

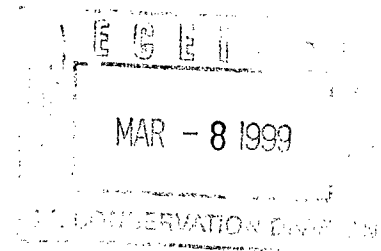


**ARCO Permian**

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 3/29/99



March 4, 1999

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

2255

RE: Application of ARCO Permian  
for Downhole Commingling on  
Washington State "33" Well No. 25  
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 Number 25. 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

## 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  
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

Operator ARCO Permian, P.O.Box 1610, Midland, Texas 779702 AddressLease Washington State "33" No.25 N-33-175-28E Unit Ltr. - Sec - Twp - Rge EDDY CountyOGRID NO. 000990 Property Code 022954 API NO. 30-015-01690 Spacing Unit Lease Types: (check 1 or more)  
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)                                                                                                                                                      | 2452' - 3008                                            |                   | to be perforated:<br>3774' - 4114' |
| 3. Type of production (Oil or Gas)                                                                                                                                                                   | Oil                                                     |                   | Oil                                |
| 4. Method of Production (Flowing or Artificial Lift)                                                                                                                                                 | Art. Lift                                               |                   | Art. 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 (°API) or Gas BTU Content                                                                                                                                                             | 40-42° API                                              |                   | 42° API                            |
| 7. Producing or Shut-In?                                                                                                                                                                             | Producing                                               |                   | Awaiting Perfs                     |
| Production Marginal? (yes or no)                                                                                                                                                                     | yes                                                     |                   | Expected in 3 to 6 months          |
| * 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: 01/20/99<br>Rates: 6 BOPD<br>3 BOPD<br>30 MCF GPD | Date:<br>Rates:   | Date:<br>Rates: N/A                |
| 8. Fixed Percentage Allocation Formula - % for each zone                                                                                                                                             | Oil: 28 % Gas: 28 %                                     | Oil: % Gas: %     | Oil: 72 % Gas: 72 %                |

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). \_\_\_\_\_

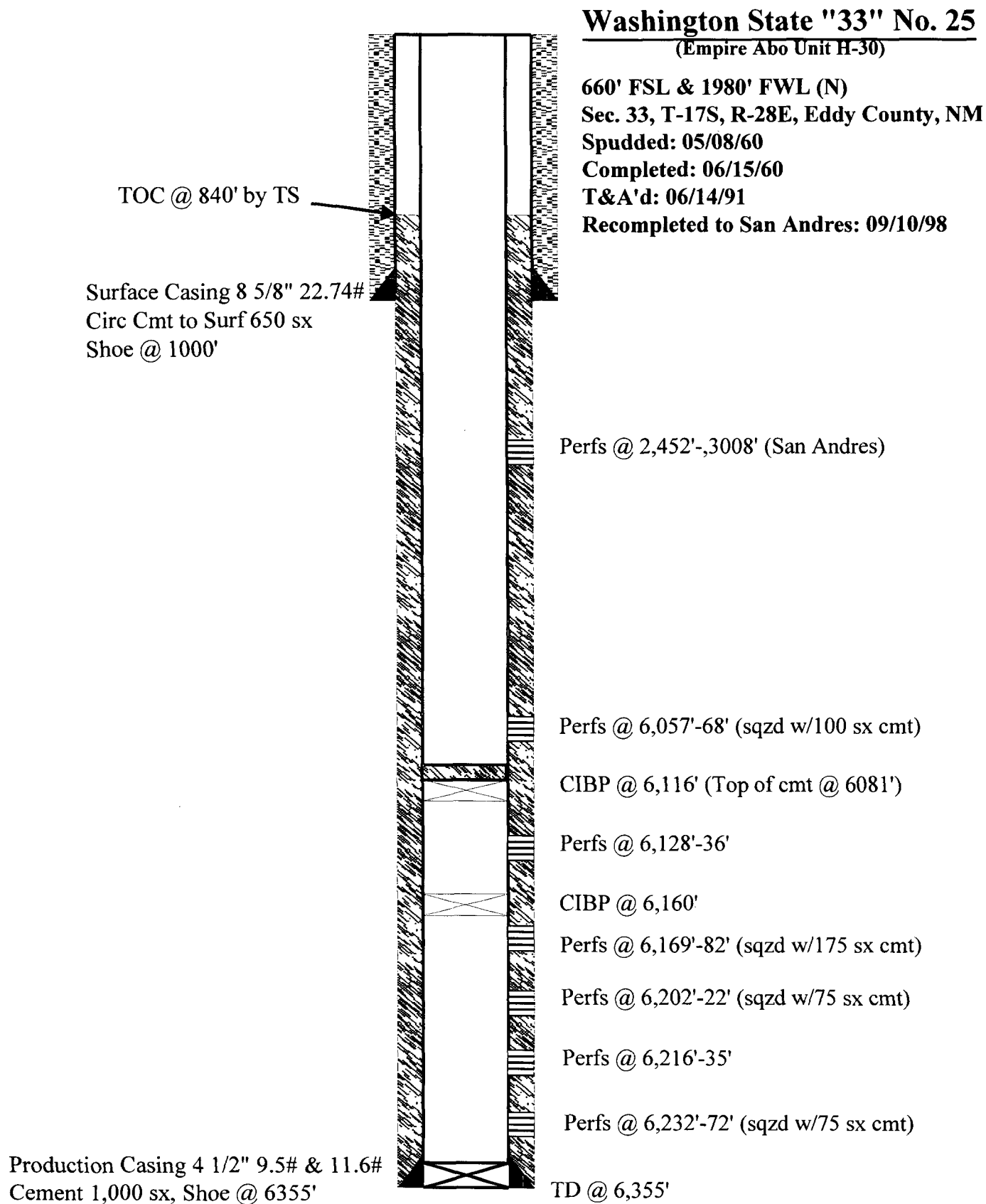
## 16. ATTACHMENTS:

- \* 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 Regulatory Analyst DATE 3/4/99TYPE OR PRINT NAME Elizabeth A. Casbeer TELEPHONE NO. ( 915 ) 688-5570

# WELLBORE SCHEMATIC



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<br><b>30-015-01690</b> | Pool Code                                   | Pool Name<br><b>ARTESIA (Q-G-5A)</b> |
| Property Code<br><b>22954</b>     | Property Name<br><b>WASHINGTON 33 STATE</b> | Well Number<br><b>25</b>             |
| OGRID No.<br><b>000990</b>        | Operator Name<br><b>ARCO PERMIAN</b>        | Elevation<br><b>3668</b>             |

Surface Location

|                           |                      |                         |                      |         |                             |                                  |                              |                               |                       |
|---------------------------|----------------------|-------------------------|----------------------|---------|-----------------------------|----------------------------------|------------------------------|-------------------------------|-----------------------|
| UL or lot No.<br><b>N</b> | Section<br><b>33</b> | Township<br><b>17 S</b> | Range<br><b>28 E</b> | Lot Idn | Feet from the<br><b>660</b> | North/South line<br><b>SOUTH</b> | Feet from the<br><b>1980</b> | East/West line<br><b>WEST</b> | County<br><b>EDDY</b> |
|---------------------------|----------------------|-------------------------|----------------------|---------|-----------------------------|----------------------------------|------------------------------|-------------------------------|-----------------------|

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<br><b>40</b> | 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>05</b>  | <b>03</b>  | <b>01</b>  |
| <b>06</b>  | <b>04</b>  | <b>02</b>  |
| <b>07</b>  | <b>011</b> | <b>013</b> |
| <b>08</b>  | <b>012</b> | <b>014</b> |
| <b>021</b> | <b>019</b> |            |
| <b>022</b> | <b>031</b> |            |
| <b>023</b> | <b>25</b>  |            |

1980' ←

660' ↓

OPERATOR CERTIFICATION

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

*Elizabeth A. Casbeer*  
Signature  
**ELIZABETH A. CASBEER**  
Printed Name  
**REG/COMP.**  
Title  
**5/20/98**  
Date

SURVEYOR CERTIFICATION

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.

**MARCH 3, 1998**

Date Surveyed  
Signature  
Professional Surveyor  
**RONALD J. EDISON**  
3239  
12641  
12185

DMCC  
5-4-98

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

**DISTRICT I**

P.O. Box 1980, Hobbs, NM 88240

**DISTRICT II**

P.O. Drawer DD, Artesia, NM 88210

**DISTRICT III**

1000 Rio Brazos Rd., Aztec, NM 87410

State of New Mexico  
Energy, Minerals and Natural Resources Department

**OIL CONSERVATION DIVISION**

2040 Pacheco St.  
Santa Fe, NM 87505

Form C-105  
Revised 1-1-89

WELL API NO.

30-015-01690

5. Indicate Type Of Lease

STATE ☒

FEE ☐

6. State Oil & Gas Lease No.

7. Lease Name or Unit Agreement Name

Washington 33 State

8. Well No.

25

9. Pool name or Wildcat

Artesia Queen Grbg San Andres

**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

3. Address of Operator

P.O. Box 1089 Eunice, NM 88231

4. Well Location

Unit Letter N : 660 Feet From The S Line and 1980 Feet From The W Line

Section 33

Township 17S

Range 28E

NMPM

Eddy

County

10. Date Spudded

11. Date T.D. Reached

12. Date Compl.(Ready to Prod.)

09/10/98

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

3668' GL

14. Elev. Casinghead

15. Total Depth

6355

16. Plug Back T.D.

6081

17. If Multiple Compl. How  
Many Zones?

18. Intervals  
Drilled By

Rotary Tools

Cable Tools

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

2452-3008' San Andres

20. Was Directional Survey Made

No

21. Type Electric and Other Logs Run

C.P.N.L.

22. Was Well Cored

No

**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             | 1000      |           | surf             |               |
| 4-1/2       | 9.5            | 6355      |           | surf             |               |
|             |                |           |           |                  |               |
|             |                |           |           |                  |               |
|             |                |           |           |                  |               |

**24. LINER RECORD**

| SIZE | TOP | BOTTOM | SACKS CEMENT | SCREEN | 25. TUBING RECORD<br>SIZE | DEPTH SET | PACKER SET |
|------|-----|--------|--------------|--------|---------------------------|-----------|------------|
|      |     |        |              |        | 2-3/8                     | 2284      |            |
|      |     |        |              |        |                           |           |            |

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

2452-3008', 1 SPI, 51 holes

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

DEPTH INTERVAL

AMOUNT AND KIND MATERIAL USED

2452-3008'

See Attached Detail

**28. PRODUCTION**

|                                   |                       |                                                                                |                           |                   |                 |                                             |                        |
|-----------------------------------|-----------------------|--------------------------------------------------------------------------------|---------------------------|-------------------|-----------------|---------------------------------------------|------------------------|
| Date First Production<br>09/10/98 |                       | Production Method (Flowing, gas lift, pumping - Size and type pump)<br>pumping |                           |                   |                 | Well Status (Prod. or Shut-in)<br>producing |                        |
| Date of Test<br>09/17/98          | Hours Tested<br>24    | Choke Size                                                                     | Prod'n For<br>Test Period | Oil - Bbl.<br>169 | Gas - MCF<br>76 | Water - Bbl.<br>3                           | Gas - Oil Ratio<br>450 |
| Flow Tubing Press.<br>70          | Casing Pressure<br>70 | Calculated 24-<br>Hour Rate                                                    | Oil - Bbl.                | Gas - MCF         | Water - Bbl.    | Oil Gravity - API (Corr.)                   |                        |

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

sold

Test Witnessed By

30. List Attachments

C.P.N.L.

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

*Kellie D. Murrish*

Printed  
Name

Kellie D. Murrish

Title

Admin. Asst.

Date 09/24/98

ARCO Permian  
Downhole Commingling  
Washington State "33" Well No. 25  
API: 30-015-01690  
660' FSL & 1980' FWL (N)  
Section 33, T-17S, R-28E  
Eddy County, New Mexico

Surface Owners for Unit N:

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

Offset Operators:

ARCO Permian  
P. O. Box 1610  
Midland, TX 79702

Altura Energy, Ltd.  
Attn: Mr. Jerry D. West  
P.O. Box 4294  
Houston, TX 77210-4294

Bulldog Energy Corp.  
P. O. Box 668  
Artesia, NM 88210

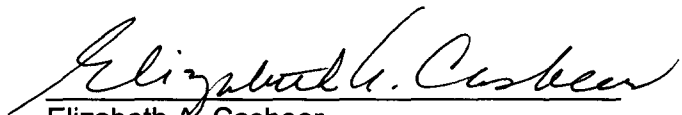
Jackie Brown  
d/b/a Sandlott Energy  
1504 W. Madison  
Lovington, NM 88260

**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 March 4, 1999, of the New Mexico Oil Conservation Division Form C-107 entitled, "Application For Downhole Commingling" for the Washington State "33" Well No. 25, located in Section 33, T17S, R28E, Eddy County New Mexico.

**ARCO Permian**

  
Elizabeth A. Casbeer

**SUBSCRIBED AND SWORN TO** before me on March 4, 1999, to certify which witness my hand and seal of office.



LEIGH ANN LANE  
Notary Public, State of Texas  
My Commission Expires: 12-12-2000

  
**NOTARY PUBLIC, STATE OF TEXAS**





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

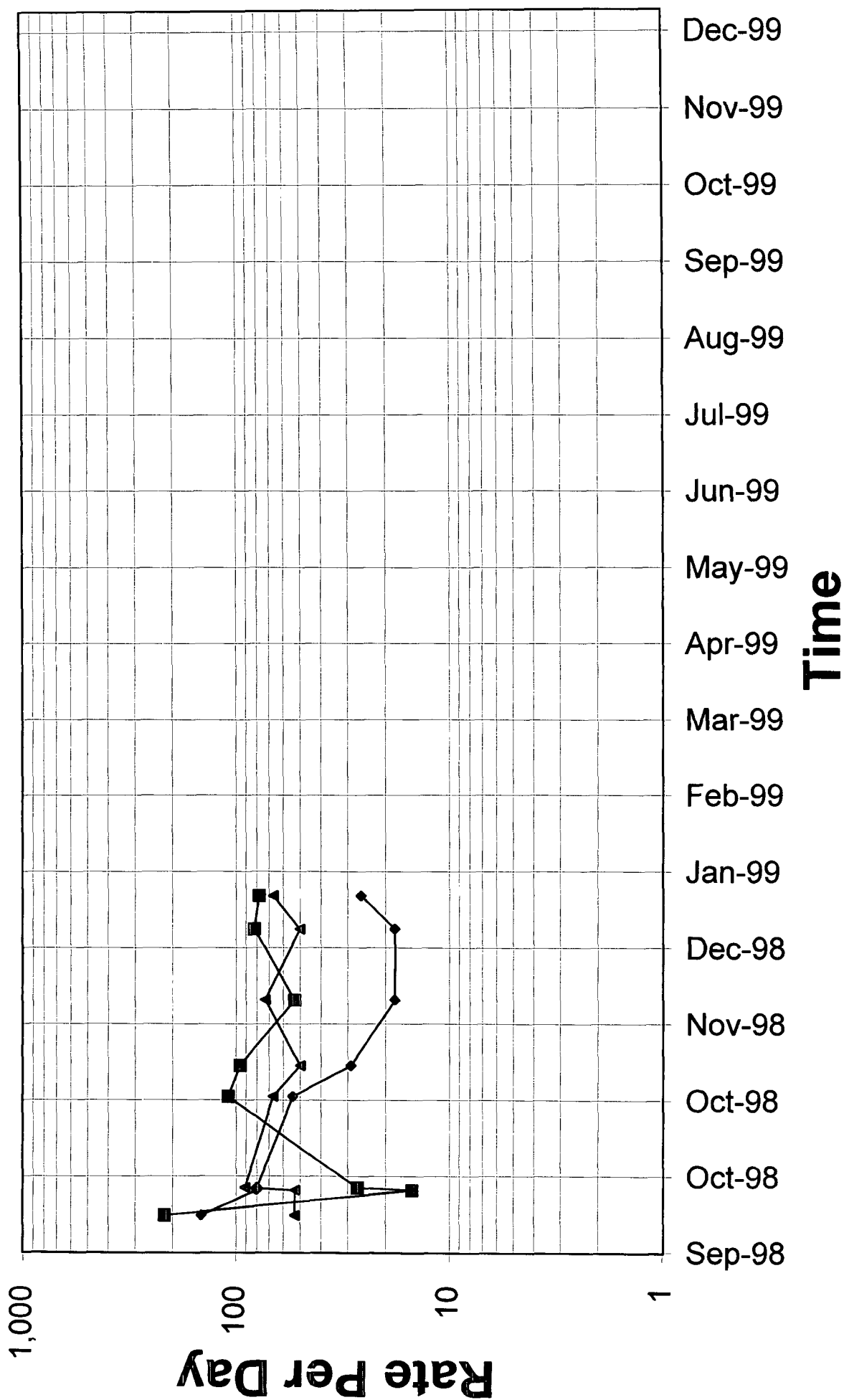
### **Allocation Formula**

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

**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.**

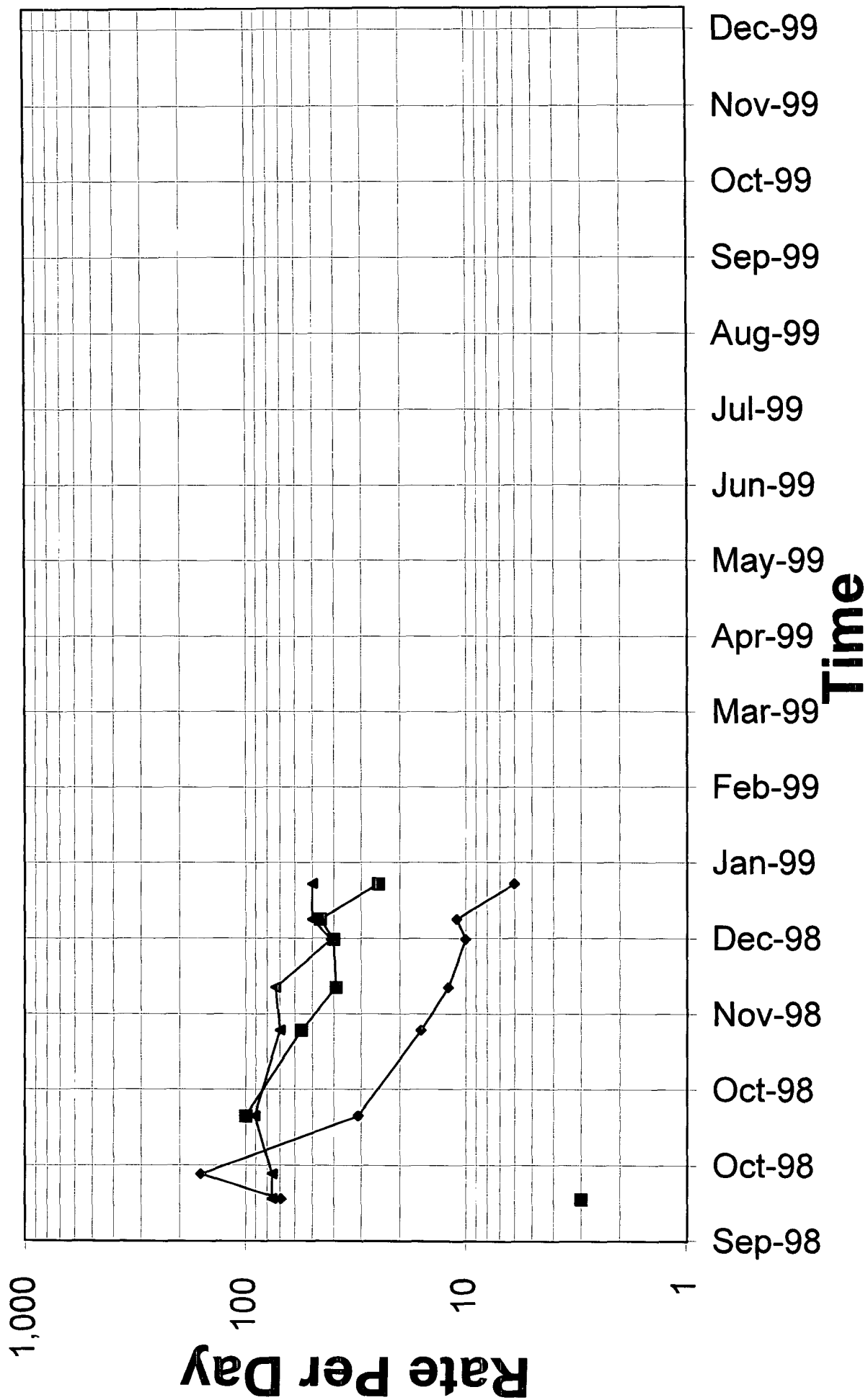
# Washington "33" State No. 24 (Yeso)

◆ OIL    ■ WATER    ▲ MCF

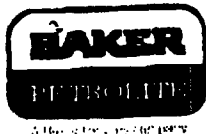


# Washington "33" State No. 25 (San Andres)

◆ OIL    ■ WATER    ▲ MCF



Sent by: BAKER PETROLITE 10155037942



## Water Analysis Report by Baker Petrolite

ARCO  
WASHINGTON 33  
WELL # 24  
WELLHEAD

Account Manager  
STEVE THOMAS

| Summary                                              |              | Analysis of Sample 108815 @ 75°F |             |              |                |             |              |
|------------------------------------------------------|--------------|----------------------------------|-------------|--------------|----------------|-------------|--------------|
| Sampling Date                                        | 2/18/99      | <b>Anions</b>                    | <i>mg/l</i> | <i>meq/l</i> | <b>Cations</b> | <i>mg/l</i> | <i>meq/l</i> |
| 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        | 1688        | 84.7         |
| TDS (mg/l or g/m <sup>3</sup> )                      | 206471       | Sulfate                          | 4174        | 86.9         | 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         | 8.29         |
| 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           |             | 7.33         | Nickel         | N/A         | N/A          |
|                                                      |              | pH used in Calculations          |             | 7.33         |                |             |              |

| 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                | 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.

PRODUCT WARRANTY, DISCLAIMER AND LIMITATION OF LIABILITY ARE FOUND ON THE BACK OF THIS SHEET

02/24/99 5:34PM Job 573

Page 4/4

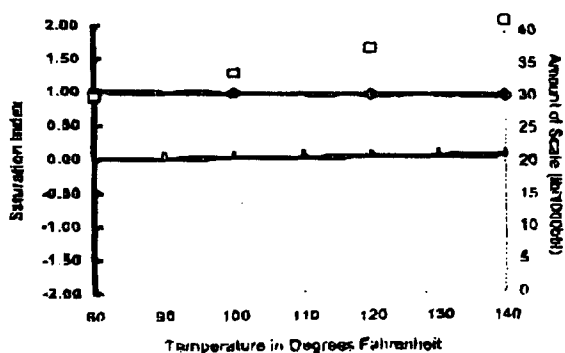
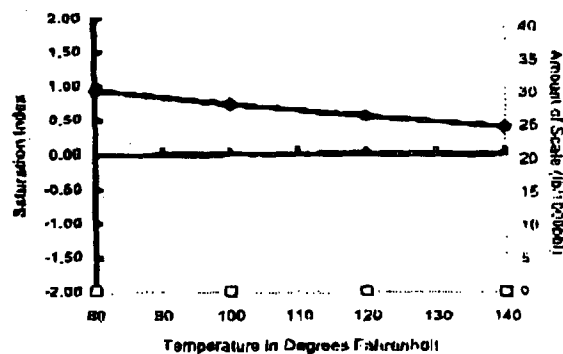
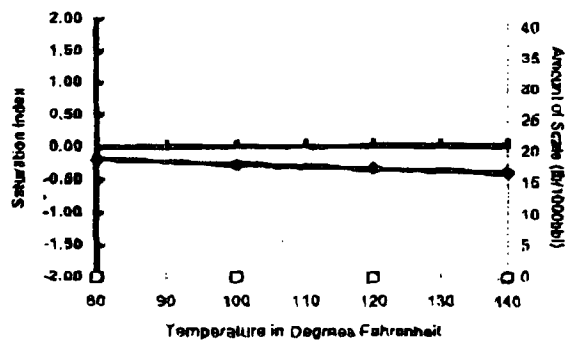
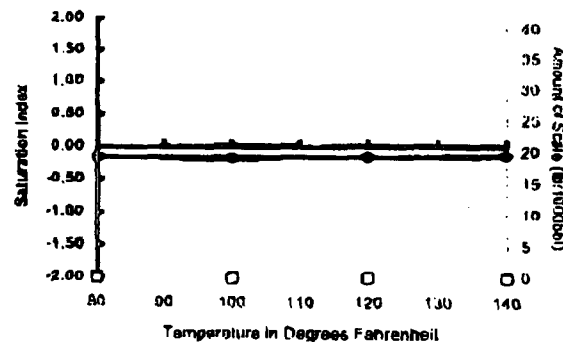
Sent by: BAKER PETROLITE 10155637942



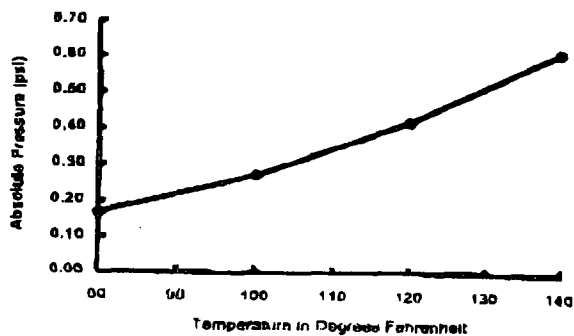
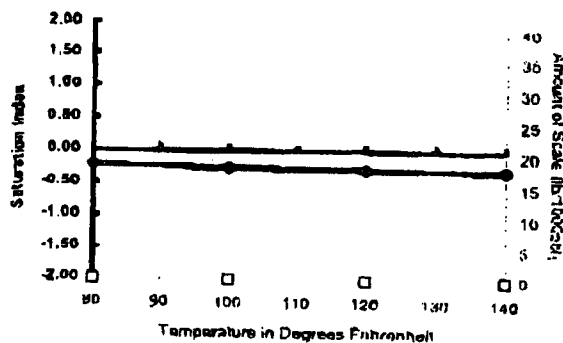
YESO

## Scale Predictions from Baker Petrolite

Analysis of Sample 100815 @ 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

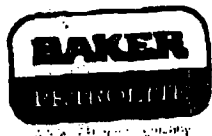
Celestite -  $\text{SrSO}_4$ 

PRODUCT WARRANTIES, DISCLAIMER AND LIMITATION OF LIABILITY ARE FOUND ON THE BACK OF THIS SHEET

RECEIVED TIME MAR. 1. 4:12PM

PRINT TIME MAR. 1. 4:15PM

Sent by: BAKER PETROLITE 19155637942



## 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   | 84.8  | Strontium      | 45.0  | 1.02  |
| 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  | 0.28  |
|                                                      |              | 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   |
|                                                      |              | pH at time of sampling           |        |       | Lead           | N/A   | N/A   |
|                                                      |              | pH at time of analysis           |        | 7.02  | Manganese      | N/A   | N/A   |
|                                                      |              | pH used in Calculations          |        | 7.02  | 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 | ps                        |
| 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   | 0.74                      |
| 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.

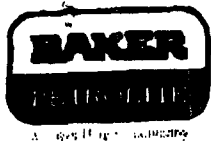
Note 3: The reported CO<sub>2</sub> pressure is actually the calculated CO<sub>2</sub> fugacity. It is usually nearly the same as the CO<sub>2</sub> partial pressure.

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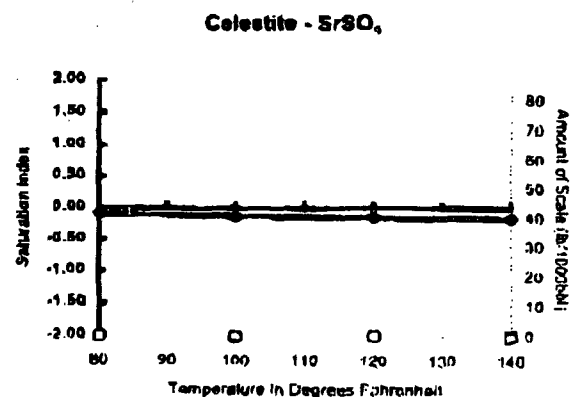
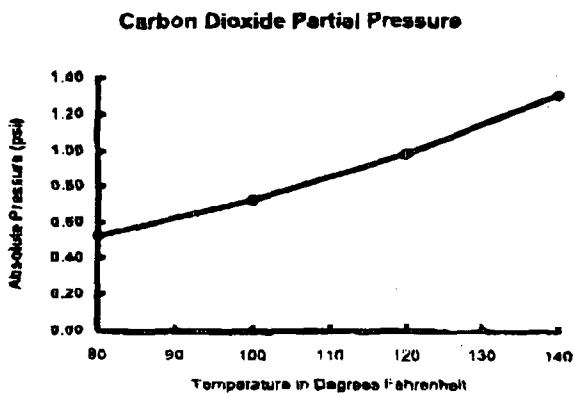
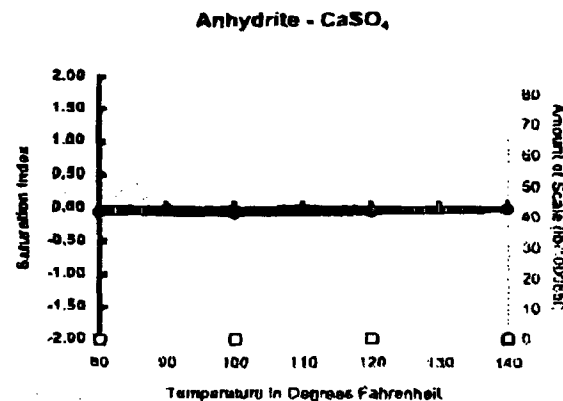
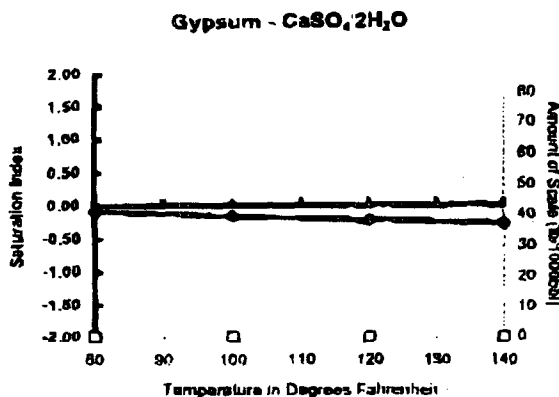
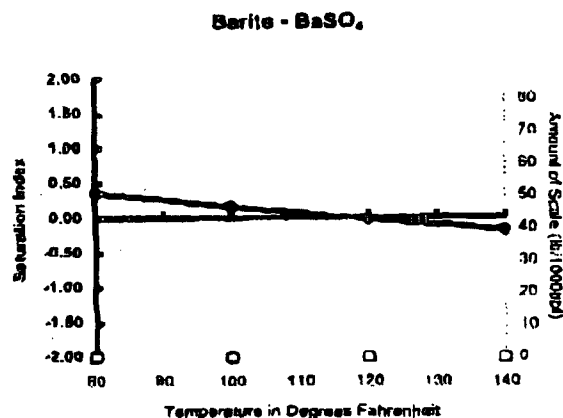
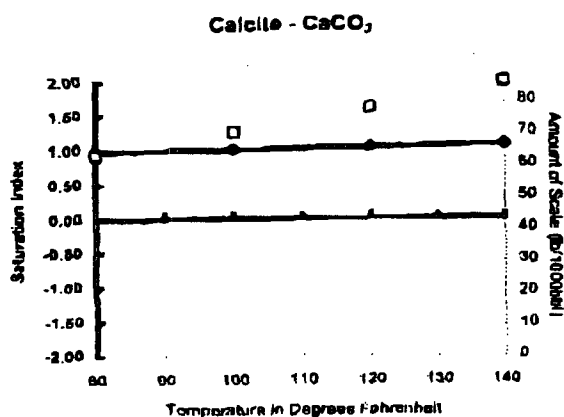
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SAND ANDROS

## Scale Predictions from Baker Petrolite

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



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