

NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

CF 11322

R-10440

December 28, 1995

Yates Petroleum Corporation
105 South Fourth Street
Artesia, New Mexico 88201

Attn: Mr. Ray Stall

**RE: Injection Pressure Increase Trailblazer Gas Storage Project,
Trailblazer 'ANL' Well No.2, Chaves County, New Mexico**

Dear Mr. Stall:

Reference is made to your request dated December 12, 1995 to increase the surface injection pressure on one well on the above referenced project. This request is based on standard engineering practices, whereby the equivalent gas pressure including hydrostatic shall be substituted for the previously permitted water injection pressure, thereby exerting similar bottom hole pressure in the subject wellbore. My staff has reviewed the data accompanying your request and we feel an increase in injection pressure on this well is justified at this time.

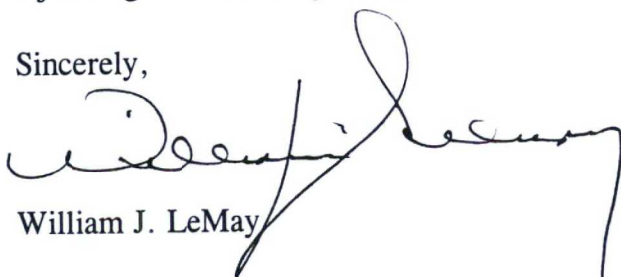
You are therefore authorized to increase the surface injection pressure on the following well:

Well and Location	Maximum Gas Injection Surface Pressure
Trailblazer 'ANL' Well No.2 Unit H, Section 11, Township 8 South, Range 27 East	1440 PSIG
This well located in Chaves County, New Mexico.	

FURTHER: The subject request with all accompanying data, and the resulting injection pressure increase is hereby made a part of Division Order R-10440. All other provisions of such shall remain in full force and effect.

The Division Director may rescind this injection pressure increase if it becomes apparent that the injected gas is not being confined to the injection zone or is endangering any fresh water aquifers.

Sincerely,



William J. LeMay

OFFICE OF THE SECRETARY - P. O. BOX 6429 - SANTA FE, NM 87505-6429 - (505) 827-5950
ADMINISTRATIVE SERVICES DIVISION - P. O. BOX 6429 - SANTA FE, NM 87505-6429 - (505) 827-5925
ENERGY CONSERVATION AND MANAGEMENT DIVISION - P. O. BOX 6429 - SANTA FE, NM 87505-6429 - (505) 827-5900
FORESTRY AND RESOURCES CONSERVATION DIVISION - P. O. BOX 1948 - SANTA FE, NM 87504-1948 - (505) 827-5830
MINING AND MINERALS DIVISION - P. O. BOX 6429 - SANTA FE, NM 87505-6429 - (505) 827-5970
OIL CONSERVATION DIVISION - P. O. BOX 6429 - SANTA FE, NM 87505-6429 - (505) 827-7131
PARK AND RECREATION DIVISION - P. O. BOX 1147 - SANTA FE, NM 87504-1147 - (505) 827-7465

Injection Pressure Increase
Yates Petroleum Corporation
December 28, 1995
Page 2

Director

WJL/BES

File: Case File No.11322

cc: Oil Conservation Division - Artesia

December 12, 1995

State Of New Mexico
Energy, Minerals, And Natural Resources Department
Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico 87504 - 2088

Attention: Mr. Ben Stone

Gentlemen;

Order No. R - 10440 dated August 21, 1995, approved Yates Petroleum Corporation's application for the Trailblazer Temporary Gas Storage Project authorizing storage in the San Andres interval 2159 feet to 2174 feet. Yates Petroleum Corporation requested and was granted a surface injection pressure of 500 psi. After further review, we now anticipate that a higher injection pressure may be necessary to inject the 400 MCFD of gas specified in our original application. Additional compression may also be required.

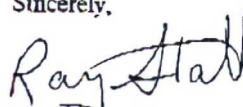
General surface pressure limits of 0.2 psi per foot of depth when injecting water are provided by NMOCC memo No. 3-77 to Operators dated August 24, 1977. This translates to an overall pressure gradient of 0.67 psi per foot of depth (for 9.0 pound per gallon water), thereby maintaining injection operations below fracture gradient.

Inasmuch as only gas will be injected into the Trailblazer ANL State #2, a higher surface pressure limit based on the lighter gas column is sought. Attachments I and II show that surface injection pressure of 1287 psi for a gas column described by the attached gas analysis, Attachment III; and 432 psi with a 9.0 pound per gallon water column will result in the same bottom hole pressure. Both systems will exert a pressure of 1442 psi at a depth of 2159 feet, the top of perforations, keeping operations below fracture gradient.

Accordingly, Yates Petroleum Corporation hereby respectfully requests that Order No. R - 10440 be amended to allow a maximum surface pressure limit of 1287 psi.

If additional information is needed please advise. Thank you.

Sincerely,


Ray Stall
Engineer

WRITE LETTER AMT
ORDER TO 1442
GAVE VERBAL
12.14.95
TO RAY STALL
ON
(Signature)

ATTACHMENT I

TRAILBLAZER TEMPORARY GAS STORAGE PROJECT

Bottom Hole Pressure = Surface Pressure + Hydrostatic Pressure - Friction Pressure

Friction Pressure will be considered negligible due to low rates and small tubing length in this case.

I. WATER SYSTEM

$$\text{BHP} = P(\text{surface}) + P(\text{hydrostatic})$$

If $P(\text{surface})$ is limited to 0.2 psi per foot of depth, then

$$P(\text{surface}) = 0.2 \text{ psi per foot} * 2159 \text{ feet} = 431.8 \text{ psi}$$

If water is 9.0 pound per gallon (150,000 ppm NaCl) which exerts a hydrostatic gradient of 0.468 psi per foot, then

$$P(\text{hydrostatic}) = 0.468 \text{ psi per foot} * 2159 \text{ feet} = 1010.4 \text{ psi}$$

$$\text{Then, BHP}(\text{maximum}) = 431.8 + 1010.4 = 1442.2 \text{ psi}$$

II. GAS SYSTEM

$$P(\text{surface}) = \text{BHP} - P(\text{hydrostatic})$$

For $\text{BHP} = 1442 \text{ psi}$, and $P(\text{hydrostatic}) = 155 \text{ psi}$ (see ATTACHMENTS II and III)

$$\text{Then, } P(\text{surface maximum}) = 1442 - 155 = 1287 \text{ psi}$$

ATTACHMENT II

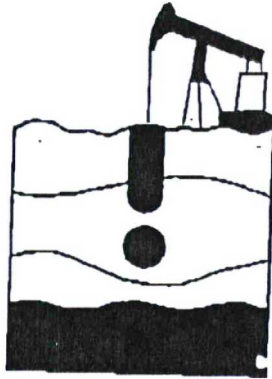
-- BHP or Pwf Calculation --

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Douglas M Boone
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Version 3.0M
06-Dec-95

Well Name: Trailblazer
Gas Gravity: 0.99 % N2 1.89
Condensate (yes=1): 1 % CO2 16.89
Reservoir Temp: 96 F % H2S 2.30
Surface Temp: 60 F Pc = 735.19
Depth of Zone: 2,159 Feet Tc = 443.99
Tubing Diameter: 2 inch

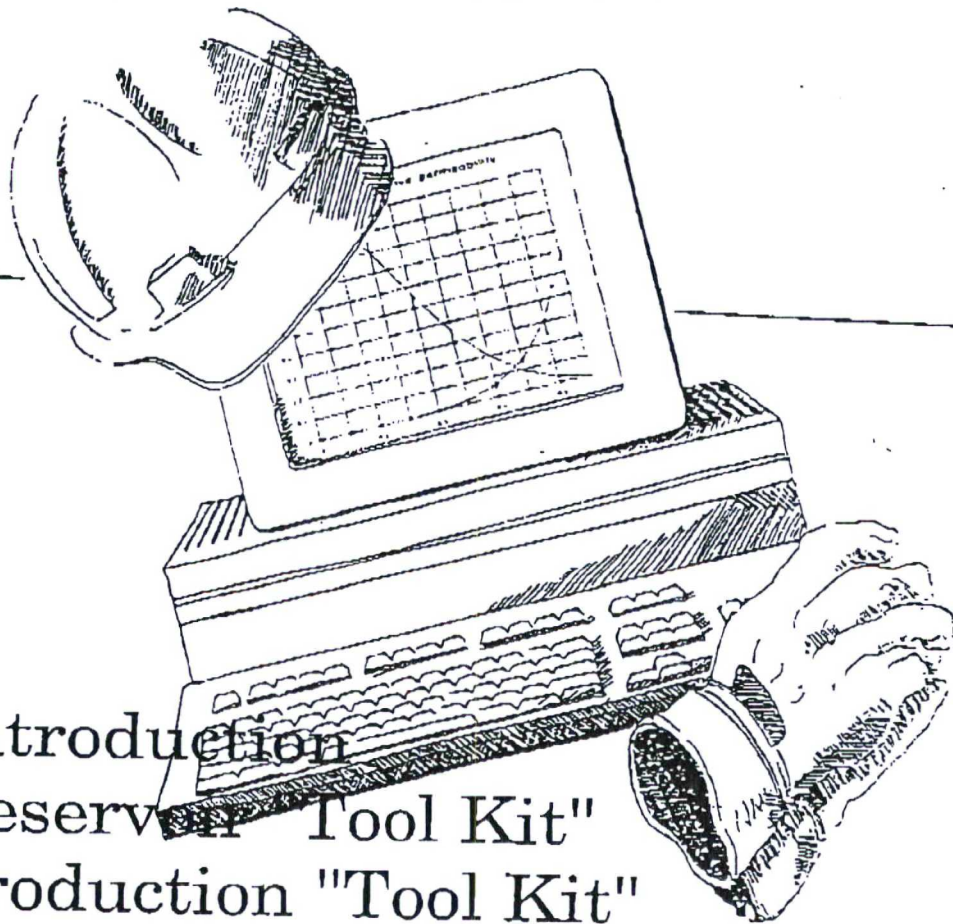
SITP	Rate	BHP	Z	BHP/Z
Psia	Mcf/d	Psia		psia
1,287	0	1,442	0.69	2,099

ATTACHMENT II (cont.)



Integrity Consulting

"Tool Kit" Series Reference Manual



Introduction
Reservoir "Tool Kit"
Production "Tool Kit"
Economic "Tool Kit"

ATTACHMENT II (cont.)

BHPWHP

This program calculates the bottom hole pressure at the formation face for either a flowing or shut-in gas well. The shut-in bottom hole pressure is calculated if a zero is entered for the gas rate. Naturally, it is preferred to measure bottom-hole pressures with a down hole gauge and surface pressures by gauge or deadweight. For many purposes, a sufficiently accurate value for one value or the other can be obtained by calculating the difference in pressure due to the weight of the gas as well as (in the case of flowing wells) frictional pressure drops.

The mathematical solution to this problem has been evaluated by many authors with most techniques requiring an iterative procedure to calculate the pressure drop. BHPWHP uses a modified version of the Cullender-Smith technique, which requires iteration for the average Z-factor. This procedure is suitable for depths less than about 12,000 FT.

$$BHP^2 = FTP^2 + \frac{GasG * T_{avg} * F * L(e^{A-1}) * QG^2}{40,000 * A * d^5}$$

$$A = \frac{GasG * TVD}{26.67 * T_{avg} * Z_{avg}}$$

BHP = Bottom hole pressure (psia)
 FTP = Flowing tubing pressure (psia)
 GasG = Gas gravity
 T_{avg} = Average temperature (F)
 T_{avg}' = Average temperature (R)
 F = Friction factor
 L = Tubing length (ft)
 QG = Gas rate (Mcf/d)
 d = Tubing diameter (in)
 TVD = True vertical depth (ft)
 Z_{avg} = Average Z factor

Friction factors are calculated using the equations presented by Cullender and Smith. These equations presume an absolute pipe roughness of 0.0006 inches. Better results may be obtained when measured flowing or static bottom-hole pressures can be compared to flowing or static surface pressures. The user can then vary the values for length, diameter, and effective gas gravity until values calculated by BHPWHP agree with the measurements. Doing so will assure better subsequent calculations for that well.

No explicit provisions are provided for liquid production. This can be done by altering the effective gas gravity. Major problems affecting the bottom hole calculation include unknown amounts of liquid hydrocarbons or water in the wellbore tubing, unusual temperature distributions, variations in gas Z-factors from the correlation, and changes in fluid composition with depth for condensate systems. There is a program named GASGRAV that will help calculate an effective gas gravity for different condensate yields.

ATTACHMENT II (cont.)

Figure #1 illustrates the "Information" screen or how the program will appear when first retrieved. The individual numbers might be different but the data descriptions and input areas will be the same. If the user has anything else on the screen then the [HOME] key should be pressed to come back to the "Information" screen. The normal arrow keys are used to move around this screen and to make data entries. The user can get brief instructions on how to use this program by pressing the [Alt][H] key while in the "Information" screen. These instructions are shown in Figure #2. Return to the "Information" screen by pressing the [HOME]. The user can make data changes only in the highlighted cells. The highlighted input cells are the cells that are either shown in green on color screens or are reverse video on monochrome monitors.

This program has some additional macros to aid in printing. [Alt][S] is used to print the header information and the first calculated pressures. The user can then enter additional pressures and rates. Between each pressure-rate entry the [Alt][P] macro is used to print just the new data points. Press [Alt][E] to eject the printed page.

Macros Utilized

- [Alt][H] - displays the "instruction" screen
- [Alt][S] - Prints header input information
- [Alt][P] - Prints a new data row
- [Alt][E] - Eject page from printer

The required data can be entered in any order the user desires and the results seen at any time by pressing the [F9] key which is the Lotus calculation key.

ATTACHMENT II (cont.)

- BHP or Pwf Calculation -

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Version 3.0M
15-Mar-93

Well Name: [REDACTED]
Gas Gravity: [REDACTED]
Condensate (yes=1): [REDACTED]
Reservoir Temp: [REDACTED] F
Surface Temp: [REDACTED] F
Depth of Zone: [REDACTED] Feet
Tubing Diameter: [REDACTED] inch

% N2 [REDACTED]
% CO [REDACTED]
% H2S [REDACTED]
Pc = 870.55
Tc = 386.63

FTP Psia	Rate Mcf/d	Pwf Psia	Z	Pwf/Z psia
[REDACTED]	[REDACTED]	5.725	1.047	5.467

INSTRUCTIONS:

- 1) Enter the shut-in tubing or flowing pressure.
- 2) Press [F9] to calculate the BHP and Z factor
- 3) To print for the first time press [Alt][S]
Then press [Alt][P] to print out new pressure-rate values
- 4) To eject page press [Alt][E]
- 5) Press [Home] to return to information screen.
- 6) Press [Alt][M] to change units

ATTACHMENT III

04-04-1995 07:38AM

Wildcat Measurement Service

1 505 623 5790

P.02

Wildcat Measurement Service

005 2.0

PO Box 8034

Roswell, New Mexico 88202

Office 1505-623-5790

"Quality and Service is our first concern"

Run No. 950404-01

Date Run 04/04/95

Date Sampled 04/03/95

Analysis for YATES PETROLEUM CORPORATION

GPANGL160

Field:

Well Name: QUINCY BATTERY

Producer: YATES PETROLEUM CORPORATION

Sta. Number:

County: CHAVES

State: NM

Purpose: SPOT

Sampled By: KARL HAERY

Sampling Temp: 61 DEG F

Atmos Temp: 57 DEG F

Volume/day:

Formation:

Pressure on Cylinder: 25 PSIG

Line Pressure: 38.2 PSIA

GAS COMPONENT ANALYSIS

Pressure Base: 14.730

Mol % GPM

Real BTU Dry: 1200

Real BTU Wet: 1179

Real Calc. Specific Gravity: 0.992

Field Specific Gravity: 0.990

Carbon Dioxide	CO2	16.805	
Nitrogen	N2	1.887	
Hydrogen Sulfide	H2S	2.300	
Methane	C1	52.029	8.819
Ethane	C2	12.395	3.315
Propane	C3	0.425	2.322
Iso-Butane	IC4	1.130	0.370
Normal-Butane	NC4	2.591	0.817
Iso-Pentane	IC5	0.725	0.265
Normal-Pentane	NC5	0.607	0.249
Hexanes Plus	C6+	0.947	0.407

Standard Pressure: 14.696

BTU Dry: 1197

BTU Wet: 1176

I Factor: 0.9949

N Value: 1.2645

Avg Mol Weight: 28.5835

Avg Cuft/Gal: 53.4979

24 Lb Product: 1.3891

Methanol GPM: 16.563

Ethanol GPM: 7.744

Propanol GPM: 4.429

Butanol GPM: 2.108

Pentanol GPM: 0.921

TOTAL 100.000 16.563

REMARKS:

H2S ON LOCATION: 2.300% = 23,000 PPM

Tue Apr 04 07:29:32 1995

Approved by: DON NORMAN

12-12-95

$$\overline{F_A x}$$

To: Ben Stone
NMOC, Santa Fe
From: Ray Stoll
Yater Pet Corp.

Ben,
Does this provide the necessary information
for the requested amendment to Order No. R-10440.
If it does, I will submit on company letterhead.
If not I will try to get whatever else you
might need.

Thank you,
Ray Hall



STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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

CASE NO. 11322
ORDER NO. R-10440

**APPLICATION OF YATES PETROLEUM CORPORATION FOR
UNDERGROUND GAS STORAGE, CHAVES COUNTY, NEW MEXICO.**

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 8:15 a.m. on June 29, 1995, in Hobbs, New Mexico, before Examiner Michael E. Stogner.

NOW, on this 21st day of August, 1995, the Division Director, having considered 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, Yates Petroleum Corporation ("Yates"), seeks authority to initiate a temporary underground gas storage project in the Undesignated Southeast Acme-San Andres Pool by reinjecting produced casinghead gas from the Southeast Acme-San Andres Pool into its existing Trailblazer "ANL" Well No. 2, located 2310 feet from the North line and 330 feet from the East line, in the SE/4 NE/4 (Unit H) of Section 11, Township 8 South, Range 27 East, NMPM, Chaves County, New Mexico.
- (3) The casinghead gas to be reinjected into the Trailblazer "ANL" Well No. 2 will be produced from the offsetting Quincy "AMQ" State lease to the east in Section 12, Township 8 South, Range 27 East, NMPM, Chaves County, New Mexico, which has common working interest and royalty interest ownership and a common state beneficiary (Water Reservoirs) with the state lease on which this injection well is located.
- (4) Subsequent to the hearing the Commissioner of Public Lands for the State of New Mexico, by letter dated July 27, 1995, authorized said temporary reinjection project.

(5) Injection and storage will be for a temporary period of time and will continue only until such time as a pipeline can be constructed to transport said casinghead gas to a gas sales plant.

(6) The Trailblazer "ANL" Well No. 2 is capable of producing approximately 1.0 MMCF of gas per day and 18 barrels of oil from the subject pool. By temporarily converting this well to injection, casinghead gas can be stored in the gas cap of the San Andres P₁ zone and then, after a pipeline is constructed, produced along with the gas that is currently recoverable from this zone.

(7) The evidence presented by the applicant demonstrated that storage of gas in the Trailblazer "ANL" Well No. 2 will benefit other wells in the pool that are currently unable to produce and will result in the more efficient production of oil from the pool thereby preventing waste.

(8) No offsetting operator or interested party appeared at the hearing in opposition to the subject application.

(9) The applicant should be authorized to store casinghead gas in the San Andres P₁ porosity zone of the Undesignated Southeast Acme-San Andres Pool by injection in its Trailblazer "ANL" Well No. 2 through the perforated interval from approximately 2159 feet to 2174 feet.

(10) The injection should be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 2074 feet; a gauge or other leak detection device should be attached to the casing-tubing annulus in order to determine leaking in the casing, tubing or packer.

(11) Prior to commencing injection operations in the subject well, the casing should be pressure tested throughout the interval from the surface down to the proposed packer setting depth to assure the integrity of such casing.

(12) The injection well or pressurization system should be initially equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to no more than 500 psi.

(13) The operator should give advance notification to the supervisor of the Artesia District Office of the Division of the date and time of the installation of injection equipment and of the mechanical integrity pressure test in order that the same may be witnessed.

(14) The injection authority granted herein for the Trailblazer "ANL" Well No. 2 should terminate: (a) one year after the effective date of this Order if the operator has not commenced injection operations into the subject well, provided however, the

Division, upon written request by the operator, may grant an extension thereof for good cause shown; or (b) the date the operator returns the Trailblazer "ANL" Well No. 2 to production.

IT IS THEREFORE ORDERED THAT:

(1) The application of Yates Petroleum Corporation for a temporary underground casinghead gas storage project is approved and the applicant is hereby authorized to reinject produced Southeast Acme-San Andres Pool casinghead gas from the Quincy "AMQ" State lease located in Section 12, Township 8 South, Range 27 East, NMPM, Chaves County, New Mexico, into the San Andres P₁ porosity zone of the Undesignated Southeast Acme-San Andres Pool through its existing Trailblazer "ANL" Well No. 2 located 2310 feet from the North line and 330 feet from the East line, in the SE/4 NE/4 (Unit H) of Section 11, Township 8 South, Range 27 East, NMPM, Chaves County, New Mexico.

(2) The applicant shall take all steps necessary to ensure that the injected gas enters only the proposed injection interval and is not permitted to escape to other formations or onto the surface from injection, production, or plugged and abandoned wells.

(3) Injection in the Trailblazer "ANL" Well No. 2 shall be accomplished through 2 7/8-inch tubing installed in a packer set at approximately 2074 feet with an approved pressure gauge or attention-attracting leak detection device.

(4) The injection well or pressurization system shall be equipped with a pressure control device or acceptable substitute which will limit the surface injection pressure to 500 psi.

(5) Prior to commencing injection operations in the Trailblazer "ANL" Well No. 2, the casing shall be pressure-tested throughout the interval from the surface down to the proposed packer setting depth to assure the integrity of such casing.

(6) The operator shall give advance notification to the supervisor of the Artesia District Office of the Division of the date and time of the installation of injection equipment and of the mechanical integrity pressure test in order that the same may be witnessed.

(7) The applicant shall immediately notify the supervisor of the Artesia District Office of the Division of the failure of the tubing, casing or packer in the injection well, and shall take such steps as may be timely and necessary to correct such failure or leakage.

(8) The subject project is hereby designated the Trailblazer Temporary Gas Storage Project, and the applicant shall conduct operations in accordance with Division

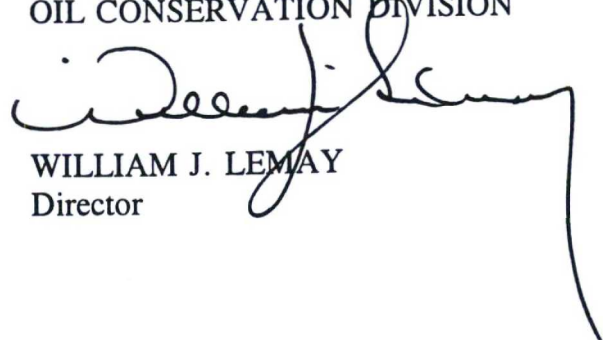
Rule Nos. 701 through 708 and shall submit monthly reports in accordance with Division Rules 706 and 1131-A.

(9) The injection authority granted herein for the Trailblazer "ANL" Well No. 2 shall terminate (a) one year after the effective date of this Order if the operator has not commenced injection operations into the subject well, provided however, the Division, upon written request by the operator, may grant an extension thereof for good cause shown; or (b) the date the operator returns the Trailblazer "ANL" Well No. 2 to production.

(10) Jurisdiction of this cause 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 hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

A handwritten signature in black ink, appearing to read 'William J. Lemay', is written over the typed name and title. The signature is fluid and cursive, with a long, sweeping line extending from the end of the name down towards the bottom right of the page.

WILLIAM J. LEMAY
Director

S E A L