



STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION



BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

July 9, 1993

KELLAHIN AND KELLAHIN
Attorneys at Law
P. O. Drawer 2265
Santa Fe, New Mexico 87504

RE: CASE NOS. 10721, 10722, 10723, 10724, 10725
ORDER NO. R-9920

Dear Sir:

Enclosed herewith are two copies of the above-referenced Division order recently entered in the subject cases.

Sincerely,

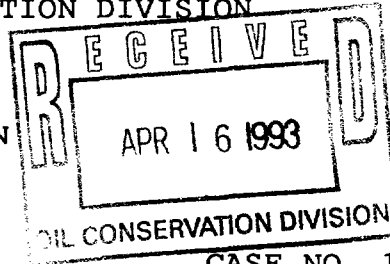
A handwritten signature in cursive script that reads "Sally E. Leichtle".

Sally E. Leichtle
Administrative Secretary

cc: BLM - Farmington
Steve Keene - TRD
Donna McDonald - OCD
Aztec OCD Office

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. 10722

APPLICATION OF MERIDIAN OIL INC.
FOR DOWNHOLE COMMINGLING,
SAN JUAN COUNTY, NEW MEXICO.

PRE-HEARING STATEMENT

This pre-hearing statement is submitted by MERIDIAN OIL
INC. as required by the Oil Conservation Division.

APPEARANCE OF PARTIES

APPLICANT

MERIDIAN OIL INC.
P. O. Box 4289
Farmington, N.M. 87499
Attn: Alan Alexander
(505) 326-9757

ATTORNEY

W. Thomas Kellahin
KELLAHIN AND KELLAHIN
P.O. Box 2265
Santa Fe, NM 87504
(505) 982-4285

OPPOSITION OR OTHER PARTY

ATTORNEY

N/A

STATEMENT OF CASE

APPLICANT:

Meridian Oil Inc. seeks approval to downhole commingle Fulcher Kutz-Pictured Cliffs Gas Pool (NE/4 dedication) and Basin-Fruitland Coal Gas Pool (E/2 dedication) production within the wellbore of its proposed McADAMS NO. 500 WELL to be drilled at a standard gas well location in Unit A of Section 28, T27N, R10W, San Juan County, New Mexico. As set forth in its application, Meridian will establish, among other things, that:

(1) Ownership is different between the two spacing units but correlative rights will not be impaired because:

(a) there are insufficient Pictured Cliffs gas reserves under either the NE/4 or SE/4 of Section 28 to justify a "stand alone" Pictured Cliff well,

(b) the NE/4 of Section 28 has better potential for a successful Fruitland Coal Gas Well, and

(c) The Pictured Cliffs gas in the spacing unit cannot economically be produced in any other means than downhole commingling;

(2) No reservoir damage will occur, and

(3) Waste will be prevented by creating an opportunity to recovery gas that might not otherwise be recovered.

The proposed Basin-Fruitland Coal Gas Pool spacing unit is the E/2 of Section 28 being 320 acres. The proposed Fulcher Kutz-Pictured Cliffs Pool spacing unit is the NE/4 of Section 28 being 160 acres. Both are standard in size for their respective pools.

PROPOSED EVIDENCE

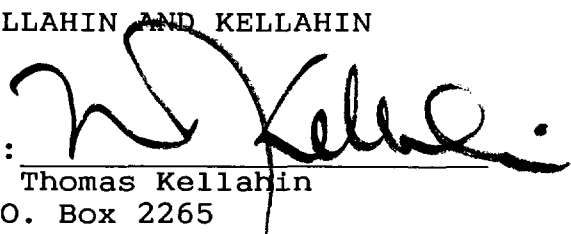
APPLICANT

WITNESSES	EST. TIME	EXHIBITS
Tom Yersak (geologist)	10 min.	2
Alan Alexander (landman)	10 min.	4
Scott Daves (petroleum engineer)	10 min.	2

PROCEDURAL MATTERS

Applicant proposes to consolidate this case with Cases 107021, 10723, 10724 and 10725 for purposes of the hearing. The consolidated direct presentation is expected to take 1 to 1.5 hours

KELLAHIN AND KELLAHIN

By: 
W. Thomas Kellahin
P.O. Box 2265
Santa Fe, New Mexico 87504
(505) 982-4285

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. 10722

APPLICATION OF MERIDIAN OIL INC.
FOR DOWNHOLE COMMINGLING,
SAN JUAN COUNTY, NEW MEXICO.

CERTIFICATE OF MAILING

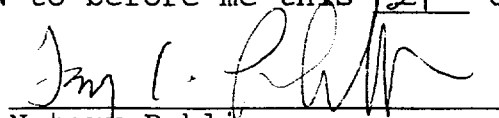
AND

COMPLIANCE WITH ORDER R-8054

W. THOMAS KELLAHIN, attorney in fact and authorized representative of Meridian Oil Inc., states that the notice provisions of Division Rule 1207 (Order R-8054) have been complied with, that Applicant has caused to be conducted a good faith diligent effort to find the correct addresses of all interested parties entitled to receive notice, that on March 29, 1993, I caused to be mailed by certified mail return-receipt requested notice of this hearing and a copy of the application for the above referenced case along with the cover letter, at least twenty days prior to the hearing set for April 22, 1993, to the parties shown in the application as evidenced by the attached copies of return receipt cards, and that pursuant to Division Rule 1207, notice has been given at the correct addresses provided by such rule.


W. Thomas Kellahin

SUBSCRIBED AND SWORN to before me this 21ST day of
APRIL, 1993.


Notary Public

My Commission Expires:

10/7/95

P 355 568 571

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

(See Reverse)

U.S.G.P.O. 1989-234-555

PS Form 3800, June 1985

Sent to	
John David Wiedemer	
Street and No.	
Trust	
930 W. Forest Drive	
P.O., State and ZIP Code	
Houston, Texas 77079	
Postage	\$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	\$
Postmark or Date	

P 670 689 670



Certified Mail Receipt

No Insurance Coverage Provided
Do not use for International Mail

(See Reverse)

PS Form 3800, June 1990

Sent to	
Emily D. Grambling	
Street & No.	
916 Cherry Hill Lane	
P.O., State & ZIP Code	
El Paso, TX 79912	
Postage	\$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	\$
Postmark or Date	

P 670 689 670



Certified Mail Receipt

No Insurance Coverage Provided
Do not use for International Mail

(See Reverse)

PS Form 3800, June 1990

Sent to	
Patricia G. Harvey	
Street & No.	
P.O. Drawer 140	
P.O., State & ZIP Code	
El Paso, TX 79980	
Postage	\$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	\$
Postmark or Date	

Is your RETURN ADDRESS completed on the reverse side?

SENDER:

- Complete items 1 and/or 2 for additional services.
- Complete items 3, and 4a & b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Texas Commerce Bank Trustee
Ben R. Howell Trust
P.O. Box 722
El Paso, Texas 79944

4a. Article Number

P 355 568 595

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)

6. Signature (Agent)

PS Form 3811, December 1991 ☆U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

Thank you for using Return Receipt Service.

Is your RETURN ADDRESS completed on the reverse side?

SENDER:

- Complete items 1 and/or 2 for additional services.
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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Amoco Production Company
P.O. Box 800
Denver, Colorado 80202

4a. Article Number

P 676 666 338

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)

6. Signature (Agent)

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Union Oil Company of CA
P.O. Box 9702135
Dallas, Texas 75397

4a. Article Number

P 355 568 591

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

APR 01 1993

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)

6. Signature (Agent)

PS Form 3811, December 1991 ☆U.S. GPO: 1992-323-402

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Michael Fitzgerald &
James Fitzgerald III
Est. Ben Dansby Jr., Dec.
P.O. Box 710
Midland, Texas 79702

4a. Article Number

P 355 568 597

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-5-93

5. Signature (Addressee)

6. Signature (Agent)

Alice E. Williams

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Rachel Lyman & Thomas C. Brown
U/W/O C.V. Lyman, Deceased
P.O. Box 3726
Midland, Texas 79702

4a. Article Number

P 670 689 664

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-5-93

5. Signature (Addressee)

6. Signature (Agent)

J. N. McLuffey

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Ann Hancock Dorie
5315 Preston Haven Drive
Dallas, Texas 75229-3043

4a. Article Number

P 355 568 599

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4/3/93

5. Signature (Addressee)

6. Signature (Agent)

A. Hancock Dorie

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

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3. Article Addressed to: Elizabeth H. Lund, Trustee Mabelle Hardie Royalty Trust 1065 Los Jardines El Paso, Texas 79912	4a. Article Number P 355 568 596	Thank you for using Return Receipt
5. Signature (Addressee) <i>Meridian Meadows #500 weu</i>	4b. Service Type <input type="checkbox"/> Registered <input type="checkbox"/> Insured <input checked="" type="checkbox"/> Certified <input type="checkbox"/> COD <input type="checkbox"/> Express Mail <input type="checkbox"/> Return Receipt for Merchandise	
6. Signature (Agent) <i>R Lund</i>	7. Date of Delivery 4-3-93	
	8. Addressee's Address (Only if requested and fee is paid)	
PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402 DOMESTIC RETURN RECEIPT		

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3. Article Addressed to: Ben Howell Langford c/o Eppler Guerin & Turner The Centre 123 Pioneer Plaza El Paso, TX 79901	4a. Article Number P 355 568 586	Thank you for using Return Receipt Service.
5. Signature (Addressee) <i>Meridian Meadows #500 weu</i>	4b. Service Type <input type="checkbox"/> Registered <input type="checkbox"/> Insured <input checked="" type="checkbox"/> Certified <input type="checkbox"/> COD <input type="checkbox"/> Express Mail <input type="checkbox"/> Return Receipt for Merchandise	
6. Signature (Agent) <i>White</i>	7. Date of Delivery 4/5/93 APR 5 1993	
	8. Addressee's Address (Only if requested and fee is paid)	
PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402 DOMESTIC RETURN RECEIPT		

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3. Article Addressed to: Howell Grandchildrens Trust Estate (5-38010) c/o Texas Commerce Bank, NA El Paso Trustee P.O. Box 722 El Paso, Texas 79944	4a. Article Number P 355 568 588	Thank you for using Return Receipt Service.
5. Signature (Addressee) <i>Meridian Meadows #500 weu</i>	4b. Service Type <input type="checkbox"/> Registered <input type="checkbox"/> Insured <input checked="" type="checkbox"/> Certified <input type="checkbox"/> COD <input type="checkbox"/> Express Mail <input type="checkbox"/> Return Receipt for Merchandise	
6. Signature (Agent) <i>[Signature]</i>	7. Date of Delivery APR 5 1993	
	8. Addressee's Address (Only if requested and fee is paid)	
PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402 DOMESTIC RETURN RECEIPT		

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I also wish to receive the following services (for an extra fee):

- ☐ Addressee's Address
- ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Rachel Lyman
P.O. Box 3726
Midland, Texas 79702

4a. Article Number

P 670 689 668

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-5-93

5. Signature (Addressee)

6. Signature (Agent)

Meridian McDams #500 well
J. H. McDuffey

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 *U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- ☐ Addressee's Address
- ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Jane Hardie Trustee
William B. Hardie, Sr.
Royalty Trust
1065 Los Jardines
El Paso, TX 79912

4a. Article Number

P 670 689 672

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-3-93

Meridian McDams #500 well

5. Signature (Addressee)

6. Signature (Agent)

R. Lund

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 *U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

- ☐ Addressee's Address
- ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

John A. Grambling
916 Cherry Hill Lane
El Paso, Texas 79912

4a. Article Number

P 670 689 662

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

APR 3 1993

Meridian McDams #500 well

5. Signature (Addressee)

6. Signature (Agent)

Emily H. Grambling

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 *U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

R.H. Feuille
11th Floor
Texas Commerce Bank Bldg.
El Paso, Texas 79901

4a. Article Number

P 670 689 666

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4/2/93

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)

6. Signature (Agent)

Gina Linden

PS Form 3811, December 1991 ☆U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

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 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

Sylvia Little
P.O. Box 1258
Farmington, New Mexico
87499

4a. Article Number

P 676 666 340

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-2-93

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)

6. Signature (Agent)

Wanda Dymon

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 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

Jim L. Sharp
P.O. Box 594
Hobbs, New Mexico 88240

4a. Article Number

P 355 568 598

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)

6. Signature (Agent)

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1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Robert Andrew Wiedemer
Trust
930 W. Forest Drive
Houston, Texas 77079

4a. Article Number

P 355 568 569

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

APR 6 1991

Meridian McAdams #500666

5. Signature (Addressee)

Robert Andrew Wiedemer

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

Thank you for using Return Receipt Service.

Is your RETURN ADDRESS completed on the reverse side?

SENDER:

- Complete items 1 and/or 2 for additional services.
- Complete items 3, and 4a & b.
- Print your name and address on the reverse of this form so that we can return this card to you.
- Attach this form to the front of the mailpiece, or on the back if space does not permit.
- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Jerry Hoover
Conoco, Inc.
10 Desta Drive, Suite 100W
Midland, Texas 79705-4500

4a. Article Number

P 676 666 339

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

Meridian McAdams #500666

5. Signature (Addressee)

6. Signature (Agent)

H. Gonzales

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

J. Burton Veteto
607 ABO
Hobbs, New Mexico 88240

4a. Article Number

P 355 568 600

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

Meridian McAdams #500666

5. Signature (Addressee)

J. Burton Veteto

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address

2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

El Paso Production Company
P.O. Box 4289
Farmington, New Mexico 87401

4a. Article Number
P 670 689 673

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
4-1-93

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)
Meridion McAdams #500 well

6. Signature (Agent)
John Hamilton

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address

2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Bureau of Land Management
Farmington Resource Area
1235 Laplata Highway
Farmington, NM 87401

4a. Article Number
P 355 568 584

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)
Meridion McAdams #500 well

6. Signature (Agent)
Paul Bourque 4/1/93

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address

2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Emily D. Grambling
916 Cherry Hill Lane
El Paso, Texas 79912

4a. Article Number
P 670 689 670

4b. Service Type

☐ Registered ☐ Insured

☒ Certified ☐ COD

☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
APR 1 1993

8. Addressee's Address (Only if requested and fee is paid)

5. Signature (Addressee)
Meridion McAdams #500 well

6. Signature (Agent)
Emily D. Grambling

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

Madeline Howell Jastrzembski
1106 Mesita
El Paso, Texas 79902

4a. Article Number

P 355 568 585

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

APR 03 1993

5. Signature (Addressee)

Madeline Howell Jastrzembski

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

APR 03 1993

PS Form 3811, December 1991

★U.S. GPO: 1982-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

Singer Brothers
c/o Bank of Oklahoma
Lockbox Department
Tulsa, Oklahoma 74182

4a. Article Number

P 355 568 590

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

APR 05 1993

5. Signature (Addressee)

meridian meadows #500 wew

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1982-323-402

DOMESTIC RETURN RECEIPT

Thank you for using Return Receipt Service.

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- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

Evelyn Smith
404 De Grummond Way
Salado, Texas 76571

4a. Article Number

P 355 568 589

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

APR 03 1993

5. Signature (Addressee)

Evelyn Smith

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1982-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Richard Parker Langford
1512 Jersey Drive
Austin, Texas 78758

4a. Article Number

P 355 568 587

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

5. Signature (Addressee)

Meridian Meadows #500 weel
Kolun Garner Langford

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 ☆U.S. GPO: 1992-323-402

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- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

United Pipe Supply Company
Suite 3130
8911 Capital of Texas Hwy
Austin, Texas 78759

4a. Article Number

P 355 568 594

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

5. Signature (Addressee)

Meridian Meadows #500 weel
Robert

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 ☆U.S. GPO: 1992-323-402

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Julie Ann Antweil Trust
4408 Canyon Court, NE
Albuquerque, NM 87111

4a. Article Number

P 355 568 592

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

Meridian Meadows #500 weel
Julie Ann Antweil

5. Signature (Addressee)

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 ☆U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

- ☐ Addressee's Address
- ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

John David Wiedemer Trust
930 W. Forest Drive
Houston, Texas 77079

4a. Article Number

P 355 568 571

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-3-95

meridiam meadows #50010011

5. Signature (Addressee)

6. Signature (Agent)

M. D. Wiedemer

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

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I also wish to receive the following services (for an extra fee):

- ☐ Addressee's Address
- ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

James D. Hancock, Jr.
4339 Versailles
Dallas, Texas 75205

4a. Article Number

P 670 689 667

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

8. Addressee's Address (Only if requested and fee is paid)

meridiam meadows #50010011

5. Signature (Addressee)

6. Signature (Agent)

PS Form 3811, December 1991 ★U.S. GPO: 1992-323-402

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I also wish to receive the following services (for an extra fee):

- ☐ Addressee's Address
- ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Gary W. Harvey Indep. Exec.
H.W. Smith Estate
401 SW 23rd
Seminole, Texas 79360

4a. Article Number

P 670 689 665

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4-5-93

meridiam meadows #50010011

5. Signature (Addressee)

6. Signature (Agent)

Gary Harvey

8. Addressee's Address (Only if requested and fee is paid)

Thank you for using Return Receipt Service.

Is your RETURN ADDRESS completed on the reverse side?

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address

2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Voit Gilmore
c/o Merrill Lynch
RE 727-10520
4011 University Drive
3rd Floor
Durham, NC 27707
Meridian McAdams #500 weel

4a. Article Number
P 670 689 669

4b. Service Type

☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
4-8-93

5. Signature (Addressee)

6. Signature (Agent)
M. Wallace

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 *U.S. GPO: 1992-323-402

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address

2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

John P. Wiedemer
P.O. Box 19392
Houston, Texas 77024

4a. Article Number
P 355 568 377

4b. Service Type

☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
4-8

5. Signature (Addressee)
Meridian McAdams #500 weel

6. Signature (Agent)
Wiedemer

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 *U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address

2. ☐ Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

Michael Fitzgerald &
James Fitzgerald III
U/W/O Blanche Dansby, Dec.
P.O. Box 710
Midland, Texas 79702

4a. Article Number
P 355 568 593

4b. Service Type

☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery
4-5-APR 07-1993

5. Signature (Addressee)
Meridian McAdams #500 weel

6. Signature (Agent)
Blanche C. Williams

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991 *U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

John L. Hancock
3600 Dartmouth Avenue
Dallas, TX 75205-3239

4a. Article Number

P 670 689 663

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

4/12/93

5. Signature (Addressee)

John L. Hancock

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1992-323-402

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- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

Robert M. Williams
P.O. Box 854
Hobbs, New Mexico 88241

4a. Article Number

P 670 689 671

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

Robert M. Williams

5. Signature (Addressee)

Robert M. Williams

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

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I also wish to receive the following services (for an extra fee):

1. ☐ Addressee's Address
 2. ☐ Restricted Delivery
- Consult postmaster for fee.

3. Article Addressed to:

James Ivy Wiedemer Trust
930 W. Forest Drive
Houston, Texas 77079

4a. Article Number

P 355 568 570

4b. Service Type

- ☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

7. Date of Delivery

James Ivy Wiedemer Trust

5. Signature (Addressee)

James Ivy Wiedemer Trust

6. Signature (Agent)

8. Addressee's Address (Only if requested and fee is paid)

PS Form 3811, December 1991

★U.S. GPO: 1992-323-402

DOMESTIC RETURN RECEIPT

Thank you for using Return Receipt Service.

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:

APPLICATION OF MERIDIAN OIL INC.
FOR AN UNORTHODOX GAS WELL LOCATION
AND DOWNHOLE COMMINGLING, SAN JUAN
COUNTY, NEW MEXICO.

Case No. 10721

APPLICATION OF MERIDIAN OIL INC.
FOR DOWNHOLE COMMINGLING, SAN JUAN
COUNTY, NEW MEXICO.

Case No. 10722

APPLICATION OF MERIDIAN OIL INC.
FOR AN UNORTHODOX GAS WELL LOCATION
AND DOWNHOLE COMMINGLING, SAN JUAN
COUNTY, NEW MEXICO.

Case No. 10723

APPLICATION OF MERIDIAN OIL INC.
FOR AN UNORTHODOX GAS WELL LOCATION
AND DOWNHOLE COMMINGLING, SAN JUAN
COUNTY, NEW MEXICO.

Case No. 10724

APPLICATION OF MERIDIAN OIL INC.
FOR AN UNORTHODOX GAS WELL LOCATION
AND DOWNHOLE COMMINGLING, SAN JUAN
COUNTY, NEW MEXICO.

Case No. 10725

Order No. R-9920

ORDER OF THE DIVISION

BY THE DIVISION:

This cause came on for hearing at 8:15 a.m. on April 22, 1993, at Santa Fe, New Mexico, before Examiner Michael E. Stogner.

NOW, on this 9th day of July, 1993, 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) At the time of the hearing Case Nos. 10721 through 10725 were consolidated for the purpose of presenting testimony.

(3) The applicant in each of the five following cases is Meridian Oil Inc. and due to the similarity, close proximity, and nature of each, a single directive issued by the Division is deemed appropriate:

- (a) in Case No. 10721 the applicant seeks approval to downhole commingle Fulcher Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Rowley Com Well No. 500 to be drilled at an unorthodox gas well location for the Fulcher Kutz-Pictured Cliffs Pool 2335 feet from the South line and 1850 feet from the West line (Unit K) of Section 7, Township 27 North, Range 10 West, NMPM, San Juan County, New Mexico. Said well is to be dedicated to a standard 332.92-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being Lots 1 through 4 and the E/2 W/2 (W/2 equivalent) of said Section 7 and to a 166.61-acre gas spacing unit for the Fulcher Kutz-Pictured Cliffs Pool being Lots 3 and 4 and the E/2 SW/4 (SW/4 equivalent) of said Section 7;
- (b) in Case No. 10722 the applicant seeks approval to downhole commingle Fulcher Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed McAdams Well No. 500 to be drilled at a standard gas well location 790 feet from the North line and 1010 feet from the East line (Unit A) of Section 28, Township 27 North, Range 10 West, NMPM, San Juan County, New Mexico. Said well is to be dedicated to a standard

320-acre gas spacing unit for the Basin-Fruitland Coal (Gas) Pool being the E/2 of said Section 28 and to a standard 160-acre gas spacing unit for the Fulcher Kutz-Pictured Cliffs Pool being the NE/4 of said Section 28;

- (c) in Case No. 10723 the applicant seeks approval to downhole commingle West Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Whitley "A" Well No. 100 to be drilled at an unorthodox gas well location for the West Kutz-Pictured Cliffs Pool 2010 feet from the South line and 1090 feet from the West line (Unit L) of Section 17, Township 27 North, Range 11 West, NMPM, San Juan County, New Mexico. Said well is to be dedicated to a standard 320-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being the W/2 of said Section 17 and to a standard 160-acre gas spacing unit for the West Kutz-Pictured Cliffs Pool being the SW/4 of said Section 17;
- (d) in Case No. 10724 the applicant seeks approval to downhole commingle West Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Rhodes "C" Well No. 101 to be drilled at an unorthodox gas well location for both the West Kutz-Pictured Cliffs Pool and the Basin-Fruitland Coal (Gas) Pool, being 100 feet from the South line and 2270 feet from the West line (Unit N) of Section 30, Township 28 North, Range 11 West, NMPM, San Juan County, New Mexico. Said well is to be dedicated to a standard 315.97-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being Lots 1 through 4 and the E/2 W/2 (W/2 equivalent) of said Section 30 and to a 158.04-acre gas spacing unit for the West Kutz-Pictured Cliffs Pool being Lots 3 and 4 and the E/2 SW/4 (SW/4 equivalent) of said Section 30; and,

- (e) in Case No. 10725 the applicant seeks approval to downhole commingle West Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Rhodes "C" Well No. 102 to be drilled at an unorthodox gas well location for the West Kutz-Pictured Cliffs Pool being 790 feet from the North line and 1950 feet from the East line (Unit B) of Section 31, Township 28 North, Range 11 West, NMPM, San Juan County, New Mexico. Said well is to be dedicated to a standard 317.85-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being Lots 1 and 2, the NE/4, and the E/2 NW/4 (N/2 equivalent) of said Section 31 and to a standard 160-acre gas spacing unit for the West Kutz-Pictured Cliffs Pool being the NE/4 of said Section 31.

(4) Both the West Kutz and Fulcher Kutz Pictured Cliffs Pools are governed under the spacing provisions of the Division's General Rules and Regulations [Rule 104.C(3)] which provides for 160-acre drilling tracts. The Basin Fruitland Coal (Gas) Pool is spaced on 320-acre spacing, pursuant to the provisions of Rule 4 of the Special Rules and Regulations for the Basin Fruitland Coal (Gas) Pool, as promulgated by Division Order No. R-8768, as amended.

(5) The proposed unorthodox locations are caused by various topographic reasons and not geologic.

(6) Applicant's geologic evidence indicates that gas production capabilities from both the Pictured Cliffs and Fruitland Coal intervals in this general area of the San Juan Basin is expected to be marginal in nature, thereby making the downhole commingling of both zones practical in order to adequately recover Basin-Fruitland Coal gas and conventional Pictured Cliffs gas reserves underlying each respective proration unit in a prudent manner.

(7) Further, the applicant's evidence indicates that due to the marginal production expected in both intervals, it will probably be uneconomic to drill either a stand alone Pictured Cliffs or Fruitland Coal Gas well or a dual producer in this area. However, in the event total gas production from both pools in a well exceeds 300 MCF per Day, downhole commingling will not be allowed in the effected well until the combined rate drops below 300 MCF/day.

(8) The ownership within the Basin-Fruitland Coal (Gas) Pool and the Fulcher Kutz-Pictured Cliffs Pool or West Kutz-Pictured Cliffs Pool underlying each respective proration unit is not common.

(9) The applicant has notified all interest owners owning an interest in either the Pictured Cliffs or Fruitland formation within the subject proration units of its proposed downhole commingling.

(10) No offset operator and/or interest owner appeared at the hearing in opposition to the proposed downhole commingling and/or unorthodox well locations.

(11) The applicant further demonstrated through its evidence and testimony that:

- (a) there will be no crossflow between the two commingled pools;
- (b) neither commingled zone exposes the other to damage by produced liquids;
- (c) the fluids from each zone are compatible with the other;
- (d) the bottomhole pressure of the lower pressure zone should not be less than 50 percent of the bottomhole pressure of the higher pressure zone adjusted to a common datum; and,
- (e) the value of the commingled production is not less than the sum of the values of the individual production.

(12) In the interest of prevention of waste and protection of correlative rights, each of the subject applications should be approved.

(13) Due to the nature of gas production from the Basin-Fruitland Coal (Gas) Pool, straight allocation of gas volumes from both zones is not appropriate. The applicant therefore seeks the adoption of a monthly allocation formula, based on initial production test and known/assumed parameters from the Pictured Cliffs zone whereby its initial rate, estimated ultimate recovery, and decline rate can be determined. Any

production rate over what is calculated for the Pictured Cliffs utilizing the applied formula can be attributed to the Fruitland coal gas interval. See Exhibit "A" attached hereto and made a part hereof for additional reference.

(14) The operator should consult with the Supervisor of the Aztec Office of the Division to insure the validity and scientific accuracy of the initial test on each well.

(15) The operator should be responsible for reporting the monthly gas production from each of the subject wells by utilizing the proposed allocation formula.

(16) An annual report should be submitted by the operator for each well to both the Aztec and Santa Fe offices of the Division showing the complete computations for each month.

(17) Any condensate production should be allocated entirely to the Pictured Cliffs interval. Water production should be reported in a manner acceptable to the supervisor of the Aztec district office of the Division.

(18) Any change in the method of gas allocation between the two pools for any of the subject wells should be made only after due notice and hearing.

(19) To afford the Division an opportunity to assess the potential of waste and to expeditiously order the appropriate remedial action, the operator should notify the Aztec district office of the Division any time one of the five subject wells is shut-in for seven consecutive days.

IT IS THEREFORE ORDERED THAT:

(1) The applicant in Case Nos. 10721, 10722, 10723, 10724, and 10725, Meridian Oil Inc., is hereby authorized:

- (a) to downhole commingle Fulcher Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Rowley Com Well No. 500 to be drilled at an unorthodox gas well location for the Fulcher Kutz-Pictured Cliffs Pool 2335 feet from the South line and 1850 feet from the West line (Unit K) of Section 7, Township 27 North, Range 10 West, NMPM, San Juan County, New Mexico. Said well shall be dedicated to a standard 332.92-acre gas spacing and proration unit for the

Basin-Fruitland Coal (Gas) Pool being Lots 1 through 4 and the E/2 W/2 (W/2 equivalent) of said Section 7 and to a 166.61-acre gas spacing unit for the Fulcher Kutz-Pictured Cliffs Pool being Lots 3 and 4 and the E/2 SW/4 (SW/4 equivalent) of said Section 7;

- (b) to downhole commingle Fulcher Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed McAdams Well No. 500 to be drilled at a standard gas well location 790 feet from the North line and 1010 feet from the East line (Unit A) of Section 28, Township 27 North, Range 10 West, NMPM, San Juan County, New Mexico. Said well shall be dedicated to a standard 320-acre gas spacing unit for the Basin-Fruitland Coal (Gas) Pool being the E/2 of said Section 28 and to a standard 160-acre gas spacing unit for the Fulcher Kutz-Pictured Cliffs Pool being the NE/4 of said Section 28;
- (c) to downhole commingle West Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Whitley "A" Well No. 100 to be drilled at an unorthodox gas well location for the West Kutz-Pictured Cliffs Pool 2010 feet from the South line and 1090 feet from the West line (Unit L) of Section 17, Township 27 North, Range 11 West, NMPM, San Juan County, New Mexico. Said well shall be dedicated to a standard 320-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being the W/2 of said Section 17 and to a standard 160-acre gas spacing unit for the West Kutz-Pictured Cliffs Pool being the SW/4 of said Section 17;
- (d) to downhole commingle West Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Rhodes "C" Well No. 101 to be drilled at an unorthodox gas well location for both the West Kutz-Pictured Cliffs Pool

and the Basin-Fruitland Coal (Gas) Pool, being 100 feet from the South line and 2270 feet from the West line (Unit N) of Section 30, Township 28 North, Range 11 West, NMPM, San Juan County, New Mexico. Said well shall be dedicated to a standard 315.97-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being Lots 1 through 4 and the E/2 W/2 (W/2 equivalent) of said Section 30 and to a 158.04-acre gas spacing unit for the West Kutz-Pictured Cliffs Pool being Lots 3 and 4 and the E/2 SW/4 (SW/4 equivalent) of said Section 30; and,

- (e) to downhole commingle West Kutz-Pictured Cliffs Pool and Basin-Fruitland Coal (Gas) Pool production within the wellbore of its proposed Rhodes "C" Well No. 102 to be drilled at an unorthodox gas well location for the West Kutz-Pictured Cliffs Pool being 790 feet from the North line and 1950 feet from the East line (Unit B) of Section 31, Township 28 North, Range 11 West, NMPM, San Juan County, New Mexico. Said well shall be dedicated to a standard 317.85-acre gas spacing and proration unit for the Basin-Fruitland Coal (Gas) Pool being Lots 1 and 2, the NE/4, and the E/2 NW/4 (N/2 equivalent) of said Section 31 and to a standard 160-acre gas spacing unit for the West Kutz-Pictured Cliffs Pool being the NE/4 of said Section 31.

PROVIDED HOWEVER, in the event total gas production from both pools in a well exceeds 300 MCF per Day, downhole commingling will not be allowed in the effected well until the combined rate drops below 300 MCF/day.

(2) The allocation of gas produced from the Pictured Cliffs and Fruitland Coal intervals in each of the subject wells shall be in accordance with the adopted allocation formula, as further referenced in Exhibit "A" attached hereto and made a part hereof.

(3) The operator shall consult with the Supervisor of the Aztec Office of the Division to insure the validity and accuracy of the initial test on each well.

(4) Further, the operator is responsible for reporting the monthly gas production from each of the five wells to the Division utilizing said allocation formula. An annual report for each well shall be submitted by the operator to both the Aztec and Santa Fe offices of the Division showing the complete computations for the previous twelve month period.

(5) Any condensate production from a well shall be allocated entirely to the appropriate Pictured Cliffs Pool. Water production shall be reported in a manner acceptable to the supervisor of the Aztec district office of the Division.

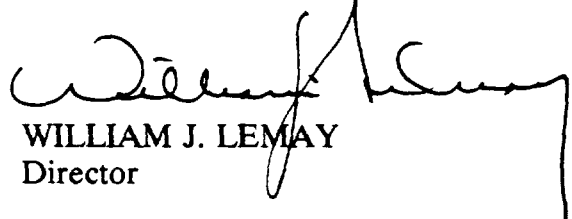
(6) Any variance in the method of gas allocation between the two pools for any of the subject wells shall be made only after due notice and hearing.

(7) The operator shall immediately notify the supervisor of the Aztec District Office of the Division any time one of the five subject wells has been shut-in for seven consecutive days and shall concurrently present, to the Division, a plan for remedial action.

(8) Jurisdiction is hereby 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


WILLIAM J. LEMAY
Director

S E A L

Exhibit "A"

CONSOLIDATED CASES 10721, 10722, 10723, 10724, AND 10725

DIVISION ORDER NO. R-9920

Case No. 10721
Case No. 10722
Case No. 10723
Case No. 10724
Case No. 10725

Rowley Well No. 500
McAdams Well No. 500
Whitley "A" Well No. 100
Rhodes "C" Well No. 101
Rhodes "C" Well No. 102

MONTHLY GAS PRODUCTION ALLOCATION FORMULA GENERAL EQUATION

$$Q_t = Q_{ftc} + Q_{pc}$$

WHERE:

Q_t = TOTAL MONTHLY PRODUCTION FROM WELL (MCF/MONTH)

Q_{ftc} = FRUITLAND COAL (FTC) MONTHLY PRODUCTION (MCF/MONTH)

Q_{pc} = PICTURED CLIFFS (PC) MONTHLY PRODUCTION (MCF/MONTH)

REARRANGING THE EQUATION TO SOLVE FOR Q_{ftc} :

$$Q_{ftc} = Q_t - Q_{pc}$$

ANY PRODUCTION RATE OVER WHAT IS CALCULATED FOR THE PICTURED CLIFFS (PC) USING THE APPLIED FORMULA IS FRUITLAND COAL (FTC) PRODUCTION.

ICTURED CLIFFS (PC) FORMATION PRODUCTION FORMULA IS:

$$Q_{pc} = Q_{pci} * e^{\{-(D_{pc}) * (t)\}}$$

WHERE:

Q_{pci} IS THE INITIAL PC MONTHLY FLOW RATE (CALCULATED FROM FLOW TEST)

OR

$$Q_{pci} = \frac{Q_t(1) * Q_{pc}(p)}{Q_{pc}(p) + Q_{ftc}(p)}$$

WHERE:

$Q_t(1)$ = FIRST MONTH TOTAL PRODUCTION (MCF)

$Q_{pc}(p)$ = FINAL PICTURED CLIFFS FLOW TEST (MCFPD)

$Q_{ftc}(p)$ = FINAL FRUITLAND COAL FLOW TEST (MCFPD)

AND WHERE:

Dpc IS THE CALCULATED PICTURED CLIFFS MONTHLY DECLINE RATE DETERMINED.

$$Dpc = (Qpci - Qpcabd) / Np(pc)$$

WHERE: Qpcabd = PICTURED CLIFFS PRODUCTION RATE AT ABANDONMENT (300 MCF/MO.); AND, Np(pc) IS THE PICTURED CLIFFS ESTIMATED ULTIMATE RECOVERY.

THUS: $Q_{ftc} = Q_t - Q_{pci} * e^{\{-(Dpc)*(t)\}}$

WHERE: (t) = TIME (MONTHS) FROM INITIAL PRODUCTION

KELLAHIN AND KELLAHIN

ATTORNEYS AT LAW

EL PATIO BUILDING

117 NORTH GUADALUPE

POST OFFICE BOX 2265

SANTA FE, NEW MEXICO 87504-2265

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RECOGNIZED SPECIALIST IN THE AREA OF
NATURAL RESOURCES-OIL AND GAS LAW

JASON KELLAHIN (RETIRED 1991)

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May 21, 1993

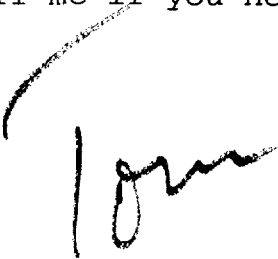
HAND DELIVERED

Michael E. Stogner
Oil Conservation Division
310 Old Santa Fe Trail
Santa Fe, New Mexico 87501

Re: Meridian Oil Inc.
DHC cases

Dear Mike:

I have enclosed a 5.25 floppy disk which contains the DHC allocation formula for NMOCD Cases 10721 through 10725. In addition, I have enclosed a hard copy of that formula for each case and printed such that it can be attached to the respective order as an exhibit. Please call me if you need anything else.

A handwritten signature in black ink, appearing to read "Tom", with a long, sweeping horizontal stroke extending to the left.

McADAMS #500

MONTHLY GAS PRODUCTION ALLOCATION FORMULA

GENERAL EQUATION

$$Q = Q_{ftc} + Q_{pc}$$

WHERE: Q_t = TOTAL MONTHLY PRODUCTION (MCF/MONTH)

Q_{ftc} = FRUITLAND COAL (FTC) MONTHLY PRODUCTION

Q_{pc} = PICTURED CLIFFS (PC) MONTHLY PRODUCTION (MCF/MONTH)

REARRANGING THE EQUATION TO SOLVE FOR Q_{ftc} :

$$Q_{ftc} = Q_t - Q_{pc}$$

ANY PRODUCTION RATE OVER WHAT IS CALCULATED FOR THE PICTURED CLIFFS (PC) USING THE APPLIED FORMULA IS FRUITLAND COAL (FTC) PRODUCTION.

ICTURED CLIFFS (PC) FORMATION PRODUCTION FORMULA IS:

$$Q_{pc} = Q_{pci} * e^{\{-(D_{pc})*(t)\}}$$

WHERE: Q_{pci} = INITIAL PC MONTHLY FLOW RATE (CALCULATED FROM FLOW TEST

D_{pc} = PICTURED CLIFFS MONTHLY DECLINE RATE DETERMINED FROM:

MATERIAL BALANCE (FIELD ANALOGY):
VOLUMETRIC RESERVES (LOG ANALYSIS)
 $G_f(P^*) = 0.82 \text{ MMCF/PSI} \times P^* \times R_f$

P^* = INITIAL RESERVOIR PRESSURE (7 DAY SIBHP)

R_f = RECOVERY (FIELD ANALOGY): = 0.85

THUS: $Q_{ftc} = Q_t - Q_{pci} * e^{\{-(D_{pc})*(T)\}}$

WHERE: (t) IS IN MONTHS

REFERENCE: Thompson, R. S., and Wright, J. D., "Oil Property Evaluation", pages 5-2, 5-3.

McADAMS #500

DETERMINATION OF Q_{pci} : (INITIAL PICTURED CLIFFS MONTHLY PRODUCTION)

$$\underline{Q_{pci} = Q_t(1) * Q_{pc}(P) \setminus \{Q_{pc}(p) + Q_{ftc}(p)\}}$$

WHERE:

$Q_t(1)$ = FIRST MONTH TOTAL PRODUCTION (MCF)

$Q_{pc}(p)$ = FINAL PICTURED CLIFFS FLOW TEST (MCFPD)

$Q_{ftc}(p)$ = FINAL FRUITLAND COAL FLOW TEST (MCFPD)

Scott Davis

326-9880

McADAMS #500

MONTHLY GAS PRODUCTION ALLOCATION FORMULA

GENERAL EQUATION

$$Q_t = Q_{ftc} + Q_{pc}$$

WHERE: Q_t = TOTAL MONTHLY PRODUCTION (MCF/MONTH)

Q_{ftc} = FRUITLAND COAL (FTC) MONTHLY PRODUCTION (MCF/MONTH)

Q_{pc} = PICTURED CLIFFS (PC) MONTHLY PRODUCTION (MCF/MONTH)

REARRANGING THE EQUATION TO SOLVE FOR Q_{ftc} :

$$Q_{ftc} = Q_t - Q_{pc}$$

ANY PRODUCTION RATE OVER WHAT IS CALCULATED FOR THE PICTURED CLIFFS (PC) USING THE APPLIED FORMULA IS FRUITLAND COAL (FTC) PRODUCTION.

PICTURED CLIFFS (PC) FORMATION PRODUCTION FORMULA IS:

$$Q_{pc} = Q_{pci} * e^{\{-(D_{pc}) * (t)\}}$$

WHERE: Q_{pci} = INITIAL PC MONTHLY FLOW RATE (CALCULATED FROM FLOW TEST

D_{pc} = PICTURED CLIFFS MONTHLY DECLINE ^{RATE} ~~DATE~~ DETERMINED FROM:

MATERIAL BALANCE (FIELD ANALOGY):
VOLUMETRIC RESERVES (LOG ANALYSIS)
 $G f(P^*) = 0.82 \text{ MMCF/PSI} \times P^* \times R_f$

P^* = INITIAL RESERVOIR PRESSURE (7 DAY SIBHP)

R_f = RECOVERY (FIELD ANALOGY): = 0.85

THUS: $Q_{ftc} = Q_t - Q_{pci} * e^{\{-(D_{pc}) * (t)\}}$

WHERE: (t) IS IN MONTHS

REFERENCE: Thompson, R. S., and Wright, J. D., "Oil Property Evaluation", pages 5-2, 5-3.

McADAMS #500

DETERMINATION OF Qpci: (INITIAL PICTURED CLIFFS MONTHLY PRODUCTION)

$$\underline{Q_{pci} = Q_t(1) * Q_{pc}(\overset{\uparrow}{P}) \setminus \{Q_{pc}(p) + Q_{ftc}(p)\}}$$

WHERE:

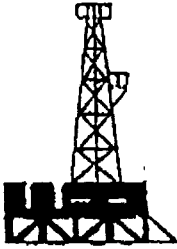
Qt(1) = FIRST MONTH TOTAL PRODUCTION (MCF)

Qpc(p) = FINAL PICTURED CLIFFS FLOW TEST (MCFPD)

Qftc(p) = FINAL FRUITLAND COAL FLOW TEST (MCFPD)

TELECOPIER FORM

MERIDIAN OIL



P.O. BOX 4209 Farmington, N.M. 87499-4209
3535 East 30th St.
Farmington, New Mexico 87401
(505) 326-9700



Telecopier Telephone: (505) 326-9781 (Land)

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HUERFANO UNIT #549

In order to facilitate an economic Pictured Cliffs completion three requirements must be met. It is the combination of these three requirements that determines the economic status and completion method (PC single completion, PC-FTC Dual, PC-FTC commingle) utilized. These three requirements are as follows:

RESERVES $N_p(pc)$

FLOW RATE (Q_{pci})

COSTS (Investment and Operating)

Shown in the following example are the parameters and calculations used to determine Pictured Cliffs initial rate (Q_{pci}), Pictured Cliffs Estimated Ultimate Recovery ($N_p(pc)$), and Pictured Cliffs decline rate (D_{pc}). Additionally, estimated costs associated with each completion method and economic sensitivities (figures 1-3) are attached to show the effects of PC reserves ($N_p(pc)$), initial PC rates (Q_{pci}), and completion method (costs).

This example is for the Huerfano Unit #549, but the methodology is applicable for each of the commingle applications submitted (Rhodes C #'s 101 & 102, Whitley A #100, McAdams #500, and the Rowley Com #500). The variations in the $N_p(pc)$'s are due to the specific drill block parameters (thickness, porosity, water saturation). Costs will be similar and the economic sensitivities are applicable for each case.

HUERFANO UNIT #549

MONTHLY GAS PRODUCTION ALLOCATION FORMULA

GENERAL EQUATION

$$Q_t = Q_{ftc} + Q_{pc}$$

WHERE: Q_t = TOTAL MONTHLY PRODUCTION (MCF/MONTH)
 Q_{ftc} = FRUITLAND COAL (ftc) MONTHLY PRODUCTION
 Q_{pc} = PICTURED CLIFFS (pc) MONTHLY PRODUCTION (MCF/MONTH)

REARRANGING THE EQUATION TO SOLVE FOR Q_{ftc} :

$$Q_{ftc} = Q_t - Q_{pc}$$

ANY PRODUCTION RATE OVER WHAT IS CALCULATED FOR THE PICTURED CLIFFS (PC) USING THE APPLIED FORMULA IS FRUITLAND COAL (FTC) PRODUCTION.

PICTURED CLIFFS (PC) FORMATION PRODUCTION FORMULA IS:

$$Q_{pc} = Q_{pci} \times e^{-\{D_{pc}\} \times (t)}$$

WHERE: Q_{pci} = INITIAL PC MONTHLY FLOW RATE (CALCULATED FROM FLOW TEST)
 D_{pc} = PICTURED CLIFFS MONTHLY DECLINE RATE CALCULATED FROM:
 $D_{pc} = (Q_{pci} - Q_{pcabd}) / N_{p(pc)}$
 See Determination of Q_{pci} and PC Estimated Ultimate Recovery ($N_{p(pc)}$)
 $Q_{pcabd} = 300 \text{ MCF/M}$

WHERE: $N_{p(pc)}$ = PICTURED CLIFFS ESTIMATED ULTIMATE RECOVERY (EUR)
 $N_{p(pc)} = P \times 1.08 \text{ MMCF/PSI}^{**} \times R_f$
 P^* = INITIAL RESERVOIR PRESSURE (SIBHP)
 R_f = RECOVERY (FIELD ANALOGY): = 0.85
 $**$ DETERMINED FROM MATERIAL BALANCE (FIELD ANALOGY) AND VOLUMETRIC RESERVES (LOG ANALYSIS)

By calculating $N_{p(pc)}$ from SIBHP and determining Q_{pci} , D_{pc} can then be calculated utilizing the previously described parameters. See derivation of D_{pc} , item (c) on page 4.

THUS: $Q_{ftc} = Q_t - Q_{pci} \times e^{-\{D_{pc}\} \times (t)}$
 WHERE: (t) IS IN MONTHS

REFERENCE: Thompson, R. S., and Wright, J. D., "Oil Property Evaluation", pages 5-2, 5-3, 5-4.

HUERFANO UNIT #549

DETERMINATION OF Q_{pci} : (INITIAL PICTURED CLIFFS MONTHLY PRODUCTION)

$$\underline{Q_{pci} = Q_t(1) \times Q_{pc}(p) / \{Q_{pc}(p) + Q_{ftc}(p)\}}$$

WHERE:

$Q_t(1)$ = FIRST MONTH TOTAL PRODUCTION (MCF)

$Q_{pc}(p)$ = FINAL PICTURED CLIFFS FLOW TEST (MCFPD)

$Q_{ftc}(p)$ = FINAL FRUITLAND COAL FLOW TEST (MCFPD)

HUERFANO UNIT #549

EXAMPLE DETERMINATION OF:

(a) $N_p(pc)$ (b) Q_{pci} (c) D_{pc}

PC EUR

INITIAL PC MONTHLY FLOW RATE

PC MONTHLY DECLINE RATE

(a) DETERMINATION OF $N_p(pc)$

(see page 5 for $N_p(pc)$ derivation)

$$N_p(pc) = 1.08 \text{ (MMCF/PSI)} \times P^* \text{ (PSI)} \times R_f$$

$$P^* = 300 \text{ PSI (FROM SIBHP)}$$

$$N_p(pc) = 1.08 \text{ MMCF/PSI} \times 300 \text{ PSI} \times 0.85$$

$$\underline{N_p(pc) = 275.4 \text{ MMCF}}$$

(b) DETERMINATION OF Q_{pci}

$$Q_{pci} = Q_{t(1)} \times \{Q_{pc(p)} / (Q_{pc(p)} + Q_{ftc(p)})\}$$

$$Q_{t(1)} = 15,000 \text{ MCF}$$

$$Q_{pc(p)} = 500 \text{ MCF/D}$$

$$Q_{ftc(p)} = 400 \text{ MCF/D}$$

1ST MONTH TOTAL PRODUCTION

PC FLOW TEST

FTC FLOW TEST

$$Q_{pci} = 15,000 \text{ MCF/M} \times \{500 \text{ MCF/D} / (500 \text{ MCF/D} + 400 \text{ MCF/D})\}$$

$$\underline{Q_{pci} = 8,333 \text{ MCF/M}}$$

(c) DETERMINATION OF D_{pc}

$$D_{pc} = (Q_{pci} - Q_{pcabd}) / N_p(pc)$$

$$Q_{pcabd} = 300 \text{ MCF/M}$$

$$D_{pc} = (8,333 \text{ MCF/M} - 300 \text{ MCF/M}) / (275,400 \text{ MCF})$$

$$\underline{D_{pc} = 0.029/\text{M}}$$

$$\underline{\text{THUS: } Q_{ftc} = Q_t(\text{MCF/M}) - 8,333(\text{MCF/M}) \times e^{-\{-(0.029(1/\text{M}))\} \times t(\text{M})}}$$

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A. DETERMINATION OF PC RESERVES $N_p(pc) = (HCPV \times B_g \times R_f)$ Volumetric Evaluation (averages are for subject 160 acre drill block)

a.	(t)	thickness	=	35.0	ft
b.	(phi)	porosity	=	15.0	%
c.	(Sw)	H2O saturation	=	55.0	%
d.	(Rf)	Recovery Factor	=	85.0	%
e.	(rcf)	Reservoir Cubic Feet	@	reservoir conditions	
f.	(scf)	Standard Cubic Feet	@	standard conditions	

1. HCPV = HYDROCARBON PORE VOLUME (rcf)

$$\begin{aligned}
 &= t \text{ (ft)} \times a \text{ (ft}^2\text{)} \times \phi \times (1-S_w) \\
 &= 35 \text{ (ft)} \times 160 \text{ (acres)} \times 43,560 \text{ (ft}^2\text{/acre)} \times 0.15 \times (1-0.55) \\
 &= 16,466,880 \text{ ft}^3 \quad 1 \text{ mmrcf} = 1,000,000 \text{ ft}^3
 \end{aligned}$$

$$\text{HCPV} = 16.466 \text{ mmrcf}$$

2. Bg = FORMATION VOLUME FACTOR (scf/rcf)

UTILIZING THE REAL GAS LAW TO DETERMINE THE FORMATION VOLUME FACTOR (Bg):

REAL GAS LAW states:

Rearranging to solve for n:

$$P V = Z n R T$$

$$n = P V / Z R T$$

assuming:

$$n_r = n_s$$

WHERE: n_r = NUMBER OF MOLES OF GAS AT RESERVOIR CONDITION

n_s = NUMBER OF MOLES OF GAS AT SURFACE CONDITIONS

$$\text{THUS: } P_r V_r / Z_r T_r R = P_s V_s / Z_s T_s R$$

$$\text{Rearranging: } V_s / V_r = B_g = Z_s T_s P_r / Z_r T_r P_s$$

assuming:

$$Z_s = 1.00$$

$$Z_r = 0.94$$

$$T_s = 60 \text{ } ^\circ\text{F} \quad \text{or } 520 \text{ } ^\circ\text{R}$$

$$T_r = 100 \text{ } ^\circ\text{F} \quad \text{or } 560 \text{ } ^\circ\text{R}$$

$$P_s = 15.025 \text{ psia}$$

$$P_r = \text{Determined from build-up test}$$

$$\begin{aligned}
 B_g &= \text{FORMATION VOLUME FACTOR (scf/rcf)} = Z_s T_s P_r / Z_r T_r P_s \\
 &= (\text{scf/rcf}) \{1.00 \times 520 \text{ (} ^\circ\text{R)} \times P_r \text{ (psia)}\} / \{0.94 \times 560 \text{ (} ^\circ\text{R)} \times 15.025 \text{ (psia)}\}
 \end{aligned}$$

$$\text{Bg} = 0.0657 \{ \text{scf} / (\text{rcf psia}) \} \times P_r \text{ (psia)}$$

3. EUR = HCPV X Bg X Rf

$$= 16.466 \text{ (mmrcf)} \times 0.0657 \{ \text{scf} / (\text{rcf psia}) \} \times P_r \text{ (psia)} \times 0.85$$

$$\text{Np(pc)} = 1.08 \text{ (mmscf/psia)} \times P_r \text{ (psia)} \times 0.85$$

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B. PICTURED CLIFFS DRILLING /COMPLETION COST SUMMARY

1. STAND ALONE SINGLE PC COMPLETION

ESTIMATED COSTS:	TANGIBLE (M\$)	INTANGIBLE (M\$)	TOTAL (M\$)
	183.39	136.12	319.51

2. FTC/PC DUAL COMPLETION*

ESTIMATED COSTS:	TANGIBLE (M\$)	INTANGIBLE (M\$)	TOTAL (M\$)
	173.49	93.67	267.16

3. FTC/PC COMMINGLE COMPLETION*

ESTIMATED COSTS:	TANGIBLE (M\$)	INTANGIBLE (M\$)	TOTAL (M\$)
	91.69	93.67	185.36

*PICTURED CLIFFS COSTS ONLY

C. ECONOMIC SUMMARY

FIGURES 1-3 PICTURED CLIFFS RESERVES VS RATE OF RETURN (%)

THREE CASES PER FIGURE (FTC/PC COMMINGLE, FTC/PC DUAL, PC SINGLE)

FIGURE 1 INITIAL RATE = 100 MCF/D

FIGURE 2 INITIAL RATE = 200 MCF/D

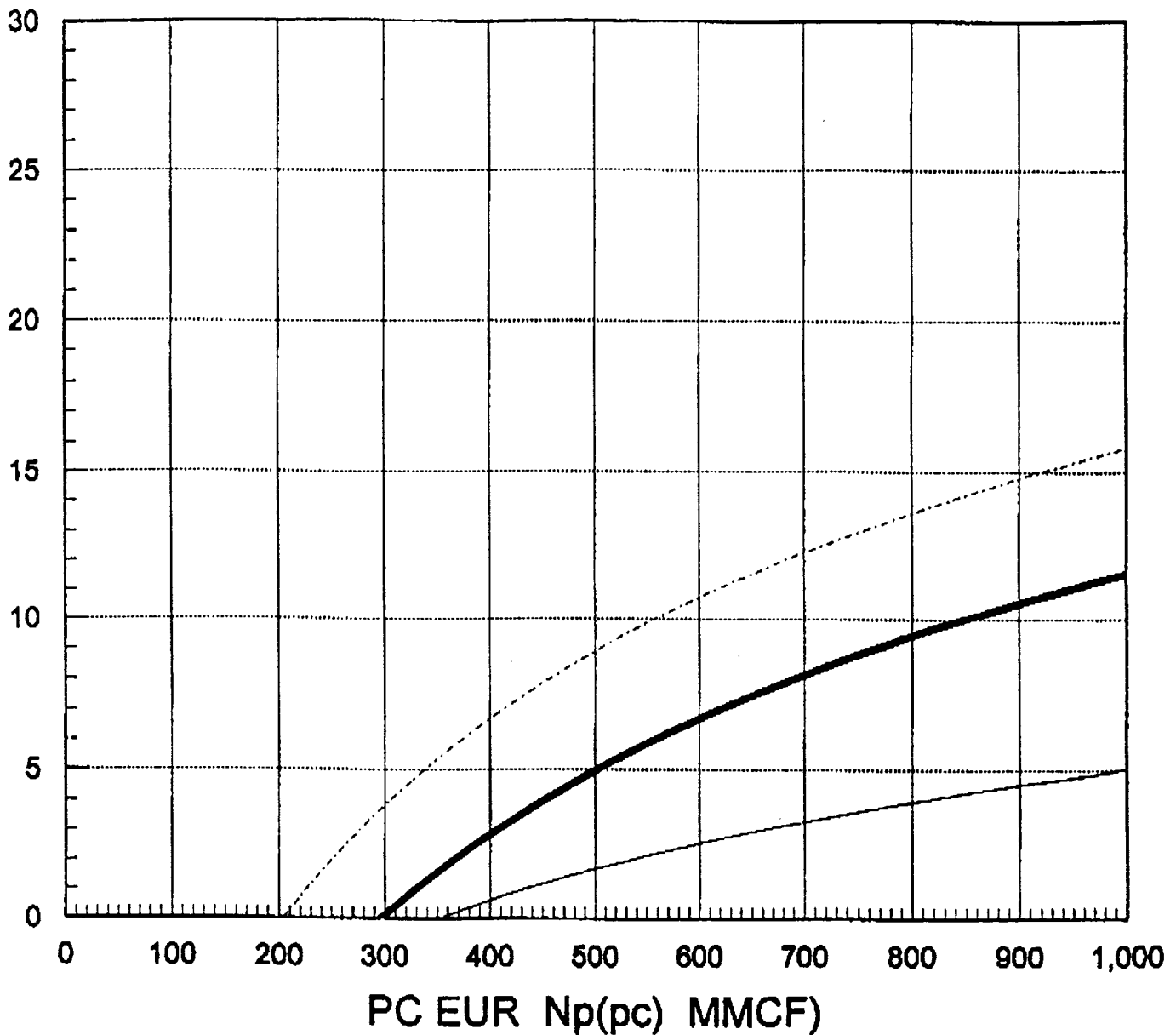
FIGURE 3 INITIAL RATE = 300 MCF/D

PICTURED CLIFFS

ECONOMIC EVALUATION

COMPLETION TECHNIQUE SENSITIVITY

RATE OF RETURN (%)



PC PC-FTC PC-FTC
SINGLE DUAL COMMINGLE

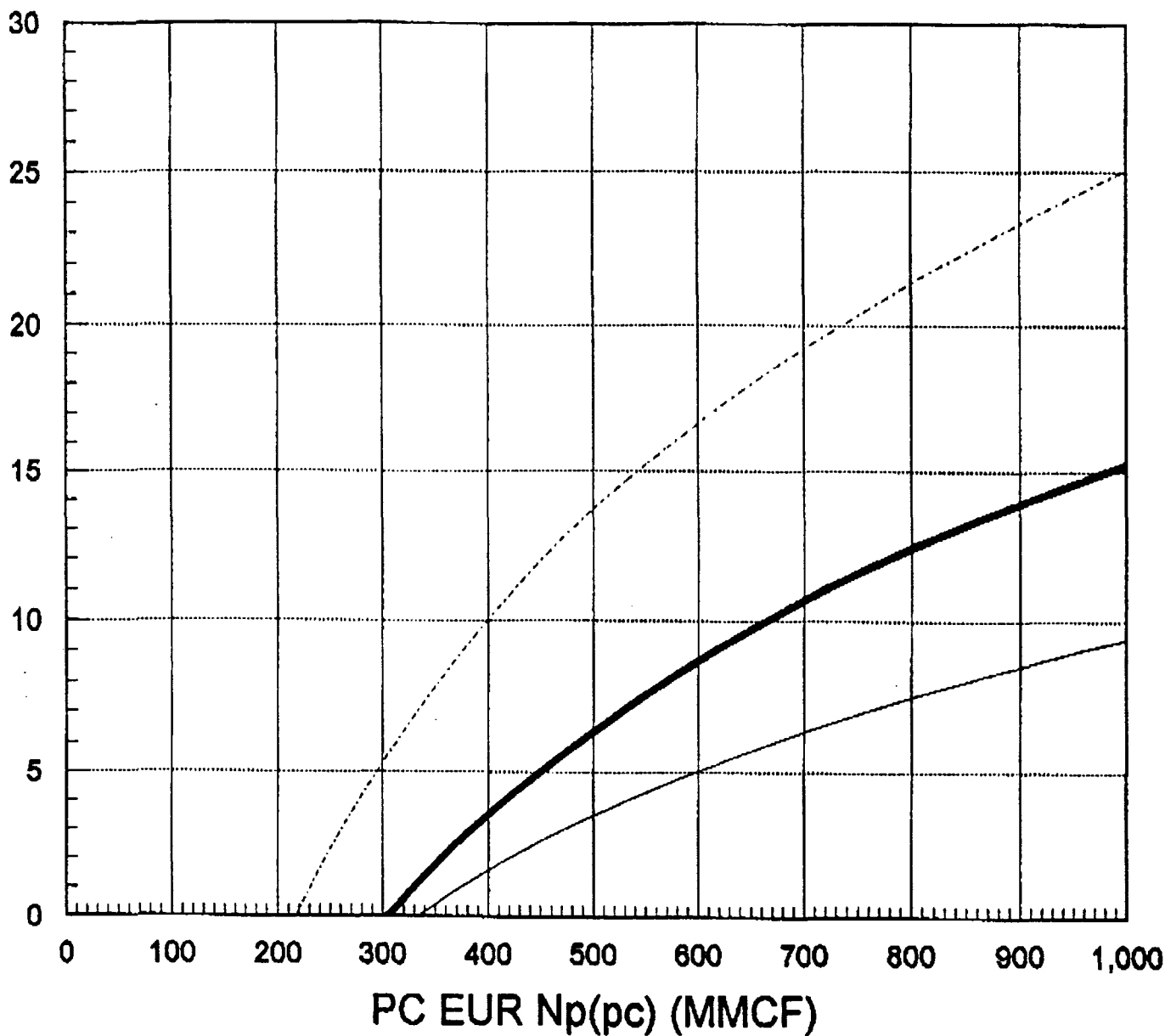
INITIAL RATE (Q_{pci}) = 100 MCF/D
OR 3,000 MCF/M
FIGURE 1

PICTURED CLIFFS

ECONOMIC EVALUATION

COMPLETION TECHNIQUE SENSITIVITY

RATE OF RETURN (%)



PC PC-FTC PC-FTC
SINGLE DUAL COMMINGLE

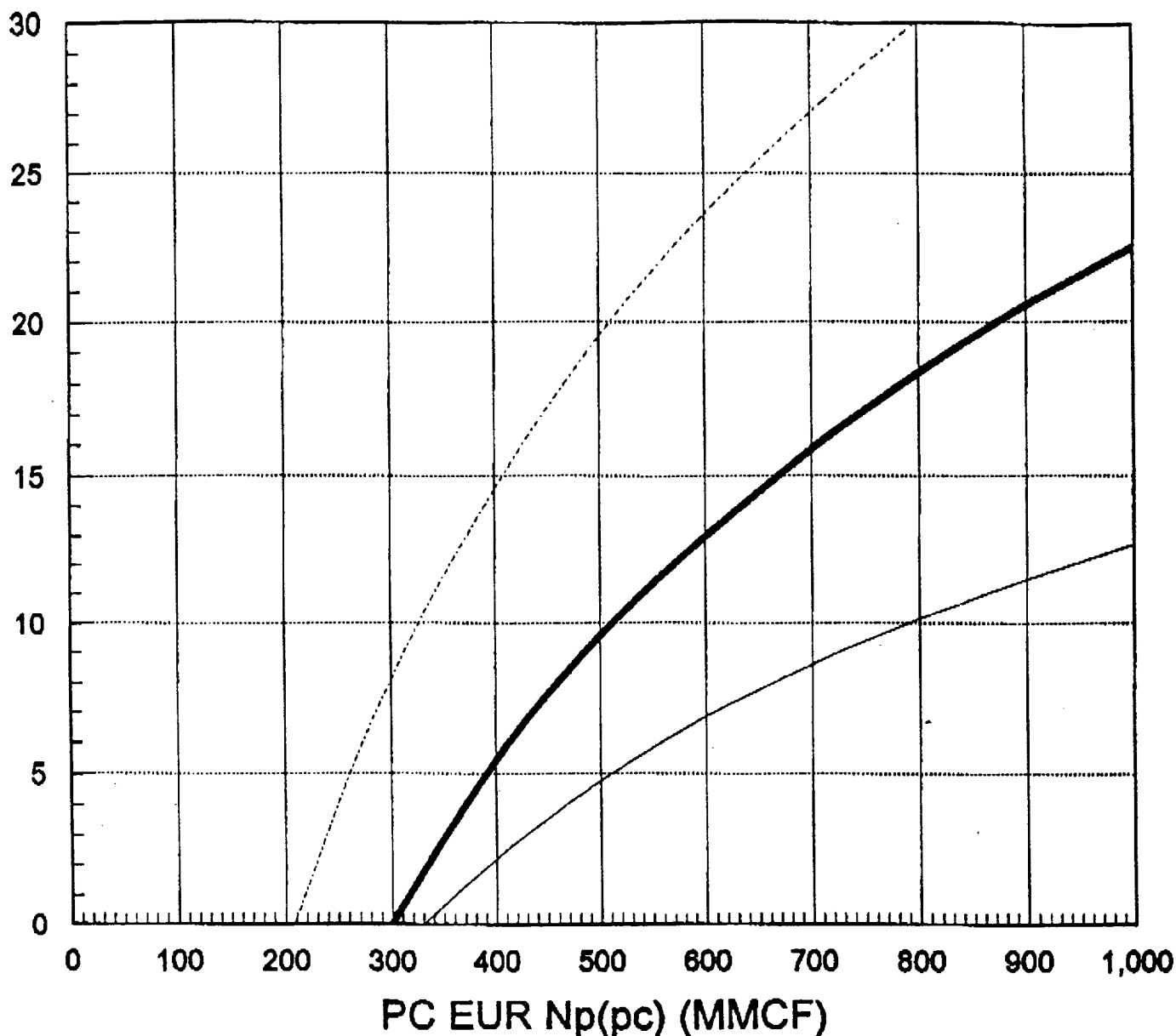
INITIAL RATE (Q_{pci}) = 200 MCF/D
OR 6,000 MCF/M

FIGURE 2

ECONOMIC EVALUATION

COMPLETION TECHNIQUE SENSITIVITY

RATE OF RETURN (%)



PC PC-FTC PC-FTC
 SINGLE DUAL COMMINGLE

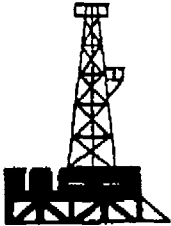
INITIAL RATE (Q_{pci}) = 300 MCF/D

OR 9,000 MCF/M

FIGURE 3

WELL	POOL	OWNERSHIP		NSL	ECONOMICS
		PC	FTC	FTC	
1. Rhodes C#101	BFTC	W-K	Comm	NSL	FTC - PC
2. Rhodes C#102	BFTC	W-K	Comm	OK	FTC - PC
3. Whitley A#100	BFTC	W-K	Comm	OK	FTC - PC
4. Rowley Com#500	BFTC	FK	Diff	OK	PC -Margin
5. McAdams #500	BFTC	FK	Diff	OK	PC

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Oil Property Evaluation

to plot, they yield results on a time basis, and they're deceptively easy to analyze. Decline curves are also one of the oldest methods of predicting reserves.

Decline curves, as used today, are simply a plot of production rate versus time on semilog, log-log, or specially scaled paper. The most common plot is semilog. When the logarithm of producing rate is plotted versus linear time, a straight line often results. This phenomenon is referred to as "exponential decline" and is similar to the decay of a radioactive element. Exponential decline is also referred to as constant percentage decline because of terminology used in the early 1900's. Occasionally, someone will state that exponential decline and constant percentage decline are different. This is not true; they are synonyms for decline curves which plot as a straight line on semi-log paper.

Often the data will not plot as a straight line on semi-log paper, but instead will "curve up" or be concave upwards. This situation, in which the decline rate continuously decreases with time, can usually be modeled with a hyperbolic equation. In cases of this type, the well is said to be experiencing "hyperbolic decline." A special case of hyperbolic decline is known as "harmonic decline."

5.1 DECLINE CURVE EQUATIONS

5.1.1 Exponential Decline

The equation of a straight line on semilog paper can be written as

$$q = q_i e^{-Dt} \quad (5-1)$$

where

q = producing rate at time t , vol/unit time

q_i = producing rate at time 0, vol/unit time

D = nominal exponential decline rate, 1/time

t = time

e = base of natural logarithms, (2.718...)

Any system of units can be used as long as the product Dt is unitless and q and q_i are expressed in the same units. Equation 5-1 can be "derived" by stating that the decline rate at any time is proportional to the production rate, but there is no theoretical foundation for this "derivation." The theoretical foundation for exponential decline will be discussed later.

5.1.1.1 Nominal and Effective Decline Rates

Equation (5-1) defines the nominal decline rate (D). In dealing with production data, we intuitively think in terms of "effective" decline rate. For example, if we are told that a well produced 100 BOPD one year ago and now produces 50 BOPD, we naturally feel that the well declined at a rate of 50% per year. Imagine our surprise when the engineer says it is declining at 69.3% per year! Which one of these is correct? Both of them are. Effective decline is defined as

$$D_e = \frac{q_i - q}{q_i} \quad (5-2)$$

for a given time period. The relationship between D and D_e can be derived as follows. We take t to be one time period (a year, perhaps). Since q_i and q are the same for both definitions of decline rate we can solve equations 5-1 and 5-2 for q and set the results equal:

$$q = q_i e^{-D}$$

$$q_i e^{-D} = q_i - q_i D_e$$

$$(t \text{ has been set to } 1)$$

$$\text{factor out } q_i$$

$$e^{-D} = 1 - D_e$$

Nominal decline as a function of effective decline is

$$D = -\ln(1 - D_e) \quad (5-3)$$

Decline Curve Analysis

or

Effective decline as a function of nominal decline is

$$D_e = 1 - e^{-D} \quad (5-4)$$

The authors strongly prefer the use of nominal decline rather than effective decline for reasons which will be discussed throughout the rest of the chapter.

One of the major reasons for using nominal decline has to do with changing the time units on decline rate. With nominal decline, a yearly rate can be changed to a monthly rate simply by dividing by 12. *This is not possible with effective decline!* In order to convert yearly effective rate to monthly effective rate, the *twelfth root* of $1 - D_e$ must be taken. Taking the twelfth root or raising a number to the twelfth power is not difficult, but it is not intuitive. An example will illustrate the above ideas.

Example 5-1

Nominal and Effective Decline Rates

Given that a well has declined from 100 BOPD to 96 BOPD during a one month period.

- A) Predict the rate after 11 more months using nominal exponential decline.
- B) Same as A using effective decline.

A) Using Nominal Decline

$$q_i = 100 \text{ BOPD}$$

$$q = 96 \text{ BOPD}$$

$$t = 1 \text{ month}$$

$$D = \left[\ln \left(\frac{q_i}{q} \right) \right] / t \quad (5-1)$$

$$D = .04082/\text{mo}$$

Find rate at end of 1 year.

$$q = q_i e^{-Dt}$$

$$q = 100e^{-.04082(12)}$$

$$q = 61.27 \text{ BOPD}$$

B) Using Effective Decline

$$D_e = \frac{q_i - q}{q_i} \quad (5-2)$$

$$D_e = \frac{100 - 96}{100}$$

$$D_e = .04/\text{month}$$

Convert to yearly

$$1 - D_{ey} = (1 - D_{em})^{12}$$

$$1 - D_{ey} = (1 - .04)^{12}$$

$$D_{ey} = .3875/\text{year}$$

Find rate at end of 1 year

$$q = q_i (1 - D_e)$$

$$q = 100(1 - .3873)$$

$$q = 61.27 \text{ BOPD}$$

The authors find it much easier to use nominal decline. No matter what the units on D and t , it is only necessary to multiply by the appropriate time factor to cause the product Dt to be unitless. Try to predict the rate 22 1/2 months from now using effective decline — it's not worth the effort.

5.1.1.2 Cumulative Production

In oil property evaluation, we are more interested in the amount of oil produced each year than the rate at any given time. In order to determine the cumulative oil production (N_p) at any