Submit 3 Copies to Appropriate District Office

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

P.O. Box 2088
Santa Fe, New Mexico 87504-2088

RECEIVED
APR 28 1997
OIL CON. DIV.
DIST. 3

Form C-103
Revised 1-1-89

WELL API NO.
30-045-13049

5. Indicate Type of Lease
Federal STATE ☐ FEE ☐

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name
Fullerton Federal

1. Type of Well: Commingled
OIL WELL [X] GAS WELL [X] OTHER

2. Name of Operator
Bonneville Fuels Corporation

8. Well No.
11

3. Address of Operator
1660 Lincoln, Suite 1800, Denver, CO 80264

9. Pool name or Wildcat
Kutz GP/Basin DK

4. Well Location
Unit Letter E : 1650 Feet From The North Line and 990 Feet From The West Line

Section 14 Township 27N Range 11W NMPM San Juan County

10. Elevation (Show whether DF, RKB, RT, GR, etc.)

11. Check Appropriate Box to Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
PERFORM REMEDIAL WORK ☐	PLUG AND ABANDON ☐	REMEDIAL WORK ☐	ALTERING CASING ☐
TEMPORARILY ABANDON ☐	CHANGE PLANS ☐	COMMENCE DRILLING OPNS. ☐	PLUG AND ABANDONMENT ☐
PULL OR ALTER CASING ☐		CASING TEST AND CEMENT JOB ☐	
OTHER: ☐		OTHER: Re-Allocation/Over Production/Testing ☒	

12. Describe Proposed or Completed Operations (*Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work*) SEE RULE 1103. Attached please find a letter and 3 exhibits in support of the following 3 requests:

1. Request to Re-Allocate production per Admin.Order DHC-1428 as follows:
   a. Dakota Fm: Oil = ~~4.09%~~ 4% Gas = ~~15.92%~~ 16%
   b. Gallup Fm: Oil = ~~95.91%~~ 96% Gas = ~~84.08%~~ 84%

   Limiting Gallup production = Oil @ 80 BOPD & Gas @ 160 MCFD & Water @ 80 BWPD
   Limiting overall Gas production : Gas @ 190 MCFD (commingled).

2. Request to allow previous over-production of 6,028 MCF gas (2/6/97 - 4/24/97) without penalty.

3. Request to allow additional testing period (5months) to determine "Proper" limiting GOR for BFC to optimize oil recovery from this well/reservoir.

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

SIGNATURE R. A. Schwering TITLE Operations Manager DATE 4/25/97

TYPE OR PRINT NAME R. A. Schwering, P.E. TELEPHONE NO.

(This space for State Use)

APPROVED BY [signature] TITLE Dist Supv DATE 5/2/97

CONDITIONS OF APPROVAL, IF ANY:

Bonneville Fuels Corporation
A Subsidiary of Bonneville Pacific Corporation

April 24, 1997

RECEIVED
APR 28 1997
OIL CON. DIV.
DIST. 3

Mr. Frank Chavez
District III Supervisor
New Mexico Oil Conservation Division
1000 Rio Brazos Road
Aztec, New Mexico 87401
Phone: (505) 334-6178

re: Fullerton Federal #11
1. Re-Allocation Request for Commingled Production.
2. Request to Allow Previous Over-Production of 6,028 MCF Gas (2/6/97-4/24/97) Without Penalty.
3. Oil Recovery Issues Associated with Production Restriction of the Gallup Fm.

Dear Mr. Chavez:

1. Request for Re-Allocation of Commingled Production based on Commingled Production Results w/ Production History: ref. Administrative Order DHC-1428:

a. Dakota Production: September/October/November of 1996:

Production Required a Compressor and the zone was becoming uneconomic to continue to produce:

Days on line:	**82 Days.**
Cumulative Oil Production:	27 STBO.
Daily Oil Rate:	**0.33 STBOD.**
Cumulative Gas Sales:	4,774 MCF.
Daily Gas Rate:	**58.22 MCFD (approx. 60 MCFD).**

b. Isolate, Stimulate and Test the Gallup Fm.:

In early December the Dakota Fm. was temporarily abandoned and isolated by a CIBP. The Fullerton Federal #11 was fractured in the Gallup Fm. on 12/10/96 w/ 70,000# 20/40 mesh sand.

From December 12, 1996 thru December 17, 1996 the Gallup Fm. frac was swab tested in daylight hours and 36 STBO, 292 STBW and a slight gas blow (est. @ 10 MCFD) was recovered. The final days swab rate was 8 STBO + 12 STBW w/ est. 10 MCFD. The oil rate had stabilized @ 7-8 STBOD and the water rate was declining steadily. The gas rate was TSTM. As a Gallup Fm. ONLY producer the well appeared to need artificial lift or gas assistance.

1660 Lincoln / Suite 1800 / Denver, Colorado 80264 / 303-863-1555 / Facsimile 303-863-1558

b. Isolate, Stimulate and Test the Gallup Fm.: Continued:

On December 17, 1996 thru December 20, 1996, a pressure build-up in the Gallup Fm. was run and the reservoir pressure P* was determined to be 1205 PSIA with a fracture permeability of 1.47 milli-darcy and a semi-log permeability of 2.03 milli-darcy. These are POST-FRAC permeabilities. See the attached well test data and analysis (Exhibit #1: Pages 1 thru 5).

c. Requesting the Commingling of Gallup/Dakota Fm. Production and Initially Allocating That Production:

BFC had what appeared to be two marginally economic zones in a single well - the latter completed Gallup Fm. being in need of the gas energy from the Dakota Fm. to produce without artificial lift. BFC submitted the data outlined above (except the well test analysis - which was not completed until late January, 1997) in support of its commingling application.

At this time in the clean-up of the fracture it was NOT apparent that the Gallup Fm. might ever contribute a commercial quantity of gas - and the reservoir pressure was substantially depleted from the 2000 PSIA based on offsets drilled in the 1960's. The State granted the allocation that BFC requested, **Administrative Order DHC-1428,** based on the following expected production rates - after flush production from the fracture was recovered:
EST. POST-FLUSH Gallup Fm. Production: 5 BOPD + 5 MCFD + 5 BWPD.
PRE-FRAC Dakota Fm. Production: 0.33 BOPD + 60 MCFD.

The order allocated gross production as follows:
OIL: Gallup = 94% (5 BOPD) vs. Dakota = 6% (1/3 BOPD).
GAS: Gallup = 8% (5 MCFD) vs. Dakota = 92% (60 MCFD).
GALLUP PRODUCTION LIMITED AS FOLLOWS: 80 BOPD + 160 MCFD.

d. Commingled Gallup/Dakota Fm. Production History:

Attached you will find the production history for the well after it was brought on line as a commingled Gallup/Dakota Fm. producer on 2/6/97 (Exhibit #2: 2 Pages: Fullerton #11 Producing GOR Study). The wells commingled productive life can be divided into 5 intervals to date:

1st Interval: 2/6/97 - 2/21/97: Flow @ 190 PSIG line pressure:
Well Avg. Production = 8.06 BOPD + 365.76 MCFD + 1.59 BWPD.
On 2/21/97 I became aware that BFC was required to limit production by the Statewide 2000 SCF/STBO Limiting GOR Rule.

2nd Interval: 2/21/97 - 3/18/97: Attempt to restrict flow with choke: Separator, choke and freezing failures led to over-production in this period: Finally used intermitter and reduced production until reached allowable:
Well Avg. Production = 4.27 BOPD + 310.88 MCFD + 0.97 BWPD.

3rd Interval: 3/19/97 - 4/12/97: Use open-flow production ratios to limit production to -190 MCFD as verbally directed by NMOCD: Use an Intermitter & a Choke:
Well Avg. Production = 1.33 BOPD + 180.96 MCFD + 0.12 BWPD.

4th Interval: 4/13/97 - 4/21/97: Mechanical Problems cause another period of over-production: Avg. 4 Hrs./Day On-Line:
Well Avg. Production = 4.54 BOPD + 235.44 MCFD + 0.11 BWPD.

5th Period: 4/22/97 - 4/24/97: Reduce time On-Line to 3 Hours per Day as originally verbally directed by NMOCD:
Well Avg. Production = 1.81 BOPD + 193.63 MCFD + 0 BWPD.

e. Establishing a Basis for Re-Allocating Production:

During Period III BFC achieved the Production Limit desired and verbally ordered by the State of New Mexico. The CORRECT allocation formula for each productive period can be determined from the first production interval in which the well was open to flow against the Line Pressure of 190 PSIG (on the basis of a proportional production of oil and gas from the Dakota Fm. at any restricted rate):

Int. I: Gross Production: 8.06 BOPD + 365.76 MCFD + 1.59 BWPD.
Dakota Production: 0.33 BOPD + 58.22 MCFD.
Dakota Fm.: 4.09% of Oil and 15.92% of Gas.
Gallup Production: 7.73 BOPD + 307.54 MCFD + 1.59 BWPD.
Gallup Fm.: 95.91% of Oil and 84.08% of Gas.

THE PROPOSED WELLHEAD RE-ALLOCATION OF PRODUCTION (ON THE BASIS OF THE POST-FRAC WELL BEHAVIOR) FOR ORDER DHC-1428 IS:
Dakota Fm.: OIL = 4.09%. GAS = 15.92%. Water = 0%.
Gallup Fm.: OIL = 95.91%. GAS = 84.08%. Water = 100%.

I am herewith requesting this production re-allocation to amend **Administrative Order DHC-1428 and** BFC's Sundry Notice request on 4/9/97 (which was in error) to reflect actual well performance AFTER co-mingled production was initiated.

The limiting GOR in the Gallup Fm. then restricts BFC's allowable gas production as follows (using the allocation requested by BFC above):

ALLOWABLE GALLUP GAS = 160 MCFD (84.08% of produced stream).
This volume is 52.026% of capacity (307.54 MCFD calc. above). Therefore, the Dakota Fm. production must be similarly reduced (to 52.026% of 58.22 MCFD capacity).
ALLOWABLE DAKOTA GAS = 30 MCFD (15.92% of produced stream).

GROSS ALLOWABLE GAS PRODUCTION = 190 MCFD.
(Based on actual well behavior and sales of production).

I apologize for the staff at BFC not being able to properly interpret the proportionate nature of the commingled streams. I hope this analysis satisfies the NMOCD's needs in this matter.

f. Allocating Production For Restricted Production Intervals Since Well Brought On-Line as a Commingled Producer:

Int. II: Gross Production: 4.27 BOPD + 310.88 MCFD + 0.97 BWPD.
Dakota Production: 0.17 BOPD + 49.49 MCFD.
Gallup Production: 4.10 BOPD + 261.39 MCFD + 0.97 BWPD.

Int. III: Gross Production: 1.33 BOPD + 180.96 MCFD + 0.12 BWPD.
Dakota Production: 0.05 BOPD + 28.81 MCFD.
Gallup Production: 1.28 BOPD + 152.15 MCFD + 0.12 BWPD.

Int. IV: Gross Production: 4.54 BOPD + 235.44 MCFD + 0.11 BWPD.
Dakota Production: 0.19 BOPD + 37.48 MCFD.
Gallup Production: 4.35 BOPD + 197.96 MCFD + 0.11 BWPD.

Int. V: Gross Production: 4.04 BOPD + 194.00 MCFD + 0 BWPD.
Dakota Production: 0.17 BOPD + 30.89 MCFD.
Gallup Production: 3.87 BOPD + 163.11 MCFD + 0 BWPD.

2. Request to Allow Previous Over-Production Without Penalty.

a. Calculation of Over-Production To Date:

DAYS ON-LINE: 2/6/97 - 4/24/97: 78 DAYS.
EST. GAS PRODUCTION TO DATE: 20,848 MCF.
ALLOWED GAS PRODUCTION TO DATE: 14,820 MCF (@ 190 MCFD).

OVER-PRODUCTION TO DATE: 6,028 MCF
(This over-production is 32 Days of allowable production.)

b. EXPLANATION OF OVER-PRODUCTION TO DATE:

The first interval of production (2/6/97 to 2/21/97) accounted for 2,812 MCF (46.64%) of over-production and was required to provide an accurate means of allocating actual production of the commingled well streams.

The second interval of over-production (2/22/97 to 3/18/97) accounted for 3,022 MCF (50.13%) was due to various failures of choke equipment (see comments on Exhibit #2: Page 1) and equipment freezing problems. Once these mechanical problems were overcome then the well production was reduced in a step-wise fashion UNTIL the stabilized production rate met the allowable restriction. BFC worked in good faith thru this interval to finally limit its production.

Since the well was put on an intermitter BFC has met the rate restrictions - with the exception of 4/13/97 to 4/21/97 when fluctuating line pressures and thawing equipment caused 409 MCF of over-production. We have reduced the on-line time to eliminate this over-production and are again in conformance with our allowables.

c. Request For Administrative Allowance of 6,028 MCF Over-Production Due to Testing and Mechanical Problems:

Bonneville Fuels Corporation does herewith request that the initial over-production at the Fullerton Federal #11 well of 6,028 MCF of gas, incurred between 2/6/97 and 4/24/97, be permitted administratively. BFC does intend to meet all of its obligations in the commingled production of this well, with regard to pool rules and production restrictions. I feel that our ability to appropriately regulate the well is now well established.

3. ULTIMATE OIL RECOVERY ISSUES ASSOCIATED WITH ANY RESTRICTION OF PRODUCTION IN THE GALLUP FM.:

a. Presentation of GOR Data:

The variation of the Gallup Fm.'s Productivity and GOR's in the various producing time intervals, since the Fullerton Federal #11 was brought on-line, is re-stated below:

Interval I: 7.73 BOPD + 307.54 MCFD + 1.59 BWPD
2/6/97-2/21/97: GOR= 39,785 SCF/STBO.

Interval II: 4.10 BOPD + 261.39 MCFD + 0.97 BWPD.
2/22/97-3/18/97: GOR= 63,754 SCF/STBO.

Interval III: 1.28 BOPD + 152.15 MCFD + 0.12 BWPD.
3/19/97-4/12/97: GOR= 118,867 SCF/STBO.

Interval IV: 4.35 BOPD + 197.96 MCFD + 0.11 BWPD.
4/13/97-4/21/97: GOR= 45,508 SCF/STBO.

Interval V: 3.87 BOPD + 163.11 MCFD + 0 BWPD.
4/22/97-4/24/97: GOR= 42,147 SCF/STBO.

Last Day: 1.25 BOPD + 168.72 MCFD + 0 BWPD.
4/24/97: GOR= 134,976 SCF/STBO.

b. Discussion of Gallup Fm. GOR Performance:

The Gallup Fm. GOR of approx. 40,000 SCF/STBO (unrestricted) is intermediate between the relatively low producing GOR's in the Kutz Gallup Oil Field (anticipate 15,000 SCF/STBO) and the very high producing GOR's in the adjacent Angel Peak Gas Field (anticipate 100,000+ SCF/STBO). The unrestricted, except as limited by Line Pressure, GOR of the Fullerton Federal #11 well is much closer to the GOR expected in the Kutz Gallup Oil Field than to the GOR in the Angel Peak Gas Field.

The fairly high GOR (40,000:1) in the Fullerton Federal #11 is reflective of the partial depletion of this interval AND of the very low permeability of the reservoir (as reflected in the well test data in Exhibit #1).

Restriction of the well causes a lower average drawdown pressure at the producing sand face - and an attendant decreased drawdown (average flowing pressure) in the reservoir. The result is that the permeability to gas is somewhat reduced while the permeability to oil (and water) is substantially reduced.

A review of the producing intervals confirms this qualitative analysis. In Interval I the gas flow rate was limited only by line pressure and the result was a GOR of approx. 40,000 SCF/STBO. In Interval II the average gas rate restriction was 85% of the flow rate in Interval I. The oil rate was then reduced 53% of the flow rate in Interval I.

In Interval III the gross gas rate was restricted to meet the allowable required (190 MCFD). The result was the restriction of gas flow in Interval III to 49.5% of the flow rate in Interval I. Oil production declined to 16.6% (1.28 STBOD) of the flow rate in Interval I

3. ULTIMATE OIL RECOVERY ISSUES ASSOCIATED WITH ANY RESTRICTION OF PRODUCTION IN THE GALLUP FM.: Continued:

b. Discussion of Gallup Fm. GOR Performance: Continued:

If the rate of loss of oil production in Interval III had been identical to the rate of loss of gas production THEN the well would have produced approx. 3.82 BOPD (a 49.5% oil flow rate reduction). This resulted in the "stranding" of approx. 2.54 BOPD in the formation as the oil was by-passed by the gas due to the production limitation.

During Interval IV the Line Pressure fell and I believe a pressure drop induced ice plug in the flow line at the choke thawed out. The result was that the well again exceeded its allowable with NO CHANGES in the settings on the production instrumentation. The gross (Gallup + Dakota) flow rate varied from 353 to 204 MCFD (est. corr. f/ sales). The oil rate averaged 4.54 BOPD. Days with less than 200 MCFD gross gas rate brought 1.66 BOPD (GOR's @ 118,000 SCF/STBO). The well unloaded 13.34 Bbl. oil from the Gallup Fm. on 4/13/97 w/ 353 MCF (GOR @ 26,485 MCF/STBO) gross gas rate.

During the 3 days in Interval V the On-Line time was reduced to 3 hrs./day from 4 hrs./day - and the well again came into conformance with the restricted rate of production. This restriction again artificially limited oil productivity and drove the GOR to approx. 143,030 SCF/STBO in the last 2 days with an average oil rate @ 1.255 BOPD and an average gross gas rate @ 179.5 MCFD (Dakota + Gallup).

c. Permeability Determination and Change After Commingled Production Initiated: Data Presentation:

Exhibit III (5 Pages) presents a permeability analysis for Interval I (2/6/97 to 2/21/97) and Interval III (3/19/97 to 4/12/97). Flow was restricted by line pressure @ approx. 190 PSIG during Interval I production. Flow was restricted by a choke and an intermitter during Interval III production - in order to limit production to the calculated allowable.

The build-up data from the Gallup Fm. well test (12/17/96 to 12/20/96) is used to interpret the permeabilities to oil, gas and water in the well. The results of the calculations are summarized below:

Drawdown Limited By:	Interval I Flow Line Pressure	Interval III Flow Choke & Intermitter	Original Test Swabbing Atmospheric Pressure
Oil Perm.:	0.193 md.	0.032 md.	0.686 md.
Gas Perm.:	0.727 md.	0.338 md.	0.081 md.
Water Perm.:	0.049 md.	0.004 md.	1.260 md.
Gross Perm.:	0.969 md.	0.374 md.	2.026 md.
Rel. Perm.:Gas/Oil:	3.77x	10.56x	0.12x

The reduced permeability numbers in Interval I and Interval III are the result of flow restrictions via reduced drawdowns. A drastic reduction in water permeability during the shut-in and work-over from 12/20/96 to 2/6/97 resulted in an increase in gas permeability.

3. ULTIMATE OIL RECOVERY ISSUES ASSOCIATED WITH ANY RESTRICTION OF PRODUCTION IN THE GALLUP FM.: Continued:

d. Tentative Permeability and GOR Study Performance Conclusions:

i. The Fullerton Federal #11 is in the Kutz Gallup Oil Field administratively and in fact (it is in the 'proper' reservoir - it is an Oil Well). The gas/oil relative permeability ratio 3.77x (when the well is only restricted by the line pressure) is also consistent with an Oil Pool. A much higher gas/oil relative permeability ratio would be expected in a Gas Pool (approx. 10x or greater). A Gas Pool type of gas/oil relative permeability was achieved by limiting production to allowable rates.

ii. The Fullerton Federal #11 well has a very low fracture and in-situ permeability. Oil permeability is more severely restricted than gas permeability by line pressure (back-pressure at the sand face) and/or artificially limiting production. During Interval IV significant amounts of oil were recovered that were 'stranded' or 'banked-up' in the well-bore vicinity during the restricted production period of Interval III. Interval IV did not last long enough to stabilize flow and reach its stable GOR (9 days).

iii. The high GOR's during the periods of restricted production are the result of 'stranding' oil in a low permeability reservoir (through artificial oil permeability reduction).

iv. The result is that limiting the gross gas rate on this well below approximately 366 MCFD appears to result in 'stranding' significant amounts of oil in place - while the gas would be produced to depletion. This is not a preferable outcome for the State of New Mexico, the United States Federal Government, or the Bonneville Fuels Corporation - in terms of optimizing oil recovery from this reservoir.

v. I further believe that additional drawdown below the Line Pressure of 190 PSIG would further mobilize oil and might result in a GOR approaching the 15,000 SCF/STBO common in the Kutz Gallup Oil Field AND that the well is young in the Gallup Fm. and I am still seeing some 'flush' production effects.

vi. All of the permeability numbers and flow rates are consistent with the determination that the Kutz Gallup Oil Reservoir is very 'tight' on the BFC acreage. Post-commingle and pre-commingle permeabilities and permeability reductions in the Gallup Fm. are consistent with a 'tight' reservoir.

vii. If substantial gas reserves are produced WITHOUT providing a sufficient drawdown to mobilize the associated oil THEN the result will be the loss of this 'stranded' oil in place in this very low permeability reservoir.

3. ULTIMATE OIL RECOVERY ISSUES ASSOCIATED WITH ANY RESTRICTION OF PRODUCTION IN THE GALLUP FM.: Continued:

e. Request For Testing:

A series of 30-day test intervals at restricted rates of production would result in stabilized data which might allow BFC to request an increase in the Limiting GOR for the low permeability reservoir in the portion of undeveloped Kutz Gallup covered by BFC's leasehold. Without such stabilized data BFC might request an allowable which would artificially limit the ultimate recovery of oil from this reservoir.

During May and June BFC intends to re-complete the Fullerton Federal #6E in Section 11 as a commingled Gallup/Dakota dual and to re-enter and wash down an abandoned dry-hole (the Fullerton Federal #9 in Section 14) and complete it as a commingled Gallup/Dakota dual. Both of these wells should have similar GOR and productivity to the Fullerton Federal #11. Substantial oil will be left in place in the reservoir if the 'proper' limiting GOR is not established. Additional drilling and production of the Gallup Fm. resource will be foregone - and reserves left unproduced - if the 'proper' limiting GOR for this area is not effectively determined. Here I define the 'proper' limiting GOR as that which optimizes ultimate oil recovery in the low permeability acreage in the Kutz Gallup Oil Pool.

I am therefore, in the interest of conservation, proposing the following test cycle for the Fullerton Federal #11:

1st 30 Day Period: Produce at 400 MCFD Gross Gas Rate.
This should eliminate any oil banking around the well-bore and allow for a stabilized 'dry' well stream flow.
2nd 30 Day Period: Produce at 350 MCFD Gross Gas Rate.
3rd 30 Day Period: Produce at 300 MCFD Gross Gas Rate.
4th 30 Day Period: Produce at 250 MCFD Gross Gas Rate.
5th 30 Day Period: Produce at 190 MCFD Gross Gas Rate.

This data should allow BFC to determine the 'proper' limiting GOR for this area in order to optimize hydrocarbon recovery on this low permeability acreage. BFC would then seek a hearing to obtain the 'Proper' Limiting GOR for this acreage and/or this pool.

I await your timely response to this proposal. The test periods are long only because the permeability is so low and the well response will be, therefore, slow. **BFC will maintain well production within allowable limits unless permission is granted for this testing program.**

Thank you for any consideration that you give these requests. I look forward to your decisions and this inquiry into the limiting GOR. BFC seeks to work with the State of New Mexico to optimize hydrocarbon recovery in this area - in the best interests of all parties in the area, and toward the protection of all correlative rights. Please call me at (303) 863-1555 ext. 213 if you have any questions.

Sincerely yours,
BONNEVILLE FUELS CORPORATION

R. A. Schwering, P.E.
Operations Manager: New Mexico

Attachments

Exhibit #2 : Fullerton Federal #11

5 Pages

Well Test : Gallup Fm.

Semi-Log Analysis: See Page 2

$k = \frac{162.6\,\Sigma q B \mu}{mh}$

Final Prod. Rate: 7 hr. Test
$q_o = 8$ STBO
$q_w = 12$ STBW
$q_g = 10$ MCF (est.)

Normalize to 24 hrs.:

$Q_o = 27.43$ STBOD
$Q_w = 41.14$ STBWD
$Q_g = 34.29$ MCFD (est.)

$m = 325$ PSI/Cycle $= m_1$ (Semi-Log)
$h = 10$ ft.

Assume: $B_o = 1.25$ Res Bbl./STBO
$B_w = 1.02$ Res Bbl./STBW

$\mu_o = 0.40$ cp.
$\mu_w = 0.60$ cp.

Flowing: $P_{avg} = 790.5$ PSIA $\therefore Z_a = 0.9053$

$*\therefore B_{ga} = 0.0035465$ Res Bbl./SCF $\therefore *\mu_a = 0.01332$ cp

*(See Following Analysis)

$\therefore k_o = \frac{162.6}{mh}\{(27.43)(0.40)(1.25)\} = 0.686$ md.

$\therefore k_w = \frac{162.6}{mh}\{(41.14)(0.60)(1.02)\} = 1.260$ md.

$\therefore k_g = \frac{162.6}{mh}\{(34,290)(0.0035465)(0.01332)\} = 0.08$ md.

$\longrightarrow \therefore k = \Sigma k = 2.026$ md.

Fracture Analysis: See Page 3:

$k_f = \frac{141.2(\Sigma Q B \mu)}{h}\frac{P_{pm}}{P_m}$

Match Pt.: $t_{rn} = 1.08$
$P_m = 390$

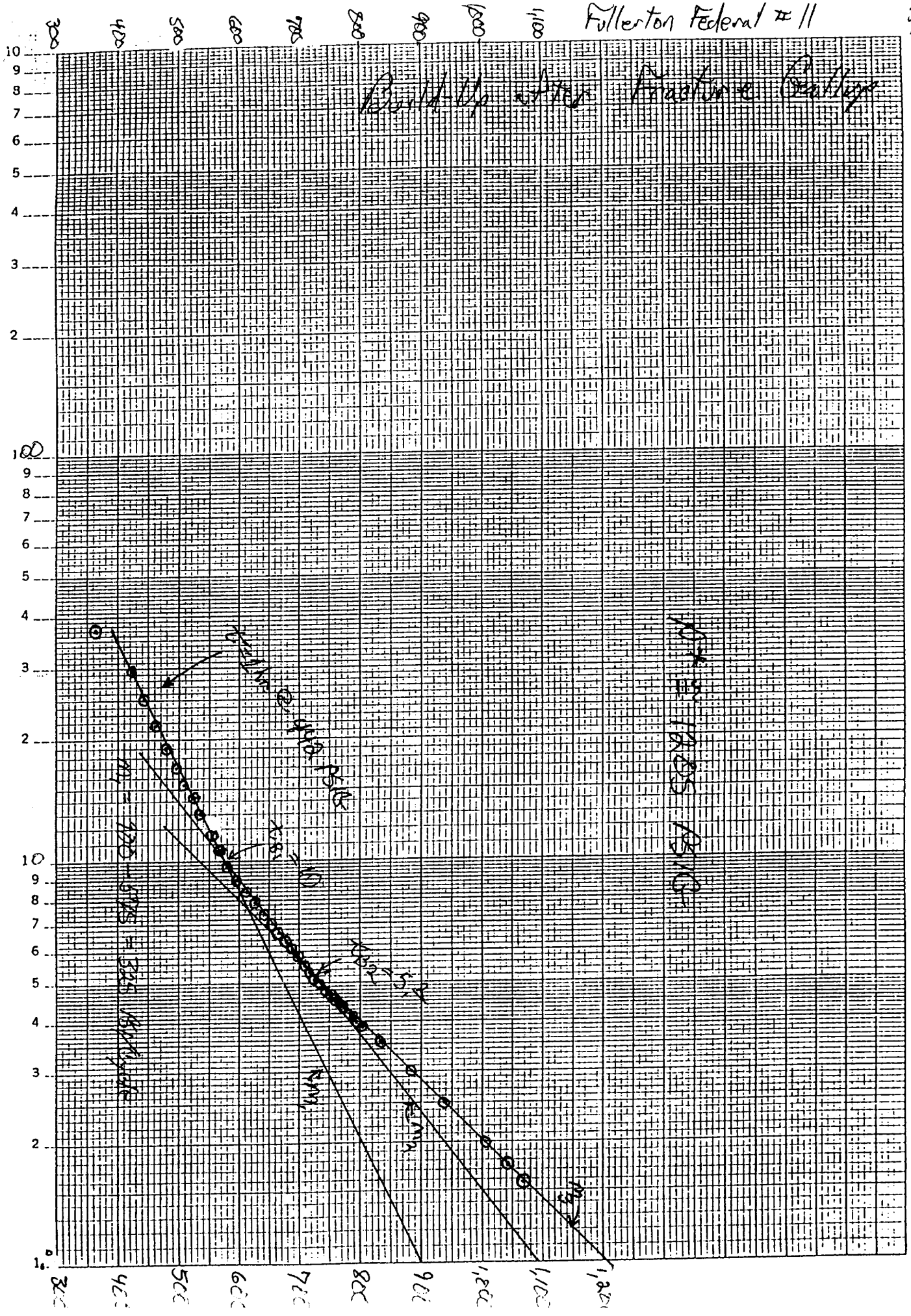
$\therefore k_f = \frac{141.2}{P_m \cdot h}\Sigma Q B \mu$ $t_{extm} = 1.0$ $P_{pm} = 1.0$

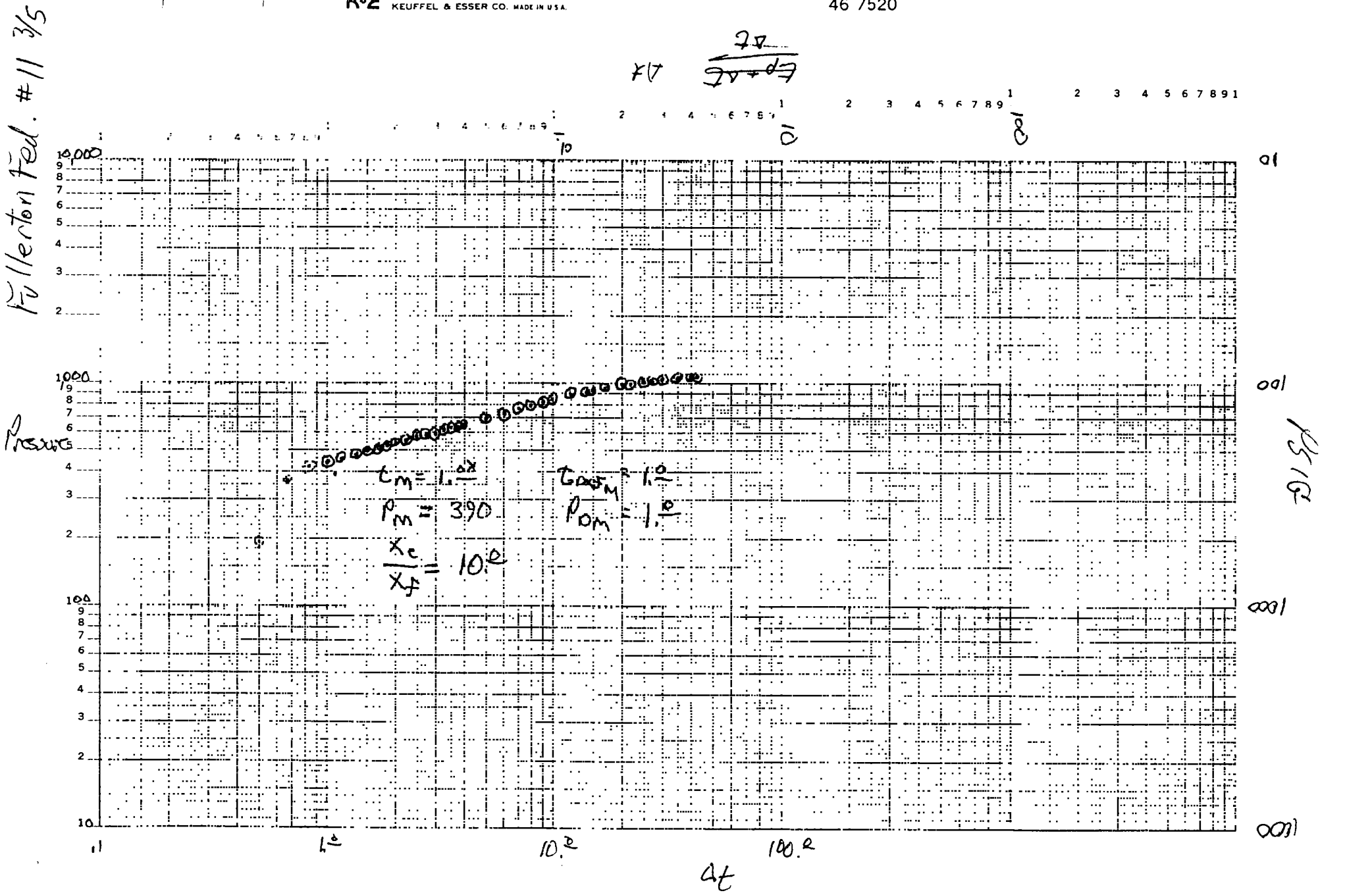
$\therefore k_o = \frac{141.2}{h P_m}\{(27.43)(0.40)(1.25)\} = 0.497$ md.

$\therefore k_w = \frac{141.2}{h P_m}\{(41.14)(0.60)(1.02)\} = 0.92$ md. $\longrightarrow \therefore k_f = \Sigma k = 1.467$ md.

$\therefore k_g = \frac{141.2}{h P_m}\{(34,290)(0.0035465)(0.01332)\} = 0.059$ md.

R. A. Schmeany


Fullerton Federal #11
4/5


K&E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7520
Pw Ilerton Fed. #11 3/5
Pressure
$t_m = 1.^{hr}$
$P_m = 390$
$\frac{x_c}{x_f} = 10.^{e}$
$t_{DA_M} = 1.^{e}$
$P_{DM} = 1.^{e}$
Δt
ΔP/P

Folleston Fed. #11

4/5

Test time	SI Time	Deltat	(tp+deltat)/deltat tp = 24 hrs.	Pressure	Temperat
42	30	0.50	49.00	194.616	32.053
52	40	0.67	37.00	363.949	77.588
62	50	0.83	29.80	422.057	145.014
72	60	1.00	25.00	442.001	153.602
82	70	1.17	21.57	461.381	154.523
92	80	1.33	19.00	479.319	154.753
102	90	1.50	17.00	495.088	154.854
112	100	1.67	15.40	509.458	154.897
122	110	1.83	14.09	522.729	154.919
132	120	2.00	13.00	534.832	154.926
147	135	2.25	11.67	551.82	154.926
162	150	2.50	10.60	566.115	154.911
177	165	2.75	9.73	580.341	155.005
192	180	3.00	9.00	598.569	155.113
207	195	3.25	8.38	614.231	155.207
222	210	3.50	7.86	628.728	155.257
237	225	3.75	7.40	642.119	155.286
252	240	4.00	7.00	654.712	155.322
267	255	4.25	6.65	666.538	155.343
282	270	4.50	6.33	677.863	155.365
297	285	4.75	6.05	688.698	155.387
312	300	5.00	5.80	699.048	155.401
327	315	5.25	5.57	708.929	155.423
342	330	5.50	5.36	718.467	155.437
357	345	5.75	5.17	727.579	155.451
372	360	6.00	5.00	736.38	155.466
387	375	6.25	4.84	744.85	155.473
402	390	6.50	4.69	753.03	155.487
417	405	6.75	4.56	760.973	155.495
432	420	7.00	4.43	768.606	155.502
447	435	7.25	4.31	776.026	155.502
462	450	7.50	4.20	783.218	155.516
477	465	7.75	4.10	790.144	155.523
492	480	8.00	4.00	797.062	155.531
507	495	8.25	3.91	803.463	155.538
522	510	8.50	3.82	809.857	155.545
537	525	8.75	3.74	816.042	155.545
552	540	9.00	3.67	822.041	155.552
582	570	9.50	3.53	833.614	155.559
612	600	10.00	3.40	844.237	155.574
641.5	629.5	10.49	3.29	854.389	155.581
672	660	11.00	3.18	864.12	155.581
701.5	689.5	11.49	3.09	873.253	155.588
732	720	12.00	3.00	882.081	155.595
762.5	750.5	12.51	2.92	890.427	155.595
792	780	13.00	2.85	898.148	155.603

t_p = 24 hrs.

822.5	810.5	13.51	2.78	905.784	155.61
852	840	14.00	2.71	912.797	155.617
882	870	14.50	2.66	919.619	155.617
912	900	15.00 ✓	2.60	926.162	155.617
942	930	15.50	2.55	932.37	155.624
972	960	16.00	2.50	938.328	155.631
1002.5	990.5	16.51	2.45	944.087	155.624
1032.5	1020.5	17.01 ✓	2.41	949.558	155.631
1062.5	1050.5	17.51	2.37	954.763	155.639
1091.5	1079.5	17.99	2.33	959.607	155.639
1122	1110	18.50	2.30	964.429	155.639
1152	1140	19.00	2.26	969.036	155.639
1182	1170	19.50	2.23	973.4	155.646
1212	1200	20.00 ✓	2.20	977.647	155.646
1272	1260	21.00	2.14	985.602	155.653
1331.5	1319.5	21.99 ✓	2.09	992.81	155.653
1392	1380	23.00	2.04	999.587	155.66
1452.5	1440.5	24.01	2.00	1005.858	155.667
1512	1500	25.00	1.96	1011.651	155.675
1573	1561	26.02	1.92	1017.108	155.675
1632	1620	27.00	1.89	1022.023	155.675
1692	1680	28.00	1.86	1026.758	155.66
1752	1740	29.00	1.83	1031.129	155.653
1812	1800	30.00	1.80	1035.22	155.667
1874	1862	31.03	1.77	1039.079	155.675
1932	1920	32.00	1.75	1042.489	155.675
1992	1980	33.00	1.73	1045.905	155.682
2052	2040	34.00	1.71	1048.988	155.682
2112	2100	35.00	1.69	1051.962	155.682
2172	2160	36.00	1.67	1054.739	155.682
2232	2220	37.00	1.65	1057.339	155.689
2292	2280	38.00	1.63	1059.857	155.689
2352	2340	39.00	1.62	1062.169	155.696
2412	2400	40.00	1.60	1064.406	155.696
2472	2460	41.00	1.59	1066.491	155.703
2532	2520	42.00	1.57	1068.54	155.703
2536	2524	42.07	1.57	1068.703	155.703

Exhibit #2: Fullerton Federal #1

2 Pages

Production History

FULLERTON #11 PRODUCING GOR STUDY:

Date Feb.	Oil Gauged Daily	Gas Gauged Daily	Gas Corrected To Sales	GOR	Choke: 64ths of an inch.	
6	3.25	215	219	67517	48	
7	4.50	292	298	66226	48	
8	5.00	299	305	61032	48	
9	10.50	306	312	29743	48	
10	10.00	311	317	31741	48	
11	10.00	327	334	33374	48	
12	9.50	340	347	36527	48	
13	8.50	347	354	41664	48	
14	10.00	340	347	34700	48	
15	10.00	361	368	36844	48	
16	9.00	365	373	41391	48	
17	8.00	378	386	48223	48	
18	4.50	654	667	148327	48	
19	11.00	391	399	36278	48	
20	8.50	402	410	48268	48	
21	6.75	406	414	61387	48	
22	2.50	283	289	115532	?: Attempt to use Limit Orifice @ Separator	
23	5.00	387	395	78994	?: Attempt to use Limit Orifice @ Separator	
24	5.50	359	366	66617	?: Attempt to use Limit Orifice @ Separator	
25	5.75	365	373	64786	?: Attempt to use Limit Orifice @ Separator	
26	6.70	365	373	55600	?: Attempt to use Limit Orifice @ Separator	
27	8.25	388	396	47999	32	Install Re-Built Choke: Repair not adequate.
28	6.75	422	431	63806	16	Install Re-Built Choke: Repair not adequate.
March						
1	6.70	440	419	62539	10	Install Re-Built Choke: Repair not adequate.
2	6.70	468	446	66519	32	NEW Re-Built Choke: Repair not adequate.
3	6.70	459	437	65240	32	NEW Re-Built Choke: Repair not adequate.
4	5.00	451	429	85897	24	NEW Re-Built Choke: Repair not adequate.
5	2.50	393	374	149702	16	NEW Re-Built Choke: Repair not adequate.
6	1.50	128	122	81263	10	NEW Re-Built Choke: Repair not adequate. Well Froze off.
7	0.10	39	37	371397	20	NEW Re-Built Choke: Repair not adequate. Well Froze off.
8	7.50	501	477	63614	32	NEW CHOKE w/ Intermitter: On 7.5 hours per day.
9	0.75	155	148	196809	32	NEW CHOKE w/ Intermitter: On 7.5 hours per day.
10	2.50	133	127	50662	32	NEW CHOKE w/ Intermitter: On 7.5 hours per day.
11	1.00	256	244	243789	32	NEW CHOKE w/ Intermitter: On 7.5 hours per day.
12	1.68	153	146	86727	32	NEW CHOKE w/ Intermitter: On 7.5 hours per day.
13	2.90	243	231	79796	32	NEW CHOKE w/ Intermitter: On 7.5 hours per day.
14	5.50	388	369	67180	32	NEW CHOKE w/ Intermitter: On 8.0 hrs./day @ 1/2 hr./cycle.
15	10.50	361	344	32741	32	NEW CHOKE w/ Intermitter: On 8.0 hrs./day @ 1/2 hr./cycle.
16	0.10	304	289	2894992	32	NEW CHOKE w/ Intermitter: On 6.0 hrs./day @ 1/2 hr./cycle.
17	3.00	283	270	89834	32	NEW CHOKE w/ Intermitter: On 4.8 hrs./day @ 1/2 hr./cycle.
18	1.68	253	241	143412	32	NEW CHOKE w/ Intermitter: On 4.8 hrs./day @ 1/2 hr./cycle.

Interval I

Interval II

1st Interval: Open Flow against Line Pressure:
GOR: Feb. 6th - 21st: OIL= 129.0 GAS= 5852 GOR= 45365
DAYS= 16 RATES: OIL = 8.0625 BOPD GAS= 365.76 MCFD

2nd Interval:
GOR: Feb. 22nd thru March 18th: OIL= 106.8 GAS= 7772 GOR= 72798
DAYS= 25 RATES: OIL = 4.272 BOPD GAS= 310.88 MCFD

GOR thru March 18th: OIL= 235.8 GAS= 13624 GOR= 57788
DAYS= 41 RATES: OIL = 5.751 BOPD GAS= 332.32 MCFD

CORRECTION FACTOR FOR GAS SALES: FEBRUARY: GAS GAUGED DAILY = 8,303 MCF.
FEBRUARY: GAS SOLD = 8,474 MCF.
FEBRUARY DAILY GAUGE CORRECTION FACTOR = (DAILY GAUGE * 1.0206).

CORRECTION FACTOR FOR GAS SALES: MARCH: GAS GAUGED DAILY = 8,113 MCF.
MARCH: GAS SOLD = 7,726 MCF.
MARCH DAILY GAUGE CORRECTION FACTOR = (DAILY GAUGE * 0.9523).

NOTE: THE GAUGE REDUCTION IN MARCH IS DUE TO SPIKING EFFECTS ASSOCIATED WITH THE INTERMITTER.
IN MARCH ONLY 24 DAYS WERE INTERMITTED. THEREFORE I USED THE SAME CORRECTION FACTOR FOR APRIL DATA.

FULLERTON #11 PRODUCING GOR STUDY:

Date March		Oil Gauged Daily	Gas Gauged Daily	Gas Corrected To Sales	GOR	Choke: 64ths of an inch.	
	19	1.67	231	220	131725	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	20	0.84	213	203	241476	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	21	0.10	255	243	2428365	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	22	1.67	227	216	129444	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	23	2.50	175	167	66661	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	24	1.26	208	198	157205	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	25	0.10	141	134	1342743	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	26	0.84	202	192	229005	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	27	1.25	236	225	179794	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	28	0.84	189	180	214268	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	29	2.93	229	218	74429	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	30	2.50	187	178	71232	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
	31	1.67	212	202	120891	32	NEW CHOKE w/ Intermitter: On 4.0 hrs./day @ 1/2 hr./cycle.
April							
	1	2.51	219	209	83089	32	On 4.0 hrs./day @ 1/2 hr./cycle.
	2	2.52	214	204	80870	32	On 4.0 hrs./day @ 1/2 hr./cycle.
	3	2.50	210	200	79993	32	On 4.0 hrs./day @ 1/2 hr./cycle.
	4	2.50	214	204	81517	32	On 4.0 hrs./day @ 1/2 hr./cycle.
	5	1.25	140	133	106658	32	On 4.0 hrs./day @ 1/2 hr./cycle.
	6	0.10	151	144	1437973	32	On 4.0 hrs./day @ 1/2 hr./cycle. Line leak.
	7	0.10	188	179	1790324	32	On 4.0 hrs./day @ 1/2 hr./cycle. Line leak.
	8	0.00	0	0	0	32	SI f/ leak repair. High line pressure.
	9	0.26	267	254	977939	32	On 4.0 hrs./day @ 1/2 hr./cycle. High Line Press.
	10	0.83	127	121	145713	32	On 4.0 hrs./day @ 1/2 hr./cycle. High Line Press.
	11	0.84	106	101	120171	32	On 4.0 hrs./day @ 1/2 hr./cycle. High Line Press.
	12	1.67	210	200	119750	32	On 8.0 hrs./day @ 1/2 hr./cycle. High Line Press.
	13	13.34	371	353	26485	32	On 8.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	14	4.18	251	239	57184	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	15	1.66	210	200	120472	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	16	3.34	239	228	68144	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	17	3.34	217	207	61871	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	18	1.67	204	194	116329	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	19	5.00	252	240	47996	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	20	4.18	267	254	60829	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	21	4.17	214	204	48871	32	On 4.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	22	2.92	234	223	76314	32	On 3.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	23	1.26	199	190	150403	32	On 3.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	24	1.25	177	169	134846	32	On 3.0 hrs./day @ 1/2 hr./cycle. Low Line Pressure.
	25						
	26						
	27						
	28						
	29						
	30						

Interval III

Interval IV

Interval V

3rd Interval: Achieve Targeted Production @ 190 MCFD per NMOCD: Use Choke & Intermitter:
GOR: 3/19 THRU 4/12: OIL= 33.25 GAS= 4524 GOR= 136071
DAYS= 25 RATES: OIL= 1.33 BOPD GAS= 180.96 MCFD

4th Interval: Well Improves w/ Surface Equipment unchanged: Low line pressure or thawing:
GOR: 4/13 THRU 4/21: OIL= 40.88 GAS= 2119 GOR= 51831
DAYS= 9 RATES: OIL= 4.54 BOPD GAS= 235.44 MCFD

5th Interval: Reduce On-Line Time w/ Intermitter & Return to Compliance w/ NMOCD Request:
GOR: 4/22 THRU 4/24: OIL= 5.43 GAS= 581 GOR= 106980
DAYS= 3 RATES: OIL= 1.81 BOPD GAS= 194 MCFD

TOTAL ON-LINE TIME TO DATE:
GOR: 2/6/97 THRU 4/24/97: OIL= 315.32 GAS= 20848 GOR= 66118
DAYS= 78 RATES: AVG.: OIL= 4.04 BOPD GAS= 267 MCFD

EXHIBIT III Fullerton Federal #1

5 Pages

Permeability Calculations & Comparisons

$k = \frac{162.6}{mh} \Sigma q B \mu$

$p^* = 1{,}205$ PSIA

Post-Frac Gallup Build-Up:

$m = m_1 = 325$ PSI/cycle

$h = 10$ Ft.

Gallup Production:		Interval I:	Interval III:	
Assume:	q_o	7.73	1.28	STBOD
$\mu_o = 0.40$ cp.	q_g	307.54	152.65	MCFD
$B_o = 1.25$ Res.Bbl/STBO	q_w	1.	0.12	STBWO
$\mu_w = 0.60$ cp. TP/CP		190/310	240/400	PSIG
$B_w = 1.02$ ResBbl/STBO CP		324.7	414.7	PSIA

Calculate Flowing BHP: Gallup Fm.: Pages 2 & 3:

	Interval I:	Interval III:
Surf. CP (PSIA)	324.7	414.7
Calc. Flowing BHP (PSIA)	376	481

Note: Assume: No liquid in annulus to perfs.
Well flowed up 2 3/8" tubing OE@ 6,473'.

Gas
Sp.Gr. = 0.72
N_2 = 1%
CO_2 = 1%
Mid-Perf @ 5,887'
T_R = 155°F
T_S = 60°F

Calculate Avg. Flowing Res. Pressure: Gallup Fm.:

Interval I: $P_{a_I} = \frac{p^* + P_{FBHP_I}}{2} = \frac{1{,}205 + 376}{2}$ $\therefore P_{a_I} = 790.5$ PSIA

Interval III: $P_{a_{III}} = \frac{p^* + P_{FBHP_{III}}}{2} = \frac{1{,}205 + 481}{2}$ $\therefore P_{a_{III}} = 843$ PSIA

Calculate Z & B_g & μ_g For Gas Flowing @ P_a:

$P_S = 14.7$ PSIA
$T_S = 60°F = 519.7°R$
$T_R = 155°F = 614.7°R$

Pages 4 & 5: $Z_I = 0.9053$ $Z_{III} = 0.8996$

$\mu_I = 0.01332$ cp. $\mu_{III} = 0.01343$ cp.

$\therefore B_{ga} = \frac{P_S}{P_a} \cdot \frac{T_R}{T_S} \cdot Z = \frac{.7.4805 \text{ gal}}{42 \text{ gal/Bbl}}$

$B_{g_I} = 0.0035465 \frac{\text{Res Bbl.}}{SCF}$ $B_{g_{III}} = 0.0033047 \frac{\text{Res Bbl.}}{SCF}$

Calculate Permeabilities & Permeability Reductions Due to Flow Restrictions:

Assume:		Interval I	Interval III	Reduction Ratio (Interval III / Interval I)
$B_o = 1.25 \frac{\text{Res Bbl.}}{STBO}$	k_o	0.193 md.	0.032 md.	0.1658
$B_w = 1.02 \frac{\text{Res Bbl.}}{STBW}$	k_g	0.727 md.	0.338 md.	0.4649
	k_w	0.049 md.	0.004 md.	0.0816
$\mu_o = 0.40$ cp.	k_T	0.969 md.	0.374 md.	0.386
$\mu_w = 0.60$ cp.	$\frac{k_g}{k_o}$	3.77 x	10.56 x	

$k_i = \frac{162.6}{mh} q_i B_i \mu$

$k_T = \Sigma k_i$

R. A. Harrington

2/5

--BHPCALC--

Calculate BHP and Z-factor from surface shut-in pressure

04/22/97

WELL NAME :	FF#11				
GAS GRAVITY:	0.72		% N2	1.00	
CONDENSATE (YES=1)	0		% CO2	1.00	%
RESERVOIR TEMP:	155	'F	% H2S	0.00	%
SURFACE TEMP:	60	'F	Pc =	671.04	%
DEPTH OF ZONE:	5,887	feet	Tc =	392.14	

SURFACE PRES	BHP	Z	BHP/Z
psia	psia		psia
325	376	0.9656	389

Version 2.0 for Quattro Pro

			BHT	SURFT
GAS Gh	0.71	A =	0.0642	0.0642
Tchc =	392.24	B =	0.3086	0.1663
Pchc =	668.77	C =	-0.7000	-0.8617
CWA =	1.83	D =	1.7204	1.4545
Tavg =	567.17	E =	0.2303	0.3222
Tc' =	357.28	F =	0.6845	0.6845
Pc' =	671.67	Tr =	1.720	1.455

Pr	G	pro	f(pr)	f(pr)'	pro'	Z	
0.483	0.130	0.095	0.000	1.304	0.095	0.947	372
0.554	0.150	0.090	0.000	1.607	0.090	0.966	425
0.554	0.150	0.090	0.000	1.607	0.090	0.966	376
0.559	0.151	0.091	-0.000	1.607	0.091	0.966	376
0.559	0.151	0.091	0.000	1.607	0.091	0.966	376

3/5

--BHPCALC--

Calculate BHP and Z-factor from surface shut-in pressure

04/22/97

WELL NAME :	FF#11				
GAS GRAVITY:	0.72		% N2	1.00	
CONDENSATE (YES=1)	0		% CO2	1.00	%
RESERVOIR TEMP:	155	'F	% H2S	0.00	%
SURFACE TEMP:	60	'F	Pc =	671.04	%
DEPTH OF ZONE:	5,887	feet	Tc =	392.14	

SURFACE PRES	BHP	Z	BHP/Z
psia	psia		psia
415	481	0.9565	503

Version 2.0 for Quattro Pro

			BHT	SURFT
GAS Gh	0.71	A =	0.0642	0.0642
Tchc =	392.24	B =	0.3086	0.1663
Pchc =	668.77	C =	-0.7000	-0.8617
CWA =	1.83	D =	1.7204	1.4545
Tavg =	567.17	E =	0.2303	0.3222
Tc' =	357.28	F =	0.6845	0.6845
Pc' =	671.67	Tr =	1.720	1.455

Pr	G	pro	f(pr)	f(pr)'	pro'	Z	
0.617	0.167	0.123	-0.000	1.265	0.123	0.932	476
0.708	0.191	0.116	-0.000	1.580	0.116	0.957	542
0.708	0.191	0.116	-0.000	1.580	0.116	0.957	481
0.716	0.193	0.117	0.000	1.578	0.117	0.957	481
0.716	0.193	0.118	0.000	1.578	0.118	0.957	481

Z - Factor Calculation

Version 1.1
22-Apr-97

Well Name	ff#11			
GAS GRAVITY	0.72		Tc =	392.14
% N2	1.00	%	Pc =	671.04
% CO2	1.00	%	Tc' =	390.32
% H2S	0.00	%	Pc' =	667.91
CONDENSATE (YES	0		Tr =	1.578
RES. TEMPERATUR	155	'F	Pr =	1.262
PRESSURE	843	psia	GAS Ghc	0.7093
			Tchc =	392.24
Z - Factor	0.8996		Pchc =	668.77
BHP/Z	937		CWA =	1.83
			pro =	0.2400
			f(pr) =	0.0000
			f(pr)' =	1.2907
			pro' =	0.2400

Z - Factor Calculation

Version 1.1
22-Apr-97

Well Name	ff#11			
GAS GRAVITY	0.72		Tc =	392.14
% N2	1.00	%	Pc =	671.04
% CO2	1.00	%	Tc' =	390.32
% H2S	0.00	%	Pc' =	667.91
CONDENSATE (YES	0		Tr =	1.578
RES. TEMPERATUR	155	'F	Pr =	1.184
PRESSURE	790.5	psia	GAS Ghc	0.7093
			Tchc =	392.24
Z - Factor	0.9053		Pchc =	668.77
BHP/Z	873		CWA =	1.83
			pro =	0.2237
			f(pr) =	-0.0000
			f(pr)' =	1.3047
			pro' =	0.2237

-- Gas Viscosity --

Well Name	FF#11	
Field Name	w. kutz	
	22-Apr-97	

Pressure	843	psia	----------	
Reservoir Temp	155	'F	Z factor	0.899
Gas Gravity	0.720		Pressure/Z	938
Condensate (yes=1)	0		Gas Viscosity	0.01343
% N2	1.00	%	----------	
% CO2	1.00	%		
% H2S	0.00	%		

-- Gas Viscosity --

Well Name	FF#11	
Field Name	w. kutz	
	22-Apr-97	

Pressure	791	psia	----------	
Reservoir Temp	155	'F	Z factor	0.905
Gas Gravity	0.720		Pressure/Z	874
Condensate (yes=1)	0		Gas Viscosity	0.01332
% N2	1.00	%	----------	
% CO2	1.00	%		
% H2S	0.00	%		