  |
| Dating Measured From <u>KELLY BUSHING</u>   |                                    | Elev. <u>KB 1771'</u><br>DF <u>GL 1759'</u>                    |  |
| Date <u>8-23-79</u>                         | Run No. <u>ONE</u>                 |                                                                |  |
| Depth - Diller <u>4840'</u>                 | Depth - Wicks <u>4827'</u>         |                                                                |  |
| Top Log Inner <u>3800'</u>                  | Casing - Diller <u>8-3/8" 669'</u> |                                                                |  |
| Casing - Wicks <u>8-5/8" 550'</u>           | Bit Size <u>7-7/8"</u>             |                                                                |  |
| Type Fluid in Hole <u>PREMIX</u>            | Dens. LVSC <u>9.1 153</u>          |                                                                |  |
| Source of Sample <u>MUD PIT</u>             | R. Meas Temp <u>17 (w) 83 F</u>    |                                                                |  |
| H. Meas Temp <u>16 (w) 80 F</u>             | H. Meas Temp <u>23 (w) 81 F</u>    |                                                                |  |
| Meas R. R. <u>MEASURED</u>                  | 12 (w) 120 F                       |                                                                |  |
| Meas Circ. <u>7 HOURS</u>                   | 120 F (w) T.D.                     |                                                                |  |
| Meas Circ. <u>702 GREAT</u>                 | Meas Circ. <u>END</u>              |                                                                |  |
| Meas Circ. <u>S. WINDER</u>                 | Meas Circ. <u>END</u>              |                                                                |  |
| Meas Circ. <u>END</u>                       | Meas Circ. <u>END</u>              |                                                                |  |





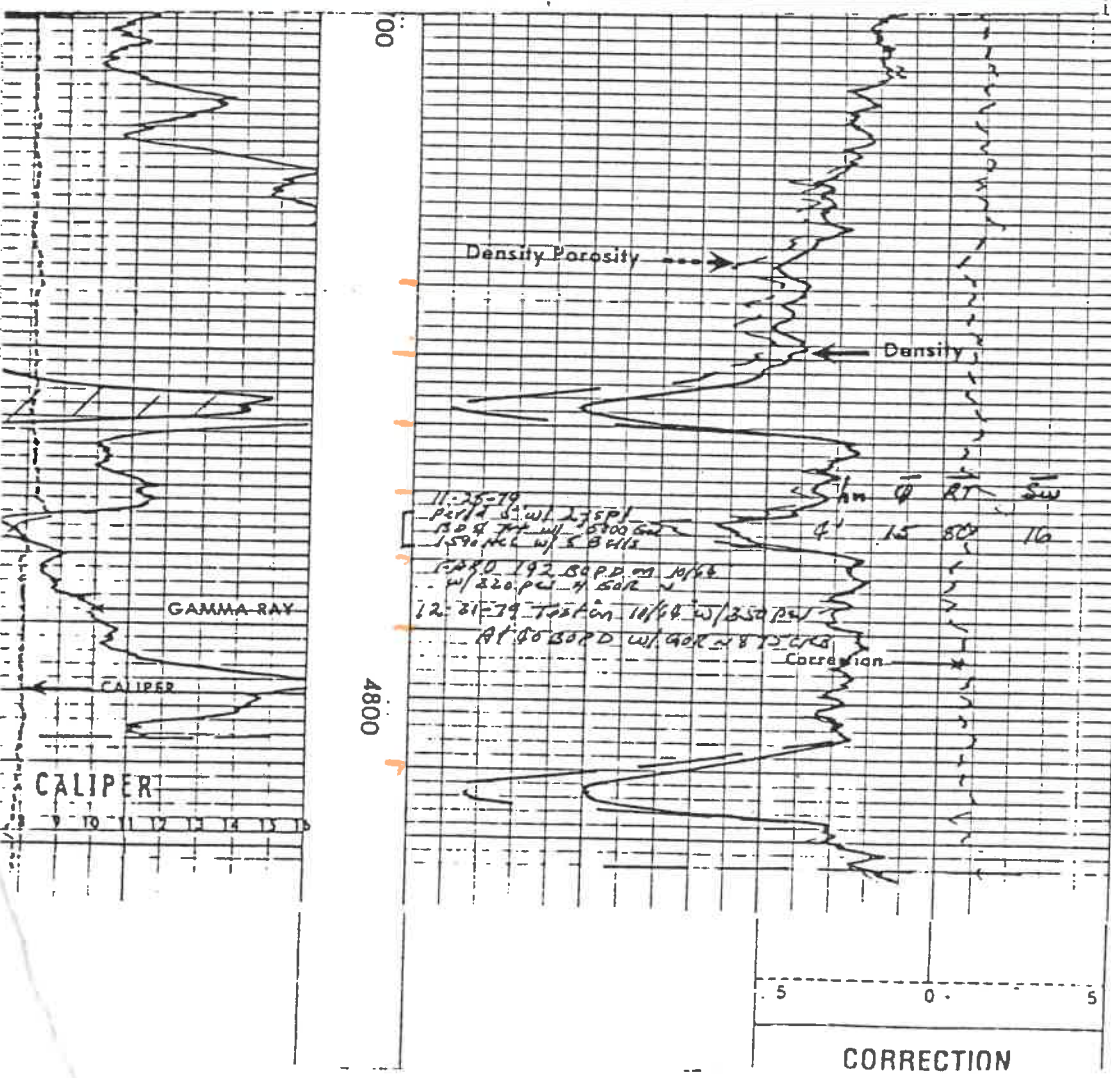
LINEAR NEUTRON  
COMPENSATED  
DENSITY  
GAMMA CALIPER LOG

COMPANY KRM PETROLEUM CORPORATION  
WELL LEMON #10  
FIELD  
County COMANCHE State KANSAS

COMPANY KRM PETROLEUM CORPORATION  
WELL LEMON #10  
FIELD  
COUNTY COMANCHE STATE KANSAS  
Location C-1W-NW  
Other Services GAMMA-GUARD

Sec 24 Twp 34S Rge 20W

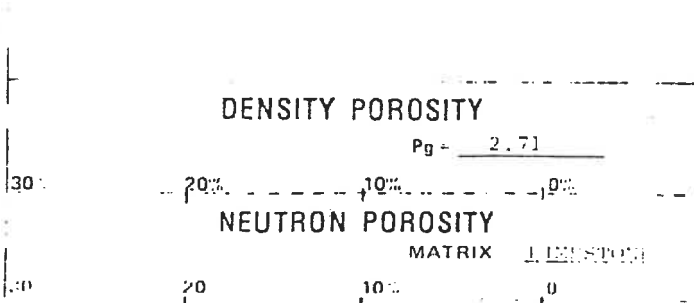
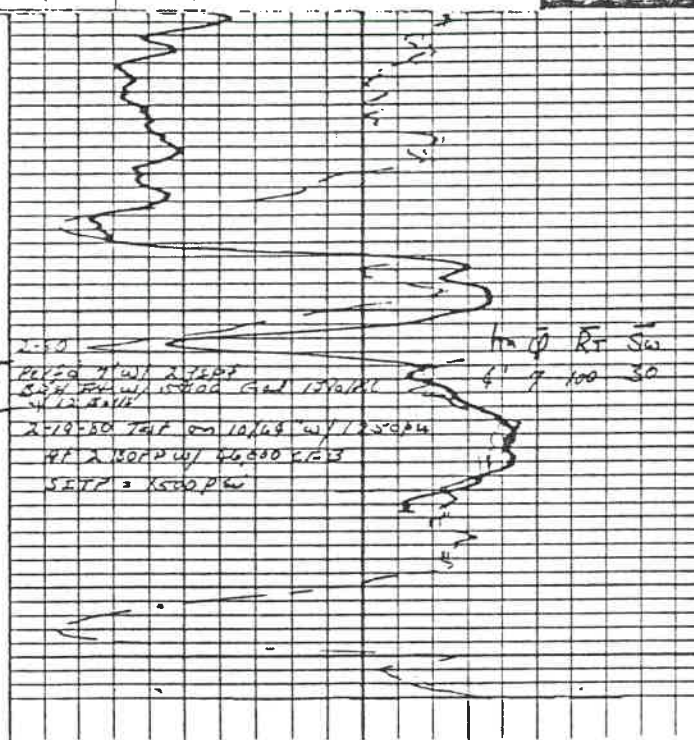
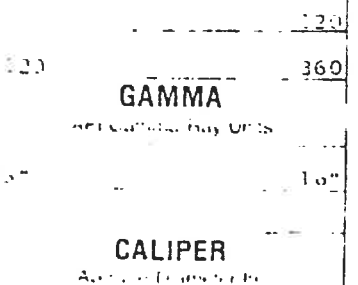
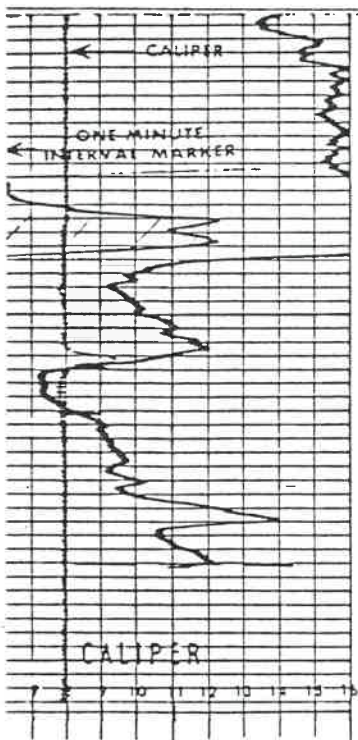
|                        |               |                       |          |       |          |
|------------------------|---------------|-----------------------|----------|-------|----------|
| Permanent Datum        | GROUND LEVEL  | Elev.                 | 1750'    | Elev. | KB 1758' |
| Log Measured From      | KELLY BUSHING | B Fl Above Perm Datum |          | DF    | 1756'    |
| Drilling Measured From | KELLY BUSHING |                       |          | GL    | 1750'    |
| Date                   | 11-19-79      | 11-19-79              | 11-19-79 |       |          |
| Run No                 | ONE           | NEUTRON               | DENSITY  |       |          |
| Depth - Driver         | 4830'         | 4830'                 | 4830'    |       |          |
| Depth - Weir           | 4825'         | 4825'                 | 4825'    |       |          |
| Bottom Log Inter       | 4805'         | 479H'                 | 4824'    |       |          |
| Top Log Inter          | 3900'         | 3900'                 | 3900'    |       |          |
| Casing Driver          | 8-5/8" 69.1'  |                       |          |       |          |
| Casing Weir            |               |                       |          |       |          |
| Dr Size                | 7-7/8"        |                       |          |       |          |
| Type Fluid in Hole     | DRILLING MUD  |                       |          |       |          |
| Dens. Visc             | 9.3 14.4      |                       |          |       |          |
| 1st Fluid Loss         | 10.0 14.4     |                       |          |       |          |
| Source of Sample       | FLOW LINE     |                       |          |       |          |
| R. W. Mo. Temp         | 33 68 F       |                       |          |       |          |
| H. W. Mo. Temp         | 31 60 F       |                       |          |       |          |
| R. W. Mo. Temp         | 28 56 F       |                       |          |       |          |
| S. W. Mo. Temp         | 19 120 F      |                       |          |       |          |
| R. W. Mo. Cat          | 2 110URS      |                       |          |       |          |
| Max. Ho Temp           | 120 F w T.D.  |                       |          |       |          |







|         |     |                           |             |
|---------|-----|---------------------------|-------------|
| COMPANY |     | KRM PETROLEUM CORPORATION |             |
| WELL    |     | LEMON #11                 |             |
| FIELD   |     | COMANCHE                  |             |
| County  |     | State KANSAS              |             |
| Sect    | 14  | County                    | COMANCHE    |
| Twp.    | 31S | Location                  | C-M-N-M     |
| Range   | 20W | STATE                     | KANSAS      |
|         |     | Other Services            | GAMMA-GUARD |

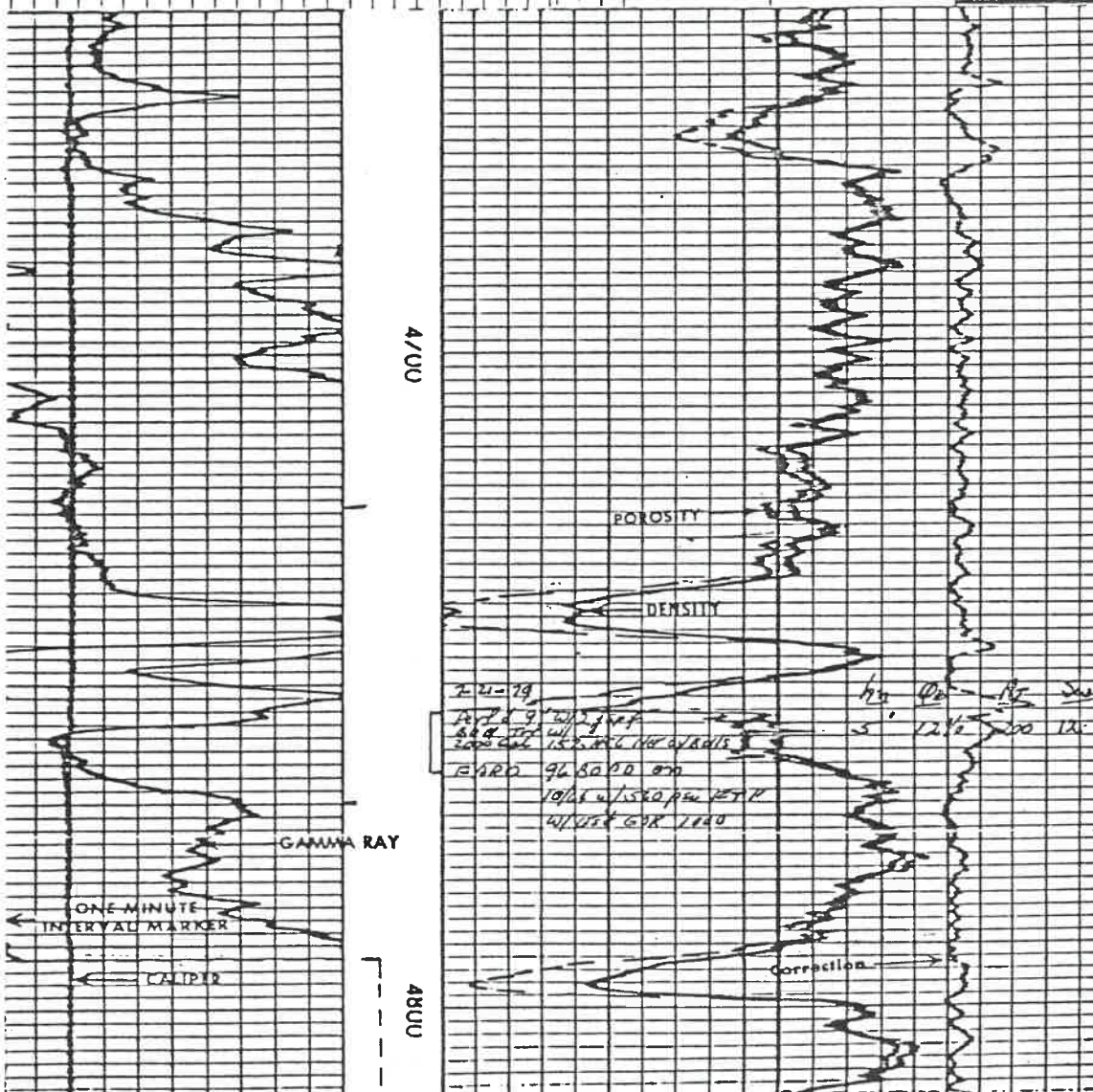
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|                                                       |                 |          |                 |             |  |
|-------------------------------------------------------|-----------------|----------|-----------------|-------------|--|
| COMPANY KRM PETROLEUM CORPORATION                     |                 |          |                 |             |  |
| WELL RHODES #2                                        |                 |          |                 |             |  |
| FIELD LEMON RANCH                                     |                 |          |                 |             |  |
| COUNTY COMANCHE                                       | STATE KANSAS    |          |                 |             |  |
| Location                                              | C-SW-N-E        |          | Other Services: |             |  |
| Sec. 18                                               | Twp 34 S        | Rge 20 W | G-GRD-SW        | 1771'       |  |
| Parent Datum GROUND LEVEL Elev. 1759'                 |                 |          | Elev. K.B.      | TOTAL       |  |
| Measured From KELLY BUSHING 12' Ft. Above Perm. Datum |                 |          | D.F.            | GL 1759'    |  |
| g Measured From KELLY BUSHING                         |                 |          |                 |             |  |
| No                                                    | DATE            |          | ONE             |             |  |
| Log                                                   | GAMMA           |          | DENSITY         |             |  |
| n - Driller                                           | 4820'           |          | 4820'           |             |  |
| n - Weiler                                            | 4818'           |          | 4818'           | SEE REMARKS |  |
| m Logged Interval                                     | 4790'           |          | 4817'           | 3900'       |  |
| ogged interval                                        | 3900'           |          |                 |             |  |
| Fluid in Hole                                         | DRILLING MUD    |          |                 |             |  |
| lurry, PPM Cl.                                        | 22.000          |          |                 |             |  |
| osity                                                 | 8.7             |          |                 |             |  |
| vel                                                   | FULL            |          |                 |             |  |
| ec temp., deg F.                                      | 120             |          |                 |             |  |
| ating Rig time                                        | 2 hrs.          |          |                 |             |  |
| ided By                                               | MARTE SCHNEIDER |          |                 |             |  |
| essed by                                              | MIR. LANDES     |          |                 |             |  |







LINEAR NEUTRON  
COMPENSATED  
DENSITY  
GAMMA CALIPER LOG

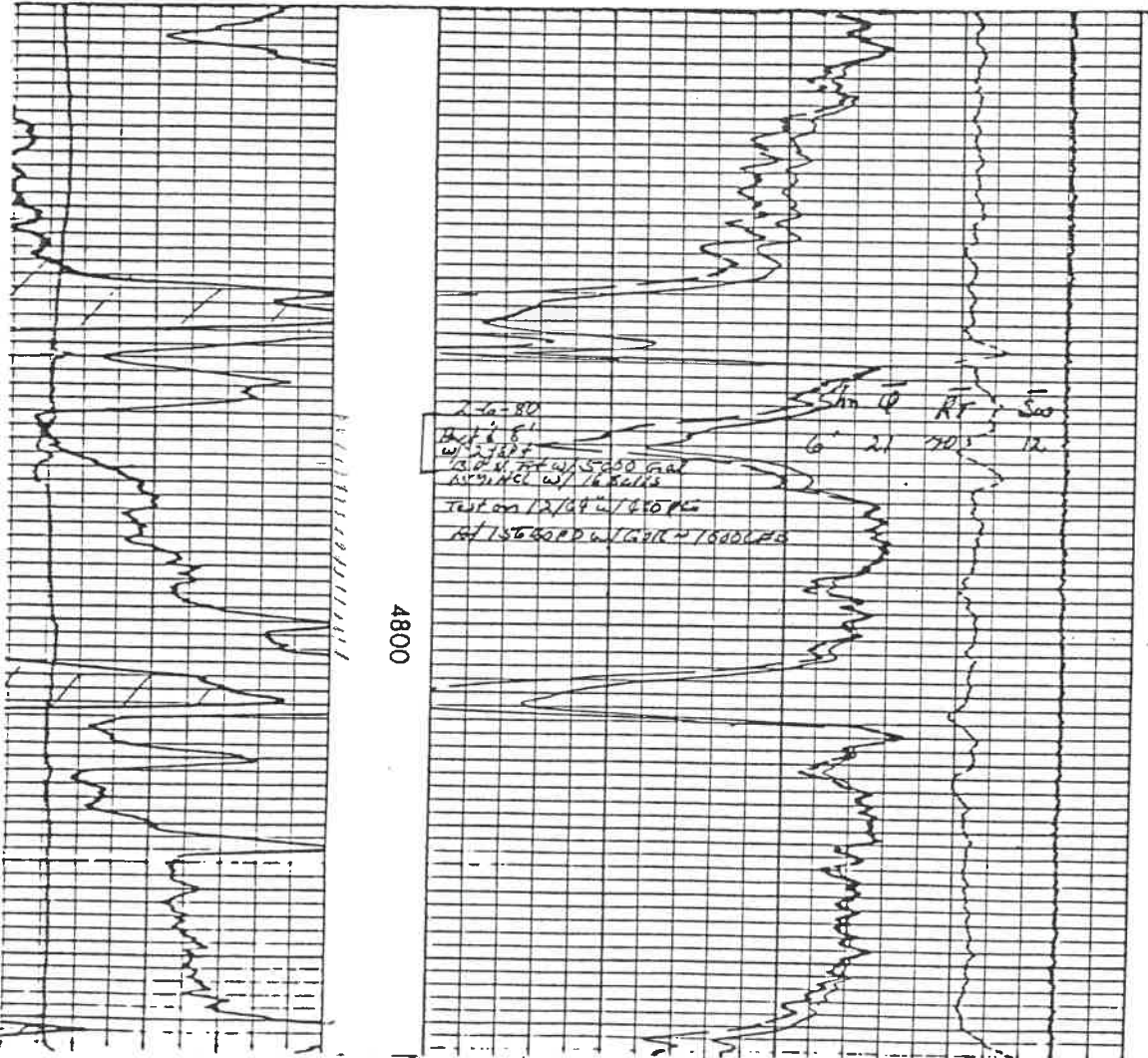
COMPANY KRM PETROLEUM CORPORATION  
WELL RIODES #3  
FIELD LEMON RANCH  
County COMANCHE State KANSAS

COMPANY KRM PETROLEUM CORPORATION  
WELL RIODES #3  
FIELD LEMON RANCH  
COUNTY COMANCHE STATE KANSAS  
Location C-NW-NE  
Other Services GAMMA-GUARD

Sec 14 Twp 34S Rge 20W

Permanent Datum GROUND LEVEL Elev 1761'  
Log Measured From KELLY BUSHING, 12' Ft. Above Perm Datum  
Drilling Measured From KELLY BUSHING

| Date               | 12-21-79         | 12-21-79 | 12-21-79 | Elev. K.B. 1773' | D.F. 1761' |
|--------------------|------------------|----------|----------|------------------|------------|
| Run In             | ONE              | GAMMA    | NEUTRON  | DENSITY          |            |
| Depth - Driller    | 5278'            | 5278'    | 5278'    | 5278'            |            |
| Depth - Well       | 5275'            | 5275'    | 5275'    | 5275'            |            |
| Blm. Log Inter     | 5255'            | 5247'    | 5274'    |                  |            |
| Top Log Inter      | 3800'            | 3800'    | 3800'    |                  |            |
| Casing - Driller   | 8-5/8" 772'      |          |          |                  |            |
| Casing - Well      |                  |          |          |                  |            |
| Bit Size           | 7-7/8"           |          |          |                  |            |
| Type Fluid in Hole | DRILLING MUD     |          |          |                  |            |
| Dens. Visc         | 9.3 142          |          |          |                  |            |
| pt. Fluid Loss     | 9.0 119.4 ml     |          |          |                  |            |
| Source of Sample   | FLOW LINE        |          |          |                  |            |
| R. in Meas Temp    | 2.4 56 F         |          |          |                  |            |
| R. in Meas Temp    | 2.6 40 F         |          |          |                  |            |
| II Meas Temp       | 3.8 40 F         |          |          |                  |            |
| Source H. R.       | MEASURED         |          |          |                  |            |
| II - LIFT          | 1.08 124 F       |          |          |                  |            |
| Flow Service Cnc   | 4 HOURS          |          |          |                  |            |
| Mass Flow Temp     | 124 F in T.D.    |          |          |                  |            |
| Log Location       | 702 GREAT BLIND  |          |          |                  |            |
| Recorded By        | MONTIE SCHRAMMER |          |          |                  |            |







COMPEN RATER-OWEN  
COMBINATION

Page 25

COMPANY KRM PETROLEUM

WELL RHOADES NO. 4

FIELD LEMON RANCH

COUNTY COMANCHE

Location: C NE NE

Sec 14 Twp. 34S Rge. 20W

State KANSAS

DIL

Permanent Datum: GL Elev. 1765  
Log Measured from KB 11 Ft. Above Perm. Datum  
Drilling Measured from KB 1777

Date 2-18-80

Run No One

Depth Driller 5280

Depth Logger 5274

Bottom logged interval 5273

Top logged interval 4050

Type fluid in hole Chem Gel

Density 9.2 Visc. 47

pH 8.5 Fluid Loss 30.4

Max inc. tempo. deg F. 120

Source of Samples Flowline

Run @ Meas. Temp. 76 58

Run @ Meas. Temp. 35 50

Source Run M M

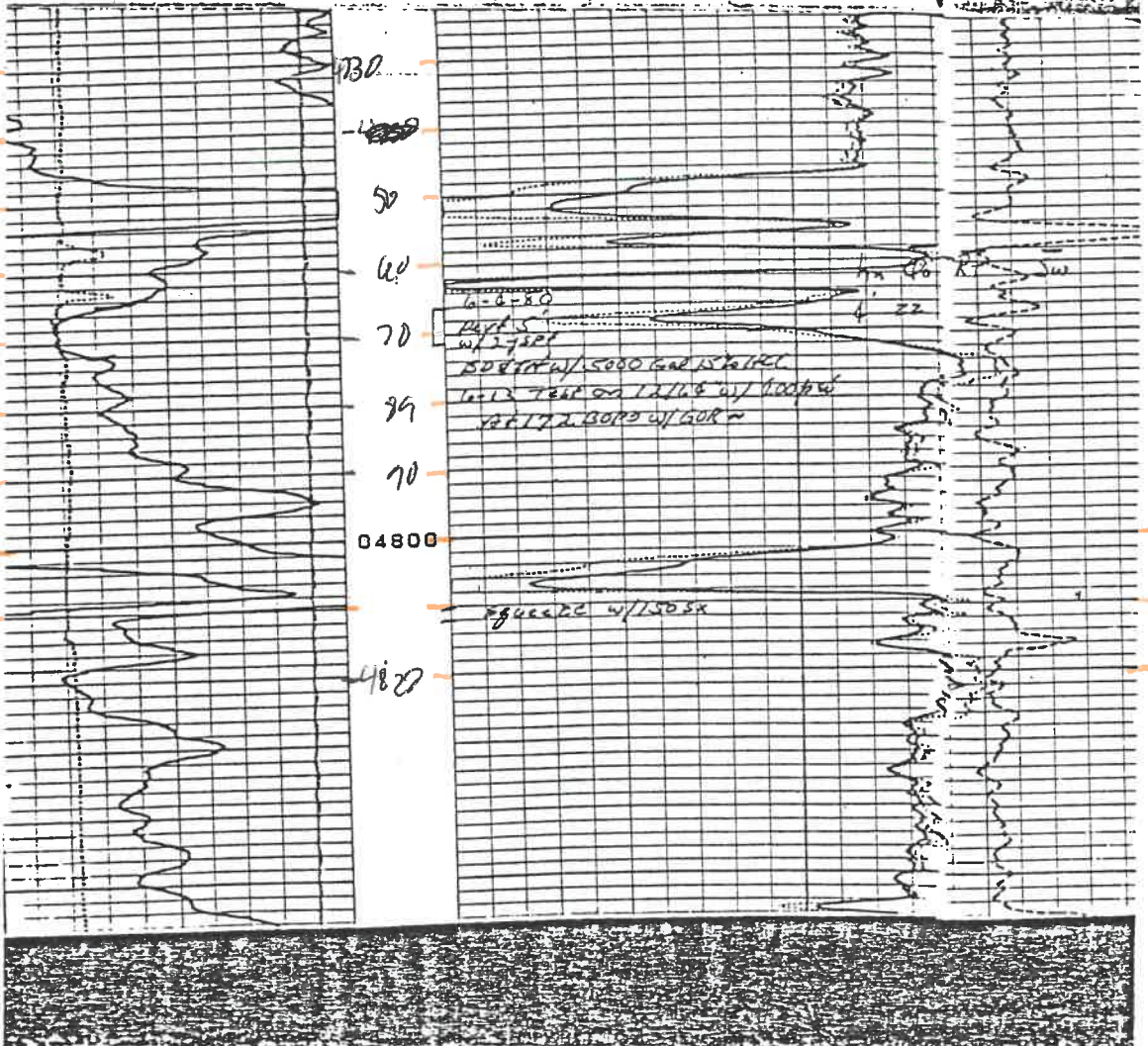
End Circulation 2300 Hours

Logged on Bottom 0615 Hours

Recorded By Dean

Initiated By Mr. Bld

Run



APPENDIX V

EXHIBIT V-2

Lemon Ranch Core Data  
Summary - Standard Analyses

| <u>Well</u>            | <u>Cored Interval</u> | <u>Net<sup>1/</sup><br/>Feet</u> | <u>Permeability - Md.</u> |                 | <u>Porosity<br/>%</u> | <u>Saturations - %</u> |            |
|------------------------|-----------------------|----------------------------------|---------------------------|-----------------|-----------------------|------------------------|------------|
|                        |                       |                                  | <u>Horizontal</u>         | <u>Vertical</u> |                       | <u>Water</u>           | <u>Oil</u> |
| ✓Lemon #2X             | 4764-67               | 0                                | 0                         | 0               | 6.9                   | 36.7                   | 11.0       |
| ✓Lemon #5              | 4784-88               | 3                                | 48.9                      | 20.6            | 25.5                  | 14.8                   | 8.2        |
| ✓Lemon #6              | 4781-92               | 8                                | 76.6                      | 63.0            | 21.2                  | 26.2                   | 9.9        |
| ✓Lemon #7              | 4793-98               | 2                                | 1.0                       | 0               | 14.8                  | 32.1                   | 1.7        |
| ✓Lemon #8              | 4776-84               | 4                                | 3.8                       | 1.2             | 9.9                   | 27.8                   | 8.2        |
| ✓Lemon #9              | 4774-78               | 1                                | 1.0                       | 0.8             | 16.9                  | 18.5                   | 9.2        |
| ✓Lemon #10             | 4770-75               | 4                                | 7.5                       | 6.7             | 22.5                  | 20.8                   | 7.6        |
| Lemon #11              | 4760-67               | 6                                | 35.3                      | 11.6            | 10.4                  | 21.7                   | 10.9       |
| ✓Rhodes #1             | 4766-70               | 2                                | 13.4                      | 7.2             | 15.1                  | 18.8                   | 11.4       |
| ✓Rhodes #2             | 4755-65               | 9                                | 84.7                      | 49.6            | 19.1                  | 22.9                   | 8.7        |
| Rhodes #3              | 4770-81               | 6                                | 17.0                      | 6.0             | 16.4                  | 25.3                   | 12.9       |
| Average                |                       |                                  |                           |                 |                       |                        |            |
| 10 Wells <sup>2/</sup> | --                    | 4.5                              | 42.5                      | 25.9            | 17.4                  | 23.5                   | 8.9        |

Notes

1/ Net feet - Greater than 1.0 millidarcy.

2/ Lemon #2X not included in average.

KRM LEMON RANCH #8  
INITIAL/DST 6-2-79  
SWOPE LIME @ 4779 MP

APPENDIX IV

EXHIBIT IV-7

P R E S S U R E   B U I L D - U P   A N A L Y S I S

| POINTS<br>USED | RADIUS<br>FELT, FT | SLOPE<br>PSI/CYC | K<br>(MDS) | P. I.<br>B/D/PSI | COMPL.<br>EFF. , % | SIBHP<br>PSIG | AVG. P<br>PSIG |
|----------------|--------------------|------------------|------------|------------------|--------------------|---------------|----------------|
| 1- 2           | 7.                 | 195. 1           | 0. 16      | 0. 00            | 174. 3             | 203.          | 476.           |
| 2- 3           | 8.                 | 346. 4           | 0. 09      | 0. 00            | 190. 0             | 261.          | 687.           |
| 3- 4           | 9.                 | 446. 4           | 0. 07      | 0. 00            | 197. 7             | 313.          | 810.           |
| 4- 5           | 9.                 | 732. 7           | 0. 04      | 0. 00            | 212. 3             | 430.          | 1129.          |
| 5- 6           | 10.                | 1011. 6          | 0. 03      | 0. 00            | 223. 7             | 623.          | 1395.          |
| 6- 7           | 11.                | 1596. 3          | 0. 02      | 0. 00            | 246. 4             | 810.          | 1841.          |
| 7- 8           | 11.                | 2081. 7          | 0. 01      | 0. 00            | 261. 6             | 902.          | 2155.          |
| 8-14           | 13.                | 2443. 9          | 0. 01      | 0. 00            | 270. 8             | 1312.         | 2372.          |
| 14-16          | 13.                | 2097. 4          | 0. 01      | 0. 00            | 262. 8             | 1393.         | 2158.          |
| 16-20          | 14.                | 1850. 1          | 0. 02      | 0. 00            | 239. 6             | 1498.         | 2132.          |

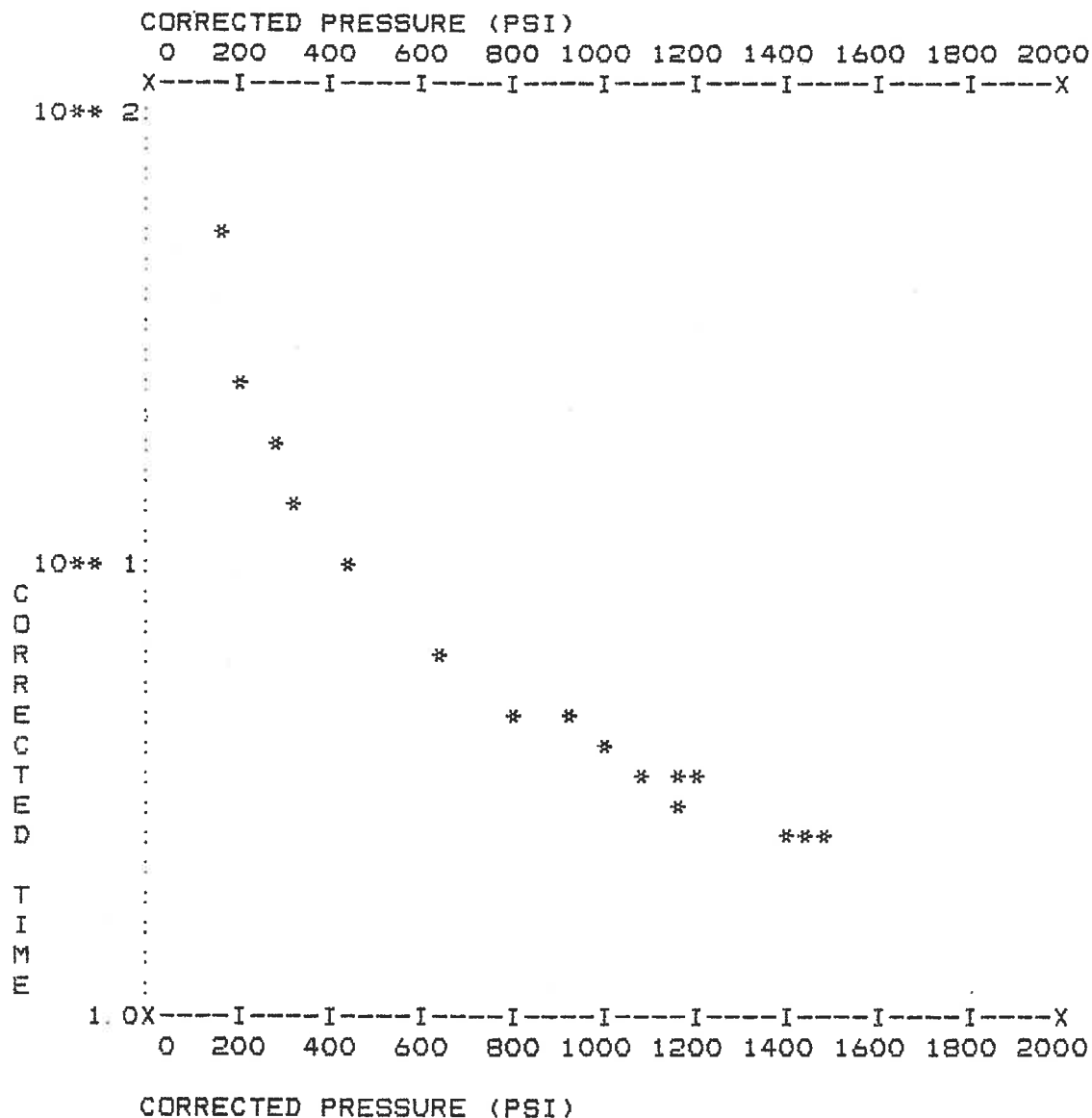
| POINT | PRESSURE | CORRECTED<br>PRESSURE@ | DT<br>(HOURS) | (T+DT)/DT | CORRECTED<br>(T+DT)/DT@@ |
|-------|----------|------------------------|---------------|-----------|--------------------------|
| 1     | 146.     | 146.                   | 0. 05         | 49. 000   | 49. 000                  |
| 2     | 203.     | 203.                   | 0. 10         | 25. 000   | 25. 000                  |
| 3     | 261.     | 261.                   | 0. 15         | 17. 000   | 17. 000                  |
| 4     | 313.     | 313.                   | 0. 20         | 13. 000   | 13. 000                  |
| 5     | 430.     | 430.                   | 0. 30         | 9. 000    | 9. 000                   |
| 6     | 623.     | 623.                   | 0. 50         | 5. 800    | 5. 800                   |
| 7     | 810.     | 810.                   | 0. 70         | 4. 429    | 4. 429                   |
| 8     | 902.     | 902.                   | 0. 80         | 4. 000    | 4. 000                   |
| 9     | 992.     | 992.                   | 0. 90         | 3. 667    | 3. 667                   |
| 10    | 1076.    | 1076.                  | 1. 00         | 3. 400    | 3. 400                   |
| 11    | 1140.    | 1140.                  | 1. 10         | 3. 182    | 3. 182                   |
| 12    | 1204.    | 1204.                  | 1. 20         | 3. 000    | 3. 000                   |
| 13    | 1266.    | 1266.                  | 1. 30         | 2. 846    | 2. 846                   |
| 14    | 1312.    | 1312.                  | 1. 40         | 2. 714    | 2. 714                   |
| 15    | 1156.    | 1156.                  | 1. 50         | 2. 600    | 2. 600                   |
| 16    | 1393.    | 1393.                  | 1. 60         | 2. 500    | 2. 500                   |
| 17    | 1428.    | 1428.                  | 1. 70         | 2. 412    | 2. 412                   |
| 18    | 1453.    | 1453.                  | 1. 80         | 2. 333    | 2. 333                   |
| 19    | 1474.    | 1474.                  | 1. 90         | 2. 263    | 2. 263                   |
| 20    | 1498.    | 1498.                  | 2. 00         | 2. 200    | 2. 200                   |

@ CORRECTED FOR AFTERFLOW  
@@ CORRECTED FOR SUPERPOSITION



KRM LEMON RANCH #8  
INITIAL/DST 6-2-79  
SWOPE LIME @ 4779 MP

APPENDIX IV  
EXHIBIT IV-7a



KRM RHODES #1  
 INITIAL/DST 6-16-79  
 SWOPE LIME @ 4765 MP

APPENDIX IV

EXHIBIT IV-8

PRESSURE BUILD-UP ANALYSIS

| POINTS<br>USED | RADIUS<br>FELT, FT | SLOPE<br>PSI/CYC | K<br>(MDS) | P. I.<br>B/D/PSI | COMPL.<br>EFF. , % | SIBHP<br>PSIG | AVG. P<br>PSIG |
|----------------|--------------------|------------------|------------|------------------|--------------------|---------------|----------------|
| 1- 2           | 13.                | 158. 5           | 0. 20      | 0. 01            | 227. 6             | 144.          | 321.           |
| 2- 3           | 14.                | 275. 6           | 0. 11      | 0. 00            | 250. 5             | 188.          | 451.           |
| 3- 4           | 15.                | 439. 9           | 0. 07      | 0. 00            | 271. 4             | 236.          | 608.           |
| 4- 5           | 17.                | 479. 1           | 0. 07      | 0. 00            | 276. 0             | 306.          | 641.           |
| 5- 7           | 21.                | 454. 6           | 0. 07      | 0. 00            | 271. 8             | 427.          | 623.           |
| 7- 8           | 22.                | 644. 1           | 0. 05      | 0. 00            | 321. 5             | 450.          | 706.           |
| 8- 9           | 22.                | 2202. 9          | 0. 01      | 0. 00            | 473. 1             | 516.          | 1326.          |
| 9-11           | 23.                | 6595. 4          | 0. 00      | 0. 00            | 516. 2             | 830.          | 2944.          |
| 11-12          | 23.                | 7201. 2          | 0. 00      | 0. 00            | 519. 6             | 969.          | 3136.          |
| 12-15          | 23.                | 6286. 8          | 0. 00      | 0. 00            | 510. 8             | 1256.         | 2863.          |
| 15-19          | 24.                | 5126. 7          | 0. 01      | 0. 00            | 483. 7             | 1474.         | 2567.          |

| POINT | PRESSURE | CORRECTED<br>PRESSURE@ | DT<br>(HOURS) | (T+DT)/DT | CORRECTED<br>(T+DT)/DT@@ |
|-------|----------|------------------------|---------------|-----------|--------------------------|
| 1     | 99.      | 99.                    | 0. 05         | 25. 000   | 25. 000                  |
| 2     | 144.     | 144.                   | 0. 10         | 13. 000   | 13. 000                  |
| 3     | 188.     | 188.                   | 0. 15         | 9. 000    | 9. 000                   |
| 4     | 236.     | 236.                   | 0. 20         | 7. 000    | 7. 000                   |
| 5     | 306.     | 306.                   | 0. 30         | 5. 000    | 5. 000                   |
| 6     | 380.     | 380.                   | 0. 50         | 3. 400    | 3. 400                   |
| 7     | 427.     | 427.                   | 0. 70         | 2. 714    | 2. 714                   |
| 8     | 450.     | 450.                   | 0. 80         | 2. 500    | 2. 500                   |
| 9     | 516.     | 516.                   | 0. 90         | 2. 333    | 2. 333                   |
| 10    | 688.     | 688.                   | 1. 00         | 2. 200    | 2. 200                   |
| 11    | 830.     | 830.                   | 1. 10         | 2. 091    | 2. 091                   |
| 12    | 969.     | 969.                   | 1. 20         | 2. 000    | 2. 000                   |
| 13    | 1080.    | 1080.                  | 1. 30         | 1. 923    | 1. 923                   |
| 14    | 1176.    | 1176.                  | 1. 40         | 1. 857    | 1. 857                   |
| 15    | 1256.    | 1256.                  | 1. 50         | 1. 800    | 1. 800                   |
| 16    | 1321.    | 1321.                  | 1. 60         | 1. 750    | 1. 750                   |
| 17    | 1383.    | 1383.                  | 1. 70         | 1. 706    | 1. 706                   |
| 18    | 1430.    | 1430.                  | 1. 80         | 1. 667    | 1. 667                   |
| 19    | 1474.    | 1474.                  | 1. 90         | 1. 632    | 1. 632                   |

@ CORRECTED FOR AFTERFLOW

@@ CORRECTED FOR SUPERPOSITION

KRM RHODES #1  
INITIAL/DST 6-16-79  
SWOPE LIME @ 4765 MP

APPENDIX IV  
EXHIBIT IV-8a

