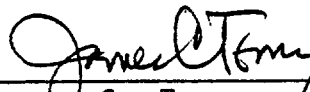


LABORATORY INVESTIGATION
JICARILLA J, G AND
McCRODEN C LEASE OILS

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.



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



Clarion Cochran, Retired
Shell Oil Company Research

BEFORE EXAMINER STAMETS
OIL CONSERVATION DIVISION
UTPC EXHIBIT NO. 11
CASE NO. 8184 & 8185
Submitted by HERRINGTON
Hearing Date 5-9-84



LABORATORY INVESTIGATION
ABSTRACT

Rocky Mountain Region

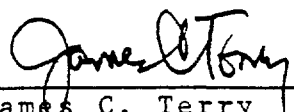
LABORATORY INVESTIGATION
OF
JICARILLA AND McCRODEN AREA LEASE OILS

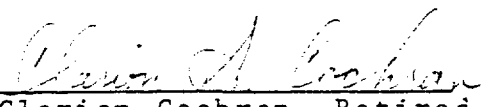
April 5, 1984

PREPARED FOR:

UNION TEXAS PETROLEUM
Mike Herrington
Petroleum Engineer

PREPARED BY:


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


Clarion Cochran, Retired
Shell Oil Company Research



LABORATORY INVESTIGATION
REPORT

Rocky Mountain Region


LABORATORY INVESTIGATION
OF
JICARILLA AND McCRODEN AREA LEASE OILS

April 5, 1984


PREPARED FOR:

UNION TEXAS PETROLEUM
Mike Herrington
Petroleum Engineer

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America-Farmington District



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Shell Oil Company Research

LABORATORY INVESTIGATION
JICARILLA J,G AND
McCRODEN C LEASE OILS

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

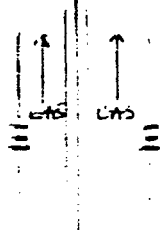
PURPOSE

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: $1.375^{\circ}\text{F}/100\text{ ft. depth}$
- 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.

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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	15.17 % 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

LABORATORY INVESTIGATION
JICARILLA J, G AND
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SAMPLE #4

Well: Jicarilla "G" 9A

API Gravity @ 60°F

Cloud Point

Pour Point

Paraffin Content

Asphaltene Content

Zone: Gallup

64.3

< -36°F

< -36°F

< 0.3% by weight

Not Enough to Measure

SAMPLE #5

Well: Jicarilla "J" 10E

API Gravity @ 60°F

Cloud Point

Pour Point

Paraffin Content

Asphaltene Content

Zone: Mesa Verde

62.0

< -36°F

< -36°F

< 0.3% by weight

< 0.3% by weight
(none observed)

SAMPLE #6

Well: Jicarilla "J" 12E

API Gravity @ 60°F

Cloud Point

Pour Point

Paraffin Content

Asphaltene Content

Zone: Mesa Verde

60.0

34°F

< -36°F

< 0.3% by weight
(paraffin observed but
not measurable)

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

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

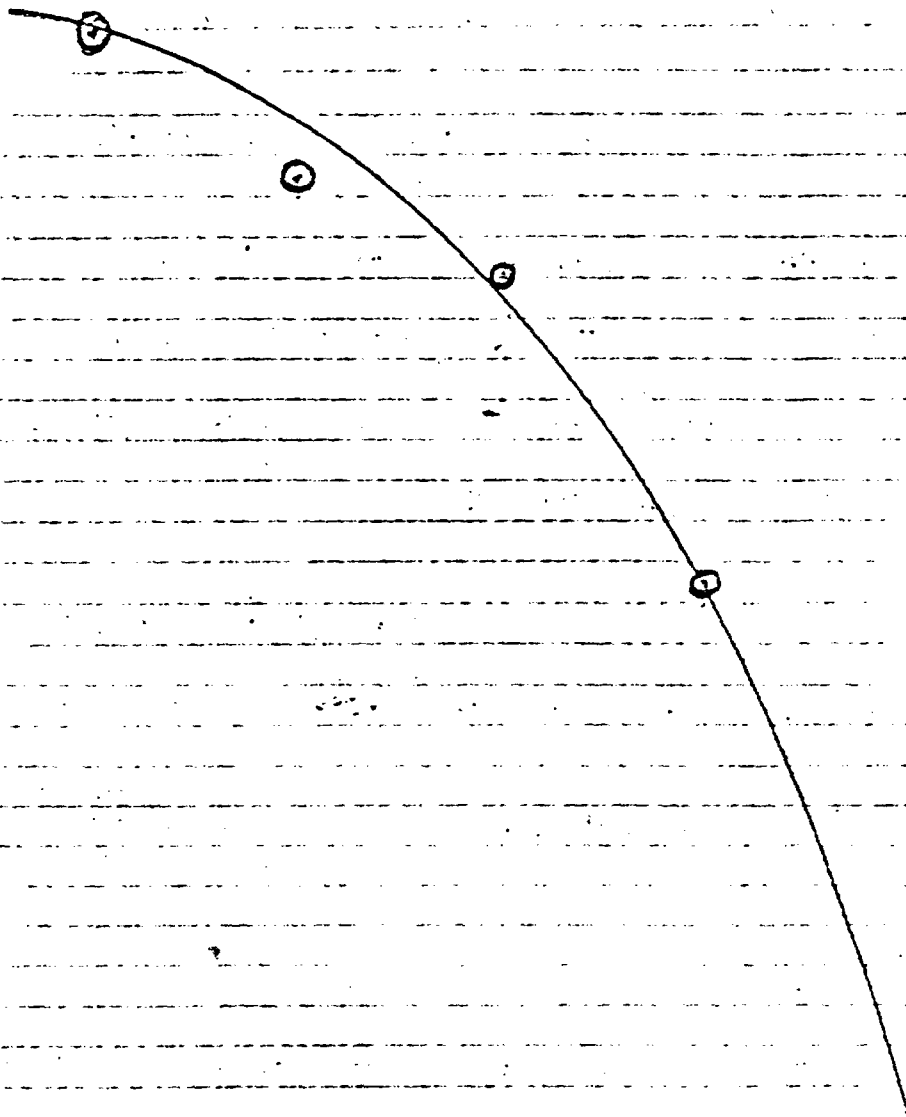
$$T_s = 180 \left(\frac{500}{2000} \right)^{0.1667}$$

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

NOTE:

A total cooldown of 38°F would be expected.

Cloud Point Temperature vs Dilution Factor



Subject Oil: McCruden C#1 GALLUP/DAKOTA

DILUANT: Jic "J" 10 E MESAVERDE OIL

10 20 30 40 50
Concentration of Sample, % dilution w/ LV 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.

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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.