LABORATORY INVESTIGATION
JICARILLA J,G AND
McCRODEN C LEASE OILS

## SUMMARY OF RESULTS

1. No precipitation of materials was observed from the admixture of oils in question.
2. No emulsion testing was performed. Very little water accompanies hydrocarbon production and water that is produced separates easily in normal surface operations. Therefore, there is no concern over emulsion effects.
3. The cloud point of oil mixtures dropped significantly with increased dilution.
4. According to calculations not enough cool down from gas expansion will occur to alter paraffin deposition significantly.

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
UTPC EXHIBIT NO. 11
CASE NO. 8186
Submitted by HERRINGTON
Hearing Date 5-9-84

James C. Terry
District Engineer
Western Company of North America - Farmington District

Clarion Cochran, Retired
Shell Oil Company Research

Rocky Mountain Region

LABORATORY INVESTIGATION
ABSTRACT

# LABORATORY INVESTIGATION OF JICARILLA AND McCRODEN AREA LEASE OILS

April 5, 1984

PREPARED FOR:

UNION TEXAS PETROLEUM
Mike Herrington
Petroleum Engineer

PREPARED BY:

James C. Terry
District Engineer
Western Company of North America-Farmington District

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LABORATORY INVESTIGATION
REPORT

Rocky Mountain Region

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P. O. Drawer 360 • Farmington, N. M. 87401

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On Thursday, March 22, 1984, a request for laboratory work was placed by Mike Herrington, Petroleum Engineer of Union Texas Petroleum Corporation.

PURPOSE

Six oil samples were received of Mike with the request that we investigate the concern of potentially detrimental effects due to triple comingling of Dakota, Gallup and Mesa Verde oils in respective wells.

INVESTIGATION

1. Background Information

a)

Proposed Mesa Verde Perforations

Existing Comingled Gallup/Dakota Perforations

b) BHST Gradient: 1.375°F/100 ft. depth

c) Current production problems are primarily due to paraffin deposition from surface down to $\approx$ 1000' depth

d) No appreciable amounts of water accompany hydrocarbon production in these wells.

2. Concern to address in analysis.
   a) The precipitation of materials produced by the admixture of oils of potentially different constitution.
   b) The creation of emulsions due to the admixture of different fluids.
   c) Increased paraffin deposition by additive properties of oils.
   d) Increased paraffin deposition due to the reduction of temperature accompanying gas expansion.
3. Steps taken in analysis
   a) API Analysis of oils including: API Gravity
      Cloud Point
      Pour Point
      Paraffin Content
      Asphaltene Content
   b) Discussion with Mike Herrington regarding the well bore production environment; e.g., mode of hydrocarbon production, pump type and operation, water componenets of production fluids, current paraffin problems, etc.
   c) Mixing of oils in appropriate cases with additional cloud point testing to determine resulting fluid characteristics.

## DATA

### SAMPLE #1

| | |
|---|---|
| Well: McCroden C #1 | Zone: Gallup/Dakota |
| API Gravity @ 60°F | 40.0 |
| Cloud Point | 73°F |
| Pour Point | 49°F |
| Paraffin Content | $15.1_7$ % by weight |
| Asphaltene Content | 4.0% by weight |

### SAMPLE #2

| | |
|---|---|
| Well: Jicarilla "J" 10E | Zone: Dakota |
| API Gravity @ 60°F | 42.3 |
| Cloud Point | 71°F |
| Pour Point | 29°F |
| Paraffin Content | 3.0% by weight |
| Asphaltene Content | Not Enough to Measure |

### SAMPLE #3

| | |
|---|---|
| Well: Jicarilla "J" 12E | Zone: Dakota |
| API Gravity @ 60°F | 55.2 |
| Cloud Point | 33°F |
| Pour Point | $< -36$°F |
| Paraffin Content | 1.0% by weight |
| Asphaltene Content | Not Enough to Measure |

SAMPLE #4

| | |
|---|---|
| Well: Jicarilla "G" 9A | Zone: Gallup |
| API Gravity @ 60°F | 64.3 |
| Cloud Point | < -36°F |
| Pour Point | < -36°F |
| Paraffin Content | < 0.3% by weight |
| Asphaltene Content | Not Enough to Measure |

SAMPLE #5

| | |
|---|---|
| Well: Jicarilla "J" 10E | Zone: Mesa Verde |
| API Gravity @ 60°F | 62.0 |
| Cloud Point | < -36°F |
| Pour Point | < -36°F |
| Paraffin Content | < 0.3% by weight |
| Asphaltene Content | < 0.3% by weight (none observed) |

SAMPLE #6

| | |
|---|---|
| Well: Jicarilla "J" 12E | Zone: Mesa Verde |
| API Gravity @ 60°F | 60.0 |
| Cloud Point | 34°F |
| Pour Point | < -36°F |
| Paraffin Content | < 0.3% by weight (paraffin observed but not measurable) |
| Asphaltene Content | Not Enough to Measure |

## CALCULATIONS

Cool down effects due to gas expansion:

Reference: Perry's Handbook of Chemical Engineering

Re: Adiabatic Expansion of Ethane, Methane

$$T_s = T_r \left(\frac{P_s}{P_r}\right) \left(\frac{K-1}{K}\right), \text{ where}$$

$T_s$ = Surface Temperature

$T_r$ = Reservoir Temperature

$P_s$ = Surface Pressure

$P_r$ = Reservoir Pressure

$K = \dfrac{\text{Specific Heat at Constant Pressure}}{\text{Specific Heat at Constant Volume}}$

Assumed values for maximum cool down due to gas expansion:

$T_s$ = Unknown

$T_r$ = 180°F

$P_s$ = 500 psi

$P_r$ = 2000 psi

$K$ = 1.2

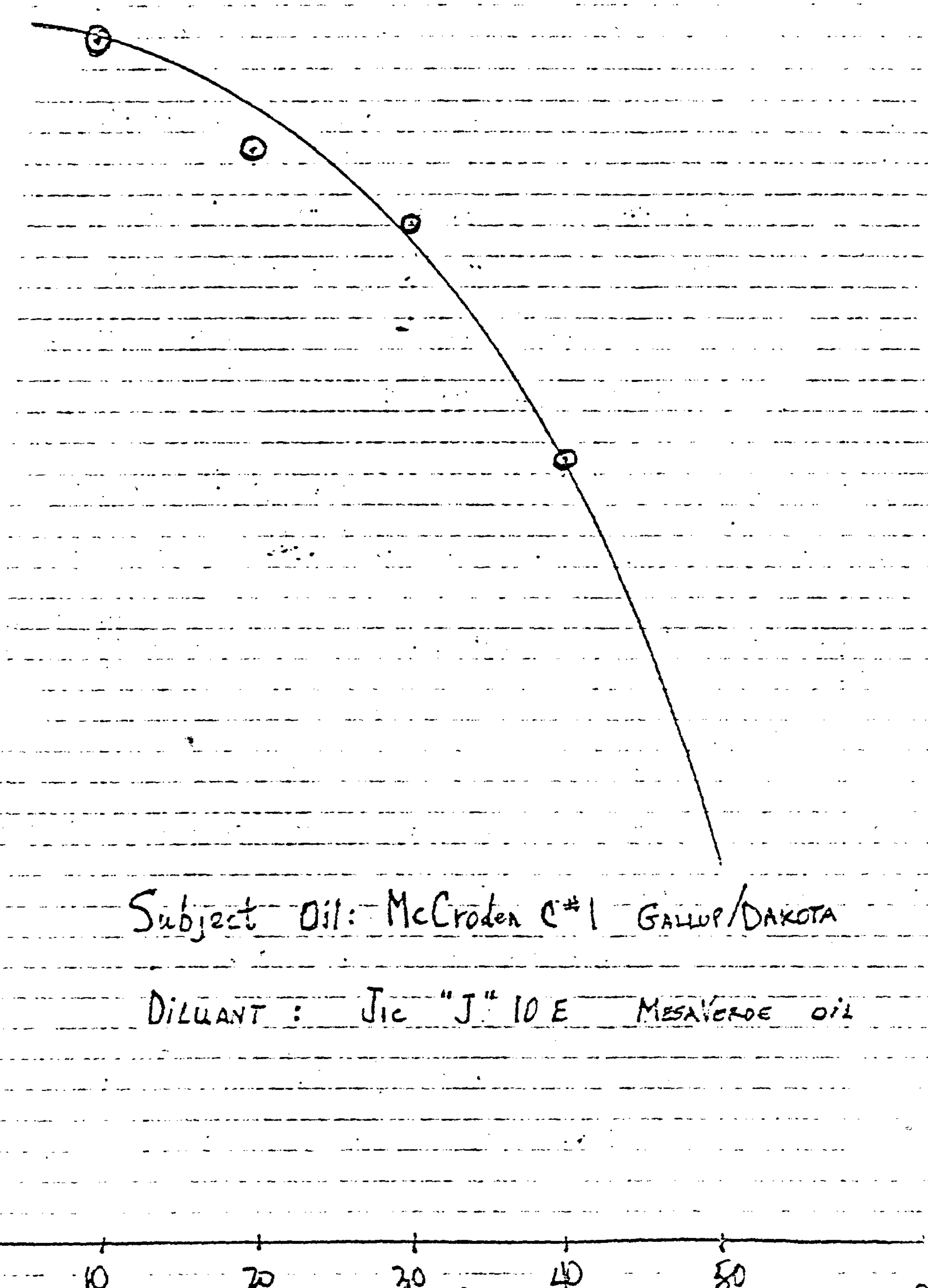
$$T_s = 180 \left(\frac{500}{2000}\right)^{0.1667}$$

$$T_s = 142^{\circ}F$$

NOTE:

A total cooldown of 38°F would be expected.

Cloud Point Temperature vs Dilution Factor




Concentration of Sample, % dilution w/ MV oil

## DISCUSSION

The API analyses conducted resulted in the awareness that the heaviest and the lightest of the oils would be comingled in the McCroden C #1 assuming that the Jicarilla "J" 10E Mesa Verde oil would be representative of Mesa Verde oil encountered in the McCroden lease as well. It was assumed that the most troublesome mixture of oils from all leases and samples represented would occur in this well. Therefore, further investigations surrounded the McCroden lease only.

The knowledge that no appreciable water production accompanies any hydrocarbon production in the wells eliminated the concern over emulsion creation. Water that is produced separates easily in normal surface operations.

The problems of precipitations was eliminated after mixing oils from the Jicarilla "J" 10E and Jicarilla "J" 12E with Gallup oil from the Jicarilla "G" 9A. No precipitates occurred at room temperature. It is assumed that no precipitates would occur at elevated temperatures due to increased solvency effects of temperature increases.

With all other concerns alleviated the potential problems surrounded only paraffin deposition with admixture of McCroden oil with Jicarilla "J" 10E Mesa Verde oil in varying proportions and in paraffin deposition with decreases in temperature due to the adiabatic expansion of gas from the solutions.

The fact that the Mesa Verde Zone from the Jicarilla "J" 10E was producing 0-1 bopd and 30-250 mcfd of dry gas brought a concern to light regarding increased paraffin deposition due to the cool down of fluids through gas expansion. Using a relationship for temperature change with adiabatic expansion of gas from Perry's Handbook of Chemistry a calculation was made that would account for maximum cool down of fluids due to gas expansion. This cool down does not take into account other temperature effects brought to bear by fluids passing through cool water zones on their way to the surface,however. Therefore, a decision was made to mix McCroden Gallup/Dakota oil with Jicarilla "J" 10E Mesa Verde oil in varying proportions and to retest the mixtures for cloud point in order to evaluate the increased or decreased deposition efficiency of paraffin resulting from mixing.

CONCLUSIONS

1. No precipitation of materials was observed by the admixture of Jicarilla "J" 10E Dakota, Mesa Verde oils and Jicarilla "G" 9A Gallup oil. No precipitation of intervals was observed by the admixture of Jicarilla "J" 12E Dakota, Mesa Verde oils and Jicarilla "G" 9A oil. No precipitation of materials was observed by the admixture of McCroden C #1 Dakota, Gallup oils and Jicarilla "J" 10E Mesa Verde oils.
2. No emulsion testing was performed. However, no concern over emulsion prevailed with the knowledge that no appreciable amounts of water are produced with hydrocarbon in any of the leases.
3. The cloud point of oil mixtures dropped significantly with increased dilution of the Gallup/Dakota oil with Mesa Verde oil.
4. According to calculation not enough cool down will occur for gas expansion to alter paraffin deposition efficiency at the points the gas expansion will occur in the well. Most gas production occurs at the Mesa Verde interval and due to the mode of production (gas via annulus, oil via tubing pump) no serious encounter of Mesa Verde gas and Gallup/Dakota oil will occur anyway.