



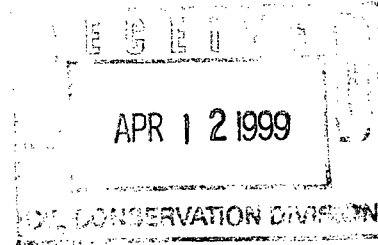
## ARCO Permian

600 North Mariefeld  
Midland, TX 79701-4373  
P.O. Box 1610  
Midland, TX 79702-1610  
Telephone 915-688-5570  
Facsimile 915-688-5956  
Email [ecasbee@mail.arco.com](mailto:ecasbee@mail.arco.com)

Elizabeth A. Casbeer  
Regulatory/Compliance Analyst

DHC 5/3/99

2309



April 9, 1999

New Mexico Oil Conservation Division  
ATTN: David Catanach  
2040 S. Pacheco Street  
Santa Fe, NM 87505

RE: Application of ARCO Permian  
for Downhole Commingling on  
Washington State "33" Well Nos. 13 & 14  
Artesia (QGSA) and Artesia (Glor-Yeso) Fields  
Eddy Co., NM

Mr. Catanach:

ARCO Permian respectfully requests administrative approval for downhole commingling on the Washington State "33" Well Nos. 13 and 14. Attached are the supporting documents for this application.

If you have any questions, please contact me at 915/688-5570. Please send the approved permit to:

ARCO Permian  
ATTN: E. A. CASBEER, Room 959-54  
P. O. Box 1610  
Midland, TX 79702

Yours very truly,

Elizabeth A. Casbeer  
Regulatory Compliance Analyst

### Attachments

xc: Larry Henson – EUN  
Donald Knipe – 61323/MIO  
Central Files - 041/MIO  
R/C Files

**ARCO Permian  
Downhole Commingling  
Washington State "33" Lease  
Section 33, T-17S, R-28E  
Eddy County, New Mexico**

**Well No. 13  
API: 30-015-22524  
1610' FNL & 250' FEL (N)**

**Well No. 14  
API: 30-015-30194  
2282' FNL & 970' FEL (H)**

**Surface Owners for Unit N & H:**

**Bogle, Ltd.  
P. O. Box 460  
Dexter, NM 88230-0460**

**Offset Operators:**

**Marbob Energy Corporation  
P.O. Box 227  
Artesia, NM 88211-0227**

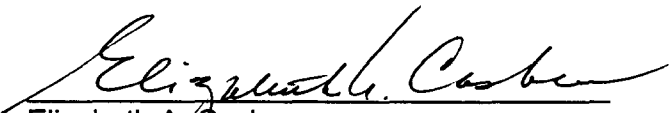
**Lauretta Phillipa  
715 N. Maple Drive  
Beverly Hills, CA 90210**

**STATE OF TEXAS**

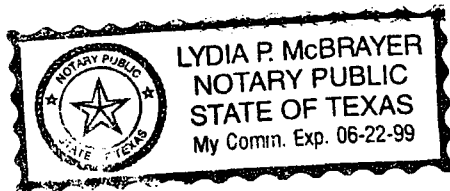
**COUNTY OF MIDLAND**

**BEFORE ME**, the undersigned authority on this day personally appeared Elizabeth A. Casbeer, an Regulatory Compliance Analyst with **ARCO Permian**, who being by me duly sworn, deposes and states that the persons listed on the foregoing attached list have been sent a copy on April 9, 1999, of the New Mexico Oil Conservation Division Form C-107 entitled, "Application For Downhole Commingling" for the Washington State "33" Well Nos. 13 and 14, located in Section 33, T17S, R28E, Eddy County New Mexico.

**ARCO Permian**

  
Elizabeth A. Casbeer

**SUBSCRIBED AND SWORN TO** before me on April 9, 1999, to certify which witness my hand and seal of office.



  
NOTARY PUBLIC, STATE OF TEXAS

[illegible]

## DISTRICT I

P.O. Box 1980, Hobbs, NM 88241-1980

## DISTRICT II

811 South First St., Artesia, NM 88210-2835

## DISTRICT III

1000 Rio Brazos Rd, Aztec, NM 87410-1693

State of New Mexico APR 12 1999  
Energy, Minerals and Natural Resources Department

## OIL CONSERVATION DIVISION

2040 S. Pacheco  
Santa Fe, New Mexico 87505-6429Form C-107-A  
New 3-12-96

## APPROVAL PROCESS:

☒ Administrative ☐ Hearing

## EXISTING WELLBORE

☒ YES ☐ NO

## APPLICATION FOR DOWNHOLE COMMINGLING

ARCO Permian P500 Box 1610 Midland, TX 79702

Operator

Address

Washington "33" State No. 14 H-33-17S-28E

Eddy

Lease

Well No.

Unit Ltr. - Sec - Twp - Rge

County

Spacing Unit Lease Types: (check 1 or more)

OGRID NO. 000990 Property Code 22954 API NO. 30-015-30194 Federal ☐ State ☒ (and/or) Fee ☐

| The following facts are submitted in support of downhole commingling:                                                                                                                                | Upper Zone                          | Intermediate Zone | Lower Zone                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------|-----------------------------------------------------------|
| 1. Pool Name and Pool Code                                                                                                                                                                           | Artesia<br>(Queen, GRBG, S.A.)      |                   | Artesia<br>(Glorieta; Yeso)                               |
| 2. Top and Bottom of Pay Section (Perforations)                                                                                                                                                      | 2200'-3000'                         |                   | 3726'-3954'                                               |
| 3. Type of production (Oil or Gas)                                                                                                                                                                   | Oil                                 |                   | Oil                                                       |
| 4. Method of Production (Flowing or Artificial Lift)                                                                                                                                                 | Artificial Lift                     |                   | Artificial Lift                                           |
| 5. Bottomhole Pressure<br>Oil Zones - Artificial Lift:<br>Gas & Oil - Flowing:<br>All Gas Zones:<br>Estimated Current<br>Measured Current<br>Estimated Or Measured Original                          | a. (Current)<br>70<br>b. (Original) | a.<br><br>b.      | a.<br>75<br>b.                                            |
| 6. Oil Gravity ( $^{\circ}$ API) or Gas BTU Content                                                                                                                                                  | 40-42 $^{\circ}$ API                |                   | 42 $^{\circ}$ API                                         |
| 7. Producing or Shut-In?                                                                                                                                                                             | Awaiting Perfs                      |                   | Producing                                                 |
| Production Marginal? (yes or no)                                                                                                                                                                     | Expected in 3 to 6 months           |                   | yes                                                       |
| * If Shut-In, give date and oil/gas/water rates of last production<br>Note: For new zones with no production history, applicant shall be required to attach production estimates and supporting data | Date:<br>Rates: N/A                 | Date:<br>Rates:   | Date:<br>Rates: N/A                                       |
| * If Producing, give date and oil/gas/water rates of recent test (within 60 days)                                                                                                                    | Date:<br>Rates: N/A                 | Date:<br>Rates:   | Date: 02/05/99<br>Rates: 9 BOPD<br>144 BWPD<br>63 MCF/GPD |
| 8. Fixed Percentage Allocation Formula - % for each zone                                                                                                                                             | Oil: 27 % Gas: 27 %                 | Oil: % Gas: %     | Oil: 73 % Gas: 73 %                                       |

9. If allocation formula is based upon something other than current or past production, or is based upon some other method, submit attachments with supporting data and/or explaining method and providing rate projections or other required data.

10. Are all working, overriding, and royalty interests identical in all commingled zones? ☒ Yes ☐ No  
If not, have all working, overriding, and royalty interests been notified by certified mail? ☒ Yes ☐ No  
Have all offset operators been given written notice of the proposed downhole commingling? ☒ Yes ☐ No11. Will cross-flow occur? ☐ Yes ☒ No If yes, are fluids compatible, will the formations not be damaged, will any cross-flowed production be recovered, and will the allocation formula be reliable. ☐ Yes ☐ No (If No, attach explanation)12. Are all produced fluids from all commingled zones compatible with each other? ☒ Yes ☐ No13. Will the value of production be decreased by commingling? ☐ Yes ☒ No (If Yes, attach explanation)14. If this well is on, or communitized with, state or federal lands, either the Commissioner of Public Lands or the United States Bureau of Land Management has been notified in writing of this application. ☒ Yes ☐ No

15. NMOCD Reference Cases for Rule 303(D) Exceptions: ORDER NO(S). \_\_\_\_\_

## 16. ATTACHMENTS:

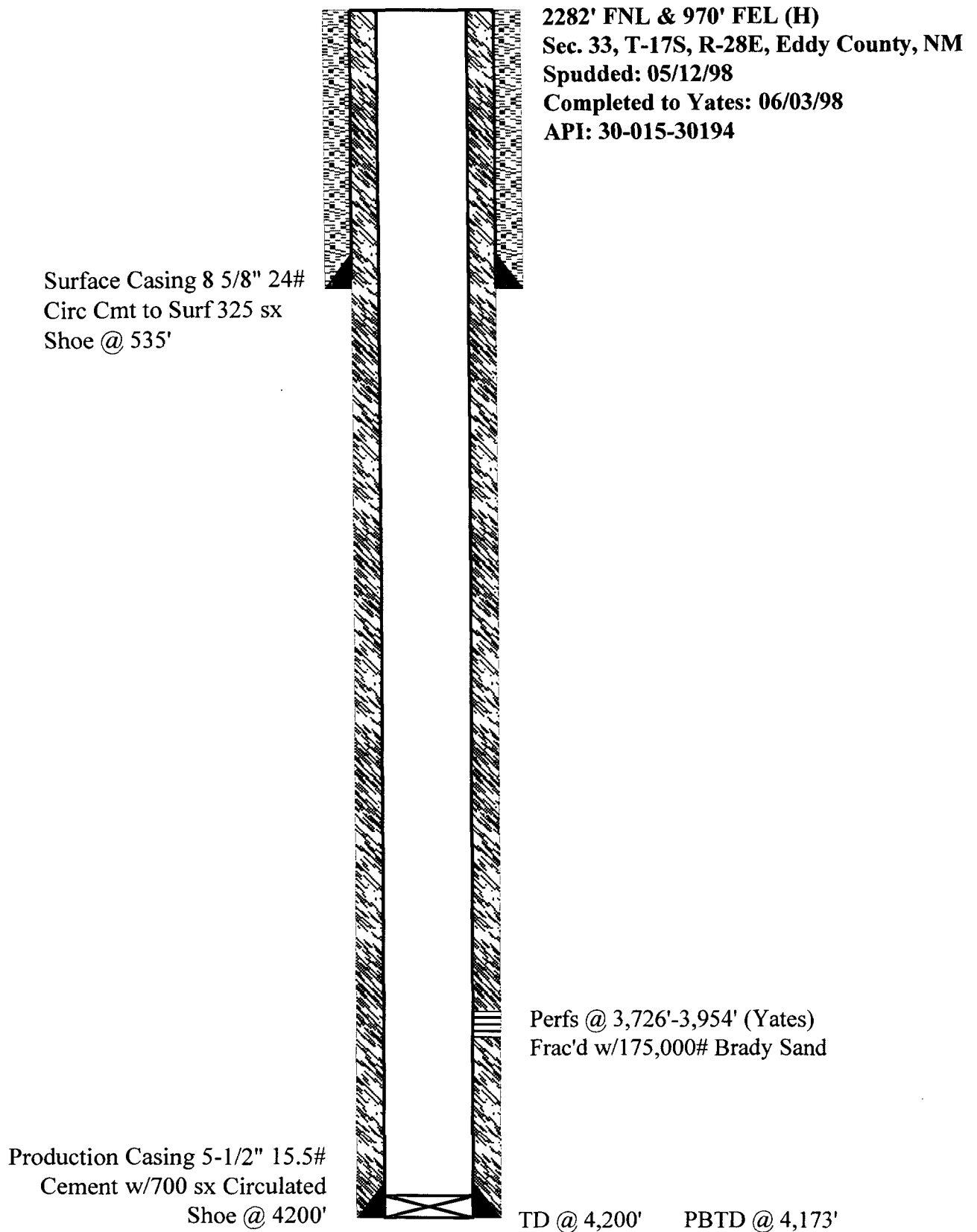
- \* C-102 for each zone to be commingled showing its spacing unit and acreage dedication.
- \* Production curve for each zone for at least one year. (If not available, attach explanation.)
- \* For zones with no production history, estimated production rates and supporting data.
- \* Data to support allocation method or formula.
- \* Notification list of all offset operators.
- \* Notification list of working, overriding, and royalty interests for uncommon interest cases.
- \* Any additional statements, data, or documents required to support commingling.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Elizabeth A. Casbeer TITLE Reg/Comp. Analyst DATE 4-9-99TYPE OR PRINT NAME Elizabeth A. Casbeer TELEPHONE NO. (915) 688-5570

# WELLBORE SCHEMATIC

## Washington State "33" No. 14



Submit to Appropriate  
District Office  
State Lease - 6 copies  
Fee Lease - 5 copies

State of New Mexico  
Energy, Minerals and Natural Resources Department

Form C-105  
Revised 1-1-89

**DISTRICT I**  
P.O. Box 1980, Hobbs, NM 88240

**OIL CONSERVATION DIVISION**

**DISTRICT II**  
P.O. Drawer DD, Artesia, NM 88210

2040 Pacheco St.  
Santa Fe, NM 87505

**DISTRICT III**  
1000 Rio Brazos Rd., Aztec, NM 87410

WELL API NO.

30-015-30194

5. Indicate Type Of Lease

STATE ☒

FEE ☐

6. State Oil & Gas Lease No.

7. Lease Name or Unit Agreement Name

WASHINGTON "33" STATE

**WELL COMPLETION OR RECOMPLETION REPORT AND LOG**

1a. Type of Well:  
OIL WELL ☒

GAS WELL ☐

DRY ☐

OTHER \_\_\_\_\_

b. Type of Completion:

NEW  
WELL ☒

WORK  
OVER ☐

DEEPEN ☐

PLUG  
BACK ☐

DIFF  
RESVR ☐

OTHER \_\_\_\_\_

2. Name of Operator

ARCO Permian

8. Well No.

14

3. Address of Operator

P.O. Box 1610 Midland, TX 79702

9. Pool name or Wildcat

WILDCAT (YES0)

4. Well Location

Unit Letter H : 2282 Feet From The NORTH Line and 970 Feet From The EAST Line

Section 33

Township 17S

Range 28E

NMPM

EDDY

County

10. Date Spudded

5/12/98

11. Date T.D. Reached

5/20/98

12. Date Compl.(Ready to Prod.)

6-3-98

13. Elevations(DF & RKB, RT, GR, etc.)

3666'

14. Elev. Casinghead

15. Total Depth

4200

16. Plug Back T.D.

4173

17. If Multiple Compl. How  
Many Zones?

18. Intervals  
Drilled By

Rotary Tools

Cable Tools

X

19. Producing Interval(s), of this completion - Top, Bottom, Name

3726-3954 (YES0)

20. Was Directional Survey Made

NO

21. Type Electric and Other Logs Run

CPNL-GR CCL

22. Was Well Cored

NO

**23. CASING RECORD (Report all strings set in well)**

| CASING SIZE | WEIGHT LB./FT. | DEPTH SET | HOLE SIZE | CEMENTING RECORD | AMOUNT PULLED |
|-------------|----------------|-----------|-----------|------------------|---------------|
| 8-5/8       | 24             | 535       | 12-1/4    | CL C-325 SX      |               |
| 5-1/2       | 15.5           | 4200'     | 7-7/8     | CL C-700 SX      |               |
|             |                |           |           |                  |               |
|             |                |           |           |                  |               |
|             |                |           |           |                  |               |

**24. LINER RECORD**

| SIZE | TOP | BOTTOM | SACKS CEMENT | SCREEN |
|------|-----|--------|--------------|--------|
|      |     |        |              |        |
|      |     |        |              |        |
|      |     |        |              |        |

**25. TUBING RECORD**

| SIZE   | DEPTH SET | PACKER SET |
|--------|-----------|------------|
| 2 7/8" | 3730      |            |
|        |           |            |
|        |           |            |

26. Perforation record (interval, size, and number)

3726-3954 / 62 HOLES

27. ACID, SHOT, FRACTURE, CEMENT, SOBBEZE, ETC.

DEPTH INTERVAL

AMOUNT AND KIND MATERIAL USED

3726-3954

3000 GAL 15% 118000 VIK 1-30;

175000 #SD

**28. PRODUCTION**

Date First Production

6-5-98

Production Method (Flowing, gas lift, pumping - Size and type pump)

PUMPING

Well Status (Prod. or Shut-in)

PRODUCING

Date of Test

6/9/98

Hours Tested

24

Choke Size

Prod'n For  
Test Period

Oil - Bbl.

9

Gas - MCF

25

Water - Bbl.

863

Gas - Oil Ratio

2778

Flow Tubing Press.

Casing Pressure

Calculated 24-  
Hour Rate

Oil - Bbl.

Gas - MCF

Water - Bbl.

Oil Gravity - API (Corr.)

38.8

29. Disposition of Gas (Sold, used for fuel, vented, etc.)

SOLD

Test Witnessed By

30. List Attachments

31. I hereby certify that the information shown on both sides of this form is true and complete to the best of my knowledge and belief

Signature

*Laurie Cherry*

Printed  
Name

Laurie Cherry

Title

REG./COMP. ASST.

Date

7-1-98

DISTRICT I  
P.O. Box 1980, Hobbs, NM 88241-1980

DISTRICT II  
P.O. Drawer DD, Artesia, NM 88211-0719

DISTRICT III  
1000 Rio Brazos Rd., Aztec, NM 87410

DISTRICT IV  
P.O. Box 2088, Santa Fe, N.M. 87504-2088

State of New Mexico  
Energy, Minerals and Natural Resources Department

Form C-102  
Revised February 10, 1994  
Submit to Appropriate District Office  
State Lease - 4 Copies  
Fee Lease - 3 Copies

OIL CONSERVATION DIVISION  
P.O. Box 2088

Santa Fe, New Mexico 87504-2088

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

|               |                                      |                    |
|---------------|--------------------------------------|--------------------|
| API Number    | Pool Code                            | Pool Name          |
| Property Code | Property Name<br>WASHINGTON 33 STATE | Well Number<br>14  |
| OGRID No.     | Operator Name<br>ARCO PERMIAN        | Elevation<br>3666' |

Surface Location

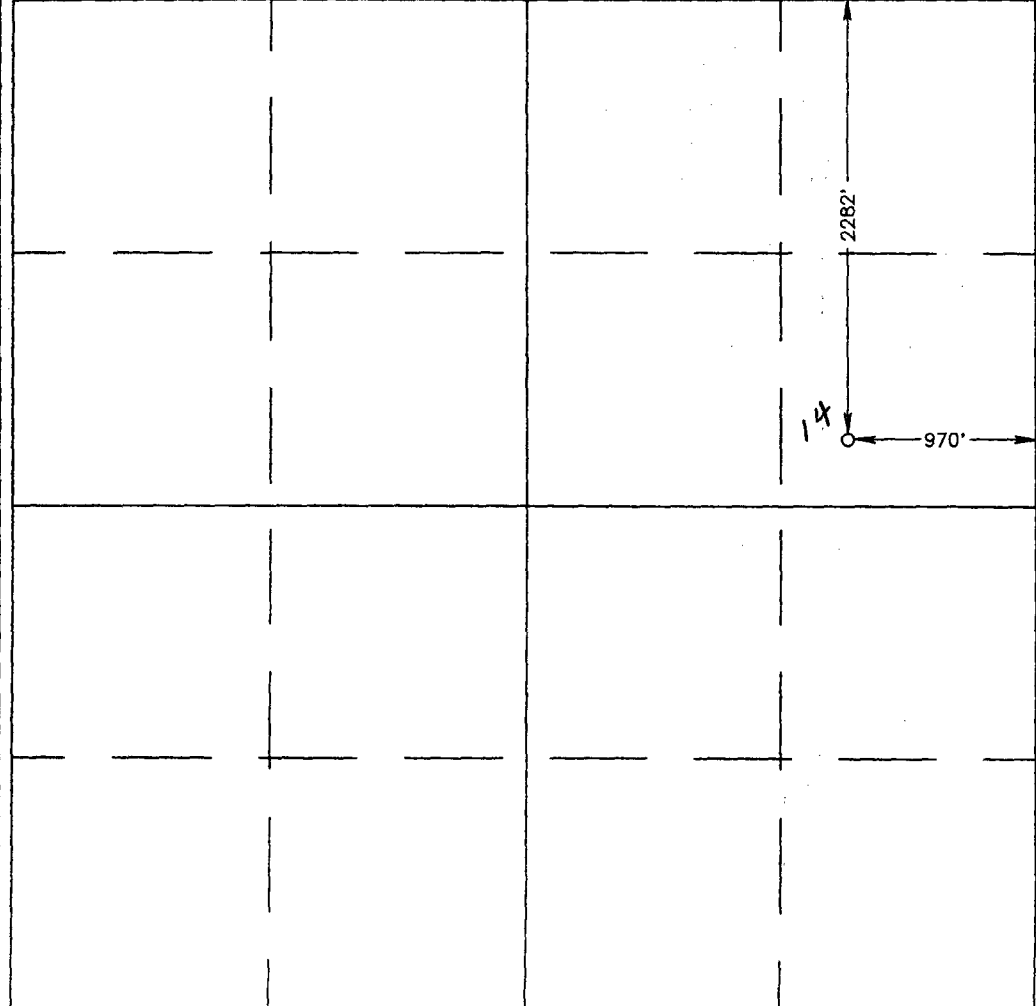
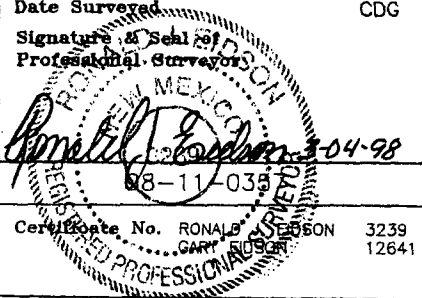
|                    |               |                  |               |         |                       |                           |                      |                        |                |
|--------------------|---------------|------------------|---------------|---------|-----------------------|---------------------------|----------------------|------------------------|----------------|
| UL or lot No.<br>H | Section<br>33 | Township<br>17 S | Range<br>28 E | Lot Idn | Feet from the<br>2282 | North/South line<br>NORTH | Feet from the<br>970 | East/West line<br>EAST | County<br>EDDY |
|--------------------|---------------|------------------|---------------|---------|-----------------------|---------------------------|----------------------|------------------------|----------------|

Bottom Hole Location If Different From Surface

|               |         |          |       |         |               |                  |               |                |        |
|---------------|---------|----------|-------|---------|---------------|------------------|---------------|----------------|--------|
| UL or lot No. | Section | Township | Range | Lot Idn | Feet from the | North/South line | Feet from the | East/West line | County |
|---------------|---------|----------|-------|---------|---------------|------------------|---------------|----------------|--------|

|                 |                 |                    |           |
|-----------------|-----------------|--------------------|-----------|
| Dedicated Acres | Joint or Infill | Consolidation Code | Order No. |
|-----------------|-----------------|--------------------|-----------|

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED  
OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>OPERATOR CERTIFICATION</b><br><br><i>I hereby certify the the information contained herein is true and complete to the best of my knowledge and belief.</i><br><br>Signature _____<br><br>Printed Name _____<br><br>Title _____<br><br>Date _____                                                                                                                                                                                                                                                                     |
|                                                                                     | <b>SURVEYOR CERTIFICATION</b><br><br><i>I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision and that the same is true and correct to the best of my belief.</i><br><br>FEBRUARY 25, 1998<br><br>Date Surveyed _____ CDG<br>Signature & Seal of Professional Surveyor _____<br><br>Certificate No. RONALD B. EDSON 3239<br>GARY EUGEN 12641 |

## **Washington State "33" No. 25**

### **Allocation Formula**

| <b>Well Name</b>                    | <b>Producing Formation</b>           | <b>Daily Production Test</b>                | <b>% of Total</b> |
|-------------------------------------|--------------------------------------|---------------------------------------------|-------------------|
|                                     |                                      | <b>(3 mo. Avg. Nov, Dec. 98', Jan. 99')</b> |                   |
| <b>Washington State "33" No. 24</b> | <b>Artesia (Glorieta, Yeso)</b>      | <b>29 BO/61 MCF/84 BW</b>                   | <b>72.5 %</b>     |
| <b>Washington State "33" No. 25</b> | <b>Artesia (Queen, Grayburg, SA)</b> | <b>11 BO/57 MCF/41 BW</b>                   | <b>27.5 %</b>     |

**The above production test represents stable production from a San Andres producer (Washington State "33" No. 25) and a Yeso producer (Washington State "33" No. 24) . We believe these rates of production represent an acceptable means to allocate production. See attached production plots.**

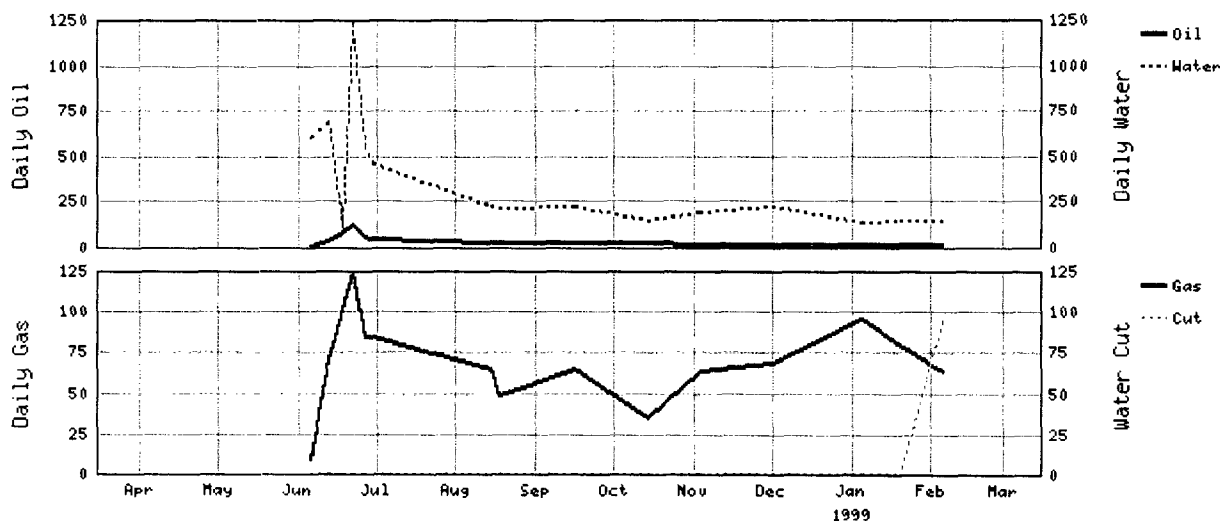


Mon Mar 15, 1999  
3:08:44 PM

**Well Test Data for SE NEW MEXICO: ARTESIA: YESO  
WASHINGTON 33 STATE #14 - 300153019400 - PO - AC**



| Date       | Oil | Water | Gas | Cut | Fl | Pd    | %C02 | GasGr | GDur |
|------------|-----|-------|-----|-----|----|-------|------|-------|------|
| 02/05/1999 | 9   | 144   | 63  | 94  | 0  | 0.000 | 0    | 0     |      |
| 01/20/1999 | 10  | 146   | 79  | 0   | 0  | 0.000 | 0    | 0     |      |
| 01/05/1999 | 8   | 131   | 95  | 0   | 0  | 0.000 | 0    | 0     |      |
| 12/01/1998 | 6   | 220   | 68  | 0   | 0  | 0.000 | 0    | 0     |      |
| 11/03/1998 | 14  | 186   | 63  | 0   | 0  | 0.000 | 0    | 0     |      |
| 10/14/1998 | 18  | 149   | 35  | 0   | 0  | 0.000 | 0    | 0     |      |
| 09/16/1998 | 22  | 224   | 64  | 0   | 0  | 0.000 | 0    | 0     |      |
| 08/18/1998 | 17  | 215   | 48  | 0   | 0  | 0.000 | 0    | 0     |      |
| 08/15/1998 | 22  | 224   | 64  | 0   | 0  | 0.000 | 0    | 0     |      |
| 06/30/1998 | 45  | 452   | 84  | 0   | 0  | 0.000 | 0    | 0     |      |
| 06/27/1998 | 53  | 555   | 84  | 0   | 0  | 0.000 | 0    | 0     |      |
| 06/22/1998 | 121 | 1223  | 124 | 0   | 0  | 0.000 | 0    | 0     |      |
| 06/18/1998 | 80  | 111   | 101 | 0   | 0  | 0.000 | 0    | 0     |      |
| 06/13/1998 | 34  | 685   | 71  | 0   | 0  | 0.000 | 0    | 0     |      |
| 06/06/1998 | 0   | 599   | 9   | 0   | 0  | 0.000 | 0    | 0     |      |
| Average:   | 31  | 351   | 70  | 6   | 0  | 0.000 | 0    | 0     |      |



execution time = 4 seconds

For questions or comments regarding this program, contact [pagemaster@permian.arco.com](mailto:pagemaster@permian.arco.com)

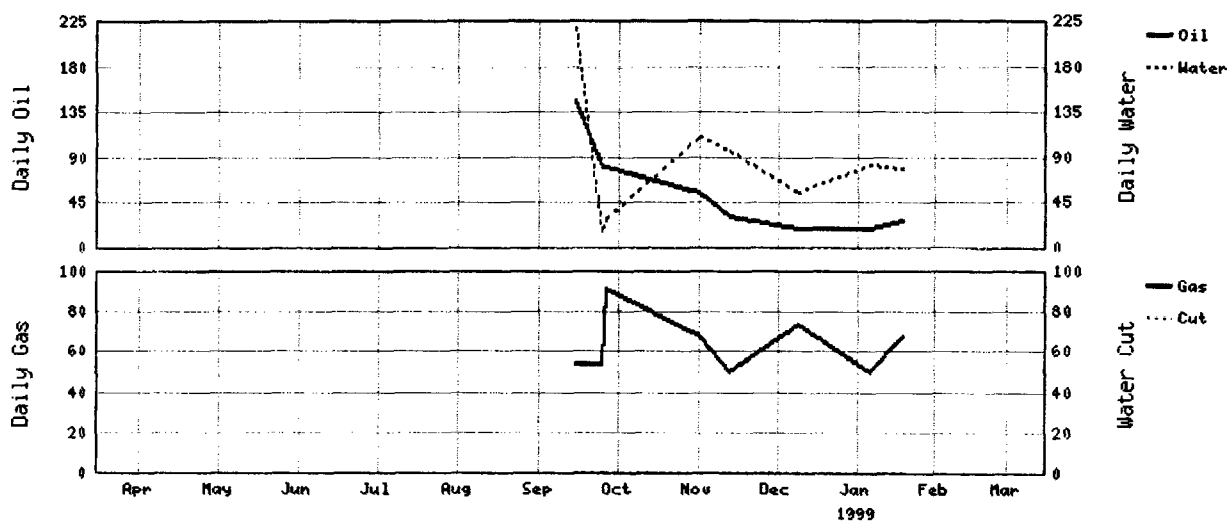


Mon Mar 15, 1999  
3:08:12 PM

# **Well Test Data for SE NEW MEXICO: ARTESIA: YESO WASHINGTON 33 STATE #24 - 300153033400 - PO - AC**



| Date       | Oil | Water | Gas | Cut | Fl | Pd | %C02  | GasGr | GDur |
|------------|-----|-------|-----|-----|----|----|-------|-------|------|
| 01/19/1999 | 26  | 78    | 67  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 01/06/1999 | 18  | 82    | 50  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 12/09/1998 | 18  | 53    | 73  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 11/13/1998 | 29  | 96    | 50  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 11/01/1998 | 54  | 109   | 67  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 09/26/1998 | 80  | 27    | 91  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 09/25/1998 | 80  | 15    | 53  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| 09/15/1998 | 146 | 218   | 53  | 0   | 0  | 0  | 0.000 | 0     | 0    |
| Average:   | 56  | 85    | 63  | 0   | 0  | 0  | 0.000 | 0     | 0    |



execution time = 2 seconds

For questions or comments regarding this program, contact [pagemaster@permian.arco.com](mailto:pagemaster@permian.arco.com)

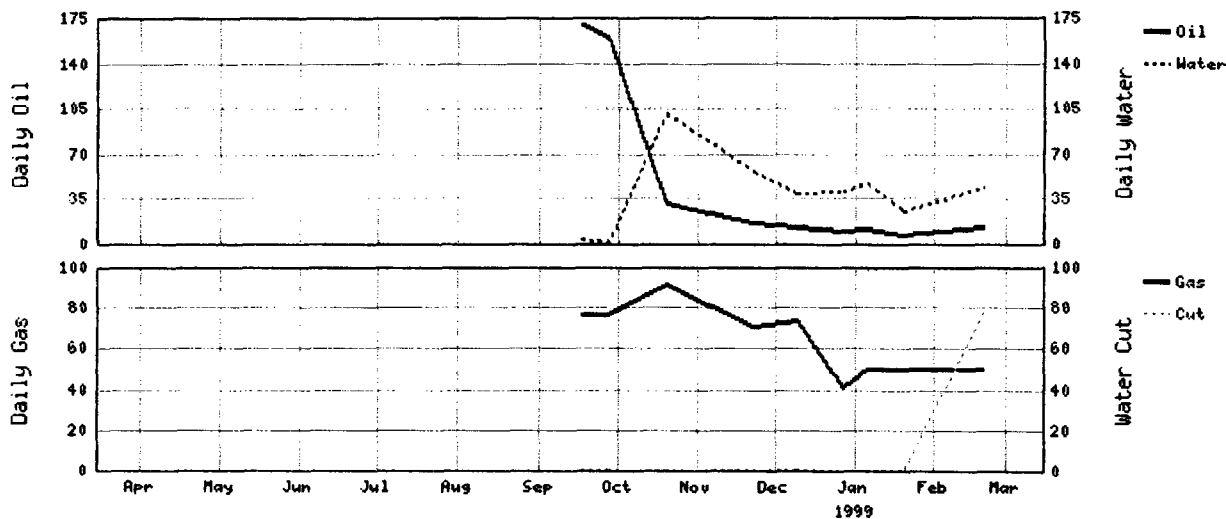


Mon Mar 15, 1999  
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**Well Test Data for SE NEW MEXICO: ARTESIA: QUEEN GRAYBURG SAN  
ANDRES**  
**WASHINGTON 33 STATE #25 - 300150169000 - PO - AC**



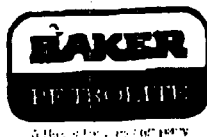
| Date       | Oil | Water | Gas | Cut | Fl | Pd    | %C02 | GasGr | GDur |
|------------|-----|-------|-----|-----|----|-------|------|-------|------|
| 02/20/1999 | 13  | 43    | 50  | 77  | 0  | 0.000 | 0    | 0     |      |
| 01/20/1999 | 6   | 25    | 50  | 0   | 0  | 0.000 | 0    | 0     |      |
| 01/06/1999 | 11  | 46    | 50  | 0   | 0  | 0.000 | 0    | 0     |      |
| 12/28/1998 | 10  | 40    | 41  | 0   | 0  | 0.000 | 0    | 0     |      |
| 12/10/1998 | 12  | 39    | 73  | 0   | 0  | 0.000 | 0    | 0     |      |
| 11/23/1998 | 16  | 56    | 70  | 0   | 0  | 0.000 | 0    | 0     |      |
| 10/20/1998 | 31  | 100   | 91  | 0   | 0  | 0.000 | 0    | 0     |      |
| 09/27/1998 | 160 | 0     | 76  | 0   | 0  | 0.000 | 0    | 0     |      |
| 09/17/1998 | 169 | 3     | 76  | 0   | 0  | 0.000 | 0    | 0     |      |
| Average:   | 48  | 39    | 64  | 9   | 0  | 0.000 | 0    | 0     |      |



execution time = 9 seconds

For questions or comments regarding this program, contact [pagemaster@permian.arco.com](mailto:pagemaster@permian.arco.com)

Sent by: BAKER PETROLITE 19155637942



## Water Analysis Report by Baker Petrolite

ARCO  
WASHINGTON 33  
WELL # 24  
WELLHEAD

Account Manager  
STEVE THOMAS

YESO

| Summary                                              |              |  | Analysis of Sample 108815 @ 75°F |        |       |                |       |       |
|------------------------------------------------------|--------------|--|----------------------------------|--------|-------|----------------|-------|-------|
| Sampling Date                                        | 2/18/99      |  | <b>Anions</b>                    | mg/l   | meq/l | <b>Cations</b> | mg/l  | meq/l |
| Analysis Date                                        | 2/24/99      |  | Chloride                         | 121426 | 3425  | Sodium         | 77942 | 3390  |
| Analyst                                              | JOANNA RAGAN |  | Bicarbonate                      | 444    | 7.28  | Magnesium      | 425   | 35.0  |
|                                                      |              |  | Carbonate                        | 0.00   | 0.00  | Calcium        | 1698  | 84.7  |
| TDS (mg/l or g/m <sup>3</sup> )                      | 208471       |  | Sulfate                          | 4174   | 88.9  | Strontium      | 36.0  | 0.82  |
| Density (g/cm <sup>3</sup> or tonne/m <sup>3</sup> ) | 1.136        |  | Phosphate                        | N/A    | N/A   | Barium         | 0.40  | 0.01  |
| Anion/Cation Ratio                                   | 1.00         |  | Borate                           | N/A    | N/A   | Iron           | 2.00  | 0.07  |
|                                                      |              |  | Silicate                         | N/A    | N/A   | Potassium      | 324   | 8.25  |
| Carbon Dioxide                                       |              |  |                                  |        |       | Aluminum       | N/A   | N/A   |
| Oxygen                                               |              |  |                                  |        |       | Chromium       | N/A   | N/A   |
|                                                      |              |  |                                  |        |       | Copper         | N/A   | N/A   |
|                                                      |              |  | pH at time of sampling           |        |       | Lead           | N/A   | N/A   |
|                                                      |              |  | pH at time of analysis           |        | 7.33  | Manganese      | N/A   | N/A   |
|                                                      |              |  | pH used in Calculations          |        | 7.33  | Nickel         | N/A   | N/A   |

| Conditions |              | Values Calculated at the Given Conditions - Amounts of Scale in lb/1000bbl |        |                                                 |        |                                |        |                                |        |                             |        |                           |
|------------|--------------|----------------------------------------------------------------------------|--------|-------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|---------------------------|
| Temp.      | Gauge Press. | Calcite<br>CaCO <sub>3</sub>                                               |        | Gypsum<br>CaSO <sub>4</sub> · 2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        | CO <sub>2</sub><br>Press. |
| °F         | psi          | Index                                                                      | Amount | Index                                           | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount | psi                       |
| 80         | 0.           | 1.01                                                                       | 30.7   | -0.18                                           |        | -0.15                          |        | -0.22                          |        | 0.94                        | 0.19   | 0.17                      |
| 100        | 0.           | 0.95                                                                       | 34.2   | -0.27                                           |        | -0.17                          |        | -0.26                          |        | 0.73                        | 0.17   | 0.27                      |
| 120        | 0.           | 0.91                                                                       | 37.8   | -0.34                                           |        | -0.17                          |        | -0.28                          |        | 0.54                        | 0.15   | 0.42                      |
| 140        | 0.           | 0.87                                                                       | 41.8   | -0.41                                           |        | -0.14                          |        | -0.29                          |        | 0.38                        | 0.12   | 0.60                      |

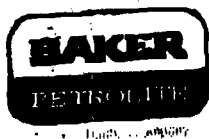
Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: The reported CO<sub>2</sub> pressure is actually the calculated CO<sub>2</sub> fugacity. It is usually nearly the same as the CO<sub>2</sub> partial pressure

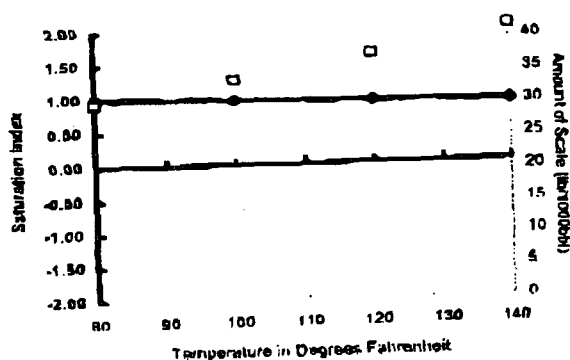
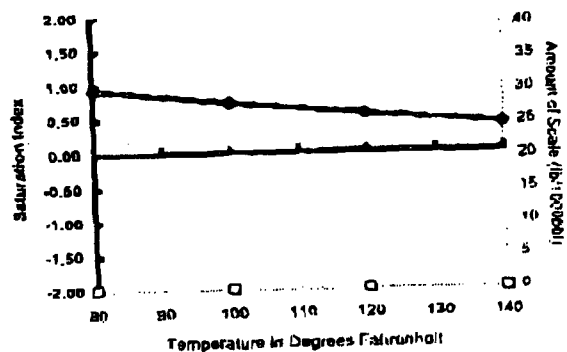
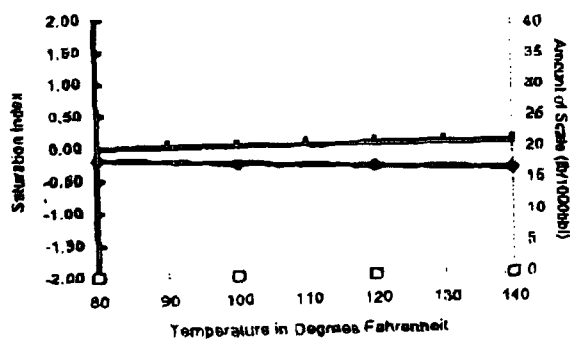
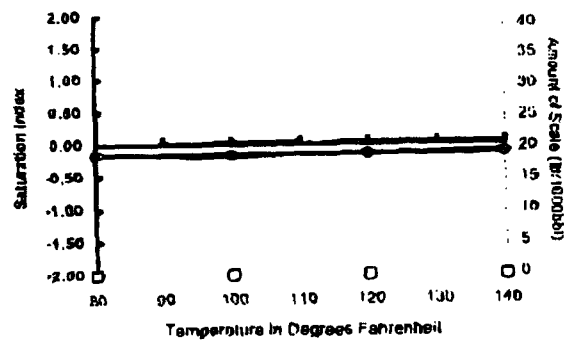
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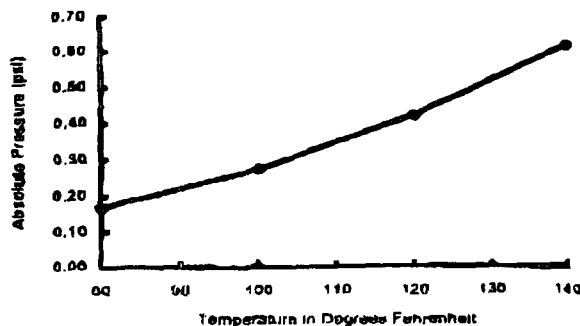
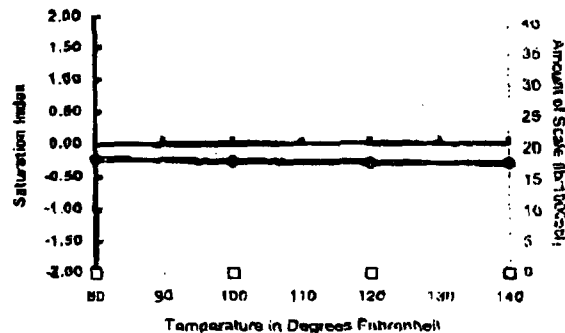


## Scale Predictions from Baker Petrolite

Analysis of Sample 108815 @ 75°F for ARCO, Feb/24/99

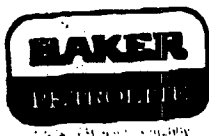
Calcite -  $\text{CaCO}_3$ Barite -  $\text{BaSO}_4$ Gypsum -  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ Anhydrite -  $\text{CaSO}_4$ 

Carbon Dioxide Partial Pressure

Celestite -  $\text{SrSO}_4$ 

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## Water Analysis Report by Baker Petrolite

**ARCO**  
**WASHINGTON 33**  
**WELL # 25**  
**WELLHEAD**

**Account Manager**  
**STEVE THOMAS**

*SAN ANDRES*

| Summary                                              |              | Analysis of Sample 108814 @ 75°F |        |       |                |       |       |
|------------------------------------------------------|--------------|----------------------------------|--------|-------|----------------|-------|-------|
| Sampling Date                                        | 2/18/99      | <b>Anions</b>                    | mg/l   | meq/l | <b>Cations</b> | mg/l  | meq/l |
| Analysis Date                                        | 2/24/99      | Chloride                         | 106506 | 3004  | Sodium         | 67398 | 2932  |
| Analyst                                              | JOANNA RAGAN | Bicarbonate                      | 714    | 11.7  | Magnesium      | 565   | 46.5  |
|                                                      |              | Carbonate                        | 0.00   | 0.00  | Calcium        | 2187  | 109   |
| TDS (mg/l or g/m <sup>3</sup> )                      | 181974       | Sulfate                          | 4076   | 84.9  | Strontium      | 45.0  | 1.03  |
| Density (g/cm <sup>3</sup> or tonne/m <sup>3</sup> ) | 1.120        | Phosphate                        | N/A    | N/A   | Barium         | 0.10  | 0.00  |
| Anion/Cation Ratio                                   | 1.00         | Borate                           | N/A    | N/A   | Iron           | 8.00  | 0.29  |
|                                                      |              | Silicate                         | N/A    | N/A   | Potassium      | 475   | 12.7  |
| Carbon Dioxide                                       |              |                                  |        |       | Aluminum       | N/A   | N/A   |
| Oxygen                                               |              |                                  |        |       | Chromium       | N/A   | N/A   |
|                                                      |              |                                  |        |       | Copper         | N/A   | N/A   |
|                                                      |              |                                  |        |       | Lead           | N/A   | N/A   |
|                                                      |              | pH at time of sampling           |        |       | Manganese      | N/A   | N/A   |
|                                                      |              | pH at time of analysis           |        | 7.02  | Nickel         | N/A   | N/A   |
|                                                      |              | pH used in Calculations          |        | 7.02  |                |       |       |

| Conditions |              | Values Calculated at the Given Conditions - Amounts of Scale in lb/1000bbl |        |                                                 |        |                                |        |                                |        |                             |        |                           |
|------------|--------------|----------------------------------------------------------------------------|--------|-------------------------------------------------|--------|--------------------------------|--------|--------------------------------|--------|-----------------------------|--------|---------------------------|
| Temp.      | Gauge Press. | Calcite<br>CaCO <sub>3</sub>                                               |        | Gypsum<br>CaSO <sub>4</sub> · 2H <sub>2</sub> O |        | Anhydrite<br>CaSO <sub>4</sub> |        | Celestite<br>SrSO <sub>4</sub> |        | Barite<br>BaSO <sub>4</sub> |        | CO <sub>2</sub><br>Press. |
| °F         | psi          | Index                                                                      | Amount | Index                                           | Amount | Index                          | Amount | Index                          | Amount | Index                       | Amount | psi                       |
| 80         | 0.           | 0.98                                                                       | 63.6   | -0.09                                           |        | -0.07                          |        | -0.10                          |        | 0.36                        | 0.03   | 0.53                      |
| 100        | 0.           | 1.01                                                                       | 70.8   | -0.16                                           |        | -0.08                          |        | -0.13                          |        | 0.16                        | 0.02   | 0.72                      |
| 120        | 0.           | 1.03                                                                       | 78.3   | -0.23                                           |        | -0.07                          |        | -0.15                          |        | -0.02                       |        | 0.98                      |
| 140        | 0.           | 1.05                                                                       | 86.2   | -0.29                                           |        | -0.03                          |        | -0.16                          |        | -0.18                       |        | 1.30                      |

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered.

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the five scales.

Note 3: The reported CO<sub>2</sub> pressure is actually the calculated CO<sub>2</sub> fugacity. It is usually nearly the same as the CO<sub>2</sub> partial pressure.

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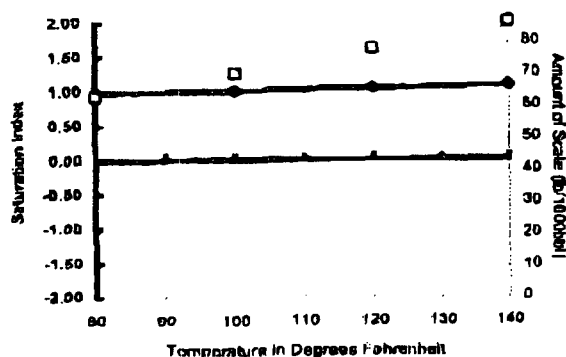
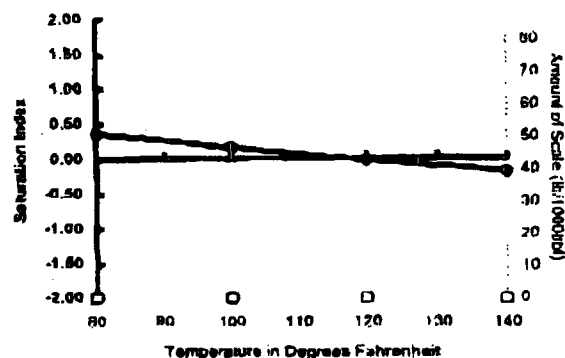
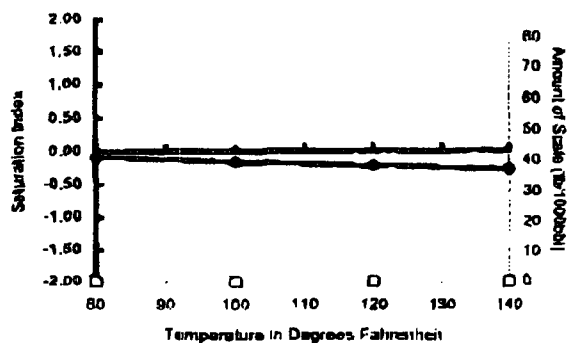
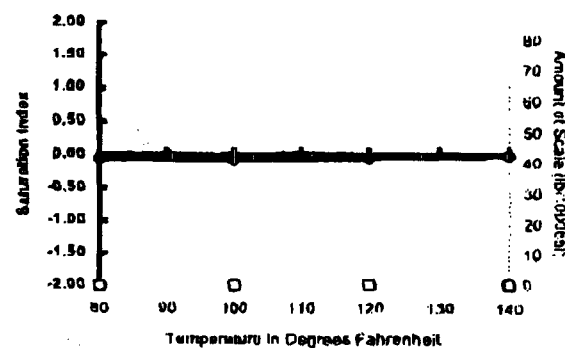
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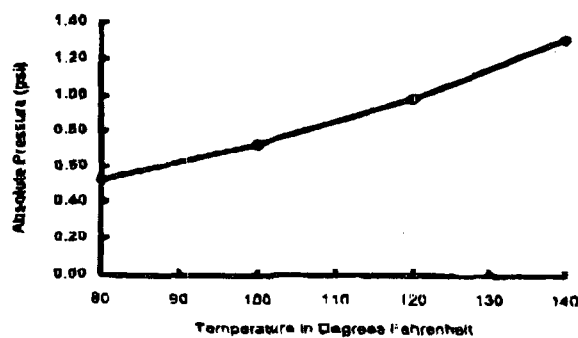
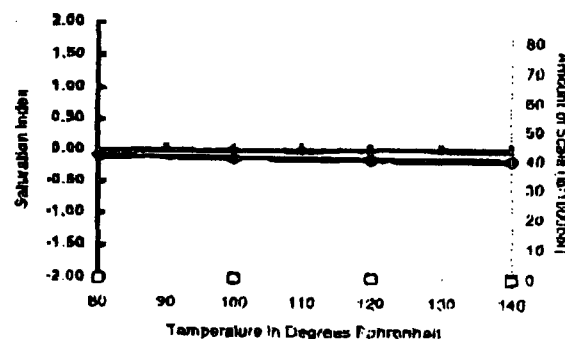


## Scale Predictions from Baker Petrolite

Analysis of Sample 104814 @ 75°F for ARCO, Feb/24/99

Calcite -  $\text{CaCO}_3$ Barite -  $\text{BaSO}_4$ Gypsum -  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ Anhydrite -  $\text{CaSO}_4$ 

Carbon Dioxide Partial Pressure

Celestite -  $\text{SrSO}_4$ 

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