Case file 5686
RLS

ANADARKO PRODUCTION COMPANY

GENERAL OFFICE
P. O. BOX 9317
FORT WORTH, TEXAS 76107

1014 W. AVENUE K
AREA CODE 505 396-4018

LOVINGTON, NEW MEXICO 88260
CABLE ADDRESS: ANDARK

P. O. Box 67
Loco Hills, New Mexico 88255
April 5, 1977

New Mexico Oil Conservation Commission
P. O. Drawer DD
Artesia, New Mexico 88210

Attn: Mr. Bill Gressett

RECEIVED
APR 8 1977
O. C. C.
ARTESIA, OFFICE

Re: CASE NO. 5686
Order No. R-5224
Premier L & M Waterflood Project
Federal L No. 2
UL E, Sec. 31, T-17S, R-30E
Eddy County, New Mexico

This letter is written in response to a provision of Order No. R-5224 which states "the operator should conduct tests to determine the pressure at which injection into said well may be maintained without causing fracturing of the cement or formation around the well and resultant migration of injected fluid out of the injection zone".

Current Rate and Pressure - 103 BWPD @ 1400#.

Cement - During October, 1967 a 4½" liner was set through the Grayburg pay zones and cemented with 100 sacks of Class C w/2% CaCL. Halliburton cementing tables show this cement to possess 3935 psi compressive strength at 80° F (bottom hole temperature) after 72 hours setting time.

Dowell Chemical Company's frac guide formulas are used in the calculations shown below to determine the maximum wellhead pressure attained at the time fracturing occurrs around the immediate well bore. This fracture pressure is generally agreed to be the instant shut down pressure after a frac job. The Federal L #2 was fraced during September, 1972 w/35,000 gals gelled water and 35,000# sand. The instant shut down pressure was 1600#. (see attached Dowell treating report - Exhibit #1) This was recorded after the flush and while the hole was loaded with fresh water.

P_F (Fracture Pressure) = $P_{FG}D$

where: P_{FG} = fracturing gradient

D = depth = 3002' (top perforation)

Fracturing gradient = $\frac{P_h + P_w - P_f - P_{pf}}{D}$

where: P_h = hydrostatic pressure, psi = specific gravity x wt/ft of fresh water x D = 1.06 (see Exhibit #2) x .433 x 3002 = 1378#

P_w = wellhead pressure, psi = I.S.D.P. = 1600#

P_f = pipe friction pressure, psi = at the rate of 103 BWPD
I assume this figure to be equal to or only slightly greater than zero, therefore = 0#

P_{pf} = perforation friction pressure, psi = same as P_f = 0#

Then: $\left(P_F = \frac{P_h + P_w - P_f - P_{pf}}{D} \times D\right) = \left(P_h + P_w - P_f - P_{pf}\right) =$

$$\left(P_h + P_w\right) = \left(1378\# + 1600\#\right) = 2978 \text{ psi}$$

Therefore: Fracturing can occur when a wellhead pressure of 1600# together with a hydrostatic of 1378# applies a total force of 2978 psi on the perforations at a depth of 3002'.

It should be noted that this fracturing can occur in a horizontal plane and still be contained within the pay zone. Dowell's frac guide says that a fracture gradient of $<.7$ consists of vertical fractures; $>.7$ but <1 = vertical or horizontal and >1 = horizontal fractures. The fracture gradient here calculates:

$$P_{FG} = \frac{P_h + P_w - P_f - P_{pf}}{D} = \frac{1378 + 1600 - 0 - 0}{3002} = .992$$

This .992 strongly suggests horizontal fractures. Due to this slow rate it would seem that the depth of penetration of a fracture would be quite limited.

Also fracturing can occur between sand stringers within the Grayburg Section without harmful effects since the Grayburg section frequently contains multiple thin sands and our intention is to ultimately flood all sand stringers in this zone.

Jerry E. Hoobler

DOWELL DIVISION OF THE DOW CHEMICAL COMPANY

2-7-[illegible]

WELL NUMBER: Cox "L" #2	LOCATION	CUSTOMER REPRESENTATIVE: Mr. D. Bell	TREATMENT NUMBER: 05-13-5[illegible]
FIELD: Jackson	FORMATION: Premier	JOB DONE DOWN: TUBING A ☒ / CASING B ☐ / ANNULUS C ☐	ALLOWABLE PRESSURE: TUG: 5000 / CSG:
	STATE: New Mexico	TYPE OF WELL: OIL A ☒ / GAS B ☐ / WATER C ☐	
SERVICE: Fracturing		AGE OF WELL: NEW WELL A ☐ / REWORK B ☒	TOTAL DEPTH: 27
COMPANY: Amerada Production Co.		CASING SIZE: Liner 4½" 9.5	CASING DEPTH: Liner 2632
ADDRESS: Box 67		LINER SIZE:	LINER DEPTH:
CITY, STATE: Lea Hills, New Mexico		OPEN HOLE:	CSG. OR ANRL. VOL.:
		TUBING SIZE: 2⅞"	TUBING DEPTH: 2650
		PACKER TYPE: Dowell	PACKER DEPTH: 2600
		TUG VOLUME: 17.4	STATIC BHT:

PERFORATED INTERVALS

DEPTH	NO. OF HOLES	DEPTH	NO. OF HOLES	DEPTH	NO. OF HOLES
3002					
3012					

FOR CONVERSION PURPOSES 24 BBLS EQUALS 1000 GALLONS

ARRIVED ON LOCATION: 11:45

TIME	INJECTION RATE	INJECTION BBLS IN	PRESSURE CSG.	PRESSURE TBG.	SERVICE LOG
					LAY LINES - WAIT TO RUN TUBING
					START F.W. TO BREAK FM.
					STOP PUMPS - FM. WON'T BREAK - SPOT 2 BBL ACID
					START F.W. TO BREAK FM.
					START ACID
	6	10		3000	ACID IN - START RF-40 PAD
		10			STOP PAD - LET ACID SOAK
					CONTINUE RF-40 PAD
	19½	110		3300	ALL PAD - START 20-40 SAND ½ #/gal
	20	45		3300	INCREASE SAND CONC. TO 1 #/GAL
	20½	264		3150	" " " " 1½ #/GAL
	21	260		3100	ALL 20-40 SAND - START 10-20 SAND 1#/GAL
	21	120		3100	ALL SAND - START F.W. FLUSH
	18	40		2600	FLUSH COMPLETE
					< ISIP 1600
					15 MIN. 1500 >

ACID	15%	1000		

TIME LEFT LOCATION	AVG. LIQUID INJ. RATE	ADJUST. RATE (SOLIDS INCL.)	TOTAL FLUID PUMPED: OIL	WATER
	20.5	21		
MAX. PRESSURE	AVG. PRESSURE	FINAL PUMP IN PRESSURE	SHUT IN PRESSURE: IMMEDIATE	15 MINUTES
	2200	3150		

PROPS AND LIQUIDS INJECTED

TYPE	SIZE OR PURPOSE	AMOUNT
RF-40	PAD - FRAC	35,000
SAND	20-40	30[illegible]
SAND	10-20	[illegible]
L-35	GEL PBAN	20

DOWELL ENGINEER: J. A. Cordero

DATE: [illegible], N.M.

CUSTOMER REP. CONTACTED

CUSTOMER CONSIDERED SERVICE: ☐ SATISFACTORY ☐ UNSATISFACTORY ☐ UNKNOWN

PROD. BEFORE TREATMENT: TEST ☐ ALLOWABLE ☐

PROD. AFTER TREATMENT: TEST ☐ ALLOWABLE ☐

DIVISION
369 Marshall Avenue / Saint Louis, Missouri 63119
(314) WO 1-3500/TWX 910-760-1660/Telex 44-2417

WATER ANALYSIS REPORT

COMPANY [illegible]ko Production Co. ADDRESS Loco Hills, New Mex. DATE: 6/9/76

LEASE Federal J & M Lease DATE SAMPLED 6/1/76 ANALYSIS NO. 11500

Analysis	Mg/l		*Meq/l	
1. pH	6.4			
2. H_2S (Qualitative)	Zoo.			
3. Specific Gravity	1.060			
4. Dissolved Solids	78,924			
5. Suspended Solids				
6. Phenolphthalein Alkalinity ($CaCO_3$)				
7. Methyl Orange Alkalinity ($CaCO_3$)	630			
8. Bicarbonate (HCO_3)	HCO_3 769	÷61	12.6	HCO_3
9. Chlorides (Cl)	Cl 46,000	÷35.5	1,296	Cl
10. Sulfates (SO_4)	SO_4 3,000	÷48	63	SO_4
11. Calcium (Ca)	Ca 3,200	÷20	160	Ca
12. Magnesium (Mg)	Mg 2,187	÷12.2	179	Mg
13. Total Hardness ($CaCO_3$)	17,000			
14. Total Iron (Fe)	9.0 ppm			
15. Barium (Qualitative)				
16.				

*Milli equivalents per liter

PROBABLE MINERAL COMPOSITION

160	Ca	HCO_3	12.6
179	Mg	SO_4	63
1,033	Na	Cl	1,296

Saturation Values Distilled Water 20°C

$Ca CO_3$ 13 Mg/l

$Ca SO_4 \cdot 2H_2O$ 2,090 Mg/l

$Mg CO_3$ 103 Mg/l

Compound	Equiv. Wt.	X	Meq/l	=	Mg/l
$Ca(HCO_3)_2$	81.04		12.6		1,021
$Ca SO_4$	68.07		63		4,290
$Ca Cl_2$	55.50		84		4,662
$Mg(HCO_3)_2$	73.17				
$Mg SO_4$	60.19				
$Mg Cl_2$	47.62		179		8,523
$Na HCO_3$	84.00				
$Na_2 SO_4$	71.03				
Na Cl	58.46		1,033		60,431

Analyst [illegible]

Baltman - Worsham - Nix - File

Respectfully submitted
TRETOLITE COMPANY

RayShaffner

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501

DIRECTOR
JOE D. RAMEY

LAND COMMISSIONER
PHIL R. LUCERO

STATE GEOLOGIST
EMERY C. ARNOLD

June 2, 1976

Re: CASE NO. 5686
ORDER NO. R-5224

Mr. Jason Kellahin
Kellahin & Fox
Attorneys at Law
Post Office Box 1769
Santa Fe, New Mexico

Applicant:

Anadarko Production Company

Dear Sir:

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

Yours very truly,

JOE D. RAMEY
Director

JDR/fd

Copy of order also sent to:

Hobbs OCC x
Artesia OCC x
Aztec OCC

Other

ANADARKO PRODUCTION COMPANY
A Panhandle Eastern Pipe Line Company Subsidiary

Two Greenway Plaza East, Suite 410
Houston, Texas 77046
(713) 626-7610

May 27, 1976

Mr. Joe D. Ramey, Secretary-Director
New Mexico Oil Conservation Commission
P. O. Box 2088
Santa Fe, New Mexico 87501

Dear Mr. Ramey:

In response to your question raised in Case 5686 regarding the injection pressure encountered in Anadarko's Loco Hills Flood, Eddy County, New Mexico, we submit the following data:

> Maximum wellhead pressure after fillup was 1660 psi at a typical injection rate of 650 BWPD. The pressure varied with rate and was as low as 1200 psi in some wells.

Our office in Loco Hills reports that the community of Loco Hills is supplied fresh water by Caprock Water Company.

Yours very truly,

D. G. Kernaghan
Division Evaluation Engineer

DGK/mm