



**Amoco Production Company**

Security Life Building  
Denver, Colorado 80202

M. S. Kraemer

Division Production  
Manager

A. M. Roney

Division Operations  
Superintendent

T. M. Curtis

W. M. Jones

Production Coordination  
Superintendents

February 10, 1977

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

File: VDP-348-986.511

Cessation of Gas Injection to Meet  
Gas Shortage, Penn "D" Pool,  
Tocito Dome Field  
San Juan County, New Mexico

*File  
Case 3434*

To help meet the gas shortage back East, Amoco discontinued its gas injection test program on February 2, 1977 and diverted that 1 MMCFD to gas sales. Inasmuch as we had been selling what gas was not injected, total gas-to-sales by Amoco since that time has been about 2.5 MMCFD.

Pursuant to your September 13, 1976 letter, NMOCC permission to inject gas up to a limit of 1 MMCFD is due to expire February 27, 1977. Before then, we intend to write you our future plans with respect to the gas injection test program in the Tocito Dome "D" Pool.

Very truly yours,

*R.B. Giles*  
R. B. Giles

RBG:cd

cc: A. R. Kendrick, Supervisor,  
District No. 3

P. T. McGrath  
U. S. Geological Survey  
P. O. Box 965  
Farmington, New Mexico  
87401

New Mexico Oil Conservation  
Commission  
1000 Rio Brazos Rd.  
Aztec, New Mexico 87110

J. C. White  
Texaco, Inc.  
P. O. Box 2100  
Denver, Colorado 80201

J. A. Morris  
Mobil Oil Corporation  
Three Greenway Plaza East, Suite 800  
Houston, Texas 77046



**Amoco Production Company**

Security Life Building  
Denver, Colorado 80202

June 13, 1975

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

File: DGW-136-538.9

Tocito Dome Gas Injectivity Test Results

This letter is to advise the New Mexico Oil Conservation Commission and other operators in the Tocito Dome Penn "D" Pool of the results of the 37 day gas injectivity test which was performed according to Order R-4983.

The primary purpose of this test was to determine injectivity characteristics of the reservoir and the injection capacity of Amoco's existing compressors. To determine these parameters, Navajo Tribal "U" No. 3, in SW/4 SW/4 Section 16, T26N, R18W was converted to gas injection as specified by the above-referenced order (refer to field map, Attachment No. 1). Two of Amoco's six compressors were manifolded so that gas compressed by these units could be reinjected.

In Amoco's opinion the test was very successful, in that we were able to inject significant quantities of gas at pressures at which all our existing compressors can operate. This is also true for equipment of other operators in the pool.

In all, a total of 85,778 MCF was injected during the 37 days of injection. The test ran longer than the 30 days specified by the Order because a packer leak was discovered six days after the test was initiated. Verbal approval to reinitiate the 30 day test was granted by the Aztec office of the New Mexico Oil Conservation Commission after proper repairs had been made.

Attachment No. 2 outlines the daily injection rates, daily injected volumes, cumulative injected volumes, wellhead tubing pressure during injection, the hours of operation and the compressor used. You will note that with the smaller Chicago Pneumatic (CP) compressor we were generally capable of injecting about 2.4 MMCFD at 810 psig. With the larger Ingersoll Rand (IR) machine, we could easily inject as much as 5.4 MMCFD or more at 940 psig. Amoco feels these rates and pressures would be very satisfactory should it be determined that a full scale gas injection project would be the optimum method to deplete the Tocito Dome Penn "D" reservoir.

✓ Gas breakthrough occurred during the test at Amoco's Navajo Tribal "U" No. 14 in the NE/4 SW/4 Section 16, T26N, R16W (shown on the field map, Attachment No. 1). It was anticipated prior to the injectivity test that some gas cycling would occur in wells located close to the injector and at the same relative structural position. This was considered to be probable because of the excellent permeability (as much as 2800 millidarcies) in this portion of the Penn "D" reservoir and because the structurally high wells are located in the original gas cap area of the pool, where gas saturations are likely to still be quite high.

Amoco's Navajo Tribal "U" No. 14 is located approximately 1950 feet from the injection well "U" No. 3. Well "U" No. 14 is structurally located only 12 feet low to "U" No. 3 and "U" No. 14 is in the original gas cap area of the field. Prior to the test period and during the test period all the other wells surrounding the injector, except "U" No. 14, had been shut in because of high GOR's in an effort to conserve energy, an Amoco compressor failure which restricted sales, and pumping equipment problems. As "U" No. 14 thus offered the only pressure sink in this highly permeable area of the field, it is felt natural that the gas injected would move quickly to this location.

Of the 85,778,000 cubic feet of gas injected into the reservoir, some 71.3% was cycled out of "U" No. 14. The remaining 28.7% of the gas stayed in the reservoir and aided in maintaining reservoir pressure. In terms of reservoir barrels, an average of 7177 barrels per day was injected during the test and 5117 barrels per day was cycled. The net effect was a decrease in reservoir voidage of 2060 reservoir barrels per day less than what would have occurred had all the gas been sold.

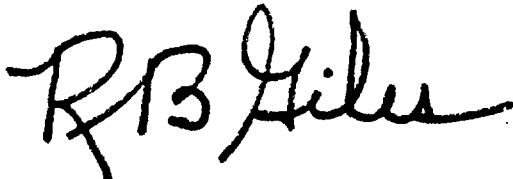
It is anticipated that, if future gas injection is determined to be desirable by all the operators in the pool, this gas cycling will decrease as the gas cap expands into areas of the field where a steeper structural dip occurs.

Joe D. Ramey

Page 3

Well "U" No. 14's test rates before, during, and after the injection test are shown on Attachment No. 3. You will note that, although gas rates increased substantially, no adverse effect was shown on either the oil production or water production. Also at the conclusion of the test the GOR on this well began approaching pre-test rates, demonstrating that no permanent damage of any kind resulted from the temporarily high gas producing rates.

Pressure surveys were run on shut-in offset wells before and after the injection test. Well "N" No. 12 in NE/4 SE/4 Section 17, T26W, R18W recorded 895 psi on both 3-24-75 and 5-15-75. Well "U" No. 12 in SE/4 NW/4 Section 21 pressures were 1084 psi and 1086 psi on 3-24-75 and 5-15-75, respectively. The only significant pressure change was at the gas injector, "U" No. 3, where the bottom hole pressure went from 874 psi immediately prior to injection to 889 psi soon after the conclusion of injection. No significant pressure changes were anticipated as withdrawals were in excess of injection volumes.



JWC/dc

#### Attachments

cc: E. C. Arnold  
New Mexico Oil Conservation  
Commission  
1000 Rio Brazos Road  
Aztec, New Mexico 87410

John D. Howard  
Mobil Oil Corporation  
Box 633  
Midland, Texas 79701

L. O. Speer, Jr.  
Farmington

J. C. White  
Texaco, Inc.  
Box 2100  
Denver, Colorado 80201

P. T. McGrath  
United States Geological Survey  
P. O. Box 959  
Farmington, New Mexico

300 752, 301 701, 707



**Amoco Production Company**

Security Life Building  
Denver, Colorado 80202

February 22, 1977

Joe D. Ramey, Director (3)  
New Mexico Oil Conservation Commission  
P.O. Box 2088  
Santa Fe, New Mexico 87501

*File Case 5434*

File: VDP-522-986.511

Dear Mr. Ramey:

Order No. R4983-A Limited Gas Injection Test  
Tocito Dome Penn "D" Pool, San Juan County, New Mexico

This refers to amended Order No. R4983-A and your letter of September 13, 1976 that extended authorization of the gas injection test program to February 27, 1977.

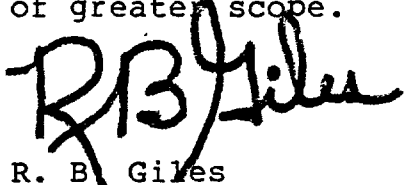
We have thoroughly analyzed performance of the pilot project, together with the latest information on the status of the Penn "D" Pool, and conclude that pilot injection (or field-wide injection--the hoped for end result) should not be continued. The merit of this conclusion was further supported by a late January, 1977 breakthrough of gas at Amoco's Navajo Tribal "U" No. 26, some 6500' east of the injection well Navajo Tribal "U" No. 7, and only 2000' from a Texaco well, Navajo Tribal BS No. 4, SWNW Section 23-T26N-R18W. During January, 1977, the gas rate from "U" No. 26 increased from a normal 500 MCFD rate to rates measured at 1002 MCFD on January 18, 1977, and 795 MCFD on January 19, 1977. It is obvious that gas movement through the reservoir is not effective in contacting any significant volumes of oil, and gas injection cannot be controlled to effect any measurable increase in recovery by the gravity drainage concept.

In summary, Amoco has injected 354,000 MCF of gas during the pilot period 2-17-76 to 2-1-77. Injection was initiated into two wells, Navajo "U" Nos. 7 and 12. Early breakthrough in a northeasterly direction necessitated the early shut-in of Navajo "U" No. 7 on March 18, 1976, but injection was continued into Navajo "U" No. 12 at a reduced rate of approximately 750 MCFD through June, 1976. Nothing developed of a detrimental nature to July 1, 1976, and because of the low injection to withdrawal balance then in effect, the injection

Mr. Joe D. Ramey

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rate was increased to approximately 1000 MCFD and has continued at that rate to this time. No sustained beneficial effect has been observed, and because of new evidence of breakthrough, we now feel it prudent to permanently terminate gas injection. We are documenting considerable detail in graphic form and will provide this material to the Commission and to the other operators in the very near future. We are extremely disappointed that the pilot results do not support a project of greater scope.



R. B. Giles

MOH/slf

cc: A. R. Kendrick, Supervisor District No. 3  
New Mexico Oil Conservation Commission  
1000 Rio Brazos Road  
Aztec, New Mexico 87110

P. T. McGrath  
U. S. Geological Survey  
P.O. Box 965  
Farmington, New Mexico 87401

J. A. Morris  
Mobil Oil Corporation  
Three Greenway Plaza East, Suite 800  
Houston, Texas 77046

J. C. White  
Texaco, Inc.  
P.O. Box 2100  
Denver, Colorado 80201



*Set for hearing*  
**Amoco Production Company**

Petroleum Center Building  
501 Airport Drive  
Farmington, New Mexico 87401

L. O. Speer, Jr.  
Area Superintendent

January 21, 1975

File: LOS-30-986.510

Re: Request for Administrative Approval to  
Conduct a Limited Gas Injection Test into  
The Pennsylvanian "D" Formation  
Tocito Dome Field, San Juan County, New Mexico

Oil Conservation Commission  
State of New Mexico  
P. O. Box 2088  
Santa Fe, New Mexico 87501

Gentlemen:

Amoco Production Company is requesting administrative approval to conduct a limited gas injection test in the Pennsylvanian "D" Formation, Tocito Dome Field, San Juan County, New Mexico. Amoco proposes to reinject produced gas into the Pennsylvanian "D" Formation for a thirty day period to determine at what rates and pressures the formation will accept injected gas. It is important to emphasize that this is not a pressure maintenance project, but instead, is a feasibility study for gas injection with our current compressor facilities.

Produced gas for the test will be obtained from oil wells on the Navajo Tribal "N", "P", and "U" leases. All wells on these leases produce from the Pennsylvanian "D" horizon. Tentative plans call for injecting up to 5 MMCFD, but this is dependent upon what we can actually inject with our current compression facilities. Amoco holds a 100% working interest in the Navajo Tribal "N", "P", and "U" leases, the Navajo Tribe is the only royalty interest owner, and there is no overriding interest.

Initially, Navajo Tribal "U" Well No. 3 will be used as the test injection well. If injection cannot be initiated into Navajo Tribal "U" Well No. 3, we will attempt injecting into Navajo Tribal "U" Well No. 8. In both instances, gas will be injected down 2-7/8" tubing under a packer. Attached are the wellbore diagrams for the subject wells containing pertinent information regarding casing, tubing, and cement programs. Also included are the open hole logs on the proposed injection wells and a plat showing the injectors and nearby producers in the field.

DOCKET MAILED

Date 2-20-75

Page 2

Oil Conservation Commission  
State of New Mexico  
January 21, 1975

Following the thirty day test period, Amoco will analyze the injection data to determine what future steps, if any, will be taken. If Amoco determines that it is feasible to continue gas injection, the necessary applications pertaining to New Mexico Oil Conservation Commission Rule 701 will be filed before any extended term gas injection is commenced. Again, we wish to emphasize that this is only a short term feasibility study and not a pressure maintenance project. We hope that you will consider this proposal as such and grant administrative approval for the test.

Yours very truly,



GOM:en  
Attachments

cc: U. S. Geological Survey  
Farmington, New Mexico



## Attachment No. 2

## Tocito Dome Gas Injection Data

<u>Date</u>	<u>Injection Rate MCFD</u>	<u>Daily Volume MCF</u>	<u>Cumulative MCF</u>	<u>Wellhead Tubing Pressure-PSI</u>	<u>Hours Injected and Compressor</u>
4-4-75	2136	979	979	820	11 hrs. - CP comp.
4-5-75	2085	2085	3064	810	24 hrs.
4-6-75	1998	1998	5062	810	24 hrs.
4-7-75	2053	2053	7115	810	24 hrs.
4-8-75	2167	2167	9282	800	24 hrs.
4-9-75	1999	1999	11281	817	24 hrs.
4-10-75	2025	913	12194	817	10 hrs.

Gas injection ceased 4-10-75 to repair packer leak at injection well.

4-15-75	2098	1311	13505	800	15 hrs.
4-16-75	2075	2075	15580	800	24 hrs.
4-17-75	1889	1889	17469	798	24 hrs.
4-18-75	2187	2187	19656	800	24 hrs.
4-19-75	2067	2067	21723	798	24 hrs.
4-20-75	2189	2189	23912	810	24 hrs.
4-21-75	2292	2292	26204	813	24 hrs.
4-22-75	2443	2443	28647	813	24 hrs.
4-23-75	2451	2451	31098	813	24 hrs.
4-24-75	2228	2228	33326	790	24 hrs.
4-25-75	2265	2265	35591	800	24 hrs.
4-26-75	2447	2447	38038	800	24 hrs.
4-27-75	2544	2544	40582	805	24 hrs.
4-28-75	2446	2446	43028	800	24 hrs.
4-29-75	2482	2482	45510	790	24 hrs.
4-30-75	2383	2383	47893	790	24 hrs.
5-1-75	2257	2257	50150	792	24 hrs.
5-2-75	2209	2209	52359	790	24 hrs.
5-3-75	2286	2286	54645	790	24 hrs.
5-4-75	2072	2072	56717	768	24 hrs.
5-5-75	2241	1494	58211	750	16 hrs.
5-6-75	2308	2308	60519	770	24 hrs.
5-7-75	5284	4403	64922	940	20 hrs. - IR comp.
5-8-75	5413	4511	69433	940	20 hrs.
5-9-75	3545	2954	72387	850	20 hrs.
5-10-75	2554	2341	74728	730	16 hrs. - IR comp. 6 hrs. - CP comp.
5-11-75	3339	3339	78067	900	14 hrs. - CP comp. 10 hrs. - IR comp.
5-12-75	3671	2753	80820	850	13 hrs. - IR comp. 5 hrs. - CP comp.
5-13-75	7437	4958	85778	980	16 hrs. - IR comp.
5-14-75	Test Concluded 5-14-75				

Attachment No. 3

Production Tests During Gas Injection Period  
Navajo Tribal "U" Well No. 14  
Tocito Dome Field

	<u>Date</u>	<u>BOPD</u>	<u>BWPD</u>	<u>MCFD</u>	<u>GOR</u>
Before Gas Injection	3-2-75	82	524	234	2841
	3-4-75	80	467	241	3012
	3-5-75	79	496	233	2949
Gas Injection Commenced	4-4-75				
Gas Injection Down	4-10-75 to Repair Packer Leak				
Gas Injection Restarted	4-15-75				
	4-27-75	93	511	1131	12161
	4-28-75	91	538	1578	17340
	4-29-75	76	544	1758	23131
	5-2-75	73	504	2532	34865
	5-5-75	67	517	2729	40731
	5-9-75	93	472	--	--
	5-10-75	90	489	--	--
	5-11-75	74	529	3569	48230
	5-12-75	70	541	3578	51114
	5-13-75	95	593	3723	39189
Gas Injection Ceased	5-14-75	68	538	3700	54412
5-14-75					
	5-16-75	58	519	2523	43500
	5-17-75	61	490	2019	33098
	5-20-75	80	535	886	11075
	5-21-75	79	509	745	9430
	5-22-75	79	513	595	7532
	5-23-75	75	508	487	6493
	5-24-75	75	508	463	6173

13-3/8" 48#  
CSA 94' x 100 sx

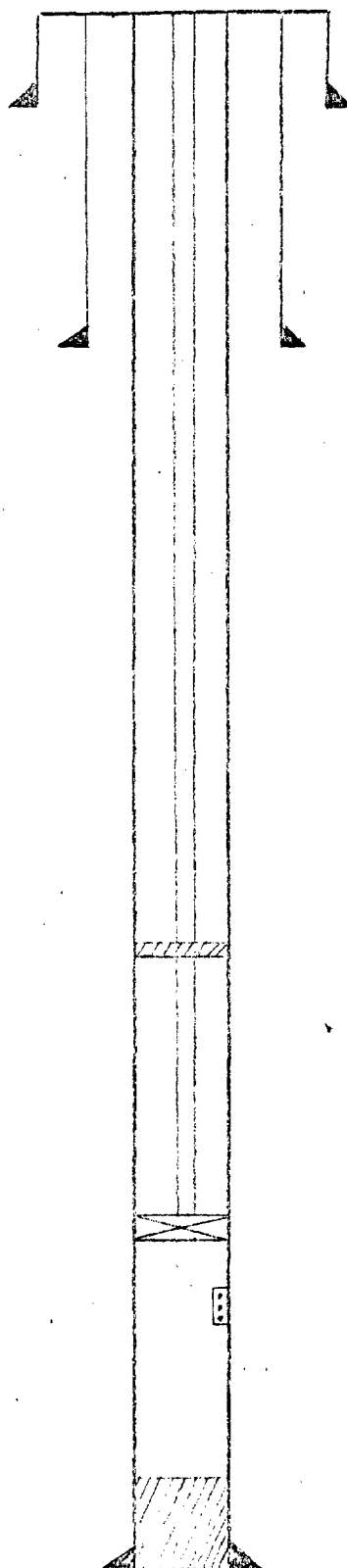
8-5/8" 24#  
CSA 1475' x 500 sx

2nd Stage:  
500 sx Poz,  
circulate

DV Tool SA 3612'

1st Stage:  
300 sx Poz  
200 sx Neat  
circulate

4-1/2" 10.5#  
CSA 6940' x 1000 sx



2-7/8" tubing

Annulus to be filled with  
treated water.

Packer SA approx. 6200'

Perfs 6216-26' x 4 SPF  
Perfs 6234-43' x 4 SPF

PBD 6330'

TD 6940'

Amoco Production Company

NAVAJO TRIBAL "U" NO. 3

PROPOSED INJECTION CONFIGURATION  
BOREHOLE DIAGRAM

SCALE:

DRG.  
NO. GOM-011775

13-3/8" 48#  
CSA 95' x 100 sx

8-5/8" 24#  
CSA 1520' x 500 sx

2nd Stage:  
500 sx "C" x 6%  
Gel x 2# MTP

2-7/8" Tubing

DV Tool SA 3813'

Annulus to be filled with  
treated water

1st Stage:  
200 sx x 4% Gel x MTP  
100 sx "C" Neat

Packer SA approx. 6340'

Perfs 6355-62' x 4 SPF

5-1/2" 14#, 15.5#, 17#  
CSA 6377' x 800 sx

PBD 6367'

TD 6377'

Amoco Production Company

SCALE:

NAVAJO TRIBAL "U" NO. 8

PROPOSED INJECTION CONFIGURATION  
BOREHOLE DIAGRAM

DRG.  
NO. GOM-011775



## OIL CONSERVATION COMMISSION

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

March 11, 1975

I. R. TRUJILLO  
CHAIRMAN

LAND COMMISSIONER  
PHIL R. LUCERO  
MEMBER

STATE GEOLOGIST  
A. L. PORTER, JR.  
SECRETARY - DIRECTOR

Mr. Paul Cooter  
Atwood, Malone, Mann & Cooter  
Attorneys at Law  
Post Office Box 700  
Roswell, New Mexico 88201

Re: CASE NO. 5434  
ORDER NO. R-4983

Applicant:

Amoco Production Company

Dear Sir:

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

Very truly yours,

A. L. PORTER, Jr.  
Secretary-Director

ALP/ir

Copy of order also sent to:

Hobbs OCC       x        
Artesia OCC                     
Aztec OCC       x      

Other Mr. Jim Sperling, Mr. Oscar Swan

*File 7.01  
Case 5434*

P. O. Drawer 1857  
Roswell, New Mexico 88201

RECEIVED  
JAN 30 1975  
FARMINGTON

January 29, 1975

Amoco Production Company  
Attn: L. O. Speer, Jr.  
Petroleum Center Bldg.  
501 Airport Drive  
Farmington, New Mexico 87401

Gentlemen:

Your letter to the N.M.O.C.C. with copy to the U.S.G.S. requests approval to initiate a limited gas injection test into the Pennsylvanian "D" formation, Tecito Dome field, San Juan County, New Mexico, for the purpose of establishing feasibility of a possible future gas repressurization for the field.

As set forth in your plan, the test would be for a period of 30 days with maximum volumes of 5 MMCFD utilizing existing compression facilities and leasehold gas into either the well No. U-3 or No. U-8, located in the W/2 sec. 16, T. 26 N., R. 18 W. Gas would be injected below a packer in the Pennsylvanian formation.

The plan as outlined in your proposal is hereby approved provided like approval is granted by the N.M.O.C.C. Any changes in the plan must receive prior approval from this office. Please notify the Farmington District office when the system is operational.

Sincerely yours,

CARL C. TRAYWICK  
Acting Area Oil and Gas Supervisor

cc:  
NMOCC, Santa Fe  
Farmington  
File

McGrath: