Rocky Mountain Region

LABORATORY INVESTIGATION

OF

JICARILLA N #2

DAKOTA AND GALLUP FORMATIONS

OCTOBER 10, 1985

PREPARED FOR

UNION TEXAS PETROLEUM
MIKE PIPPIN
PETROLEUM ENGINEER

PREPARED BY

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SUMMARY OF RESULTS

1. No precipitation of materials was observed from the admixture of oils under consideration.
2. No emulsion testing was performed. Emulsion effects was not a concern as very little water accompanies hydrocarbon production. The little water that is produced is easily separated in normal surface operations.
3. The initial paraffin deposition dropped markedly with increased dilution.
4. Adiabatic cooling due to gas expansion was investigated and found not to alter paraffin deposition significantly.

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On Monday, October 7, 1985, a request for laboratory work on the Dakota and Gallup produced oils from the Jicarilla N #2 was placed by Mike Pippin, Petroleum Engineer of Union Texas Petroleum Corporation.

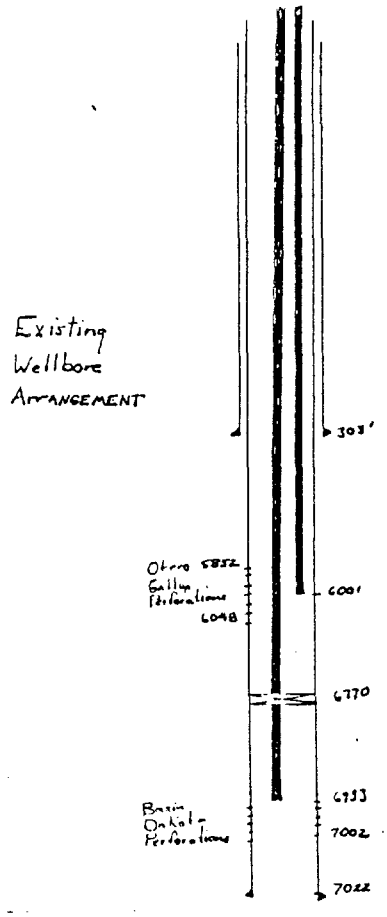
PURPOSE

Mike requested that we investigate the concern of possible detrimental effects due to comingling of the Dakota and Gallup produced oils from the Jicarilla N #2.

INVESTIGATION

1. Background Information

(A)



(B)

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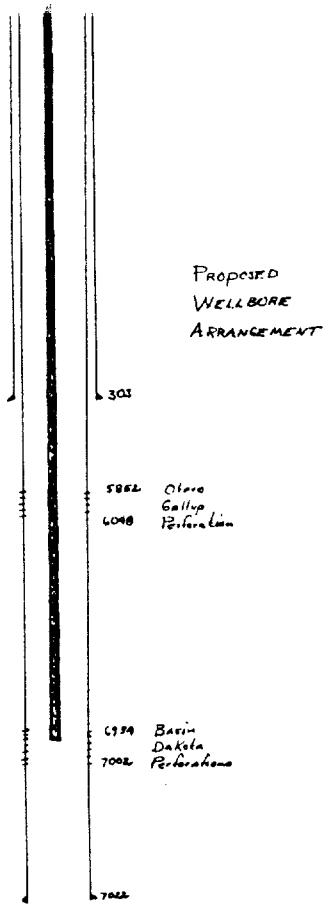

(C) BHST Gradient: 2.° F/100 ft depth

(D) Paraffin deposition problems occur mainly from surface down to 1000 ft. of depth.

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

(F) Paraffin deposition increases with decreasing temperature.

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2. Concerns to be addressed in analysis:
   a. The precipitation of materials produced by the admixture of oils of potentially different constitution.
   b. The formation of emulsion due to the admixture of different fluids.
   c. Increased paraffin deposition by additive properties of oils.
   d. Increased paraffin deposition due to the decrease in temperature as a result of 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. Mixing of oils in appropriate cases with additional paraffin testing to determine resulting fluid characteristics.
   c. Discussion with Mike Pippen regarding the well bore production and conditions.

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DATA

WELL NAME	JICARILLA N #2
LEGAL DESCRIPTION	790' FSL 1850' FWL Sec. 3 T24N R5W Rio Arriba County, N.M.

SAMPLE #1

Formation	Otero-Gallup
Perforation Depth (ft)	5852-6048
API Gravity @ 60°F	39.8°
Cloud Point	Unable to determine due to the color of the oil
Pour Point	26°F
Paraffin Content	8.84%
Asphaltene Content	5.10%

SAMPLE #2

Formation	Basin-Dakota
Perforation Depth (ft)	6934-7002'
API Gravity @ 60°F	58.2°
Cloud Point	Unable to detrmine due to the color of the oil
Pour Point	$<$-30°F
Paraffin Content	No paraffins observed
Asphaltene Content	Not enough to measure

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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

$T_r = 138^{\circ}F$

P_s = 300 psi

P_r = 1150 psi

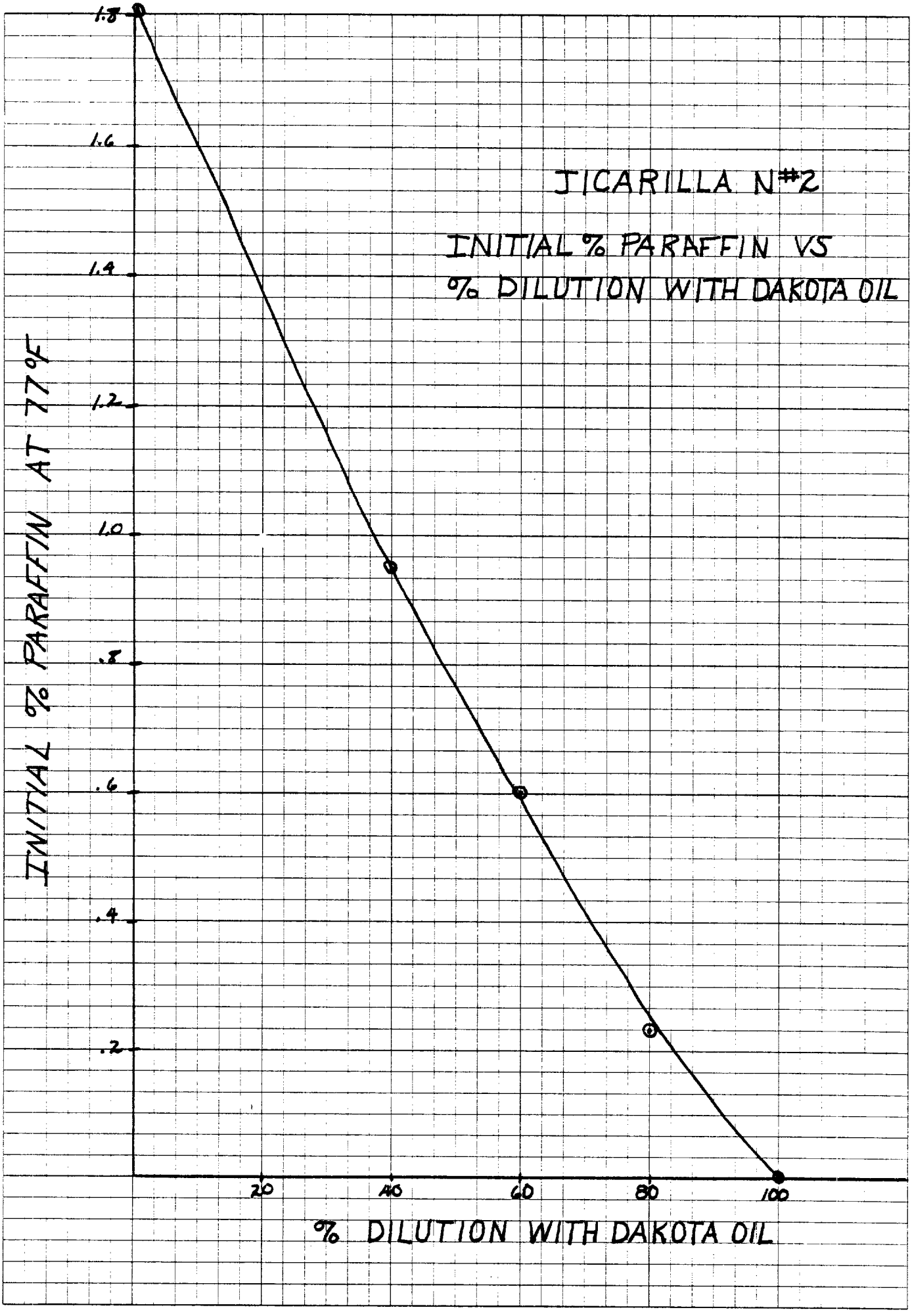
$K = 1.2$

$$T_s = 138 \left(\frac{300}{1150}\right)^{0.1667}$$

$T_s = 110^{\circ}F$

NOTE:

A total cooldown of 28° F would be expected



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DISCUSSION

The API analyses conducted resulted in the awareness that the possible paraffin deposition would increase with increasing volume fraction of Gallup produced oil. Any addition of Dakota oil would only serve to decrease the possible amount of paraffin deposition.

The knowledge that no appreciable water production accompanies any hydrocarbon production in the wells eliminated the concern over emulsion formation. The small amount of water produced is easily separated under normal surface operations.

The problems of precipitations was eliminated after mixing oils from the Dakota and Gallup formations. No precipitates was observed at room temperature. The various mixtures, by volume, of the oil was further tested by the addition of methyl ethyl Ketone (MEK) and filtered through (1) one micron paper at room temperature. The results are presented on Figure 3. 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 Dakota and Gallup oils 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 Dakota zone from the Jicarilla N #2 was producing 1/2 bopd and 40 Mcfd and the Gallup zone producing 1 bopd and 24 Mcfd brought about a concern regarding increased paraffin deposition due to the cool down of fluids through gas expansion. Using a relationship for temperature change with adiabatic expansion of gases from Perry's Handbook of Chemical Engineering a calculation was made that would account for maximum cool down of fluids due to gas expansion. This cool down assumes adiabatic conditions and does not take into account

temperature effects imposed by other zones. Therefore, a decision was made to test the Dakota/Gallup oils in varying proportions and determine the initial paraffin depositions at room temperature to evaluate the increased or decreased deposition efficiency of paraffin resulting from mixing.

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
DIVISION FOR THE PURPOSE OF
CONSIDERING:

CASE NO. 8768
Order No. R-8106

APPLICATION OF UNION TEXAS PETROLEUM
CORPORATION FOR THE EXTENSION OF THE
HORIZONTAL LIMITS OF THE WEST LINDRITH
GALLUP-DAKOTA OIL POOL AND THE
CONTRACTION OF THE HORIZONTAL LIMITS
OF THE OTERO-GALLUP OIL POOL,
RIO ARRIBA COUNTY, NEW MEXICO.

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 8 a.m. on November 21, 1985, at Santa Fe, New Mexico, before Examiner Michael E. Stogner.

NOW, on this 26th day of December, 1985, the Division Director, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS THAT:

(1) Due public notice having been given as required by law, the Division has jurisdiction of this cause and the subject matter thereof.

(2) The applicant, Union Texas Petroleum Corporation, is the owner of certain oil and gas interests in Sections 3, 4, 9, and 10, Township 24 North, Range 5 West, NMPM, and in Sections 33 and 34, Township 25 North, Range 5 West, NMPM, all in Rio Arriba County, New Mexico.

(3) The applicant seeks the contraction of the horizontal limits of the Otero-Gallup Oil Pool by the deletion therefrom of the following described lands:

RIO ARRIBA COUNTY, NEW MEXICO
TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Irregular Section 3: W/2
Irregular Section 4: S/2
Section 9: N/2
Section 10: NW/4, SW/4 NE/4

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 33: SE/4
Section 34: SW/4

(4) The applicant further seeks the concomitant extension of the horizontal limits of the West Lindrith Gallup-Dakota Oil Pool to include the following described lands in Rio Arriba County, New Mexico:

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Irregular Section 3: W/2, SE/4, S/2 NE/4
Irregular Section 4: S/2
Section 9: N/2
Section 10: N/2

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 33: SE/4
Section 34: SW/4

(5) Several wells within the proposed extension area described in Finding Paragraph No. (4) above have previously received authority for downhole commingling of Gallup and Dakota production under provisions of Division Orders Nos. R-5354 and R-5354-A, dated January 17, 1977 and February 8, 1977, respectively.

(6) The evidence presented in this case indicates that the aforesaid wells in the proposed extension area are each capable of draining 160-acres, which is the proper spacing for wells within the West Lindrith Gallup-Dakota Oil Pool.

(7) The standard spacing and proration unit size in the Otero-Gallup Oil Pool is 40-acres.

(8) No party appeared and objected to the proposed contraction and extension of said pools.

(9) Contraction of the horizontal limits of the Otero-Gallup Oil Pool and the concomitant extension of the West Lindrith Gallup-Dakota Oil Pool, all as described in Finding Paragraphs Nos. (3) and (4) above, will permit the proper

development of the aforesaid pools, will not cause waste nor impair correlative rights and should therefore be approved, subject to the following provisions:

A. The location of any well reclassified from the Otero-Gallup Oil Pool to the West Lindrith Gallup-Dakota Oil Pool whose location does not comply with the Special Pool Rules for the West Lindrith Gallup-Dakota Oil Pool should be automatically approved as an exception to the location requirements of said special pool rules.

B. The operator of any well so reclassified should have 60 days from the date of entry of this order in which to file new Division Forms C-102, Well Location and Acreage Dedication Plat, for each well, dedicating thereto 160-acres, or to obtain approval of a non-standard proration unit.

IT IS THEREFORE ORDERED THAT:

(1) The Otero-Gallup Oil Pool in Rio Arriba County, New Mexico, as heretofore classified, defined, and described, is hereby contracted by the deletion therefrom of the following described area:

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Irregular Section 3: W/2
Irregular Section 4: S/2
Section 9: N/2
Section 10: NW/4, SW/4 NE/4

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 33: SE/4
Section 34: SW/4

(2) The West Lindrith Gallup-Dakota Oil Pool in Rio Arriba County, New Mexico, as heretofore classified, defined, and described, is hereby extended to include therein the following described area:

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Irregular Section 3: W/2, SE/4, S/2 NE/4
Irregular Section 4: S/2
Section 9: N/2
Section 10: N/2

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 33: SE/4
Section 34: SW/4

(3) Any well drilling to or completed in the Gallup and/or Dakota formations within the lands described in Ordering Paragraph No. (2), above, whose location does not comply with the well location requirements of the West Lindrith Gallup-Dakota Oil Pool as set forth in Order No. R-4314, is hereby granted an exception to said well location requirements.

IT IS FURTHER ORDERED THAT:

(4) Pursuant to Section 70-2-18, NMSA (1978), any well, which by virtue of this order, is subject to pool rules providing for spacing and proration units larger than the one which is presently dedicated thereto, shall have 60 days from the date of entry of this order in which to file new Forms C-102 dedicating a standard unit for the pool to said well, or to obtain a non-standard unit approved by the Division. Pending such compliance, the well shall receive a maximum allowable in the same proportion to a standard allowable for the pool that the acreage dedicated to the well bears to a standard unit for the pool. Failure to file form C-102 dedicating a standard unit to the well or to obtain a non-standard unit approved by the Division within said 60-day period shall subject the well to cancellation of allowable.

(5) Jurisdiction of this cause and the subject matter thereof is retained for the entry of such further orders as the Division may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year herein-above designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

R. L. STAMETS
Director

S E A L

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

CASE NO. 8768
Order No. R-8106-A

APPLICATION OF UNION TEXAS PETROLEUM CORPORATION FOR THE EXTENSION OF THE HORIZONTAL LIMITS OF THE WEST LINDRITH GALLUP-DAKOTA OIL POOL AND THE CONTRACTION OF THE HORIZONTAL LIMITS OF THE OTERO-GALLUP OIL POOL, RIO ARRIBA COUNTY, NEW MEXICO.

NUNC PRO TUNC ORDER

BY THE DIVISION:

It appearing to the Division that Order No. R-8106, dated December 26, 1985, does not correctly state the intended order of the Division,

IT IS THEREFORE ORDERED THAT:

(1) Finding Paragraph No. (4) on page 2 of Division Order No. R-8106 is hereby corrected to read in its entirety as follows:

"(4) The applicant further seeks the concomitant extension of the horizontal limits of the West Lindrith Gallup-Dakota Oil Pool to include the following described lands in Rio Arriba County, New Mexico:

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Irregular Section 3: W/2 and SE/4
Irregular Section 4: S/2
Section 9: N/2
Section 10: N/2

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 33: SE/4
Section 34: SW/4"

(2) Ordering Paragraph No. (2) on pages 3 and 4 of said Order No. R-8106 is hereby corrected to read in its entirety as follows:

"(2) The West Lindrith Gallup-Dakota Oil Pool in Rio Arriba County, New Mexico, as heretofore classified, defined, and described, is hereby extended to include therein the following described area:

TOWNSHIP 24 NORTH, RANGE 5 WEST, NMPM
Irregular Section 3: W/2 and SE/4
Irregular Section 4: S/2
Section 9: N/2
Section 10: N/2

TOWNSHIP 25 NORTH, RANGE 5 WEST, NMPM
Section 33: SE/4
Section 34: SW/4"

(3) The corrections set forth in this order be entered nunc pro tunc as of December 26, 1985.

DONE at Santa Fe, New Mexico, on this 17th day of January, 1986.

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STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

R. L. STAMETS
Director

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