1R - 279

GENERAL CORRESPONDENCE

YEAR(S):

1986 - 1974

Dave

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79762
4001 PENBROOK
EXPLORATION AND PRODUCTION GROUP

September 5, 1986

Vacuum Field Waterflow
Management Committee
September 4, 1986, Meeting Minutes

Vacuum Field Waterflow
Management Committee Members

Attached are the minutes from the committee meeting held on September 4, 1986, in Odessa, Texas.

A joint meeting with the Technical and Geological - Geophysical Committees is scheduled for Thursday, October 2, 1986, at 9:00 A.M. CDLST. It will be held in the 2nd floor Conference Room of the Phillips Building, 4001 Penbrook, Odessa, Texas.

Very truly yours,

W. J. Mueller, Chairman
Management Committee

WJM:ko

Attachment

cc: Technical Committee Members

Vacuum Field Waterflow Committee
Management Committee Meeting Minutes
September 4, 1986

The fourth meeting of the Vacuum Field Waterflow Management Committee was held September 4, 1986, at the Phillips Petroleum Company building in Odessa, Texas. An attendance list is attached.

Bill Mueller opened by stating that the main purposes of the meeting were to review Mr. R. L. Stamets' letter received subsequent to the meeting with the N.M.O.C.D. on August 19, 1986, and to determine charges to the Technical Committee. The minutes of the above meeting were reviewed and then the requests contained in Mr. Stamets' letter were discussed. All operators expressed their desire and willingness to proceed with a positive action program to locate the source or sources of injected fluid movement into the salt section. A program will be approved and actual work commenced prior to Mr. Stamets' requested December, 1986, meeting.

All operations will immediately proceed to verify the mechanical integrity of every injection well they operate. This to include a complete surface inspection of all wellhead equipment including any below - ground - level valves. An annulus and bradenhead pressure survey should also be conducted at this time. These data are to be forwarded to the Technical Committee for compilation and report presentation to the N.M.O.C.D.

The charges to the Technical Committee are as follows:

1. Select "Hot Spot" locations for the drilling of nine monitor wells through the salt section.

   Locations to be as follows:

   1 - Phillips' M. E. Hale Lease
   2 - Phillips' East Vacuum G-SA Unit
   1 - Texaco's Central Vacuum Unit
   1 - Texaco's Vacuum G-SA Unit
   1 - Texaco's West Vacuum Unit
   2 - Mobil's Bridges State Lease
   1 - Arco's SWD Well Offset
   9 TOTAL

   If a field-wide tracer survey program is approved, each operator will handle his own drilling, completion and disposal procedures and costs.

2. Design tracer and pressure pulse testing programs between each of the current monitor wells in addition to the above wells and their directly offsetting injection wells.

3. Design detailed channel check well survey programs for both Graybury-San Andres and Abo injection wells with a wellhead injection pressure of 900 psi or greater. Investigate both commercial and any R & D tools available. High resolution is important.

It is requested that the above charges be completed and presented to the Management Committee at a joint meeting scheduled for Thursday, October 2, 1986, at 9:00 A.M. It will be held in the 2nd floor Conference Room of the Phillips Building, 4001 Penbrook, Odessa, Texas.

Mobil will form and chair a Geological - Geophysical Committee for a detailed description of the Vacuum Field area. Names of individual company representatives are to be sent to Matt Sweeney. The charges to the Geological - Geophysical Committee are as follows:

1. Prepare a detailed Geological description of all formations.

   1st priority - Interval from surface to base of salt
   2nd priority - Interval below base of salt

2. Investigate possible use of seismic data to locate fluid pockets, solution caverns, fractures, etc. in the salt section.

3. Formulate the "most likely" condition that would occur with subsidence in the area due to salt dissolution.

It is requested that a report on the above charges be presented to the Management Committee at the joint meeting scheduled for October 2, 1986.

V[redacted]um Field Waterflow Committee [redacted]
Management Meeting
September 4, 1986

ATTENDANCE LIST

NAME	REPRESENTING	LOCATION	TELEPHONE
Bancker Cade	Texaco	Hobbs	505-393-7191
Bill Mueller	Phillips	Odessa	915-367-1313
John Roam	Arco	Midland	915-688-5269
Kris Singh	Mobil	Midland	915-688-2189
T. L. Hill	Mobil	Midland	915-688-2064
Matt Sweeney	Mobil	Midland	915-688-1777
Glenn Smith	Phillips	Odessa	915-367-1203

VACUUM FIELD WATERFLOW
TECHNICAL COMMITTEE MEMBERS

Texaco Inc.
Mr. David Cain
P. O. Box 728
Hobbs, New Mexico 88240

Mobil Producing Texas and New Mexico, Inc.
Mr. Glenn Bankson
P. O. Box 1900
Midland, Texas 79702

Phillips Petroleum Company
Mr. Mike Brownlee
4001 Penbrook
Odessa, Texas 79762

ARCO Oil and Gas Company
Mr. David Douglas
P. O. Box 1610
Midland, Texas 79702

Conoco, Inc.
Mr. Brian Horanoff
P. O. Box 460
Hobbs, New Mexico 88240

VACUUM FIELD WATERFLOW
MANAGEMENT COMMITTEE MEMBERS

ARCO Oil & Gas Company
Mr. John Roam
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Midland, Texas 79702

Conoco, Inc.
Mr. Hugh Ingram
P. O. Box 460
Hobbs, New Mexico 88240

Mobil Producing Texas & New Mexico, Inc.
Mr. Matt Sweeney
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
Mr. Bill Mueller
4001 Penbrook
Odessa, Texas 79762

Texaco, Inc.
Mr. Bancker Cade
P. O. Box 728
Hobbs, New Mexico 88240

STATE OF NEW MEXICO

ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501-2088
(505) 827-5800

August 22, 1986

Mr. William J. Mueller
Phillips Petroleum Company
4001 Penbrook
Odessa, Texas 79762

RE: VACUUM POOL WATERFLOW STUDY

Dear Mr. Mueller:

The following will confirm our conversation at the close of the meeting on the Vacuum Pool Waterflow Study Committee in Hobbs on June 19, 1986.

Based upon the Committee's work, there seems to be little likelihood that the water in the salt section has any other origin than water injected in wells in the pool. While this has apparently been established, no concrete work has commenced on actually locating the source or sources of injected fluid movement from the pay to the salt section. I believe it is critically important that substantive work, with a real chance of success, begin in this area in the very near term for the following reasons:

(1) Continued leakage of water into the salt section can lead to expansion of the waterflow area increasing the threat of its finding a vertical avenue to the shallower fresh water zones.

(2) Continued migration of water into the salt section must be dissolving large volumes of salt which may lead to collapse of the salt and overlying beds again threatening fresh water supplies.

(3) Amendments to the Safe Drinking Water Act require the EPA to assume enforcement when a state fails to take action to protect fresh water supplies under their approved Underground Injection Control Program.

(4) Provisions of the State Oil and Gas Act require this office to regulate injection in such a manner as to protect fresh waters.

The Committee has done very good work so far, but it must now begin to address, in a substantive manner, my concerns with the waterflows in the salt section as outlined in (1) and (2) above, how the water is moving from the injection interval into the salt section, and what remedial action(s) may be appropriate. If satisfactory progress is not made in these areas by the first of the year, I would expect to call a public hearing where all

operators in the Vacuum Pool would be given the opportunity to appear and show cause why injection should be allowed to continue in that pool or why it should not be severely curtailed.

Again, I want to express my thanks and appreciation for your work as Committee Chairman and the work of the Committee on this problem.

Sincerely,

R. L. STAMETS
Director

RLS:dp

cc: Paul Biderman
Jerry Sexton

Mobil Producing Texas & New Mexico Inc.

December 8, 1986

P.O. BOX 633
MIDLAND, TEXAS 79702

New Mexico Oil Conservation Division
P. O. Box 2088
Santa Fe, New Mexico

VACUUM WATERFLOW STUDY
VACUUM FIELD
LEA COUNTY, NEW MEXICO

Gentlemen:

Mobil Producing Texas and New Mexico Inc. (MPTM) appreciates the opportunity to attend this meeting and to present its program to the Director of the NMOCD. MPTM recognizes the seriousness of the waterflow problem and is aware that a potential danger to the Ogallala aquifer may exist. With this in mind, MPTM wishes to outline the steps that have been taken and will be taken to determine the source of the pressured water in the salt section and to implement corrective action.

1. MPTM surveyed the bradenhead pressures in all the injection wells during the summer of 1986. The survey was done in the presence of an NMOCD representative. All of the wells that were tested were found satisfactory except for three wells that were repaired. Annual surveys of all the injectors will be continued as required by the NMOCD.

2. MPTM plans to investigate whether fluid migration is occurring behind the casing in the injection wells. To initiate this survey, fourteen San Andres and twenty Abo injection wells have been selected, distributed evenly across the lease. The attached map shows the location of the wells to be surveyed.

   The Technical Committee has recommended using the radioactive tracer log along with a temperature survey as a primary tool of investigation to detect any fluid movement uphole. A radioactive tracer tool with scintillation counters will be used which is an improvement over the Geiger-Mueller counters used in the past.

   Four of the 34 surveys have been completed prior to this meeting. Based on the results of the initial surveys, the remaining wells will be investigated on a priority basis with the San Andres wells given higher priority. Any injector found to have water channelling behind the pipe, will be taken out of service until the problem is corrected.

A:M634269A.MES

3. MPTM plans to run step rate tests in four San Andres wells to determine the reservoir frac pressure and to ensure that the current injection pressure of 1800-2200 psig is below the parting pressure of the San Andres reservoir. In addition, the pressure distribution obtained from these tests will indicate if an areal variation in frac pressure exists across the lease.

   Step rate tests run previously on Abo injection wells have been submitted to the NMOCD and indicate that injection at the current well head injection pressure of 1700-4300 psig is below the Abo reservoir frac pressure.

4. MPTM plans to monitor pressure in the salt section by recompleting an existing well. The location was selected in the vicinity of an area identified as a problem area in the past and is shown on the attached map. The pressure will be monitored in this well to determine if communication has occurred into this zone. At the recommendation of the Technical Committee, water will not be produced from the salt section to prevent any leaching of the salt which might cause subsidence in the area.

5. Mobil produces injection makeup water from fresh water source wells in the Ogallala aquifer. The water will be analyzed on a regular basis to monitor any change in the composition indicating possible contamination.

6. Pressure fall off tests will be run on selected wells if the results from the interpretation techniques being investigated by Phillips research indicate the usefulness of these tests in inferring channels behind pipe.

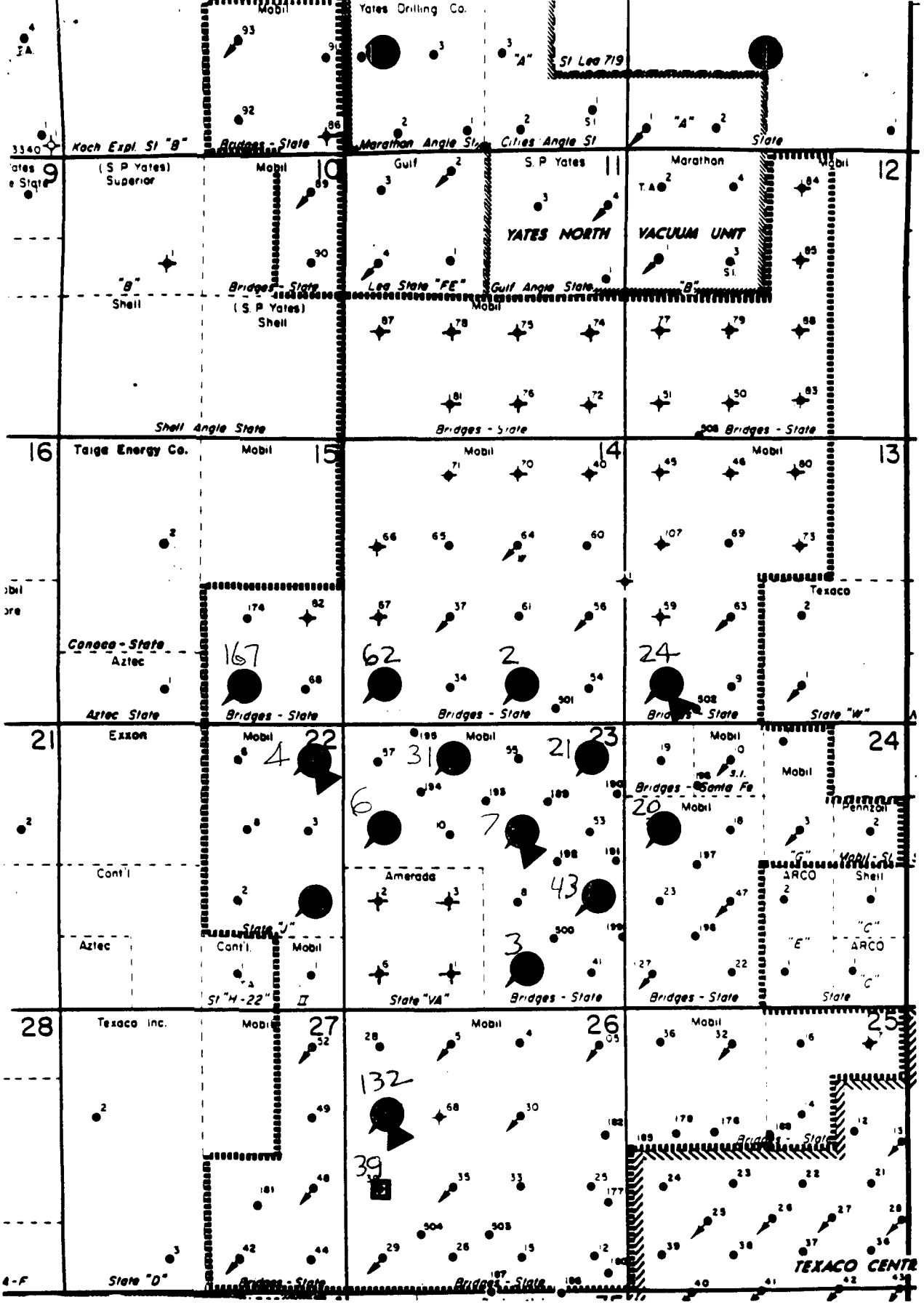
Mobil recognizes the importance of protecting the ground water resources of New Mexico and every effort will be made to prevent contamination of the Ogallala aquifer in this area.

Very truly yours,

M. E. Sweeney
Env. & Reg. Manager

KSingh/TLHill/hjw

A:M634269A.MES



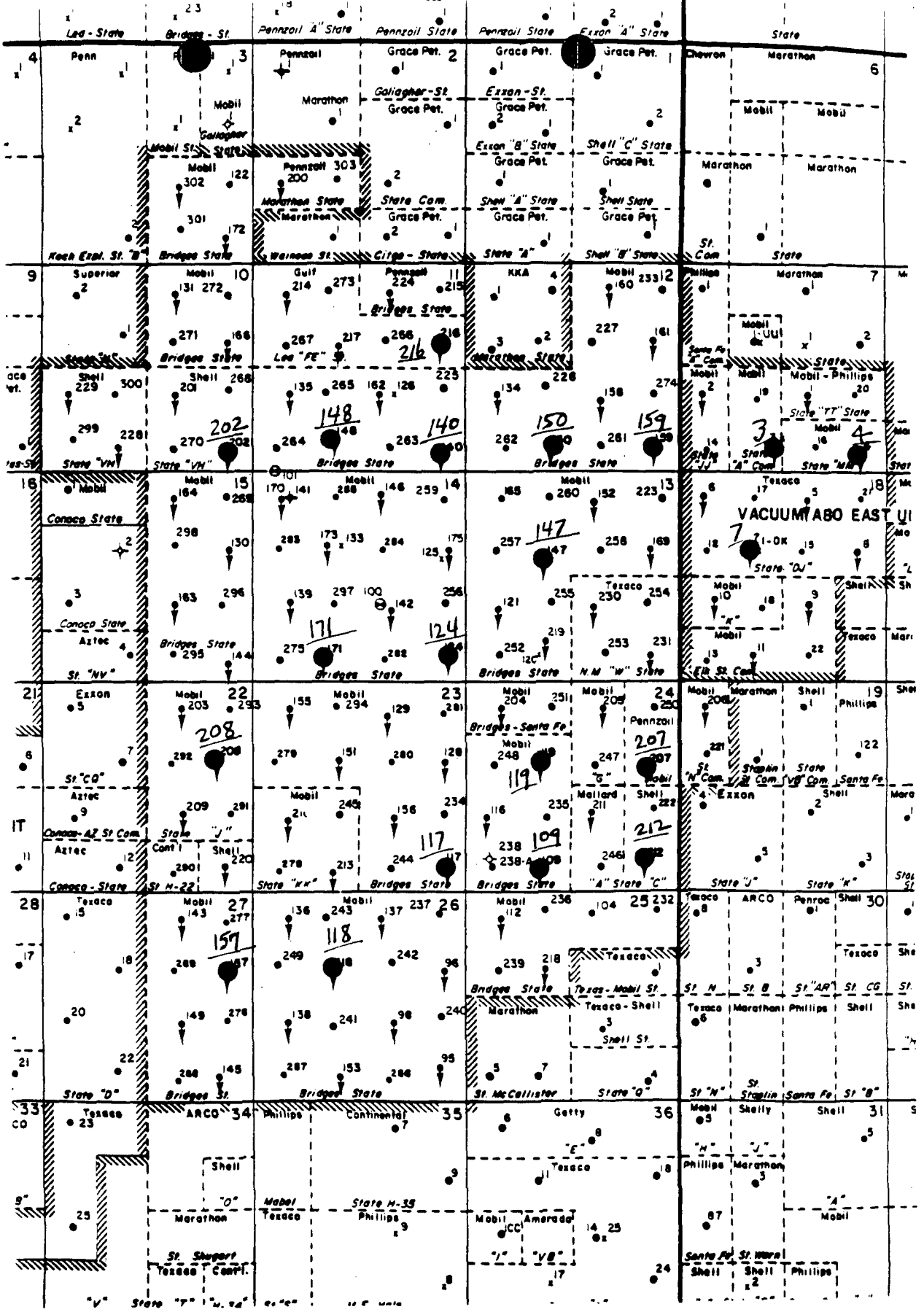
● TRACER/TEMP SURVEY

▶ STEP-RATE TEST

◘ PRESS MONITOR SALT SECTION

MOBIL

Bridges State Lease
San Andres Waterfloo
Vacuum (San Andres) Fie


VACUUM ABO EAST UI
ABO WELLS FOR TRACER/
TEMP. SURVEY
MOBIL
NVAU
NVAEU

[redacted]CUUM SALADO WATERFLOW STU[redacted]

PROPOSED WORK SCHEDULE FOR 1986

BRIDGES	NOVEMBER 1986		DECEMBER 1986			
STATE	WK 3	WK 4	WK 1	WK 2	WK 3	WK 4
2 WIW				A,C		
3 WIW		A,C				
6 WIW				A,C		
7 WIW		A,B,C				
20 WIW	A,C					
21 WIW	A,C					
24 WIW	A,C,B					
30 WIW	A,B,C					
31 WIW				A,C		
37 WIW		A,C				
43 WIW		A,C				
167 WIW			A,C			
STATE J						
1 WIW			A,C			
4 WIW			A,B,C			
NVAU						
117 WIW					A	
118 WIW					A	
140 WIW					A	
148 WIW						A
157 WIW						A
202 WIW						A

SINKER BAR RUN

KEY TO THE PROPOSED WORK SCHEDULE

A = TRACER/TEMPERATURE/SPINNER LOG

B = STEP RATE TEST

C = PULL AND CLEAN WELL TO ALLOW THE RUNNING OF TESTS A AND B

VACUUM SALADO WATERFLOW STUDY

PROPOSED WORK SCHEDULE FOR 1987

	JANUARY 1987				FEBRUARY 1987	
NVAU	WK 1	WK 2	WK 3	WK 4	WK 1	WK 2
109 WIW	A					
119 WIW	A					
124 WIW	A					
147 WIW	A					
150 WIW		A				
159 WIW		A				
207 WIW		A				
212 WIW		A				
216 WIW			A			
171 WIW			A			
208 WIW			A			
NVAEU						
3 WIW			A			
4 WIW				A		
7 WIW				A		
BRIDGES STATE 39 MONITOR WELL				DRILL OUT AND COMPLETE WELL IN THE SALT SECTION		

SINKER BAR RUN

KEY TO THE PROPOSED WORK SCHEDULE

A = TRACER/TEMPERATURE/SPINNER LOG

B = STEP RATE TEST

C = PULL AND CLEAN WELL TO ALLOW THE RUNNING OF TESTS A AND B

MOBIL BRIDGES STATE (SAN ANDRES) WATERFLOOD

INJECTION WELL DATA AS OF JULY 31, 1986

WIW NO.	INJ. RATE (BWPD)	CUM. INJ. (MBW)	WHP (PSIG)
2*	368	2211	2100
3*	435	1427	2150
5*	64	551	2131
6*	616	1786	2125
7*	66	2523	2125
20*	33	2467	2125
21*	389	1431	2113
24*	135	869	2192
30*	257	1472	2075
31*	34	2886	2163
32	236	824	2075
35	473	1777	2031
37*	244	2203	2193
42	29	482	2150
43*	464	1385	2106
47	128	2129	2081
48*	29	1571	2100
52	40	533	2100
56	100	1799	2150
62	488	2510	2150
63	304	906	2238
64*	359	1824	2250
105	179	1023	2113
127	33	832	2112
132	383	1108	2150
State "G" 3	258	1002	2100
State "J" 1*	157	1138	2088
State "J" 4	165	811	2200

* Planned for Tracer and Temp. Surveys

KKSingh
9/24/86

A:M626744B.KKS

NORTH VACUUM ABO FIELD

INJECTION WELL DATA AS OF JULY 1986

NORTH VACUUM ABO UNIT

WIW NO.	INJ. RATE (BWPD)	CUM. INJ. (MBW)
96	230	1257
98	63	4
109*	260	1445
112	153	7
117*	415	2249
118*	345	1789
119*	314	1623
124*	108	610
128	133	755
129	74	6
130	158	778
140*	261	1078
143	201	6
144	81	435
145	77	562
147*	245	1022
148*	291	1103
150*	356	1664
151	3	121
153	99	757
155	245	8
156	148	8
157*	231	1486
159*	222	1080
161	193	1044
166	156	903
169	185	976
171*	79	493
172	166	930

NORTH VACUUM ABO FIELD

INJECTION WELL DATA AS OF JULY 1986

WIW NO.	INJ. RATE (BWPD)	CUM. INJ. (MBW)
173	158	536
175	224	700
202*	280	1472
203	169	5
204	87	3
205	191	11
207*	312	2296
208*	55	267
209	194	6
211	107	8
212*	170	1283
213	25	788
216*	314	1702
217	235	1000
218	178	898
219	149	758
220	125	564
228	123	547
231	215	938
302	19	1
NORTH VACUUM ABO EAST UNIT		
1	73	23
2	47	23
3*	32	283
4*	40	312
5	46	16
6	46	23
7*	53	442
8	27	164
9	69	26
10	44	19
11	27	145

* Wells for Radioactive Tracer/Temperature Surveys

NOTE: All wells have WHP greater than 900 psig.

Jan Bailey

PHILLIPS PETROLEUM COMPANY
ODESSA, TEXAS 79762
4001 PENBROOK

EXPLORATION AND PRODUCTION GROUP

November 24, 1986

915
367-1313

Vacuum Field Waterflow
Committees Meeting with
NMOCD, December 11, 1986
Santa Fe, New Mexico

Vacuum Field Waterflow
Management Committee Members

I met with Mr. R. L. Stamets, Director, New Mexico Oil Conservation Division, on Wednesday, November 19, 1986. I delivered to him the individual company reports prepared by the Management Committee members.

Mr. Stamets requested that we proceed with the December joint meeting of he and his staff with the Vacuum Field Waterflow Committee members. This meeting has been scheduled for 9:00 A.M. MST, Thursday, December 11, 1986. It will be held in the Oil Conservation Division Conference Room (No. 205), State Land Office Building, Santa Fe, New Mexico. An agenda for this meeting is attached. Please let me know of any recommended changes or additions.

Very truly yours,

W. J. Mueller, Chairman
Management Committee

WJM/sdb
RE12/vacuum8

Attachment

cc: Oil Conservation Division
Technical Committee Members
Geological - Geophysical Committee Members

Vacuum Field Waterflow Committees
Meeting with
New Mexico Oil Conservation Division
Thursday, December 11, 1986
Santa Fe, New Mexico

Time: 9:00 A.M. MST
Place: Oil Conservation Division Conference Room (No. 205)
State Land Office Building

AGENDA

1. Call to order - Bill Mueller, Phillips

2. Introductory Remarks - Dick Stamets, NMOCD

3. Technical Committee's Report and Discussion - David Cain, Texaco
   A. Pressure Falloff Testing - Arlene Pollin, Phillips

4. Geological - Geophysical Committee's Report and Discussion - Bill Hermance, Mobil

5. Individual Company Reports and Recommendations
   A. Arco
   B. Mobil
   C. Phillips
   D. Texaco

6. Discussion and Comments

7. Closing - Dick Stamets

WJM/sdb
RE12/vacuum9

Vacuum Field Waterflow Committee
and
New Mexico Oil Conservation Division
Wednesday, December 10, 1986
Santa Fe, New Mexico

"A DUTCH-TREAT, VOLUNTARY, GET-TOGETHER"

Time: 7:00 PM MST Social Hour
8:00 PM MST Dinner

Place: The INN of the Governors
Alameda & Don Gaspar
(505) 982-4333
(800) 552-0070 Ext. 224

Reservations required by Monday, December 8, 1986.

Wives and Husbands invited.

Please indicate your selections from the attached menu when making reservations.

WJM/sdb
RE12/vacuum10

Attachment

Thanks for coming!
Bill

FINE SEAFOOD

Shrimp, 8 oz.
Broiled or Fried

13.50

Sea Scallops, 8 oz.
Broiled or Fried

13.50

Shrimp and Scallops Combo, 8 oz.
Broiled or Fried

13.50

*Salmon
Broiled
Market Price

*Tuna
Blackened Louisiana Style
Market Price

Fried Oysters
Served with Cocktail and Tartar Sauce
Market Price

Alaskan King Crab
12 oz. - 19.95

Half King Crab
8 oz. - 14.95

Large Lobster Tail, 11-12 oz.
Steamed and Lightly Broiled

19.95

Small Lobster Tail, 6-8 oz.
Steamed and Lightly Broiled

14.95

FROM OUR GRILL

Cooked to Your Specification

Prime Rib Eye, Grilled or Blackened with Choice of Bordelaise or au Jus,
12 oz. ..... 12.95 Petite, 8 oz. 9.95

Filet, 11 oz. ..... 13.95 Petite, 8 oz. 10.85

Top Sirloin, 11.5 oz. ... 12.95 Petite, 6.5 oz. 9.95

New York Strip, 12 oz. 12.95

*Teriyaki, 11.5 oz. ..... 12.95 *Petite, 6.5 oz. 9.95

Two Boneless Chicken Breasts, Broiled with or without Teriyaki 9.95

FIVE STAR COMBOS

Half Shrimp, Broiled or Fried with *Petite Sirloin or Petite Teriyaki* 13.95

Half Scallops, Broiled or Fried with *Petite Sirloin or Petite Teriyaki* 13.95

Half Crab with Petite Sirloin or Petite Teriyaki 19.95

Small Lobster Tail with Petite Sirloin or Petite Teriyaki 19.95

**Half Fried Oysters with Petite Sirloin or Petite Teriyaki* ..... Market Price

All Entrees Include Dinner Salad, Baked Potato, French Fries or Rice, Hot Bread and Butter

**We Tend to Sell Out of these Items Nightly*

A Service Charge Will be added for 7 or More

VACUUM FIELD WATERFLOW
TECHNICAL COMMITTEE MEMBERS

ARCO Oil and Gas Company
Mr. David Douglas
P. O. Box 1610
Midland, Texas 79702

Conoco, Inc.
Mr. Brian Horanoff
P. O. Box 460
Hobbs, New Mexico 88240

Mobil Producing Texas and New Mexico, Inc.
Mr. Glenn Bankson
P. O. Box 1900
Midland, Texas 79702

Phillips Petroleum Company
Mr. Mike Brownlee
4001 Penbrook
Odessa, Texas 79762

Phillips Petroleum Company
Ms. Arlene Pollin
335 Frank Phillips Bldg.
Bartlesville, Oklahoma 74004

Texaco Inc.
Mr. David Cain
P. O. Box 728
Hobbs, New Mexico 88240

RE12/vacuum5

VACUUM FIELD WATERFLOW
GEOLOGICAL-GEOPHYSICAL COMMITTEE MEMBERS

ARCO Oil and Gas Company
Mr. Robert Orlando
2300 West Plano Parkway, PAL 508
Plano, Texas 75075

Mobil Producing Texas and New Mexico
Mr. William Hermance
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
Mr. David White
4001 Penbrook
Odessa, Texas 79762

Texaco Inc.
Mr. David Cain
P. O. Box 728
Hobbs, New Mexico 88240

RE12/vacuum6

VACUUM FIELD WATERFLOW
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Conoco, Inc.
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Hobbs, New Mexico 88240

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Mr. Matt Sweeney
P. O. Box 633
Midland, Texas 79702

Phillips Petroleum Company
Mr. Bill Mueller
4001 Penbrook
Odessa, Texas 79762

Texaco, Inc.
Mr. Bancker Cade
P. O. Box 728
Hobbs, New Mexico 88240

RE12/vacuum7

Texaco USA

P O Box 728
Hobbs NM 88240
505 393 7191

November 15, 1985

VACUUM FIELD WATERFLOW
MANAGEMENT COMMITTEE

Re: VACUUM FIELD WATERFLOW
TECHNICAL COMMITTEE
STATUS REPORT

As requested, the following is a progress report from the Technical Committee to the Management Committee concerning the progress made to date in identifying the source of the salt section waterflows in the Vacuum Field. This report shall summarize all work done to date and present a timetable for completion of the charges set forth by the Management Committee during their meeting of June 19, 1985.

The Technical Committee was initially working under the assumption that the fluid produced from the waterflows is naturally occurring, but that this naturally occurring fluid could possibly be displaced by out-of-zone injection. This initial assumption was based on the supersaturation of the brine and the very high magnesium to calcium ratios seen in the analyses of the samples.

All companies represented on the Technical Committee reviewed all injection tracer surveys and no upward channeling was found anywhere in the Vacuum Field.

The Technical Committee agreed that disposal operations should be ruled out as a source of the waterflows before any testing of Vacuum field injection systems would take place. The ARCO Sinclair-Vacuum SWD Well No. 1 was the only disposal well in the field injecting at a sufficiently high pressure to be a possible source of the flows. Therefore, the following course of action was initially recommended to the Management Committee:

1.) Contract for the running of a geochemical model.

2.) Contact the New Mexico Oil Conservation Division (NMOCD) with the results of the deochemical modeling and stable isotope analysis already in progress and inform them that the Vacuum Field operations intend to proceed with pressure testing to identify the source of the problem.

3.) Run injection profile in ARCO's Sinclair Vacuum SWD Well No. 1.

4.) Reenter Conoco's C. Brice Well No. 1-I and run survey to detect fluid movement. If movement is detected then obtain fluid samples for analyses.

5.) Recomplete in the salt section either Well No. 5 or Well No. 6 on ARCO's Lea State "403" lease.

6.) Conduct a pulse test between ARCO's Sinclair-Vacuum SWD Well No. 1, Conoco's C. Brice No. 1-I and the well to be recompleted in the salt section on ARCO's Lea State "403" lease.

The Management Committee held its first meeting on June 19, 1985, to discuss these recommendations. At the time of this meeting, an injection profile had been run by ARCO on their Sinclair-Vacuum SWD Well No. 1 and it showed approximately one-third of the injected water channeling upward around the casing shoe.

The Management Committee then outlined four responsibilities to the Technical Committee. These are restated below, followed each time by a report on their status.

1.) Evaluate credibility of consultants, obtain a cost estimate, and submit a recommendation to the management committee as to who should do the geochemical modeling work.

Status: Originally the geochemical model was seen as a second method for determining the origin of the Salado waterflows. It was hoped that both it and the isotopic analyses would agree that the water produced in the waterflows were natural evaporite brines. However, the isotope analyses showed this water apparently is a result of fresh water dissolving salt strata. At this time all members of the Technical Committee are in agreement on this so the need for geochemical modeling no longer exists.

2.) Develop cost estimates for a) reentering for testing purposes Conoco's C. Brice Well No. 1-I, b) reentering and completing ARCO's Lea State "403" Well No. 6, and c) pulse testing between these two wells and the ARCO SWD well.

Status: A cost estimate for reentering Conoco's C. Brice No. 1-I has been completed. The estimated cost for this work (including replugging) is $184,650. Other estimated costs include $4,000 for the interference testing and $40,000 for water hauling (40,000 barrels @ $1.00/barrel hauling cost). The total amount of water to be hauled could range from 20,000 to 60,000 barrels. A cost estimate for ARCO's Lea State "403" Well No. 6 has not been received by the Technical Committee. However, this work now appears to be unnecessary. Geochemical analysis of water from the ARCO disposal well indicates that this well is probably not responsible for the waterflow problem.

3.) Investigate the geographical expansion of the waterflow area by constructing maps showing when and where bradenhead flows were encountered in the field.

Status: This work is nearing completion. A presentation of all collected information will be ready to present to the NMOCD by year's end.

4.) Outline a pressure testing procedure to conduct during and subsequent to the drilling of Texaco's infill wells in Section 6.

Status: A pressure test design is presented herewith (see Exhibit 2) by Ulrich Kiesow of Phillips for pressure testing between Texaco's infill wells and Central Vacuum Unit Monitor Well No. 1. In addition, a preliminary design has been outlined for pressure testing involving the ARCO SWD well, ARCO's Lea State "403" No. 6, and Conoco's C. Brice No. 1-I. A final design will be generated when a better understanding of characteristics of flow in the salt section is obtained from testing the Central Vacuum Unit wells. As stated above, interference testing involving the ARCO disposal well appears to be unnecessary at this time.

In addition to the work mentioned above, the Technical Committee propose to continue to analyze water samples from different sources in the field, and to plan for and initiate injection of a tracer into selected injection systems in the field.

The following is a timetable for the completion of the work currently proposed:

By January 1, 1986:

1.) Develop cost estimate for recompleting ARCO's Lea State "403" Well No. 6.

2.) Complete a map showing when and where bradenhead flows have occurred in the Vacuum Field for submittal to the Management Committee.

First Quarter, 1986:

1.) Conduct pressure tests between Texaco's infill wells and the Central Vacuum Unit Monitor Well No. 1, and analyze data.

2.) Continue to analyze different samples of water from injection systems, disposal wells, and bradenhead flows.

Second Quarter, 1986:

1.) Initiate tracer injection into selected San Andres injection systems and begin daily sampling program to test for its appearance in Central Vacuum Unit Monitor Well No. 1, or other active waterflows.

2.) If necessary, reenter and complete Lea State "403" Well No. 6 and C. Brice 1-I and conduct pressure test between these wells and the ARCO SWD well.

If these steps fail to determine the source(s) of the waterflows, then the Technical Committee will determine a further course of action.

Stephen Guillot
Chairman,
Vacuum Field Waterflow
Technical Committee

SNG:jm

PHILLIPS PETROLEUM COMPANY
BARTLESVILLE, OKLAHOMA 74004 918 661-6600

EXPLORATION AND PRODUCTION GROUP

November 6, 1985

Vacuum Field Waterflow
Well Testing

Mr. Stephen N. Guillot
Texaco Inc.
1401 North Turner
P. O. Box 728
Hobbs, NM 88240

Dear Steve:

Enclosed is a discussion of and procedure for well testing intended for inclusion in the Vacuum Field Waterflow project summary requested by the New Mexico Oil Conservation Division. Please contact me if any additional information is needed.

Regards,

Ulrich Kiesow

Ulrich Kiesow

UK:kp
Enclosures

cc: M. H. Brownlee - Odessa
J. F. Griggs (r) M. J. Fetkovich
C. J. Lord, III - R&D

VACUUM FIELD WATERFLOW: WELL TESTING

The following recommendations are based on what is currently known or hypothesized about waterflow in salt zones. As additional information becomes available - from, to mention one possibility, infill wells scheduled for drilling in the vicinity of Texas's monitor well and possible communication in the salt between infill wells and the monitor well - modifications and refinements in testing methods will undoubtedly be made.

RECOMMENDATIONS - listed in order of "most likely" to "least likely" to be successful.

1) Tracer testing where appropriate is judged to have the greatest likelihood of success in unambiguously identifying possible source wells for water entering the salt. Tracer testing in this context includes one or more of the following: (a) injecting 100-200 bbl slug of iso-propanol or other suitable liquid, (b) injecting a radioactive tracer and, (c) trying to identify the water source by taking advantage of a natural tag, in this case the oxygen 18 isotope ratio.

2) Interference testing

3) Pulse testing

DISCUSSION

Flow in salt zones is hypothesized to have these characteristics:

. flow occurs in "pipes" as opposed to flow in a porous and permeable medium

. the pipes have a preferred orientation

. relatively large (100000 BBL +) storage volumes are likely to exist in the wellbore region and are also possible along the pipe network in regions of higher solubility.

The main sources for these concepts are papers appearing in the annual SALT SYMPOSIUM reports. These papers are listed in the attached bibliography.

However, as a first-approach to what pressures and times may be expected in pulse or interference testing, conventional methods for flow in a porous and permeable system have been used. Note that in the second of the test procedures outlined on the next page, that between the ARCO SWD and other wells, the situation is likely to be a combination of flow in a porous and permeable medium, possibly along fractures, and flow in the salt.

For a pulse test the assumed values are:

q = 1000 BD	r = 1000'
k = 10000 md	c_t = 6E-6
μ = 1.6 cp	ϕ = 0.5
h = 1 ft	β = 1.0

Note that revised pulse testing plots published in SPE 14253 were used and that storage has been neglected. The pressure response for several rates is

q, BWD	Δp, psi
500	.44
1000	.87
2000	1.74
3000	2.61

Problems with pulse testing are:

- small pressure changes - 1-3 psi @ 1000 - 3000 BD, respectively
- salt compressibility, plasticity of the salt may have a major effect in test design/interpretation
- storage volumes may be large and will act to dampen the pressure response
- with small Δp, all else in the system would have to remain constant, a condition unlikely to be met in the context of these tests.

Interference Test; storage and skin neglected

ASSUMED:

q = 2000 BD	r = 1000'	r_w = 0.5
k = 10,000 md	c_t = 6E-6	
μ = 1.6 ft	ϕ = 0.5	
h = 1 ft	β = 1.0	

Time for a pressure drop or rise of 100 psi to occur as a function of distance (r) between wells is

r ft	time hours
100	.7
500	17
1000	67
1500	150
2000	270

VACUUM FIELD WATERFLOW: WELLTEST DESIGN

I. Testing between Texaco's Monitor Well and Infill Wells in Section 6

OBJECTIVES:

1) Establish whether or not the monitor well and the infill well(s) are in communication
2) Develop a better understanding of the characteristics of flow in salt zones
3) Determine depth of the flow(s) if there are any

Note that surface instrumentation only is suggested for these tests because, (1) it may be expensive and operationally difficult to equip the monitor well with a high-sensitivity BH pressure gauge, and (2) if only small pressure differences (1-10 psi) were detected, it would be difficult to say that the infill well flow and no other operation had caused these pressure fluctuations. Because only large (50 psi +) pressure differences allow unequivocal interpretation, standard surface pressure recording equipment should be adequate.

Note also that all surrounding operations should be kept as constant as possible during the test period.

Option 1:

MONITOR WELL IS SHUTIN

Procedure:

2 days before drilling into the salt, SI and pressure-instrument the monitor well. Record the BU and continue recording, preferably continuously while drilling through the salt.

If a significant flow occurs at the infill well, an attempt should be made to record pressures and flow rates.

If a response occurs at the monitor well, the time lag (between flow onset at the infill well and response at monitor well) may be on the order of 1-2 days depending primarily on storage and flow rate. A shorter time lag of hours as opposed to days is possible.

If the flow is unsustainably high, then the monitor well will necessarily have to be opened.

If the flow diminishes to a tolerable level, it is suggested that the monitor well be shutin again and the response observed at both wells.

Option 2:

MONITOR WELL IS FLOWING

The success of this approach depends on how stable the monitor well flowrate and pressure are. If the flow fluctuates widely and if a flow occurs at the infill well, then any effects from that flow may be masked by the normal pressure-rate variations of the monitor well flow.

Procedure:

Approximately 2 days before drilling into the salt, connect continuous recording pressure instrumentation to the well. Also record rates, at least every 1 - 2 hours if there is considerable variation, less often if pressure and rate are essentially stable (stable $\equiv \sim \pm 20$ psi). The purpose here is to establish the base-line behavior of the monitor well under flowing conditions.

If a flow occurs at the infill well, the time lag for a response at the monitor will be as discussed earlier.

If the flow is relatively low, say, 1000-5000 BD, and relatively stable during a 6-12 hour observation period, the possibility exists of shutting in the monitor well and waiting for a response at the infill well. Again, time lag may be in the 1 to 2 day range.

II. Arco SWD Well and Conoco's C. Brice No. 1-I, Arco's Lea St. 403 #6

OBJECTIVES:

1) Demonstrate that the SWD well is in communication with one or both of the reentered wells
2) Establish depths of fluid entry/exit

A) TRACER TEST

This is the least uncertain method of establishing communication. To establish communication only, a non-radioactive fluid should be injected. Possible fluids are iso-propanol or lithium chloride; the estimated volume range is fifty to several hundred barrels. The recompleted well is allowed to flow continuously and water samples are collected periodically.

If communication is shown, then a radioactive tracer may be added to the disposal water and the observation well may be logged to identify channelling and fluid entry/exit points.

B) INTERFERENCE TEST

As a 1st attempt, the reentered well may be shutin at the surface and equipped with continuous-recording pressure gauge.

SI SWD well for 2-4 days or until surface pressure has stabilized at both wells. For the SWD well, this apparently occurs at ~ 1700 psi. Resume injection of at least 2000 BD at the disposal well and monitor pressure at the observation well for ~ 4 days.

Alternatively, a high precision BH gauge, either 8 day recording or surface readout, may also be run.

BIBLIOGRAPHY: VACUUM FIELD WATERFLOW

Sources of the papers:

3rd (1970), 4th (1974), 5th (1979) Symposium on Salt published by the Northern Ohio Geological Society, Inc., Cleveland, Ohio; various editors.

1. Haimson, Bezalel C.: "Well Communication in Salt Formations."

2. Haimson, Bezalel and Stahl, Edwin J.: "Hydraulic Fracturing and the Extraction of Minerals Through Wells."

3. Eaton, B. A.: "Fracture Gradient Prediction and Application."

4. Jessen, F. W.: "Solution Mining Operations in the Presence of Vertical Fracture Systems."

5. Terzaghi, Ruth D.: "Brinefield Subsidence at Windsor, Ontario."

6. Wassmann, Th. Hans: "Mining Subsidence in the East Netherlands."

7. Piper, Thomas B.: "Offset Access Well Offers Solution to Problem of Debris Accumulation in Bedded Salt Storage Cavities."

8. Kupfer, Donald H.: "Problems Associated with Anomalous Zones in Louisiana Salt Stocks, USA."

9. Adams, Samuel S.: "Ore Controls, Carlsbad Potash District, Southeast New Mexico."

10. Taylor, Donald S.: "Experiments on Solution Mining of Borax at Boron, California."

11. Herrmann, A. Gunter: "Methodical Investigations on the Origin of Brines in Salt and Potash Mines."

Salt Water Disposal

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

MAY 5, 1976

M E M O R A N D U M

TO: JOHN F. O'LEARY

FROM: JOE D. RAMEY

SUBJECT: WATER FLOWS IN AND NEAR WATERFLOOD PROJECTS IN LEA COUNTY

It has recently come to our attention that there are numerous salt water flows in and around waterfloods in Lea County.

Basically the problem is that water injected at around 3600' is escaping from the injection interval, migrating upward to the base of the salt section and then moving horizontally through this section. Waterflows of 5000-6000 barrels per day and recorded surface pressures of 1600 pounds on wells outside waterflood areas are not uncommon. This has resulted in collapsed casing in several wells but the critical aspect in this is the threat of widespread contamination of fresh water.

On April 8, 1976, a meeting was held between myself and representatives of around 35 oil companies. As a result of the meeting, an industry committee was formed to study the problem. The committee has met three times in general session and nearly continuously in subcommittees since April 8.

The committees' recommendations to date would entail the shutting in of portions of waterfloods for a fifteen day period. During the shut-in period, nearby wells with waterflows would be monitored for decrease in

flow rates and pressures. Hopefully, by the process of elimination, the injection wells responsible can be located and repaired. If not, certain waterfloods in the area will have to be shut down.

Attached are copies of the minutes of the meetings for your information.

JDR/fd
Attachments

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 1980 - HOBBS
88240

DIRECTOR
JOE D. RAMEY

LAND COMMISSIONER
PHIL R. LUCERO

STATE GEOLOGIST
EMERY C. ARNOLD

May 5, 1976

Dick--

Industry Committee came up with essentially the following:

Before any corrective steps are taken, the following will be done:

1. Find all wells in area with water problems.

2. Select from above wells--the wells with largest flow rates and those which the pressure returns to a preflow pressure in the least amount of time.

3. When the above is done, the injection wells in the area will be shut down (in groups) and the wells selected above will be observed through pressure recorders for the pressure changes (indicating where there are problems in an injection area).

4. Then the salt section will be blown down (how this will be done has not been determined).

5. After problem area is found, each well will be examined and corrective measures taken.

6. The wells in the total area can be examined for additional work, but fresh water will be safe.

Eunice Area--
Will start cycling injection by 5-12-76 (est.--this may occur earlier).
Steps 1 & 2 will be completed by 5-6-76.

Oil Center-Monument Area--
Are in Steps 1 & 2 now. Step 3 should be done by 6-15-76.
Step 4 should be in effect by 7-1-76, and maybe by 6-15-76.

Vacuum Area--
Are in Steps 1 & 2, together to be completed by 7-1-76.
Step 4 should be in effect by 7-15-76.

4-27-76

Joe D. Ramey

Three sub-committees have been appointed to study the problem areas with regard to waterflows in high bradenhead pressures.

Sub-Committee No. 1 has been assigned to the Eunice Area. Skelly is Chairman of the Committee. Other members of the Committee are Anadarko, Agua, Arco, Gulf and Reserve.

The second Sub-Committee will study the Oil Center-Monument Area. Getty is Chairman of this Committee. Other members are Conoco, Texaco, Amoco, W. K. Byrom and John H. Hendrix Production.

The third Sub-Committee will study the problem in the Vacuum Field. Mobil is Chairman of this Committee. Other members are Phillips, Shell, Texaco, Arco and Rice Engineering Company.

All Sub-Committees met on April 20, 1976 to formulate plans for studying the problem in their respective areas. Chairmen of the three sub-committees met with me on April 21, 1976 and presented summaries of the work of their respective sub-committees. As closely as possible, the same general procedures have been recommended for each area for gathering data and analyzing the problem. Letters have been sent to the operators in the Eunice Area and the Oil Center-Monument Areas requesting information on bradenhead flow tests and casing and cementing records. The Eunice information is to be reported by May 12 and the Oil Center-Monument information is to be reported by May 3rd. The Vacuum Field bradenhead survey will be completed on or before July 1st.

Recommendations of the three Sub-Committees are attached hereto.

Jerry Sexton
for
Industry Committee

TO: N.M.O.C.C. APPOINTED COMMITTEE

FROM: SUBCOMMITTEE ASSIGNED TO THE EUNICE AREA.

SUBJECT: APPROACH TO THE PROBLEM OF PRESSURED ANNULUS, ZONES AND SALT SECTION IN THE EUNICE AREA.

Members assigned to this committee are: Skelly (chairman), Anadarko, Aqua, Arco, Gulf, Reserve.

The first meeting of this committee was held in the Hobbs N.M.O.C.C. conference room at 1:30 P.M. (MST) on April 20, 1976. Representatives of all assigned companies were in attendance at this meeting.

A decision was made by the Sub-committee to proceed with a study of the old problem area, which was defined by N.M.O.C.C. Order no. R-5003. Also included in the initial study will be an area North of the 36 section area covered by R-5003, designated as the "J.J. Walker special survey". A recent bradenhead survey by the N.M.O.C.C. has shown that several wells in these areas are experiencing abnormal pressures and waterflows. The Commission, on behalf of the industry committee, has requested that each operator conduct the following tests:

(1) Each annulus that is capable of flowing water, shall be flowed for 24 hours, volumes and flowing pressures are to be recorded.

(2) Each annulus then shall be shut in and buildups recorded for 24 hours.

(3) Results shall be submitted to the Commission not later than May 12,1976.

These tests should indicate if a particular well is connected to the main problem area and its value as a "Monitor Point". The N.M.O.C.C., on behalf of the Industry committee, must set up a schedule to successively shut in (cycle) on each waterflood (or portion of a waterflood) as indicated by results of the tests.

Recent bradenhead surveys on the areas indicate 20 wells that have abnormal pressures and/or waterflows. The N.M.O.C.C. has requested that these wells be flowed for up to 24 hours, recording rates and total volume produced and then be shut in and the buildup recorded. This testing will indicate if that pressure is connected to the main problem area and its value as a monitor point. The wells are as follows:

Texas Pacific Oil Company

Ella Drinkard # 2-E 25-22-37

Aqua, Inc.

Blinebry Drinkard (SWD) # 35-H 35-22-37

Petro-Search

Citgo State # 1-E 2-23-37

Fluor # 1-M 35-22-37

Gulf State (SWD) #1-M 2-23-37

Summit Energy, Inc.

Gulf Sims # 1-P 25-22-37

Gulf "B" State # 1-F 36-22-37

Morance

State 36 # 1-K 36-22-37

Exxon Corp.

Paddock San Angelo Unit # 88-P 10-22-37

Paddock San Angelo Unit # 89-M 11-22-37

New Mexico "S" State # 23-P 2-22-37

New Mexico "S" State # 25-N 2-22-37

Gulf Oil Corporation

Eaves # 6-A 10-22-37

S. Penrose Skelly Unit # 143-D 10[redacted]7

Anadarko Production Company

Lou Wortham # 6-E 11-22-37

Walden (SWD) # 4-K 15-22-37

John Hendrix Production Co.

Cossatot "L" # 1-N 11-22-37

Mobil Oil Co.

Brunson Argo #6-E 10-22-37

Brunson Argo (SWD) # 11-A 9-22-37

Getty Oil Co.

R. L. Brunson # 2-P 4-22-37

As soon as bradenhead data and well information ha[redacted] received another meeting will be called. Data wil[redacted] viewed and evaluated and monitor points [redacted]ted. schedule, in conjunction with the N.M.O.C.C., will be set up to initiate the cycling phase of the ope[redacted]

TO: MEMBERS OF THE NEW MEXICO OIL CONSERVATION COMMISSION APPOINTED COMMITTEE

FROM: SUB-COMMITTEE APPOINTED TO STUDY THE OIL CENTER-MONUMENT AREA

SUBJECT: MINUTES OF THE FIRST MEETING

This Sub-Committee was appointed by the New Mexico Oil Conservation Commission (NMOCC) Appointed Committee April 20, 1976 at the 9:00 A.M. Meeting. The first Sub-Committee Meeting was held at 1:00 P.M. April 20, 1976 at Getty's Hobbs Office.

After reviewing the assigned area it was decided that individual well data on all wells (i.e., injection, producing, P & A, etc.) should be gathered via a NMOCC memorandum to all Operators. The requested data would be obtained from all operators operating in the following Committee selected study area:

T-19-S, R-37-E, Sections: 15, 16, 21, 22, 26, 27, 28, 33, 34, 35, and 36

T-20-S, R-37-E, Sections: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 35, and 36.

T-20-S, R-36-E, Sections: 13, 24, 25.

T-20-S, R-38-E, Sections: 5, 6, 7, 8, 17, 18, 19, 20, 29, 30, and 31.

T-21-S, R-36-E, Sections: 1 and 12.

T-21-S, R-37-E, Sections: 5, 6, 7, and 8.

It was further decided that the Chairman would meet with the Chairman of the other Study Areas so that the requested data would be uniform. The deadline for getting the data back was set for May 3, 1976.

When this data (csg. points, cement tops, etc.) is returned each well will be reviewed as to its potential as a "Monitor Point". Each Operator will then be requested to run a bradenhead pressure and flow test on the selected wells. It is anticipated that this portion of the testing should be completed by June 1.

It is felt that cycling of floods could begin about June 15. It is not yet known how many floods would be cycled; although, there are six in the Study Area.

The larger companies were requested to gather recommendations from their respective Reservoir Departments on the following:

1. Suggested procedure for running the flow tests on the "Monitor Points", so that a uniform method can be established and this procedure requested of the Operators while testing the water flows.

2. A length of time that each flood should be shut-in for cycling - in days/mile from "Monitor", etc.

At the Chairman Meeting April 21 at 9:00 A.M. in the Hobbs NMOCC Office it was decided that the uniform request for data from the Operators should consist of a complete downhole sketch consisting of hole sizes, size casings, wt. of casings, depth of casings, quality and type cement, DV Tools, cement top showing method

located, size and depth of tubings, packers, plugs, producing intervals, etc. It was requested that the data sheets be checked as they are received to insure that all wells in the Study Area are included. These requests are to go out April 22, 1976 and are due in May 3, 1976.

MONUMENT-OIL CENTER SUB-COMMITTEE
ATTENDANCE

1:00 P.M. APRIL 20, 1976 MEETING AT GETTY OIL COMPANY'S HOBBS OFFICE

NAME	COMPANY	LOCATION	A/C & PHONE
V. T. Lyon	CONOCO, Box 460	HOBBS, N.M.	505-393-4141
C. C. Woodward	CONOCO, Box 460	HOBBS, N.M.	505-393-4141
Eugene Miller	GETTY, Box 249	HOBBS, N.M.	505-397-1723
J. V. Gannon	TEXACO, Box 728	HOBBS, N.M.	505-393-7191
C. W. Byrom	W. K. BYROM, Box 147	HOBBS, N.M.	505-393-9519
Aubrey E. Kenyon	JOHN H. HENDRIX PROD. 1310 N 18th 88231	HOBBS, N.M. EUNICE, N.M.	505-392-6145-Home 505-394-2649-Office
Jerry F. Bowen	AMOCO PRODUCTION CO. Drawer A 79336	LEVELLAND, TEX.	806-894-3167
Jerry Sexton	NMOCC, Box 1980	HOBBS, N.M.	505-393-6161

RECOMMENDATIONS OF VACUUM WATERFLOW
COMMITTEE TO NMOCC APRIL 27, 1976
MOBIL-PHILLIPS-SHELL-TEXACO-RICE-ARCO

1. Operators in the Vacuum Field shall report all annulus pressures on all wells in accordance with NMOCC procedures on or before July 1, 1976 to the NMOCC and to the chairman of the Vacuum Waterflow Committee as the data is completed.

2. At the time the annulus pressures are taken, annuli that are capable of flowing shall be tested a sufficient length of time to establish flow rate and type of fluid. The operator will furnish necessary equipment.

3. The operator will notify the NMOCC and at least one member of the Vacuum Waterflow Committee 48 hours prior to taking the annulus pressure survey.

4. Operators will furnish wellbore diagrams of all wells in the Vacuum Field to the NMOCC and the chairman of the Vacuum Waterflow Committee on or before July 1, 1976 on an 8½ X 11" approved form.

5. Problem wells identified above will not be repaired unless at NMOCC request.

6. The Vacuum Waterflow Committee will meet periodically as needed to review the information gathered and will re-convene no later than July 9 to prepare final recommendations to the NMOCC that will lead to appropriate corrective measures.

NMOCC above refers to District 1 Office, P. O. Box 1980, Hobbs, New Mexico 88240

Vacuum Waterflow Committee, Mobil Oil Corporation, P. O. Box 633, Midland TX 79701

I. The water is getting away from the flood and disposal zones. Cooperation from the Industry in solving this problem must be obtained to allow continued water injection projects in these areas. As you can see in the Eunice Area, it took 2 years to complete the gathering of information and recommendation of corrective steps. In this area the Commission witnessed the casing test, tracer survey, and remedial work. As you can see with the problems now occurring in the area this is not possible. Additional information and communication between the Industry and the Commission is essential to solve the problems.

II. To date the areas where water is getting away is in multi-zone areas and Order R-5003 may prevent additional damage from the water floods and disposal zones, but it cannot be looked upon as a final solution.

(1) The salt section cannot be left with the pressures and volumes of water in it without casing leaks and collapsed casing becoming an increasing problem.

(2) A more involved study of your waterfloods to the cementing records of non-flood wells must be made.

(3) Your flood efficiency must be utilized. Injection of large volumes of water without response cannot be ignored.

(4) Casing depths and cementing procedures need to be evaluated in a different light as to prevent future problems.

III. Even though disposal wells and injection wells are non-productive as to earnings, it is now apparent that they must be monitored and kept in condition so that water will not escape from the desired formation.

EUNICE AREA

1. Date of 1st trouble was January 8, 1974. A fresh water well went bad in Unit E of Section 2, T23S, R37E, Lea County. Originally the well was an abandoned oil well. The well was re-entered and flow from down the hole was not encountered.

2. In February 1974 the Oil Conservation Commission ran casing surveys on the surrounding wells and found Armer well in area had problems. A temperature survey showed water coming around intermediate casing to shoe of surface pipe.

3. Skelly ran temperature and tracer surveys in their flood in March and April 1974. In August and September 1974 Anadarko ran surveys. The surveys showed the wells were not injecting out of formation (Queen).

4. In June 1974 Skelly had a LPG well start flowing salt water from the salt section 800 psi closed in surface pressure -- is still flowing intermittantly.

5. On December 3, 1974, in Santa Fe, an Industry Committee was formed to study and make recommendations on the area. On December 5, 1974, the above met and was divided into 2 groups, a north and south area.

6. On April 29th the Oil Commission issued Order R-5003 which covered 36 sections (Sec. 13 thru 36 T22S-R37E and Sec. 1 thru 12 T23S, R37E, Lea Co.)
   It essentially said that in deep wells in the area the cement behind the producing string should be brought back to 3100' which is above the Queen. That all wells with pressure problems on the intermediate will be corrected by perforating at the top of salt and bring cement back to the surface.
   The operators were given 6 months to do the above.

7. Agua was ordered to cease injection into their H-35 SWD well (Sec. 35-22S-37E) by September 26, 1975. The injection pressure in this well was above the parting pressure of the zone.

8. Bradenhead surveys are now being taken every 3 months and are witnessed by the Oil Commission. It is too early to tell if the area is stable.

9. In March 1975 a bradenhead survey was taken in a 4 square mile area north of area in the R-5003 order. 12 wells in this area had water flows, indicating the area in the R-5003 order is bigger than originally thought or has expanded. Additional surveys are now required in the area.

JAL AREA

Gulf McBuffington, Sec. 13-25S-37E, March 9th water started coming to surface.

Fresh water well in area contaminated.

Tubing and casing strings eaten up and water going into fresh water sands.

Injection wells are not being monitored .

OIL CENTER -- MONUMENT AREA

1. In February an operator, W.K. Byrom, reported casing collapsed in 5 wells due to pressure in the salt section (surface pressure of 1200 psi).

2. In March Texaco in their Skaggs unit had water break up around a producing well on the outside of surface pipe. A hole in the intermediate had occurred at from 60' to 100'.

   With further study another injection well was found to have a hole in the production string in the Yates, with a closed in pressure of 1800 psi and a flow of 250 BPD.

3. Amoco in Section 23-T20S-R37E had a valve blow off a well, before it could be capped 5700 bbls SW was hauled. 7 additional wells had pressure and water flows in the area. Also, a well in Sec. 24-T19S-R36E has a waterflow.

4. Getty had a hole come in the riser from their intermediate casing and water flowed from the salt section at 35--15 BPH. Surveys confirmed flows from salt. Have additional well with 750 psi pressure and salt water flow in Sec. 16-T20S-R37E.

5. There are 5 floods in the area:

Getty -- Eumont	Eff.	3.1
Continental -- Skaggs		5.6
Texaco -- Skaggs		11.6
Texaco--Eunice Monument		6.24
Amerada-Warren McKee		11.9

   Three of the operators are now digging out casing strings for a casing survey

6. The area of water flow could cover as much as 40 sections. Additional surveys will be run to determine the actual size of the problem.

VACUUM AREA

1. Shell had a water flow from the intermediate casing July 1st on a well offsetting the Texaco San Andres waterflood (Sec. 31-17S-35E) Date reported.

2. On July 27 and 28 a bradenhead survey was run and 12 wells were found to have waterflows.

3. By December profiles had been run, which did not pinpoint the trouble but did show that several of the wells were injecting in non-productive zones.

4. In January a letter was sent to Texaco proposing work to be done along the line of the order of R-5003 with a 6 month completion time.

   (a) Well cemented to base of salt
   (b) Where water or gas flows were encountered cement brought to the surface from the top of the salt.

5. In March a bradenhead survey of 199 wells offsetting Texaco flood was made.

   (a) 39% of the wells had problems, gas and/or water
   (b) 32 wells had water flows

6. At the present time a bradenhead survey is being set up for an additional 400 wells and will take in the Mobil flood which is also in the area.

VACUUM AREA

1. Shell had a water flow from the intermediate casing July 1st on a well offsetting the Texaco San Andres waterflood (Sec. 31-17S-35E) Date reported.

2. On July 27 and 28 a bradenhead survey was run and 12 wells were found to have waterflows.

3. By December profiles had been run, which did not pinpoint the trouble but did show that several of the wells were injecting in non-productive zones.

4. In January a letter was sent to Texaco proposing work to be done along the line of the order of R-5003 with a 6 month completion time.

   (a) Well cemented to base of salt
   (b) Where water or gas flows were encountered cement brought to the surface from the top of the salt.

5. In March a bradenhead survey of 199 wells offsetting Texaco flood was made.

   (a) 39% of the wells had problems, gas and/or water
   (b) 32 wells had water flows

6. At the present time a bradenhead survey is being set up for an additional 400 wells and will take in the Mobil flood which is also in the area.

Report of Industry Comittee
To Examine Water Flow in and Around Waterflood and Disposal Systems

The Industry Committee appointed by Mr. Ramey at the April 8, meeting in Santa Fe, met April 13, to undertake the requested study. Chairman, Jerry Sexton divided the group into four subcommittees with the following charges:

1. A committee to make recommendations to the Commission as to injection pressures to be allowed in waterflood and disposal wells and also to advise if the ratio of injection fluid to produced fluid can be used as a tool to determine problems in a waterflood.

2. A committee to outline what information is required to monitor waterfloods.

3. A committee to deal with problems of pressured-up salt section and shallow zones.

4. A committee to determine what data is necessary before a new waterflood can be approved.

The general committee was reconvened on April 20, to review reports from the four appointed committees.

Subcommittee No. 1 was composed of Conoco*, Amoco, Phillips, Skelly, and Texaco. This committee reported as follows:

Conclusions

1. The current NMOCC rules amply define the responsibility of all project operators to confine their fluid injected to the approved interval and/or formation.

2. The fluid injection wellhead pressure necessary for secondary and improved oil recovery projects will vary widely with both reservoir characteristics and fluid injection characteristics.

3. No single injection pressure limitation can be established which can be applied uniformly and equitably to all injection projects in the State or in Lea County, even if said pressure limitation were to be based on depth to injection interval, but any such limitation should be set on an individual reservoir or project basis.

4. The communication problems which currently exist in Lea County are primarily mechanical in nature.

5. Arbitrary limitation of injection pressure and/or injection-withdrawal ratio could result in the premature abandonment of a substantial number of secondary recovery projects.

6. The ratio of fluid injection volumes to fluid withdrawal volumes will vary widely throughout the life of all secondary recovery projects and to a lesser degree in pressure maintenance and improved oil recovery projects. No single limiting injection-withdrawal ratio can be applied fairly to all secondary recovery projects in the State or in Lea County.

7. Fluid-in/fluid-out ratios, if used with discretion and with proper consideration of reservoir characteristics, including invaded gas-saturated areas, aquifer recompression and reservoir volume factor of oil with gas in solution, can be used as a tool to detect loss of injection water from the zone of interest, but only after fill-up of the project area.

Recommendation

The subcommittee recommends that bottomhole injection pressure be limited to the original formation parting pressure and that that pressure not be exceeded without approval of the Commission.

The subcommittee recommends no limitation be placed on injection/withdrawal ratio since this is a function of the particular reservoir and time in the life of each projects.

Subcommittee No. 2 was composed of Mobil*, Reserve, Shell, and Exxon. The committee report follows, and is a recommended addition to Rule 701 of the Commission's Rules and Regulations:

Monitoring of Injection Operations

1. The operator of an injection well (or wells) shall monitor all annular pressures on all wells including inactive wells in the injection project area and report such pressures monthly on Form 120 and Form 120-A as required to the Commission. Operators in the vicinity of a fluid injection project (as designated by the NMOCC) shall report all annulus pressure data quarterly.

2. Waterflows from any well annulus will be sampled, analyzed, and the results submitted to the NMOCC.

3. The operator of an injection well (or wells) shall be aware of and shall observe abandoned wellbores in the injection project area for irregularities and shall report irregularities immediately to the NMOCC.

4. Abandoned or inactive properties in the vicinity of fluid injection projects shall be inspected periodically by the NMOCC.

5. Irregularities, anomalies and inconsistencies in injection well performance shall be noted and explained on Form 120 or 120A, as required, to the NMOCC's satisfaction. Generally accepted industry surveys will be used to further define problems or potential problems as required. Corrective action will be undertaken immediately in problem situations.

6. In special problem areas as designated by the NMOCC, it is anticipated that additional monitoring survey(s) may be required for adequate project control. The type and frequency of such surveys shall be determined to the satisfaction of the operator and the NMOCC.

7. An injection well as used above is consistent with the NMOCC definition which includes injection of air, gas, water or other fluids into any underground stratum.

Subcommittee No. 3 was composed of Getty*, Byrom, Hendrix, Agua, and Texaco. This committee made the following report outlining an approach to the handling of problems of abnormally pressured annulus, and water flows from non-injection formations.

Subcommittee No. 3 was formed April 13, 1976 to:

1. Determine what should be done immediately with wells exhibiting bradenhead pressure.

2. Determine what should be done with wells exhibiting bradenhead waterflows.

3. Determine the value of using pressure falloffs and other means to locate the water pressure/flow problem.

The first meeting was held at 9:00 A.M. April 14, in Getty's Hobbs Office. It is felt that the problem does vary from area to area, but generally the following is a logical approach to the problems such as we have encountered. In arriving at the following approach we have considered the following:

1. The poor success achieved in Eunice when the source was not located first.

2. The excessive cost, frustration and poor success in attempting to squeeze cement in a zone with water flowing.

3. The cost and the possibility of missing the problem completely by trying to analyze the problem with logs alone.

Conclusions

1. Gas pressure by itself is not indication of flood fluid escape.

2. The pressured system(s) of formation(s) and salt section is near stable with the source(s) and should not be severely disturbed until the sources or area of origin of the problem is located.

3. Each pressure/flow point should be identified and evaluated as a possible "Monitor Point" before beginning a disturbance of the system.

4. By systematically "Creating a series of disturbances by area" (i.e., shutting-in each flood successively) and correlating the pressure at each injector, the source of the water intrusion can be better pinpointed to an area.

5. The completion of every well in the area will have to be reviewed, i.e., casing points, cement used, cement tops, etc.

6. When all fluid injectors in the area have been "cycled" and the "source area(s)" have been located, then (4) above could be reviewed closely to determine what surveys should be run and on what wells - surveys such as Noise Logs, Tracers, Temperature Logs, Cement Bond Logs, etc.

7. Pressure bleed off, and remedial work (such as bradenhead squeezes, re-cementing, squeeze, etc., except for emergencies) should be delayed until the above work is completed or any correction between the water flows and the source will be seriously impaired if not lost completely.

8. To attempt to solve the problem without a systematic approach such as that outlined above would be unnecessarily expensive and/or ineffective.

Recommended Procedure

1. The bradenheads should be pressure surveyed in an affected area in order to provide sufficient monitoring locations while the waterfloods are being "cycled". A deadline to complete this survey work could be June 1.

2. Each annulus that is found to be capable of flowing water should be flowed for up to 24 hours recording rates and total volume produced; it should then be shut-in and the buildup pressure recorded. This procedure test should indicate if that pressure is connected to the main problem area and its value as a "Monitor Point".

3. The NMOCC must then set up a schedule to successively shut-in (cycle) on each waterflood (or portion of a waterflood) all injectors that are injecting water at pressures equal to or above the pressure of the "Monitor Points" in the area. The shut-in wellhead injection falloff pressures should be compared to the "Monitor Points" pressure with time of shut-in. (For example: If the shut-in injection pressure drops below all "Monitors" in the area, that injector could probably be eliminated as a source).

4. If a response (pressure falloff) is found in "Monitor" well(s) during shut-in of a flood, further pinpointing of the problem area could be made by selectively beginning injection in a smaller area and observing the reaction on the "Monitor(s)".

5. After all floods in the area have been cycled and a problem area identified, the completion of all wells in that area must be reviewed for possible leakage out of the flood zone. This includes not only the injectors that caused the pressure response, but all producing wells (deep and shallow), plugged wells, injection wells, etc.

6. At this point selected wells should be surveyed with appropriate logs and surveys as required to identify the problem(s).

7. Remedial work on all potential problem wells should be decided at this point.

8. The pressured zone(s) should then be bled down - especially in the area where remedial work is to be performed.

9. If the water pressure can be effectively bled down, it will eliminate the necessity of squeezing-off the "Monitor Points" to protect the fresh water and to protect the casings from collapse. Further, if the "Monitor Points" can be left open, they can be watched for re-currence of the pressure problem(s).

10. Normal water injection should then be resumed.

Subcommittee No. 4 was composed of Anadarko*, Arco, Rice, Gulf, and Shell

This committee reported as follows in regard to information which should be

investigated and reported to the Commission prior to making application for secondary recovery or salt water disposal project:

Subcommittee Objective:

To present to the full Committee recommended changes in procedure for applying for NMOCC approval of secondary recovery and salt water disposal projects in order to further safeguard oil, gas, fresh water and surface resources.

Subcommittee Recommendations:

NMOCC Rules and Regulations Section I should be revised to:

1. Provide that all boreholes within the project area that penetrate the proposed injection interval be adequately cased and/or cemented to assure that all injected media will be confined to the proposed injection interval. A diagramatic sketch of all such boreholes will be submitted with the application showing all casing strings, including diameters and setting depths, quantities used and tops of cement (logged or calculated), location of cement plugs and intervals covered, perforation or open hole intervals, tubing strings, including diameters and setting depths, and the type and location of packers, if any.

2. Provide that bradenhead surveys be conducted and the results submitted with the application on all project wells; such surveys to include all appropriate pressures and flow data with any fluid(s) identified. Provide further that this same data be obtained on all other non-project wells in and adjacent to the proposed project area prior to initiation of fluid injection.

The reports of the committees were accepted and the general committee proceeded with investigation of the individual areas by the establishment of committees to investigate each of the problem areas.

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 5403
Order No. R-5003

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION ON ITS OWN MOTION TO
FURTHER CONSIDER THE SUBJECT
MATTER OF CASE NO. 5377.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on January 22, 1975, at Santa Fe, New Mexico, before Examiner Daniel S. Nutter.

NOW, on this 29th day of April, 1975, the Commission, a quorum being present, having considered the testimony, the record, and the recommendations of the Examiner, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That on December 3, 1974, the Commission heard Case No. 5377, and thereafter entered Order No. R-4936 on December 5, 1974.

(3) That by said Order No. R-4936, the Commission found that all water being injected into the Queen and/or San Andres formations in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and in Sections 1 through 12, Township 23 South, Range 37 East, NMPM, Lea County, New Mexico, is not being contained in the formation in which it is placed, and that injected water has appeared in formations above the top of the salt section found at a depth of approximately 1300 feet in the subject area, in the salt section from approximately 1300 feet to 2400 feet, and in formations from the base of the salt section at approximately 2400 feet to the top of the Queen formation at approximately 3400 feet.

(4) That by said Order No. R-4936, the Commission ordered that the operator of each secondary recovery injection project in Sections 14, 21, 22, 23, 26, 27, 28, 33, and 34, Township 22 South, Range 37 East, NMPM, and in Sections 3, 4, 9, and 10, Township 23 South, Range 37 East, NMPM, reduce the total injection of water into the Queen formation to an amount equalling the reservoir voidage of the Queen formation by wells in said area; further, that the operator of each secondary recovery injection project in Sections 19, 20, 29, 30, 31, and 32, Township 22 South, Range 37 East, NMPM, and in Sections 5, 6, and 8, Township 23 South, Range 37 East, NMPM, reduce the total injection of water into the Queen formation to an amount equalling 150 percent of the reservoir voidage of the Queen formation by wells in said area.

(5) That by said Order No. R-4936, the Commission further ordered that the Skelly Oil Company LPG Well No. 3, located in Unit F of Section 27, Township 22 South, Range 37 East, NMPM, be produced at the capacity of the well to flow water; further that Skelly Oil Company not dispose of any waters other than normal gasoline plant water effluent into its Eunice GP Well No. 1, located in Unit L of Section 27, Township 22 South, Range 37 East, NMPM, but that disposal into said well into the San Andres formation would be continued to be permitted; and further that continued disposal of water into the San Andres formation by Agua, Inc., and Armer Oil Company into their disposal wells located in Unit H of Section 35, Township 22 South, Range 37 East, NMPM, and Unit M of Section 2, Township 23 South, Range 37 East, NMPM, respectively, be permitted.

(6) That by said Order No. R-4936, the Commission further ordered that the operator of any well in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, or Sections 1 through 12, Township 23 South, Range 37 East, NMPM, when planning to cement or recement casing in the Queen and/or San Andres formations, notify the Hobbs district office of the Commission at least 24 hours prior to commencement of cementing operations; that the District Supervisor of the Commission notify the operator of any injection or disposal well within a radius of 1320 feet of the well to be cemented of the date and hour of commencement of cementing operations; and that the operator of such injection or disposal well cease injection into said well at least 12 hours prior to commencement of cementing operations and not resume injection for at least 36 hours after completion thereof.

(7) That by said Order No. R-4936 the Commission directed the Secretary-Director of the Commission to appoint a study committee to further investigate the condition of all wells in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and in Sections 1 through 12, Township 23 South, Range 37 East, NMPM, and that said committee report its findings and also make recommendations as to the proper remedial action or actions which should be taken or required.

(8) That the Secretary-Director of the Commission did appoint a study committee and that said committee, chaired by the Supervisor of the Hobbs District Office of the Commission, hereinafter referred to as the Supervisor, divided itself into two sub-committees, one to study and investigate the north area of the lands under consideration, being all of Sections 13 through 30, the N/2 of Section 31, the E/2 NE/4 of Section 32, the N/2 of Section 33, the N/2 and SE/4 of Section 34, and all of Sections 35 and 36, Township 22 South, Range 37 East, NMPM, and the other sub-committee to study and investigate the south area of the lands under consideration, being the S/2 of Section 31, the NW/4, W/2 NE/4 and S/2 of Section 32, the S/2 of Section 33, and the SW/4 of Section 34, Township 22 South, Range 37 East, NMPM, and all of Sections 1 through 12, Township 23 South, Range 37 East, NMPM.

(9) That in the hearing of the instant case, testimony, evidence and recommendations were presented concerning each of the aforesaid areas.

(10) That casing cement throughout the Queen formation and with a cement top of no more than 3100 feet beneath the surface of the ground has been established by the study committee as being necessary to ensure that fluids in the Queen formation and other formations beneath the Queen formation are contained in their respective formations and cannot migrate into formations above the top of the Queen formation; that the Commission concurs with said determination and hereby finds that all wells in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and in Sections 1 through 12, Township 23 South, Range 37 East, NMPM, completed in the Queen formation, or deeper, should be cemented, or recemented, to provide that there is casing cement throughout the Queen formation and immediately above, to a depth of 3100 feet beneath the surface of the ground, or less.

(11) That there exist in the "north" area some 37 deep wells which have been drilled through the Queen formation which either do not have intermediate casing strings or in which the intermediate casing string is set above 3100 feet, and in which cement around the production casing string is calculated to be insufficient to come back to at least 3100 feet beneath the surface of the ground.

(12) That the aforesaid 37 wells should be recemented with a sufficient amount of cement to ensure that there is cement around the production casing string throughout the Queen formation and immediately above to a depth of 3100 feet beneath the surface of the ground, or less; and that the aforesaid 37 wells are identified as follows:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Armer Oil Company	Keohane	1	I	26
Atlantic Richfield Co.	Boyd	2	D	23
Amerada-Hess Corp.	Walden	1	K	15
" " "	"	2	K	15
" " "	"	3	N	15
" " "	"	6	M	15
" " "	Wood	5	B	22
" " "	"	9	G	22
" " "	"	10	H	22
Cleary	Parks	7	K	14
"	"	8	J	14
"	"	9	N	14
Coquina Oil Corp.	Baker	1	B	26
Exxon Company, USA	Paddock Unit	98	H	15
Gulf Oil Corporation	Cole	5	O	16
John H. Hendrix	Cossatot F	1	C	23
Samedan Oil Corp.	Parks	3	P	14
" " "	"	4	I	14
" " "	"	5	O	14
Skelly Oil Co.	Baker A	5	E	26
" " "	Baker	9	N	22
" " "	"	10	A	27
" " "	"	11	B	27
" " "	Baker C	1	A	26
Sohio Petroleum Co.	Walden	3	F	15
" " "	"	4	E	15
" " "	"	5	E	15
Texas Pacific Oil Co., Inc.	Danglade	1	L	13
Texas Pacific Oil Co., Inc.	Walden	3	C	15
Texas Pacific Oil Co., Inc.	"	4	C	15
Texas Pacific Oil Co., Inc.	Boyd	1	G	23
Texas Pacific Oil Co., Inc.	"	2Y	H	23
Texas Pacific Oil Co., Inc.	"	3	A	23
Texas Pacific Oil Co., Inc.	"	5	B	23
Texas Pacific Oil Co., Inc.	Cary	7	F	22
Texas Pacific Oil Co., Inc.	"	8	L	22
Bruce A. Wilbanks	Baker	2	A	26

(13) That there exist in the "north" area two deep wells which have been drilled through the Queen formation which have intermediate casing strings set below 3100 feet and cemented, but in which cement around the production casing string is calculated to be insufficient to come back to the intermediate casing shoe.

(14) That the aforesaid two wells should be recemented with a sufficient amount of cement to ensure that there is cement around the production casing string throughout the Queen formation and coming up into the intermediate casing string to a depth of 3100 feet beneath the surface of the ground, or less; and that the aforesaid two wells are identified as follows:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE NAME	WELL NO.	UNIT	SECTION
Samedan Oil Corp.	Boyd	1	J	23
Skelly Oil Co.	Baker A	1	D	26

(15) That there are two plugged and abandoned wells in the "north" area which, according to the original casing and cementing programs and the plugging programs as reported, may provide passage for waters injected into the Queen and/or San Andres formations to migrate upward to the salt section.

(16) That the aforesaid two wells should be re-entered and re-plugged in such a manner as to prevent the migration of fluids from one formation to another; and that the aforesaid two wells are identified as follows:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE NAME	WELL NO.	UNIT	SECTION
Samedan Oil Corp.	Boyd	2	J	23
Wolfson Oil Co.	Boyd	1	L	23

(17) That there are five wells in the "south" area which indicate either a casing leak or waterflow on the bradenhead.

(18) That the aforesaid five wells should be entered and remedial work performed to eliminate the aforesaid conditions satisfactorily; and that the aforesaid five wells are identified as follows:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE NAME	WELL NO.	UNIT	SECTION
Skelly Oil Co.	Penrose "A" Unit	3	I	33

TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Skelly Oil Co.	Penrose "A" Unit	14	C	3
" " "	" " "	23	F	3
" " "	" " "	46	B	9
" " "	" " "	48	H	9

(19) That there are two plugged and abandoned wells in the "south" area which, according to the original casing and cementing programs and the plugging programs as reported may provide passage for waters injected into the Queen formation to migrate into other formations.

(20) That the aforesaid two wells should be re-entered and re-plugged in such a manner as to prevent the migration of fluids from one formation to another; and that the aforesaid two wells are identified as follows:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Skelly Oil Co.	H. O. Sims	16	M	34

TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Skelly Oil Co.	Sims "C"	1	N	3

(21) That there is one well in the south area which was originally drilled as a Queen sand well, but which was plugged back to an undetermined depth and converted to a fresh water well, said well being identified as the Intercoast Petroleum Corporation J. C. Clower State Well No. 1 (also known as the R. D. Sims Water Well) located in Unit E, Section 2, Township 23 South, Range 37 East, NMPM, Lea County, New Mexico.

(22) That the plug-back procedures used on said well cannot be ascertained, but there is evidence that said procedures were inadequate to properly confine fluids in their respective strata; that said well should be re-entered and cleaned out to total depth, and re-plugged in such a manner as to prevent the migration of fluids from one formation to another.

(23) That a number of wells in the subject area, being Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and Sections 1 through 12, Township 23 South, Range 37 East, NMPM, other than those wells cited in Findings Nos. (11) through (22) above, are known to have abnormal pressures on the surface

casing or intermediate casing; that some of these wells, when the aforesaid surface- or intermediate-casing pressure was blown down, exhibited a waterflow from either the surface casing or the intermediate casing or both.

(24) That any such well which has heretofore shown a waterflow on the surface casing or intermediate casing or on which an abnormal surface casing or intermediate casing pressure has been encountered which indicates a likelihood of water movement behind the casing, should have conducted thereon a temperature survey, and remedial work performed on the well, if such work is deemed necessary by the Supervisor.

(25) That all wells in the subject area should be so equipped that periodic pressure tests can be conducted on the surface and intermediate casing strings; that such tests should be witnessed by a representative of the Commission; and that such tests should be conducted on a quarterly basis, provided that the Secretary-Director of the Commission should have the authority to change the pressure survey frequency from quarterly to semi-annually in any portion of the subject area where four such quarterly tests have been conducted and, in his opinion, the results thereof indicate that an accurate and continuous analysis of subsurface conditions may be made on the basis of such semi-annual tests.

(26) That the Supervisor should have authority to require temperature surveys (and water injection profile surveys on injection wells) on wells which exhibit abnormal surface casing or intermediate casing pressures during scheduled pressure tests or at any other time, and to require such remedial work to be performed as is necessary on such wells.

(27) That, pending additional information concerning the subject area, continued disposal of water into the San Andres formation through three wells should be permitted provided that injection not exceed certain amounts.

(28) That continued disposal into Skelly Oil Company's Eunice GP Well No. 1, located in Unit L, Section 27, Township 22 South, Range 37 East, NMPM, should be permitted provided that such disposal should be limited to gasoline plant water effluent only, and in no event should average more than 1500 barrels per day during any one-month period.

(29) That continued disposal into Agua, Inc.'s SWD Well No. H-35, located in Unit H, Section 35, Township 22 South, Range 37 East, NMPM, should be permitted provided that in no event should such disposal average more than 5500 barrels per day during any one-month period.

(30) That continued disposal into Armer Oil Company's Gulf State SWD Well No. 1, located in Unit M, Section 2, Township 23 South, Range 37 East, NMPM, should be permitted provided that in no event should such disposal average more than 350 barrels per day during any one-month period.

(31) That Skelly Oil Company should continue to produce, at its maximum capacity to flow, water currently being produced from its LPG Well No. 3, located in Unit F, Section 27, Township 22 South, Range 37 East, NMPM.

(32) That water injection volumes into the Queen formation in Sections 19, 20, 29, 30, 31, and 32, Township 22 South, Range 37 East, NMPM, and in Sections 5, 6, and 8, Township 23 South, Range 37 East, NMPM, should be limited to 150 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, water, and gas produced.

(33) That water injection volumes into the Queen formation in Sections 14, 21, 22, 23, 26, 27, 28, 33, and 34, Township 22 South, Range 37 East, NMPM, and in Sections 3, 4, 9, and 10, Township 23 South, Range 37 East, NMPM, should be limited to 100 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, water, and gas produced.

(34) That upon satisfactory completion of the remedial and other work described in Findings Nos. (12), (14), (16), (18), (20), (22), and (24) above, water injection volumes into the Queen formation in the area described in Finding No. (33) above should be permitted to increase to 150 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, water, and gas produced.

(35) That in the event all of the remedial and other work prescribed for all wells in the "100 percent voidage" portion (Finding No. (33) above) of either the "north" area or the "south" area, as described in Finding No. (8) above, has been satisfactorily completed, the Supervisor should be authorized to permit injection volumes in that portion of said area to be increased to 150 percent of reservoir voidage, notwithstanding the fact that the prescribed remedial and other work for the other area of the 100 percent voidage portion is incomplete.

(36) That a reasonable period of time in which to accomplish the remedial and other work described in Findings Nos. (12), (14), (16), (18), (20), (22), and (24) above should be afforded, and six months from the date of entry of this order is a reasonable period of time.

(37) That workover operations are being and will continue to be conducted on certain wells in the subject area, said workover operations including the cementing or recementing of casing through the Queen and San Andres formations.

(38) That to enable the cement to properly set on said wells, water injection into any well within a radius of 1320 feet of the well being cemented or recemented should not occur for a minimum of 12 hours prior to commencement of actual cementing operations or 36 hours after completion thereof.

(39) That this case should be reopened in November, 1975, to reconsider all aspects of the case, including the possible curtailment or prohibition of underground water disposal in any or all of the three disposal wells described in Findings Nos. (28), (29), and (30).

(40) That approval of an order embodying the above findings will prevent waste of oil and gas, will protect correlative rights, and will alleviate the contamination of fresh water supplies.

IT IS THEREFORE ORDERED:

(1) That each of the following wells shall be recemented with a sufficient amount of cement to ensure that there is cement around the production casing string throughout the Queen formation and immediately above to a depth of 3100 feet beneath the surface of the ground, or less:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Armer Oil Company	Keohane	1	I	26
Atlantic Richfield Co.	Boyd	2	D	23
Amerada-Hess Corp.	Walden	1	K	15
" " "	"	2	K	15
" " "	"	3	N	15
" " "	"	6	M	15
" " "	Wood	5	B	22
" " "	"	9	G	22
" " "	"	10	H	22
Cleary	Parks	7	K	14
"	"	8	J	14
"	"	9	N	14
Coquina Oil Corp.	Baker	1	B	26
Exxon Company, USA	Paddock Unit	98	H	15
Gulf Oil Corporation	Cole	5	O	16
John H. Hendrix	Cossatot F	1	C	23

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY con'd

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Samedan Oil Corp.	Parks	3	P	14
" " "	"	4	I	14
" " "	"	5	O	14
Skelly Oil Co.	Baker A	5	E	26
" " "	Baker	9	N	22
" " "	"	10	A	27
" " "	"	11	B	27
" " "	Baker C	1	A	26
Sohio Petroleum Co.	Walden	3	F	15
" " "	"	4	E	15
" " "	"	5	E	15
Texas Pacific Oil Co., Inc.	Danglade	1	L	13
Texas Pacific Oil Co., Inc.	Walden	3	C	15
Texas Pacific Oil Co., Inc.	"	4	C	15
Texas Pacific Oil Co., Inc.	Boyd	1	G	23
Texas Pacific Oil Co., Inc.	"	2Y	H	23
Texas Pacific Oil Co., Inc.	"	3	A	23
Texas Pacific Oil Co., Inc.	"	5	B	23
Texas Pacific Oil Co., Inc.	Cary	7	F	22
Texas Pacific Oil Co., Inc.	"	8	L	22
Bruce A. Wilbanks	Baker	2	A	26

(2) That each of the following wells shall be recemented with a sufficient amount of cement to ensure that there is cement around the production casing string throughout the Queen formation and coming up into the intermediate casing string to a depth of 3100 feet beneath the surface of the ground, or less:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Samedan Oil Corp.	Boyd	1	J	23
Skelly Oil Co.	Baker A	1	D	26

(3) That each of the following wells shall be entered and remedial work performed to eliminate the existing casing leak or bradenhead water flow:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Skelly Oil Co.	Penrose "A" Unit	3	I	33

TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Skelly Oil Co.	Penrose "A" Unit	14	C	3
" " "	Penrose "A" Unit	23	F	3
" " "	Penrose "A" Unit	46	B	9
" " "	Penrose "A"	48	H	9

(4) That each of the following plugged and abandoned wells shall be re-entered, cleaned out into the Queen formation, and re-plugged in such a manner as to prevent the migration of fluids from one formation to another:

TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Samedan Oil Corp.	Boyd	2	J	23
Skelly Oil Co.	H. O. Sims	16	M	34
Wolfson Oil Co.	Boyd	1	L	23

TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY

COMPANY	LEASE	WELL NO.	UNIT	SECTION
Skelly Oil Co.	Sims "C"	1	N	3

PROVIDED HOWEVER, that in the event mechanical difficulties prevent clean-out of any of the aforesaid four wells to the prescribed depth or otherwise prevent compliance with the provisions of this order, the operator thereof shall consult with the Supervisor and arrive at a suitable plan for the satisfactory plugging of the well.

(5) That the Intercoast Petroleum Corporation-J. C. Clower State Well No. 1 (also known as the R. D. Sims Water Well) located in Unit E, Section 2, Township 23 South, Range 37 East, NMPM, shall be re-entered, cleaned out to total depth, and re-plugged in such a manner as to prevent migration of fluids from one formation to another.

PROVIDED HOWEVER, that in the event mechanical difficulties prevent clean-out of said well to total depth or otherwise prevent compliance with the provisions of this order, the operator thereof shall consult with the Supervisor and work out a plan for the satisfactory plugging of the well.

(6) That the operator of any well in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and Sections 1 through 12, Township 23 South, Range 37 East, NMPM, which well has shown a waterflow on the surface casing or intermediate casing or on which an abnormal surface casing or intermediate casing pressure has been encountered, shall notify the Supervisor of such fact, whereupon the operator and the Supervisor shall make arrangements for a temperature survey on said well; the Supervisor, upon receipt of the results of said temperature survey, shall prescribe such remedial action as in his opinion is deemed necessary on the well, which the operator of the well shall perform.

(7) That the Supervisor shall prepare and promulgate a schedule and rules for conducting quarterly pressure tests on the surface and intermediate casing strings of all wells in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and Sections 1 through 12, Township 23 South, Range 37 East, NMPM, and he shall assign a Commission representative to witness all such tests.

(8) That the operator of each well in the area defined in Order No. (7) above shall equip each such well in such a manner that periodic pressure tests can be conducted on the surface and intermediate casing strings, and shall conduct such tests in accordance with the schedule promulgated by the Commission.

(9) That the Supervisor shall require temperature surveys (also, in the case of water injection wells, injection profile surveys) on wells which exhibit abnormal surface casing or intermediate casing pressures during the aforesaid scheduled pressure tests or at any other time. Further, he shall prescribe such remedial action to eliminate such conditions as in his opinion is deemed necessary on the well, which the operator of the well shall perform.

(10) That the Secretary-Director of the Commission shall have authority to change the frequency for the pressure tests required by Order No. (7) above from a quarterly basis to a semi-annual basis in any portion of the subject area where four such quarterly tests have been conducted and, in his opinion, the results thereof indicate that an accurate and continuous analysis of subsurface conditions may be made on the basis of such semi-annual tests.

(11) That the continued disposal of water into the Skelly Oil Company Eunice GP Well No. 1, located in Unit L, Section 27, Township 22 South, Range 37 East, NMPM, shall be permitted until further order of the Commission, provided however, that waters disposed of into said well shall be limited to normal gasoline plant water effluent, and said disposal shall not exceed an average of 1500 barrels of water per day during any one-month period.

(12) That the continued disposal of water into the Agua, Inc. SWD Well No. H-35, located in Unit H, Section 35, Township 22 South, Range 37 East, NMPM, shall be permitted until further order of the Commission, provided however, that said disposal shall not exceed an average of 5500 barrels of water per day during any one-month period.

(13) That the continued disposal of water into the Armer Oil Company Gulf State SWD Well No. 1, located in Unit M, Section 2, Township 23 South, Range 37 East, NMPM, shall be permitted until further order of the Commission, provided however, that said disposal shall not exceed an average of 350 barrels of water per day during any one-month period.

(14) That Skelly Oil Company, until further order of the Commission, shall continue to produce its LPG Well No. 3, located in Unit F, Section 27, Township 22 South, Range 37 East, NMPM, at the capacity of the well to flow water.

(15) That the operator of each secondary recovery injection well in Sections 14, 21, 22, 23, 26, 27, 28, 33, and 34, Township 22 South, Range 37 East, NMPM, and in Sections 3, 4, 9, and 10, Township 23 South, Range 37 East, NMPM, Langlie-Mattix Pool, Lea County, New Mexico, shall limit the total injection of water into the Queen formation in said sections to an amount equalling the reservoir voidage of the Queen formation by wells under his operation in said sections.

(16) That the operator of each secondary recovery injection well in Sections 19, 20, 29, 30, 31, and 32, Township 22 South, Range 37 East, NMPM, and in Sections 5, 6, and 8,

Township 23 South, Range 37 East, NMPM, Langlie-Mattix Pool, Lea County, New Mexico, shall limit the total injection of water into the Queen formation in said sections to an amount equalling 150 percent of the reservoir voidage of the Queen formation by wells under his operation in said sections.

(17) That the aforesaid limitations in water injection volumes shall take place and continue to take place on as near a current basis as possible, i.e., daily injection rates shall be in the required proportion of daily production rates as nearly as can be reasonably ascertained. In no event shall total injected volume for a given month exceed the permitted volume.

(18) That to calculate the permitted volume of water which may be injected into the Queen formation, produced oil, water, and gas shall be converted to reservoir barrels at the calculated reservoir pressure. Surface barrels of injection water shall be in the permitted proportion to reservoir barrels of voidage. The operator's Monthly Injection Report, Form C-120, shall be accompanied by the operator's calculations of reservoir voidage.

(19) That the Supervisor is hereby authorized to permit water injection into the Queen formation in wells located in Sections 14, 21, 22, 23, 26, 27, 28, the N/2 of Section 33, and the N/2 and SE/4 of Section 34, Township 22 South, Range 37 East, NMPM, to be increased to 150 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, gas, and water produced, if he determines that the remedial and other work described in Findings Nos. (12), (14), and (16) above and on the applicable wells referred to in Findings Nos. (23) and (24) above has been satisfactorily completed.

(20) That the Supervisor is hereby authorized to permit water injection into the Queen formation in wells located in the S/2 of Section 33 and the SW/4 of Section 34, Township 22 South, Range 37 East, NMPM, and in Sections 3, 4, 9, and 10, Township 23 South, Range 37 East, NMPM, to be increased to 150 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, gas, and water produced, if he determines that the remedial and other work described in Findings Nos. (18), (20), and (22) above and on the applicable wells referred to in Findings Nos. (23) and (24) above has been satisfactorily completed.

(21) That all work prescribed by Orders Nos. (1), (2), (3), (4), (5), and (6) above shall be completed within six months after date of entry of this order.

(22) That the operator of any well in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, or Sections 1 through 12, Township 23 South, Range 37 East, NMPM, who is planning to cement or recement casing in the Queen and/or San Andres formations, shall notify the Supervisor at least 24 hours prior to commencement of cementing operations, whereupon the Supervisor shall notify the operator of any injection or disposal well within a radius of 1320 feet of said well of the date and hour the cementing operations are to be commenced. The operator of such injection well or wells shall cease injection into said wells at least 12 hours prior to commencement of cementing operations and shall not resume injection for at least 36 hours after completion thereof.

(23) That this case shall be reopened at public hearing in November, 1975, at which time all aspects of the case will be reconsidered, including the possible curtailment or prohibition of underground water disposal in any or all of the three disposal wells described in Orders Nos. (11), (12), and (13) above.

(24) That this order shall remain in full force and effect until further order of the Commission.

(25) That Commission Order No. R-4936, dated December 5, 1974, is hereby superseded.

(26) That jurisdiction of this cause is retained by the Commission for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

PHIL R. LUCERO, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

dr/

OIL CONSERVATION COMMISSION
P. O. BOX 2088
SANTA FE NEW MEXICO 87501

March 27, 1975

Mr. Richard Williams
Arthur D. Little, Inc.
Acorn Park
Cambridge, Massachusetts 02140

Dear Mr. Williams:

Enclosed please find the completed questionnaire which was attached to your letter of February 28, 1975. Because of the complexity of hydrocarbon and associated water production, many of the questions could not simply be answered yes or no. If there are any questions about the responses, please do not hesitate to call upon me.

Further enclosed for clarification, you will find a copy of my letter of February 25, 1975, to Catharine Sanderson of your office relative to this matter, a copy of our Rule 701 relative to injection of fluids into reservoirs, and a copy of our Order No. R-3221.

Very truly yours,

R. L. STAMETS
Technical Support Chief

RLS/dr
enc.

Arthur D. Little, Inc. ACORN PARK • CAMBRIDGE MASSACHUSETTS 02140 • (617) 864-5770

February 28, 1975

Mr. A.L. Porter, Jr.
State Geologist
Oil Conservation Commission
P.O. Box 2088
Santa Fe, New Mexico 87501

Dear Mr. Porter:

Arthur D. Little, Inc., is conducting a study for the U.S. Environmental Protection Agency of the economic impact of the Agency's proposed effluent limitation guidelines for oil and gas well operations. These regulations would require the reinjection of brine produced in association with crude oil and gas at all existing and new wells.

As part of our evaluation of the impact of these regulations on the oil and gas industry, we are compiling present regulations and practices in the various states. From conversations with state agencies and other sources, we have filled out the attached form describing practices in your state. We will be using this information to determine whether there is likely to be any impact from the proposed regulations in the state and, thus, whether we should look more carefully at what the impact will be.

I would appreciate your checking over the form and forwarding any comments or changes to me as soon as possible. There may also be some blanks which I hope you will be able to fill in. In addition, we would like to receive any statistical reports you have on oil, gas, and water production in the state.

Your assistance will be most welcome and will enable us to accurately determine whether the EPA's standard would result in premature well closures or the discouragement of exploration and development projects in your state.

Best Regards,

Richard Williams

Richard Williams

SUMMARY OF OIL FIELD BRINE DISPOSAL REQUIREMENTS

1. State NEW MEXICO

2. Responsible Regulatory Agency Oil Conservation Commission

3. Is reinjection required by state law or administrative regulations?

   a. New Wells (1975 and after) Not exactly
   Depends on area and volume. (See our letter of February 25, 1975)

   b. Existing Wells Not exactly
   As above.

4. In practice, what percentage of oil/gas wells have their produced brine reinjected?

   a. New Wells

   b. Existing Wells

   over 95% of those which produce significant volumes - many wells produce no water or negligable volumes.

5. If brine reinjection is required or allowed,

   a. Must the brine be returned to the producing stratum? No

   b. If not, what are the regulations on the use of other stratum?

   All disposal into SWD wells or waterflood injection wells is below fresh water zones after notice and hearing or administrative approval. Disposal may be into a different zone from the producing zone. Disposal into impermeable salt lakes is after notice and hearing.

   See enclosed regulations relative to administrative procedure.

6. Do state regulations allow disposal of production water into surface streams or other surface bodies of water?

a. Brine Production — no

b. Fresh Water Production

In Southeast New Mexico where over 90% of the total "associated" water is produced, no such disposal is or would be authorized without notice and hearing.

7. If surface disposal of fresh water is allowed, what is the definition of fresh water? by the N.M.

For the purpose of this statute, the State Engineer has designated all waters containing less than 10,000, ppm total disolved solids as fresh water. No produced water in Southeast New Mexico may be disposed of on the surface without approval after notice and hearin In Northwest New Mexico there is no prohibition on disposal of fres water.

Also see response to question 12.

8. Is the disposal of production brine into evaporation ponds allowed by state law or administrative regulations?

a. New Wells — yes - Surface disposal into impermeable ponds or lakes is permitted after notice, hearing, and approval. Surface disposal of negligable volumes of brine is permitted under Order R-3221.

b. Existing Wells — yes - SAME AS ABOVE

Also see response to question 12.

9. As a practice, what percentage of wells have their production brine discarded into evaporation ponds?

a. New Wells — No records as to specific number of wells, however, only 1.5% of total salt water disposal takes place in impermeable salt lakes.

b. Existing Wells

An unknown number of wells are discharging negligable volumes of produced water to pits. See Order R-3221 for definition of negligable volumes.

What percentage of total brine production is disposed of by

a. reinjection over 95%

b. drainage to surface waters None

c. disposal into evaporating ponds? Not ponds. About 1.5% of total disposal is to impermeable salt lakes.

Also see response to questions 9 and 12.

11. What percent of oil production comes from wells whose brine is disposed of by

a. reinjection About 95% of oil production and 55% of gas production is from those counties where surface disposal is prohibited except for negligable volumes or exceptions after notice and hearing.

b. drainage to surface waters
NONE

c. disposal into evaporating ponds?

Unknown

12. Special comments on state regulations or practices:

The requirements for evaporation pits are very strict: the pits must be lined to prevent seepage and observation sumps or systems to monitor the pits. As a result, most producers choose reinjection as a disposal method.

There have been no applications for lined pits since 1967, when the order for monitoring systems was passed. Open unlined pits are prohibited.

A few areas of New Mexico have no fresh water (for example some parts of Chaves and / Counties). In these areas, disposal is primarily to evaporation pits or into natural salt lakes after notice and hearing where it was established that contamination of fresh water would not result. In Northwest New Mexico about 80% of the land is Federal or Indian and is subject to U.S.G.S. regulations prohibiting pollution from disposal of produced waters. Much produced water in this area is as fresh or fresher than the local ground water and surface waters. To date, approximately 46 requests for exception to Order R-3221 have been approved for Southeast New Mexico permitting surface disposal in unlined pits. Each of these requests was granted after notice, public hearing, and presentation of proof that fresh water would not be contaminated thereby. At this time our records reflect that approximately 151 oil wells with monthly

production of about 32,000 barrels of oil are covered under such exceptions.

STATE BRINE DISPOSAL PRACTICES

State	Crude Oil Production 1973 (1,000 Bbl daily)	Reinjection Required		Number of Oil Wells 1973	% Brine Reinjected	% of Wells Whose Brine Is Reinjected	% of Oil Production Whose Brine Is Reinjected
		Existing Wells	New Wells				
• Texas	3,547.0	no	no	159,090	94%	94% or more	94% or more
• Louisiana	2,278.1	no	yes	27,869	35.2%		35.2%
• California	920.8	yes	yes	38,626	over 90%	over 90%	
• Oklahoma	523.8	yes	yes	72,880	100%	100%	100%
• Wyoming	388.8	no	no	7,642	over 50%		
• New Mexico	276.7	partially no	partially no	17,099	over 95%		
Alaska	198.1			192	99% onshore wells	99% onshore wells	99% onshore
Kansas	181.5	no	no	41,520	99%	99.9%	99%
• Mississippi	153.7	no	yes	2,901	80-85%	85%	
Colorado	100.2	no	no	2,004			
Montana	94.8	no	no	3,471	90%	85-90%	
Florida	89.6	yes	yes	147	100%	100%	100%
Utah	89.5	no	no	989	over 96%	90%	
• Illinois	84.0	no	no	24,309	over 50%	80%	
North Dakota	55.4	no	no	1,404	90%	90%	
Arkansas	49.4	no	no	7,232	92%	60%	
Michigan	40.0	yes	yes	3,733	almost 100%	almost 100%	almost
• Ohio*	24.1	yes	yes	15,236	65-75%	65-75%	65-75%
• Kentucky	23.8	no	yes	14,416		over 50%	

*Ohio recently revised its regulations to require reinjection. They are just beginning the enforcement procedure.

Revision Date: 2/27/75

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

CASE NO. 5377
Order No. R-4936

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION ON ITS OWN MOTION TO PERMIT ALL INTERESTED PARTIES TO APPEAR AND SHOW CAUSE WHY THE CONTINUED INJECTION OF WATER FOR SECONDARY RECOVERY OR DISPOSAL PURPOSES INTO ANY FORMATION FROM THE SURFACE OF THE GROUND DOWN TO AND INCLUDING THE DRINKARD FORMATION SHOULD BE PERMITTED IN SECTIONS 13 THROUGH 36, TOWNSHIP 22 SOUTH, RANGE 37 EAST, NMPM, AND SECTIONS 1 THROUGH 12, TOWNSHIP 23 SOUTH, RANGE 37 EAST, NMPM, LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 a.m. on December 3, 1974, at Santa Fe, New Mexico, before the New Mexico Oil Conservation Commission, hereinafter referred to as the "Commission."

NOW, on this 5th day of December, 1974, the Commission, a quorum being present, having considered the testimony and the record, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That pursuant to Order No. R-2633, dated January 16, 1964, and other orders of the Commission, Anadarko Production Company has been and is injecting water into the Queen formation of the Langlie-Mattix Pool for the purpose of secondary recovery of oil in Sections 14, 21, 22, 23, 26, 27, 28, 29, 20, 32, 33, and 34, Township 22 South, Range 37 East, NMPM, Lea County, New Mexico.

(3) That pursuant to Order No. R-2566, dated August 23, 1963, and other orders of the Commission, Petro-Lewis Corporation has been and is injecting water into the Queen formation of the Langlie-Mattix Pool for the purpose of secondary recovery of oil in Sections 19, 20, 29, 30, and 31, Township 22 South, Range 37 East, NMPM, Lea County, New Mexico.

(4) That pursuant to Order No. R-2956, dated August 16, 1965, Order No. R-3208, dated March 17, 1967, and other orders of the Commission, Skelly Oil Company has been and is injecting water into the Queen formation of the Langlie-Mattix Pool for

the purpose of secondary recovery of oil in Sections 31, 32, 33, and 34, Township 22 South, Range 37 East, NMPM, and Sections 3, 4, 5, 6, 8, 9, and 10, Township 23 South, Range 37 East, Lea County, New Mexico.

(5) That pursuant to Administrative Order No. SWD-29, dated September 21, 1961, Skelly Oil Company is injecting water into the San Andres formation for disposal purposes in a well located in Unit L, Section 27, Township 22 South, Range 37 East, NMPM, Lea County, New Mexico.

(6) That pursuant to Administrative Order No. SWD-82, dated October 26, 1968, Agua, Inc., is injecting water into the San Andres formation for disposal purposes in a well located in Unit H, Section 35, Township 22 South, Range 37 East, NMPM, Lea County, New Mexico.

(7) That pursuant to Administrative Order No. SWD-138, dated May 15, 1973, Armer Oil Company is injecting water into the San Andres formation for disposal purposes in a well located in Unit M, Section 2, Township 23 South, Range 37 East, NMPM, Lea County, New Mexico.

(8) That this case was called to investigate the possibility that some of the water being injected into the Queen and/or San Andres formations is not being contained in the formation into which it is placed, but may be in fact migrating into another formation or other formations.

(9) That the evidence indicates that such is the case, and that injected water has appeared and is appearing in formations above the top of the salt section found at a depth of approximately 1300 feet in the subject area, in the salt section from approximately 1300 feet to 2400 feet, and in formations from the base of the salt section at approximately 2400 feet to the top of the Queen formation at approximately 3400 feet.

(10) That there is evidence that some contamination of fresh water supplies in the subject area has occurred.

(11) That the actual avenue or avenues of escape for the waters being injected in the subject area are not now known, but are probably through the bore holes of inadequately plugged or cemented wells.

(12) That further investigation of the avenue or avenues of escape for the injected waters should be made, and to that end a study committee should be appointed to make a thorough and immediate study of the wells in the subject area and to report its findings to the Commission.

(13) That the evidence presently available indicates that the major problem area is confined to the easternmost 24 sections of the area under consideration.

(14) That the evidence presently available indicates that while the injection of water into the Queen formation in the westernmost 12 sections of the area under consideration may be contributing to the problem, this injection is not so serious a threat as injection of water into the Queen formation in the easternmost 24 sections.

(15) That there is no evidence now available to support the theory that water injected into the San Andres formation through the three disposal wells described in Findings Nos. (5), (6), and (7) is migrating upward past the Queen formation and into the formations described in Finding No. (9).

(16) That injection volumes in the secondary recovery areas described in Findings Nos. (2), (3), and (4) greatly exceed reservoir voidage and should be curtailed.

(17) That water injection volumes into the Queen formation in Sections 14, 21, 22, 23, 26, 27, 28, 33, and 34, Township 22 South, Range 37 East, NMPM, and in Sections 3, 4, 9, and 10, Township 23 South, Range 37 East, NMPM, should be limited to 100 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, water, and gas produced.

(18) That water injection volumes into the Queen formation in Sections 19, 20, 29, 30, 31, and 32, Township 22 South, Range 37 East, NMPM, and in Sections 5, 6, and 8, Township 23 South, Range 37 East, NMPM, should be limited to 150 percent of the reservoir voidage from the secondary recovery wells in said area, including oil, water, and gas produced.

(19) That Skelly Oil Company should continue to produce, at its maximum capacity to flow, water currently being produced from its LPG Well No. 3, located in Unit F, Section 27, Township 22 South, Range 37 East, NMPM.

(20) That because of its proximity to the aforesaid LPG Well No. 3, injection of water for disposal purposes into Skelly Oil Company's Eunice GP Well No. 1, located in Unit L, Section 27, Township 22 South, Range 37 East, NMPM, should be limited to gasoline plant water effluent only.

(21) That injection of water into the San Andres formation for disposal purposes into Agua, Inc.'s SWD Well No. H-35, located in Unit H, Section 35, Township 22 South, Range 37 East, NMPM, and into Armer Oil Company's Gulf State SWD Well No. 1, located in Unit M, Section 2, Township 23 South, Range 37 East, NMPM, should continue, at least pending further study.

(22) That workover operations are being and will continue to be conducted on certain wells in the subject area, said workover operations including the cementing or recementing of casing through the Queen and San Andres formations.

(23) That to enable the cement to properly set on said wells, water injection into any well within a radius of 1320 feet of the well being cemented or recemented should not occur for a minimum of 12 hours prior to commencement of actual cementing operations or 36 hours after completion thereof.

(24) That approval of an order embodying the above findings will prevent waste of oil and gas, will protect correlative rights, and will alleviate the contamination of fresh water supplies.

IT IS THEREFORE ORDERED:

(1) That the operator of each secondary recovery injection well in Sections 14, 21, 22, 23, 26, 27, 28, 33, and 34, Township 22 South, Range 37 East, NMPM, and in Sections 3, 4, 9, and 10, Township 23 South, Range 37 East, NMPM, Langlie-Mattix Pool, Lea County, New Mexico, shall reduce the total injection of water into the Queen formation in said sections to an amount equalling the reservoir voidage of the Queen formation by wells under his operation in said sections.

(2) That the operator of each secondary recovery injection well in Sections 19, 20, 29, 30, 31, and 32, Township 22 South, Range 37 East, NMPM, and in Sections 5, 6, and 8, Township 23 South, Range 37 East, NMPM, Langlie-Mattix Pool, Lea County, New Mexico, shall reduce the total injection of water into the Queen formation in said sections to an amount equalling 150 percent of the reservoir voidage of the Queen formation by wells under his operation in said sections.

(3) That the aforesaid reductions in water injection volumes shall take place immediately, and shall take place and continue to take place on as near a current basis as possible, i.e., daily injection rates shall be in the required proportion of daily production rates as nearly as can be reasonably ascertained. In no event shall total injected volume for a given month exceed the permitted volume.

(4) That to calculate the permitted volume of water which may be injected into the Queen formation, produced oil, water, and gas shall be converted to reservoir barrels at the calculated reservoir pressure. Surface barrels of injection water shall be in the permitted proportion to reservoir barrels of voidage. The operator's Monthly Injection Report, Form C-120, shall be accompanied by the operator's calculations of reservoir voidage.

(5) That Skelly Oil Company shall produce its LPG Well No. 3, located in Unit F of Section 27, Township 22 South, Range 37 East, NMPM, at the capacity of the well to flow water.

(6) That Skelly Oil Company shall not dispose of any waters other than normal gasoline plant water effluent into its Eunice GP Well No. 1, located in Unit L of Section 27, Township 22 South, Range 37 East, NMPM.

(7) That Skelly Oil Company, Agua, Inc., and Armer Oil Company are hereby authorized to continue the disposal of water into the San Andres formation in their disposal wells located in Unit L of Section 27, Township 22 South, Range 37 East, NMPM, Unit H of Section 35, Township 22 South, Range 37 East, NMPM, and Unit M of Section 2, Township 23 South, Range 37 East, NMPM, respectively.

(8) That the operator of any well in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, or Sections 1 through 12, Township 23 South, Range 37 East, NMPM, who is planning to cement or recement casing in the Queen and/or San Andres formations, shall notify the Hobbs district office of the Commission at least 24 hours prior to commencement of cementing operations, whereupon the District Supervisor of the Commission shall notify the operator of any injection or disposal well within a radius of 1320 feet of said well of the date and hour the cementing operations are to be commenced. The operator of such injection well or wells shall cease injection into said wells at least 12 hours prior to commencement of cementing operations and shall not resume injection for at least 36 hours after completion thereof.

(9) That the Secretary-Director of the Commission is hereby directed to appoint a study committee to further investigate the condition of all wells in Sections 13 through 36, Township 22 South, Range 37 East, NMPM, and Sections 1 through 12, Township 23 South, Range 37 East, NMPM, particularly with respect to casing, cementing, and plugging. Said committee shall report its findings to the Secretary-Director in accordance with a time schedule designated by him, and the Committee shall also make recommendations as to the proper remedial action or actions which should be taken or required.

(10) That this order shall remain in full force and effect until further order of the Commission.

(11) That jurisdiction of this cause is retained by the Commission for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

I. R. TRUJILLO, Chairman

ALEX J. ARMIJO, Member

A. L. PORTER, Jr., Member & Secretary

S E A L

jr/

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
December 3, 1974

COMMISSION HEARING

IN THE MATTER OF:

The hearing called by the Oil Conservation Commission on its own motion to permit all interested parties to appear and show cause why the continued injection of water for secondary recovery or disposal purposes into any formation from the surface of the ground down to and including the Drinkard formation should be permitted in Lea County, New Mexico.

CASE NO. 5377

BEFORE: A. L. Porter, Jr., Commissioner
Ralph Trujillo, Commissioner

For the New Mexico Oil Conservation Commission

Thomas Derryberry, Esq.
Legal Counsel for the Commission
State Land Office Building
Santa Fe, New Mexico

and

William F. Carr, Esq.
Legal Counsel for the Commission
State Land Office Building
Santa Fe, New Mexico

For Anadarko Production Company

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Santa Fe, New Mexico

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APPEARANCES continued:

For Skelly	Chester E. Blodget, Esq. Tulsa, Oklahoma
For Texas Pacific Oil Company	John F. Russell, Esq. Roswell, New Mexico
For Petro-Lewis Corp.	Don Stevens, Esq. Santa Fe, New Mexico
For Agua	James T. Jennings, Esq. JENNINGS, CHRISTY & COPPEL Roswell, New Mexico

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MR. PORTER: The hearing will come to order. Let the record show that we have reconvened at Room 336 of the State Capital Building for the purpose of hearing Case No. 5377.

MR. DERRYBERRY: In the matter of the hearing called by the Oil Conservation Commission on its own motion to permit all interested parties to appear and show cause why the continued injection of water for secondary recovery or disposal purposes into any formation from the surface of the ground down to and including the Drinkard Formation should be permitted in the following described area in Lea County, New Mexico: Township 22 South, Range 37 East, NMPM, Sections 13 through 36: all; Township 23 South, Range 37 East, NMPM, Sections 1 through 12: all.

MR. PORTER: Before we get into testimony, the Commission would like to call for appearances.

MR. KELLAHIN: Jason Kellahin, of Kellahin and Fox, Santa Fe, appearing for Anadarko Production Company, in association with Mr. Irley Bonnette, a member of the Texas Bar. I also wish to enter in appearance for Skelly Oil Company in association with Mr. Chester Blodget, who is a member of the Texas and Oklahoma Bars. Mr. Blodget will present the case for Skelly.

MR. PORTER: Thank you.

MR. RUSSELL: John F. Russell, of Roswell, appearing on behalf of Texas Pacific Oil Company.

MR. STEVENS: Don Stevens, Santa Fe, New Mexico, appearing on behalf of Petro-Lewis Corporation.

MR. CARR: William F. Carr, appearing for the Commission.

MR. JENNINGS: James T. Jennings, of Jennings, Christy, and Coppel, Roswell, appearing on behalf of Agua.

MR. PORTER: Anyone else?

MR. KALTEYER: C. F. Kalteyer, Gulf Oil Corporation. I have a statement.

MR. FRANTZ: Lavele Frantz, of the Phillips Petroleum Corporation. I probably will have a statement also.

MR. STUMHOFFER: C. W. Stumhoffer, of the Armor Oil Corporation, and I probably will have a statement.

MR. LYON: Victor T. Lyon, Continental Oil Company. We may wish to enter a statement.

MR. PORTER: Anyone else?

Mr. Carr, would you like to go forward with your testimony?

MR. CARR: I have a witness to be sworn at this

time.

MR. PORTER: Have him stand, please.

JOE T. RAMEY

called as a witness on behalf of the New Mexico Oil Conservation Commission, first being duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. CARR:

Q Would you state your name for the record?

A Joe T. Ramey.

Q By whom are you employed and for how long have you been employed?

A I am employed by the New Mexico Oil Conservation Commission as a District Supervisor at Hobbs, New Mexico, and I have held that position for something over 15 years.

Q Mr. Ramey, as a District Supervisor, have you been called upon to testify before the Commission in District Court matters appearing as a petroleum engineer?

A Yes, sir, I have.

Q Are you familiar with the subject matter of Case 5377?

A Yes, this is a hearing to permit all interested to show cause why continued injection for secondary recovery disposal should be permitted in Township 22 South, Range 37 East, and Township 23 South.

MR. CARR: At this time, may it please the Commission, I tender Mr. Ramey as a qualified petroleum engineer.

MR. PORTER: The Commission considers Mr. Ramey qualified to testify in this case.

BY MR. CARR:

Q Mr. Ramey, will you give the Commission a brief history of the situation in the problem which has caused the Commission to call this hearing, and feel free to refer to Exhibit No. 1 so you can show the location of the various trouble spots.

A I think first that the problem here is that the injection of water for secondary recovery or disposal purposes in this area has resulted in migration of water from the disposal and injection intervals into shallow water intervals into the fresh water sands and has resulted in contamination of fresh water in the area.

This problem was first brought to the attention when Mr. Sims, who lives near Eunice, New Mexico, reported

contamination of fresh water in a well of his that is used for watering stock. This well is located in Eunice of Section 22 of 23 South, Range 37 East, and it is indicated on Exhibit No. 1 as a dry hole. This was an oil well drilled by Intercoast and J. C. Clower some years back, and I don't know the status of the plugging or anything as our records are incomplete on the well. It was converted by Mr. Sims to a water well, and Mr. Sims reported that this well had turned salty, and it was almost overnight after Armor treated the well that he had drilled in the same forty acres approximately 300 feet in the water well.

We took a sample of the water from the well and we found chlorides in excess of 80 thousand parts per million, where near 200 had been the figure for water, fresh water, in the area; so there is no doubt the well was contaminated in some way from somewhere. Immediately we checked Armor's well in the same forty, and we found a full stream of salt, 2 inch saturated salt water, coming from the bradenhead to the surface, and we requested Armor to immediately enter the well and run a temperature survey to determine where the water was coming from. The temperature survey indicated water entering the well about 2600 feet near the base of the salt section in this area going up the well bore outside of

the 4½" pipe to around 400 feet where it was then going out into the Formation at 400 feet. The water was then coming into the surface, so, as we stated, the water at that time was well over 500 barrels a day, and the water flowed to the surface of the ground and the pressure in the well built up to 400 pounds immediately and they opened up a full 2" string saturated salt water. We requested Armor to go in and repair this well because we couldn't permit the water, this saturated salt water, to be going out into the fresh water sand at 400 feet, and we evidently had reached the shallow water which is in the neighborhood of 100-plus feet in the area in at least this No. 1 well, the Sims well.

Armor, after some $80,000 and several cementing jobs, did manage to shut off the flow of water from 2600 feet upwards, and so we projected (protected) fresh water, but they were never able to squeeze off the water flow at 2600 feet. It was moving water and it is tremendously hard for cement to set up in this area in moving water.

Due to the proximity of this well to Skelly's Penrose "A" Unit, we requested that Skelly conduct tracer and temperature surveys on all of their injection wells in the unit, which they did. We found several wells where water was channeling, and we wanted it to go into the injection

interval, and at least three wells where water was channeling above the injection interval. Just how high to turn it on on the pressure surveys, we did find three wells which Skelly promptly repaired. During all of this time, we were checking to see the extent of these water floods plugs and the more we checked, the more we would find that Skelly, who was drilling wells in the Unit, encountered water flows in the well unit "L" of Section 3, 23 37. The well in "M" of the same Section, the well in "H" of the same Section, of course, we found water flows in the Armor flow well, and the water flowed into the Armor well in Section 2 in Unit "M" of Section 2, and as we checked further on this, we found more water flows in and around the area of Anadarko's water flooded Langlie-Mattix Penrose Sand Unit where it first came to our attention where Skelly reported to us that they had been encountering some unusual pressure in their LPG Storage Wells which they operated in conjunction with the gasoline plant which was located in Section 27, which is approximately in the middle of Anadarko's water flood. They normally carried 600 pounds pressure on the well, so they unloaded the LPG that they stored in the well and shut the well in, and there was a pressure build-up of about 1700 pounds. Since these wells are completed in the

salt section, they are actually washed cavities in the salt section, and since the top of the salt is around 1200 feet, they were afraid that with 1700 pounds surface pressure, the hydrostatic head of the water at or near the rupture of the overburden pressure, we were afraid that they might have some salt sections in the area. They were producing the water from this well, and their production rate is fluctuating around 350 to 1400 barrels of saturated brine water a day. They were then, in turn, injecting into their salt water disposal well. This LPG well is in Unit E of Section 27, so at this time they requested Anadarko to run tracer and temperature surveys, and they commenced work on the first of August and are still working on obtaining the surveys. They seem to be going extremely slow. They have been having well trouble in some instances, and they have cleaned out the well and back-flowed it and then there are equipment problems also.

Further, investigation has indicated water flows in this well in Unit I of 26 of 20 to 37, these wells were wells in which they encountered water flows in drilling or at some later date the wells in this area, the waterflows encountered during the drilling of the wells in this area have been encountered after completion of the wells. Some

of the wells have produced. Sometimes the operators needed pressure on the bradenhead between the surface string and the production string.

MR. NUTTER: By saying the wells in the area, the water encountered during drilling, do you mean the southernmost area in the Section?

MR. RAMEY: In Section 22 and 23.

MR. NUTTER: Which is the water you encountered during the drilling operations?

THE WITNESS: Yes, sir.

MR. NUTTER: Do you mean subsequent to the well being drilled?

MR. RAMEY: Yes, sir, that is right.

A (Continuing) There are three wells in 24 and a total of six wells in Section 23. Now, we have in October of this year, the Commission staff and Skelly and Anadarko had a meeting in Hobbs in which we went over some of these problems. At that time we suggested that Skelly re-enter two 22 dry holes in this Unit, being wells in Section 3, and one in Unit E, and the other in Unit J of Section 23, 37, and probably plug the wells. We felt that those dry holes would not contain any injected water into the interval, and we requested Anadarko to enter a well that was drilled by

Elder and Willingham in Unit B of Section 34, Township 22, Range 37 East, for the purpose of properly plugging this well. Skelly had agreed to do this work. Anadarko has re-entered their well and they are in the process of cementing or getting close to cementing the well, or properly plugging it at this time.

Also, at that meeting I advised both Skelly and Anadarko that I would write to the operators of the deeper wells in the area where the wells were inadequately cemented, to contain the water in either of the San Andres or the Queen Formation. To clarify, we have three disposal wells in the area that are disposing water into the San Andres, and the Agua well in Unit H of 35, 2237, and the Skelly well in Unit L of 2722, 37, and the Armor well in Unit M of 22, 2337, these are disposal wells for the production of water and the injection interval for the four floods in question, which are the Skelly Penrose "B", which is the southwesternmost flood, and Skelly Penrose "A", the southeasternmost flood, and Anadarko's Langlie-Mattix Penrose Sand Unit, which is the northern flood, and the Pete Lewis flood, which is to the northwest. These injection intervals in these floods, these are primarily the Queen Formation, and probably portion of Seven Rivers, which is the vertical

limit of the Langlie-Mattix Pool.

So, anyway, I wrote several operators in the area stating that their deeper wells did not have adequate cementing to cover these injection and disposal intervals, and it would be necessary for them to go in and locate the top of the cement, perforate and bring cement back either to tie it into the next string of casing or into the salt section, whichever was deepest.

Now, I think that Continental has gone down to work on the well. Skelly has indicated that they would be the only operator that has indicated that they would not do this work. Amerada, I had written them about the wells in Section 22, and they wrote me back and said that at the time the wells were cemented that they had been approved by the Commission and they felt that they were adequate, and that they had no problem of waterflows, and so they didn't feel it was necessary for them to do the work. Also, John Hendrix, on one of these wells, we just had to pick the best well and he didn't want to do the work, but if so ordered to do so, he would demand a hearing before he did the work, and he would only do the work after he was heard by the Commission. Texas Pacific in the Northeast Quarter

of 23, the map fortunately shows Amerada, that this quarter section does belong to Texas Pacific Oil Company, and it is indicated that they would plug some of their wells in the area and repair others, but then they started to work on their well No. 4, and they found water flow outside of the surface pipe in this well. They attempted to plug the well, and to date have been unsuccessful in shutting off this water flow outside the surface pipe, and if the water is busted through out the surface pipe, it is going through and probably into fresh water in the area, so basically that is the problem. I think that covers it.

Q Do you have any further testimony that you would like to make in regard to Exhibit No. 1?

A I do have some completion cross sections which are Exhibit Nos. 2 and 3, labeled here A' and B, and B' which I will go into now. These are, as I say, completions showing a cross section which I will illustrate with various types of completions and plugging plans that we have in this area. On this I have placed some possible water flows that could be going in this area to account for the contamination we have had. Starting over on the left, two injection wells in the waterflood. This water is in-

jected into the Queen Formation, and in the meantime, you sand and dress the top approximately 200 feet here at below the Grayburg, so you have a San Andres approximately through there, and your water is contained as it flows to the right. It is contained in the Queen, and then when it reaches the well such as this, the Amerada Hess-Wood 9, it can, because of the inadequate cement, migrate up to approximately 2700 feet over the base of the next string of casing. Then, again, it will progress until it hits another well bore such as this Atlantic-Boyd 4, and you have casings similar near the top of the salt, so now we have it to the top of the salt section, and then it progresses until it is at a well which was plugged some years back. This well has a 10-sack plug and a 2600-ton-sack plug and 1200 feet with casings stuck off, so it really moves to prevent the water migrating clear to the surface in the casing, but we will bring it on through here and we come over to this Texas Pacific-Boyd 4, and it has a casing set at 564 feet. If there is enough pressure, or any pressure as we experienced on some of these other wells, from there it is very easy to bring it to the surface, or it could progress over to this well where the casing happens in the well at 2160, and so a 15-sack plug was placed above the collapse, and a

pipe unscrewed at 344 feet, and a 17-sack plug put there and a well such as this would certainly hold much pressure. You can trace the water from the disposal interval which is here in the injection interval, and you just pretty well can trace it through the well up to the surface of the ground, or within 200 or 300 feet of the ground, with any pressure at all going to break through. I want to stress that I am not saying this has happened. It possibly could be happening. I kind of feel that probably it is happening in some manner along this way.

Exhibit 3, which is B, B' which is more or less north-south -- I don't know -- it goes into quite a bit of detail on this, but in this case on the left side of the Exhibit you have an injection well here at the disposal well.

Q Would you give the name of those wells?

A Yes. The injection well is the Anadarko Langlie-Mattix Penrose Sand Unit in Tract 37 No. 1, and the disposal well is the disposal well of Skelly's that is operated in conjunction with their gasline plant in Section 2237, but water injection into the Queen Formation can go to this dry hole, which is drilled down to some 6000 feet with a 20-sack plug in the bottom, and a 20-sack plug at

2022 feet, and from there the water hits this well bore and goes anywhere in the San Andres Disposal. The water in the well bore goes anywhere, and this could be siphoning prior to conducting, or coming on the LPG well into the disposal or into the dry hole back to the storage well. It is very remote.

On the right,side, this is some more of the same. These are two Skelly wells that we felt were inadequately plugged to contain water into the injection-well interval. These are both wells which are offset by injection wells, so the water is injected into this Penrose "A" Unit No. 26, and it can go to the Ellen Sims No. 6 and hit the well bore, and go up to the depth of 2790, and from 2790 with 2000-plus pounds of injection pressure, it could easily break this up into your 2600. This is the Armor Sitgo State where we found the water bringing in at 2600, and going out at 400 up to the surface also.

Going this way to the other dry hole, which is Sims No. 2, the water can go up to 2790 where the injection plug is set, and come over offsetting the injection well which has a 7-inch line at about 3400 feet, cemented with 200 sacks. Out of this well it goes over to the well where we have a 7-inch line set at 3450 sacks, which is probably not enough to bring the cement back to, say, the level where it

shows the water entering, so you have actually water entering and going down into the injection well and hitting the dry hole and going into the injection well. It goes up to 1100 feet through the injection string of casing which is set there by charging all zones in this interval.

I think these things could be happening. I am not saying it is this way. I feel that it is something which is similar to what is illustrated on these two cross sections, that is what is happening in this area. This water is escaping out of the disposal and injection intervals, and is getting into the shallower zones.

Q You indicated four water floods involved in the area. Would you refer to each and indicate on what date the injection was started, the cumulative water injected to date, the injection pressure, and the daily average amount of water injected?

A Okay. We have Skelly Penrose A Unit, which is the southeastern unit on Exhibit A. The first water injected was in June of 1958. The cumulative water injected through July is 21,750,000 barrels. The daily injection is about 9300 barrels a day. The maximum pressure is 2000 psi at the surface. Skelly Penrose B Unit, the first injection was in July of 1965. They injected slightly over 20

million barrels of water. They were injecting 6400 barrels a day, and the injection pressure, the maximum was 2100, and then in Anadarko Penrose Unit, the first injection was February of 1958. They injected very close to 43 million barrels. Their daily average injection is 2100 in Section 21, and 100-barrel maximum pressure was 2300 pounds. Petro-Lewis in State "M" flood, the first injection was in November of 1963. They had injected around 16 million barrels, with a daily average of around 5000-barrels, and with a maximum pressure of 1915.

Q Would you give the same data on the well involved on the Agua No. 35 salt water disposal well?

A The first disposal was in February of 1969 and they have disposed of some 27,750,000 barrels at the daily rate of 5000 barrels a day, and at a maximum pressure of 1700 pounds. Skelly's salt water disposal well, the first injection was November of 1966. They have disposed of nearly 4 million barrels at 1500 barrels daily, with an indicated pressure to 1855 pounds. The Armor-Gulf State No. 1, was first started in May of '74 and the first injection was by Armor. However, this well had been used for a short period by trucker's for disposal prior to this for this essential purpose in May of '74. The first injection, they

first injected 45,431 barrels, and their daily average of water injected was 4000 at 1200 pounds.

Q Mr. Ramey, are you prepared to make a recommendation to the Commission as to how they are to deal with these problems?

A Unless the operators here today can assure this Commission that this continued injection of water into the area will not result in further contamination of fresh water, I would have no choice but to recommend that all injection cease in the area.

Q Do you have anything further to add to your testimony?

A No, sir, I have nothing else.

Q Were Exhibits No. 1, 2, and 3 prepared by you and under your direction or supervision?

A Yes, sir, they were.

Q At this time I would offer the Oil Conservation Commission's Exhibit 1, 2, and 3.

MR. PORTER: Without objection, those Exhibits will be admitted.

MR. CARR: We will make Mr. Ramey available for cross examination.

CROSS EXAMINATION

BY MR. NUTTER:

Q Could you give us the amount of water which is involved in the current injection?

A I didn't bring that, Mr. Nutter, but as you know, I can probably get the Statute on it, which is in front of you.

Q I was just wondering; I have got them.

A I am aware that this shut-down of the injection well into the disposal area would be quite drastic in so far as oil production is concerned.

Q I was just wondering how the injection compares with the rate of production; do you have a general idea?

A I don't remember that, Mr. Nutter.

CROSS EXAMINATION

BY MR. STEVENS:

Q I would like to point out that I am representing Petro-Lewis, and the flood is in the extreme western portion of the area that we are concerned with here, and our contention is we have to get to different areas to work with here, and in that connection I would like to use your figure of maximum

pressure of these various floods, such as in the Anadarko, for example, which is to the east of the Petro-Lewis which you stated had 1500 pounds pressure. At the time it was 1915 pounds maximum pressure, and since Petro-Lewis lies west of Anadarko, and the problem area is in the Anadarko area to the east, is it possible that in your opinion that Petro-Lewis could contribute to the problems you experienced in the east since Anadarko's pressure is higher?

A Well, I will say, Mr. Stevens, that we have found no indication of any water escaping from the injection interval into the Petro-Lewis or the Skelly Penrose "B".

Now, there were three contributing -- I don't know -- water flows in strange manners: If it gets into this zone that is at the base of the salt, it would seem to spread out; it seems to dig itself a pipeline.

Would it be possible for, say, 1900 pounds of pressure in the Petro-Lewis area to contribute 2300 pounds to the Anadarko area farther east to your problem area?

A Well, of course, these maximum pressures, I am sure Anadarko's area where they have injection under 1900

so this is the maximum. Just to find the maximum pressure on a given well, so to say that Anadarko area has 2300 pounds of pressure, that is the highest of 1900, and we can't say that you might have a well here that has 2300 pounds or you might have here a well that has 1500 pounds. You have to have a well that has 1900, so you could, in general, if there was much water moving from here to here, there is no indication that this contributed to the problem in here.

Q In your opinion is it the primary -- not the total -- problem, but the primary problem caused by additional deep wells with possibly uncemented casing or casing that has been washed around by the injection water?

A I think it is probable that some your wells in this area, the new completions, but the majority of the old Drinkard wells which were drilled in the 50's --

Q (Interrupting) I am not suggesting that there is no possible problem on the west side. With the lack of deep wells on the west side, it may be a factor in the possibility of pollution.

A Yes, sir, I am sure it would be, I feel a lot more confident there is no deep production over here, and that the water is staying in the injection intervals.

MR. STEVENS: Thank you, Mr. Ramey.

MR. PORTER: Does anyone else have any questions of Mr. Ramey?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Ramey, in the answer to Mr. Stevens, do you feel that the distance of improperly cemented deep wells is a major factor in the contamination?

A Yes, sir, I sure do, Mr. Kellahin, I very definitely do.

Q Your recommendation is that injection, unless we come up with something else, injection should immediately be curtailed or discontinued, and that would mean production would also be discontinued in the area, would it not?

A I am afraid it would. It is a little hard to dispose of water.

Q Do large volumes of water have to be disposed of?

A Yes, sir.

Q In that connection, just by shutting down the reservoir, that would be effective, and you would still leave the pressure up and have no relief, isn't that correct?

A I think that when you shut it in, Mr. Kellahin,

I mean, my theory -- as you know, I am not a hydrologist -- is that the water in the higher zones would seek a level, and that would continue to move out until they have attained zero pressure.

Q Would it be a better approach to attempt to reduce the pressures?

A Well, this could be done if you continually were injecting into a leak. You can inject one spot and take it out, and what essentially Skelly is doing there is relieving the pressure, and probably where the water has been broken through the base of the salt into the cavity reducing pressure, and something is feeding down the line, and the flow doesn't seem to be diminishing much.

MR. KELLAHIN: Thank you, sir.

BY MR. PORTER:

Q You referred to the volume of water being removed on a daily basis.

A From there to the LPG, I meant the storage well.

MR. PORTER: Does anyone else have a question of Mr. Ramey?

CROSS EXAMINATION

BY MR. STUMHOFFER:

Q I am C. W. Stumhoffer of the Armor Oil Corporation, and I just wanted to question you about something where you made a statement in your testimony that before the days of disposal of the Armor's well, I believe, you said 400 --

A (Interrupting) 200, I am sorry.

Q It should have been 400, it is about 200, right?

A The last figure I had was 4.

Q Well, to go to the vacuum, when we were not disposing, I just thought I would like to mention that.

A Pressure is 1200 while you are disposing, and when you're not disposing, it goes to zero.

Q Yes.

A That is interesting.

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Ramey, is there any indication that there were water flows in the formation before these various projects of disposal production were started?

A Somebody brought up yesterday that we had a little discussion with some operators yesterday afternoon that Texaco had encountered tremendous water flow when drilling a

well down Section 16 of 2337. However, I checked the well files, and I vaguely remember something to the effect that back before I went to work for the Commission, I checked the well files in our office here, and I could find nothing in any of the Texaco wells that indicated this. I do remember something along this line; perhaps somebody else has some definite information on it.

Q Apparently, when drilling the old Drinkard wells, they didn't have a big problem.

A No, not to my knowledge, and I should point out that up here the Texas Pacific, in that area they encountered error in the salt section, and had at least two wells blew out. This Number 4 well, where the water was breaking through this well, it blew out several times when we were drilling. We managed each time to blow the red bed, and it would cave in, and they were planning to get 564 feet of casing into the hole, and they cemented 1000 sacks of cement, and when I checked the top of the cement, they only had 100-foot fill up on it, so we have got a tremendous cavity of some kind back in there, and this has been indicated in this other well. This well of Sinclair's, Sinclair drilled it to the cross section, and it also encountered air in the salt section. They set 958 feet, and this was 2900 feet and

it was perforated with 1000 sacks of cement, and then they came up and perforated at 950 feet and squeezed 2570 sacks of cement into that perforation, and before they could complete the casing, it collapsed at 2160, so there is something in that area. But it was an error in this case, and there have been occasions where the water has been encountered in a salt section in this particular area, and the only one is this rumored Texaco well.

Q It appears that these various water flows must be diminished and halted, and adequate repairs on a number of them should be made.

A I would think so. There is, from what I have seen, Texas Pacific is trying to squeeze off this No. 4 Boyd, and from Armor attempting to squeeze off this Sitgo State and pump cement in, and it just flows down the river.

Q Some of these injection pressures, the maximum pressures of 2300 pounds, what depth are they injecting into?

A You are looking at the interval 34 to 3700.

Q Would you make the bottom pressure something like 3000 pounds? I may be a little high on that.

A It is probably another 1400 pounds, so you are looking at about 3700 pounds less 46. Whatever that would be, it is not excessive at that depth. It looks pretty

excessive to me.

Q It is not as much above what you would expect as you get indication from this Skelly well of 1700 pounds, but 1200 feet.

A Right, yes. It is 3700 pounds at 3700 feet, and it is probably safer at 1700 pounds than at 1200 feet.

Q Do you think you might accomplish any pressure relief in these reservoirs by producing them and reinjecting only the produced water -- say -- selectively in the project?

A That would be a possibility.

Q Perhaps if you stayed away from the east side of the area, however, that may be a factor in staying away from the dry holes, away from the edges where there may be some deeper wells, until these wells are repaired, if they are repaired.

MR. KELLAHIN: Thank you.

MR. PORTER: Are there any other questions of Mr. Ramey?

The witness may be excused.

(Witness sworn.)

DANIEL S. NUTTER

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CARR:

Q Would you state your name for the record, please?

A Dan Nutter.

Q By whom are you employed and how long have you been employed in this position?

A New Mexico Oil Conservation Commission, Chief Engineer, approximately 17 years.

Q Mr. Nutter, as Chief Engineer of the Commission have you been called upon to testify as an expert petroleum engineer before the Commission and in the District Court?

A Yes, sir, I have.

Q Are you familiar with the subject matter of Case 5377?

A Yes, I am.

MR. CARR: I tender Mr. Nutter as an expert petroleum engineer.

MR. PORTER: Mr. Nutter's qualifications are

acceptable.

BY MR. CARR:

Q Mr. Nutter, would you explain the data you have on the rate of injection in the various water-flood projects and disposal wells and indicate how this data relates to the rate of production from the pools involved?

A Yes, I will. First we have previous testimony that says there are three water-disposal projects in the area; presumably there is no production from those water-disposal projects, so everything that goes in is in the reservoir or in a reservoir. The four water-flood projects that are operating in the area, though, which is under consideration, I have August production and injection figures here which I would like to testify to. The Anadarko Langlie-Mattix Penrose Sand Unit in the month of August, 1974, produced 55,937 barrels of oil, 264,172 barrels of water, and 22,341 mcf of gas. This gives us a total fluid produced, or liquids produced, of 310,109 barrels of oil and water and the 22,341 mcf of gas. Against this was injected 601,965 barrels of water. Now, I don't have a conversion figure at hand and I have not converted this gas produced into barrels of reservoir space, however, 22,341 mcf of gas is not

going to occupy a great deal of reservoir space when we consider that injection pressures being as high as they are, we know that the reservoir pressure is rather high, because the Anadarko Project, as Mr. Ramey testified, is injecting at a maximum pressure of 2300. This plus the hydrostatic head is going to give you a fairly high reservoir pressure in there and the 22,341 mcf of gas converted to barrels at that pressure is almost negligible. So, we have an injection-production ratio of 1.9 to 1 in this particular flood. In other words, almost twice as much is going in as is coming out.

The Petro-Lewis flood, in the month of August, produced 14,631 barrels of oil, 115,351 barrels of water, for a total liquid production of 129,982 barrels. This was accompanied by 27,260 mcf of gas. The liquid ratio again, without converting the gas into barrels, would be -- there was injected 152,838 barrels of water, so the liquid injection-production ratio is 1.2 to 1, which is just a little more than 1 to 1, of course.

The Skelly Penrose "A" Unit, in the month of August, produced 41,567 barrels of oil, 115,854 barrels of water for a total liquid production of 157,421 barrels.

This was accompanied by 8631 mcf of gas, a negligible amount. Injection totaled 272,780 barrels of water. The ratio of injected fluids to produced liquids is 1.7 to 1 in this project.

The Penrose "B" Unit operated by Skelly in the month of August had 7174 barrels of oil produced, 96,398 barrels of water produced for a total liquid production of 103,572. This was accompanied by 2607 mcf of gas. There were 167,829 barrels of water injected in the project. The injection ratio of liquids to liquids is 1.6 barrels of liquid injected to 1 barrel of liquid produced.

Now, it appears that each of these floods, with the possible exception of the Petro-Lewis, is far exceeding the amount of withdrawals if we consider the amount of injection taking place. After fill-up is achieved on a water-flood there is no real necessity for exceeding the rate of production by the injection rate. Of course, prior to fill-up you do have to because you have a void in the reservoir that must be filled. But, if you exceed it, without increasing the reservoir pressure, the liquids have to go somewhere. This may be the problem that we've got here.

MR. CARR: I have no further questions of this Witness.

MR. PORTER: Does anyone have any questions of Mr. Nutter? The Witness may be excused.

Mr. Kellahin, do you have some testimony that your client --

MR. KELLAHIN: (Interrupting) Mr. Porter, we have two witnesses that I would like sworn.

MR. PORTER: Do we have anyone else that desires to present testimony in this Case? If we do, let's have all the witnesses stand and be sworn at this time.

(Witnesses sworn.)

FARRIS NELSON

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Farris Nelson.

Q Mr. Nelson, by whom are you employed, and in what position?

A I am employed by Anadarko Production Company as Area Engineer in the Eunice Area.

Q Where are you located?

A I live in Hobbs.

Q Have you ever testified before the Oil Conservation Commission?

A No, I have not.

Q For the benefit of the Commission would you briefly outline your education and experience as an engineer?

A Yes. I have a BS in Petroleum Engineering from the University of Oklahoma; I worked --

Q (Interrupting) When was that?

A 1954. I worked for three years with Gulf Oil Corporation and the last 17 years with Ambassador Oil and its subsequent owner, Anadarko Production Company.

Q Have you been working during all this period as an engineer?

A Yes.

Q Working with Ambassador, did you have anything to do with the institution of what is now known as the Anadarko Penrose Sand Unit Waterflood Project?

A Yes, I have worked on that project for the last 13 years.

Q And you are familiar with the wells in the

project and the injection that has been made in it?

A Yes.

Q And other details?

A Yes, I am.

MR. KELLAHIN: Are the Witness' qualifications acceptable?

MR. PORTER: Yes, they are.

BY MR. KELLAHIN:

Q Mr. Nelson, referring to what is marked as Anadarko's Exhibit No. 1.

(Whereupon, Anadarko's Exhibit No. 1 is marked for identification.)

Q (Continuing) Would you identify that Exhibit and discuss the information that is shown on it?

A Yes. This Exhibit shows the Anadarko Langlie-Mattix Penrose Sand Unit and further it shows other leases in the area outside of the Langlie-Mattix Unit which is operated by Anadarko.

Q Are those the areas colored in yellow?

A Yes.

Q What is the significance of the red outline?

A The red outline is the area being considered

in this hearing.

Q That is under the Commissions advertisement on this particular hearing?

A Yes, that is correct.

Q Now, you heard the testimony this morning that Anadarko was asked to make a survey of all their injection wells. Has this been done?

A The job hasn't been completed. We received directions from the Oil Commission in July of this year to commence in injection profiles to include temperature surveys and radioactive tracers on all injection wells operated by Anadarko. I might state that there are 49 injection wells in the Langlie-Mattix Unit, there are two injection wells outside of the Unit on leases operated by Anadarko. To date we have completed 31 of the surveys; we have, as Mr. Ramey pointed out, it has been progressing rather slowly and I will try to point out some of the reasons for that. We have completed 31 of the surveys with no indication of problems. Let me digress just a minute and say that the purpose of these surveys was to try to show that there was or there was not fluid movement out of zone, out of the Queen's section, around the casing shoe vertically into

the other zones. We have completed 31 of the surveys with all in good order. We have six of the wells that are ready to survey as soon as the surveying company can get to those. We have four wells that we'll have to pull the tubing on to move tubing obstructions. There are nine wells that we have fill-up in the open hole section and this must be cleaned out.

Now, part of the delay in completing this work has been in the cases where work had to be performed either to remove tubing obstructions or to clean out the wells. When you start to go into a well to pull the tubing, it generally takes one to two weeks to bleed the pressure down sufficiently that a pulling unit can move in and pull the tubing. Then, equipment has been a problem too. Pulling units just haven't been available. We've had anywhere from one to three units working on this project and we would have had more except they just were not available. Then I would like to mention on one of the wells, the only well on which we found a problem, was the Langlie-Mattix 4-3, which is located in Section 22, Unit F. This survey did indicate a leak around the casing shoe. That leak has been repaired and it has been resurveyed and the second survey was

satisfactory. This is the only well in all of the 31 wells that has shown any problem, any indication, that they could be contributing to the problem. Now, we did find a casing leak in 13-B-2 and 35-2.

Q Would you locate those wells, please?

A All right. 13-B-2 is located in Section 27, Township 22, Range 37, in Unit B. 35-2 is located in Unit H in Section 33, same township and range. The casing leak in 13-B-2 was at a depth of 2480 feet. This leak was coming back into the casing, was a result of the problem, not contributing to the problem. It has been squeezed and repaired. We currently are working on the 35-2.

The only other well that indicated any problem on the survey was Well No. 7-3 located in Section 21, Unit B, same township and range. This well indicated a water flow between the surface casing and production casing from a depth of about 1350. This has been cemented off and the water flow has been stopped.

Q Was this water flow occasioned by the 7-3 well or is it a result of water coming into that formation from elsewhere?

A No, the survey on 7-3 indicated there was no

problem with the casing shoe on that well. The water that was being injected was going into the correct formation; as far as the survey was concerned it was staying in that formation.

Q What do you think was the cause of the water flow?

A The water flow had to be coming from the zone that was pressured out by some other source.

Q Now, did you find any temperature anomalies in connection with your survey?

A Yes. We found several wells that indicated temperature anomalies. These ranged from about 2900 feet up generally to about 2300 feet.

Q What is the significance of the temperature anomaly?

A The temperature anomaly indicated that there was a fluid movement outside of the wellbore that changed the temperature gradient different from what it normally should have been.

Q That has no significance in connection with the cementing job on that particular well, does it?

A That is correct. The fluid could be placed into that particular zone at some other point; it definitely

was not from the wells where the anomaly occurred.

Q You made reference to an area of about 2600 feet and I believe Mr. Ramey gave some testimony about the water entering this level at 2600 feet. In your opinion is that a continuous zone across the area involved here?

A Just from these temperature anomaly that we have noted here it doesn't seem like it is a blanket zone. It occurs in toward the bottom of the zone, say at 2900 feet in some wells and others up as high as 2300 feet.

Q Now, you heard Mr. Ramey's testimony that in his opinion a major source of the problem is improper cementing jobs on these deep wells in the area. Do you agree with that testimony?

A Yes, I definitely do.

Q Do you recommend to the Commission that some action be taken to assure that these wells are properly cemented?

A Yes. I think this is the only way we can cure the problem.

Q Now, would shutting in the flood in any way solve the problem; shutting in all injection?

A No. Shutting in all injection will not solve

the problem. It may stop the recharging of the zone, but the potential is still there; if there is any injection ever into any of these zones from the San Andres up, the potential for flooding problems is still there unless deep wells are correctly cemented.

Q But just shutting in the injection wells, would that in any way reduce the pressures in the formation, within a reasonable time?

A In a short time, no. There needs to be some fluid withdrawals in order to reduce that fluid, that pressure.

Q Now, you heard Mr. Nutter's testimony in regard to the injection ratios in connection with this area, and there was some mention made of just injecting produced waters. What would be the effect of following that recommendation?

A The effect of just reinjecting the produced water would be finally a reduced pressure in all of these zones from the Queen up through the top-most zone to the salt, but at the same time there is going to be a drastic drop in oil production.

Q In your opinion would that productivity of the water flood ever be recovered?

A From experience , zones in floods where there has been an interruption of injection or production, the production rate of oil never returns to the trend that had already been established. That is, it doesn't return to the decline curve at the same rate as you shut it in at. It usually returns to the decline curve where it would be extrapolated to in time.

Q That would result in a loss of oil that would otherwise be recovered?

A Yes, that's right.

Q In you opinion, if you just reinjected produced water, would the decline in pressure be rapid?

A Fairly rapid; your production rate is going to fall very sharply without additional water.

Q Have you had any experience in the reduction in your production rate as a result of shutting in injection wells?

A Yes, we have. Since we started this work in August, as Mr. Ramey testified, our injection rate is averaging about 21,500 barrels in August. Our rates are now down to about 17,500 barrels per day and that reduction is due to the work that we're having to do in order to run the surveys. During this same period of

time our oil production has dropped approximately 125 to 150 barrels per day.

Q Do you attribute that to closing in the injection wells for testing?

A Yes, I think it is a reflection of reduced injection rates.

Q And you would expect a comparable reduction in production if you merely reinject produced water, is that correct?

A Yes, that's correct.

MR. TRUJILLO: Excuse me, what was that reduction drop that you just mentioned?

MR. NELSON: The production drop on the oil?

MR. TRUJILLO: Yes.

MR. NELSON: Approximately 125 to 150 barrels per day of oil.

MR. TRUJILLO: Okay. Thank you.

BY MR. KELLAHIN:

Q Now, you heard the testimony in regard to your injection pressures and it was stated your maximum pressure was 2300 pounds. Do you have any comment on that?

A Yes. I feel like maybe there was a typographical

error in preparing the C-115 because our water-injection plant pressure is only 2200 pounds.

Q So you couldn't achieve a 2300-pound pressure?

A No. We couldn't achieve a 2300-pound pressure.

Q What is your injection pressure at the present time, do you know?

A The pressure ranges in October from 1100 pounds to 2150 with -- I'll start to give an average pressure of 1525 but that's really not very meaningful.

Q It varies from one well to another, is that correct?

A Yes, it does.

Q Would you be adverse to putting your major injection over on the west side as opposed to the east side as a temporary measure?

A No. This would seem to be a reasonable approach since most of the deeper wells and the plugged wells are along the east of the Langlie-Mattix Unit.

Q You did re-enter this Willingham Well, the T. O. May Well No. 1, did you not?

A Yes, we have. Rather, we are in the process of re-entering that, and I might give the Commission a little bit more information than what Mr. Ramey has: This

morning we were at 4210 cleaning out this well. We went in and we encountered the top of 8-5/8 casing where the well records says it should be at 1904. In order to hold the red bed back, we had to set 260 feet of 10-3/4 casing and then finally a string of 7 inch was tied into the 8-5/8 at 1904. There is a reported plug of 20 sacks at 2000 feet but we didn't find it; it wasn't there. As I said, this morning we were at 4210, which puts us down in the San Andres Formation. We expected to get a tremendous waterflow. I really believe that plug was there because I expected to get an immediate waterflow when we penetrated that plug, but the plug wasn't there. We were actually loosing fluid; the fluid is actually going down the hole and evidentally into the San Andres Formation.

Q You didn't encounter any waterflow at any level in that well, is that correct?

A We had a waterflow that lasted for something less than an hour and then it has been on a vacuum ever since that time. We have been having to supply make-up water in order to keep that and clean it out.

Q You said you didn't find the plug. Anadarko didn't drill that well, did they?

A No, they did not.

Q And they didn't plug it originally did they?

A No, they did not.

Q You have taken on the job of plugging it at the Commission's request?

A That is correct.

Q Now, there has been some indication that the reduction in reservoir pressure is required here. Do you agree with that?

A Yes. I think that probably we are going to have to reduce pressure in order to allow the deeper wells to be properly cemented.

Q Would that be just an area problem around the well where the cement job is being attempted?

A I think this could be accomplished by just closing in or reducing the rate immediately surrounding the well to be worked on.

Q But as a measure to show the wells have been cemented, do you have any recommendations as to injection rates or any other action that could be taken to reduce reservoir pressures? What would you propose?

A If I understand your question correctly, your question is: How would we go about reducing the --

Q (Interrupting) What would Anadarko recommend as to future injection rates?

A We would like to recommend that future injection rates be limited to reservoir voidage. This way we are just putting back what we are taking out of the reservoir and this would be dissipating the reservoir pressure at basically the same rate as if we closed the reservoir in.

Q In other words, it would have the same effect as Mr. Ramey's recommendation?

A Yes, this is true, but it would have the advantage that it would continue to allow us to produce some of the oil during that period of time.

Q Would that result in a reduction over a period of time in the reservoir pressures?

A Yes, it will, because as Mr. Nutter pointed out, our injection rate had been varying from 1.8 to 1.9 barrels per barrel of withdrawal. When we start limiting our injection just to the reservoir voidage we're going to be from month to month increasing the amount of injection, therefore the pressure will decline.

Q Over a period of time the volume of fluid injection will be reduced, is that right?

A That's right.

Q Below the initial rate of replacement, is that right?

A That's right.

Q Do you have anything else, Mr. Nelson?

A No, I don't believe so.

Q Was Exhibit No. 1 prepared by you or under your supervision and direction?

A It was prepared under my direction.

MR. KELLAHIN: I would like to offer Exhibit No. 1.

MR. PORTER: With no objection Exhibit No. 1 will be admitted.

(Whereupon, Anadarko's Exhibit No. 1 was admitted into evidence.)

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Nelson, are you suggesting that what you are recommending here, as far as reducing the pressure, would offer a better permanent solution to this thing than complete shut-in?

A I think that it would, Mr. Porter, because complete shut-in is going to mean that production has to

cease during the time that all injection is stopped. We will achieve reduced bottomhole pressures and at the same time -- we will achieve reduced bottomhole pressures by our proposals and this will allow the deeper operators to complete their recementing jobs. At the same time we will be able to produce some of the oil we would otherwise not be able to produce.

Q Do you feel that they can come nearer completing their repair jobs on the deeper wells under your recommendations than could a complete shut-in?

A I don't think that it would be a better situation from their point of view, no, but I just don't believe that we have to go to that extreme in order to achieve the cement job. I might point out that Armor has had some very bad experience with this trying to cement in the waterflow, but we have also had one case where we had casing failure on our Metex Supply A No. 1 which is located in Unit B of Section 35, 22, 37, that required a casing repair, a cement squeeze, and we had some trouble but it was achieved.

Q I see.

A So, I don't feel that we have to reduce this reservoir pressure just to -- the original reservoir

pressure--in order for them to adequately cement the deeper wells.

Q But you feel that any reduction in pressure here will interfere with ultimate production of oil?

A Well, when you say any that becomes -- could be very small, but if we reduce the rate down to just reinjected produced fluids, then it will result in lower ultimate recovery.

Q Some loss of oil?

A Right.

Q Thank you.

MR. PORTER: Does anybody have any questions of Mr. Nelson? Mr. Nutter?

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Nelson, do you have any idea what your average injection pressure would have to be in order to reinject produced fluids?

A No. I might add that we are already reducing -- we already several days ago started reducing -- the injection pressures and injection rates on these wells as we complete the injection profiles. We have many wells that are not going to take a significant amount

of water at 1700 pounds wellhead pressure. This will vary from well to well.

MR. NUTTER: Thank you.

MR. PORTER: Mr. Stamets.

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Nelson, is there anything else that Anadarko could do to reduce the pressure in these other pressure zones, I'm not talking about the reservoir zones but these stray sands up and down the hole in the salt sections which are pressured up now?

A Well, short of relief wells I don't know of anything that Anadarko could do to reduce the pressure.

Q Is a relief well a reasonable possibility?

A I don't really believe that it is a necessary step at this time. I believe that the pressure and the fluid flow will decrease fairly rapidly and that within a short period of time the cement job can be completed.

Q Short period of time; how short is a short period of time?

A 60, 90 days.

Q You testified that you had experienced a decline in oil production of 125, 150 barrels per day; what

periods of time are you talking about there?

A That is from the first of August through October.

Q Had this flood stabilized on production before this time or was it declining?

A It had been fairly stable, between 1800 and 1900 barrels per day, for the last several months.

Q How about 1973? Was this flood producing more oil at the beginning of the year than the end?

A Yes, it was.

Q So 1973 had experienced a decline?

A That's right.

Q Is it possible that this decline you experienced here is just a natural decline in the productivity of the flood rather than altogether due to the decline in injection?

A Well, the decline charts indicate that it is a faster decline now than it was earlier.

Q The Wellingham re-entry, you say that you had a little waterflow early. At what depth did you have the waterflow?

A I'm sorry, but I can't answer that. I don't know.

Q Do you know if it was in the Queen Formation?

A No, I'm sorry, I didn't ask that question so I don't have the answer. Of course, it would be hard to say anyway because we have found no competent plugs anywhere in that formation so everything from 2800 feet down is communicated together, which would include most of the Seven Rivers, Queen, and all deeper formations.

Q You limited your injection to reservoir voidage; do you have any idea what that figure would be currently, what your injection volume would be?

A That would be in the range from 10 to 11 thousand barrels of injection per day.

Q It would be roughly 1 to 1; for every barrel of fluid produced you put in another barrel of fluid?

A Roughly that, a little more than that.

Q If you were to reinject only the produced water that would reduce that ratio to a little less than 1 to 1?

A Yes, and it would be a real fast decline; it's my opinion.

Q Referring back to Mr. Nutter's figures for August, it would appear as though one-sixth of the voidage would be oil so you would be able to put back

five-sixths of the voidage.

A Where you just reinjected produced water, is that what you're saying?

Q Right.

A This should be correct.

MR. STAMETS: That's all.

MR. PORTER: Does anyone else have a question of the Witness? Mr. Trujillo?

CROSS EXAMINATION

BY MR. TRUJILLO:

Q Mr. Nelson, how many of these deep wells are you required to cement? Do you have any idea how many that would be?

A Well, that's kind of a loaded question.

Q What I'm really trying to find out is how long, Mr. Nelson, how long you would take to do the recementing that is required, that is the cementing that's required on these deep wells? I'm trying to get an idea how long you would have to operate under these reduced pressures.

A Reduced rate?

Q Right.

A It's at least probably going to take in excess of 3 months, and part of that is going to be because of

equipment trouble. Equipment just will not be available for that much additional work in the area. There's going to be several of these wells that are either within the unit area or one location removed from injection; approximately 15 to 20 wells are going to have to be re-cemented in that area. Now if you expand the area out there's going to be more than that, but I think all of us would agree that the immediate concern is the wells closest to the injection.

MR. TRUJILLO: Thank you.

MR. PORTER: Mr. Ramey, did you have any questions?

MR. RAMEY: Yes.

CROSS EXAMINATION

BY MR. RAMEY:

Q Mr. Nelson, you know it has been common practice when an operator finds a flow of water down there in between casing strings that he just puts a squeeze on it. Is this going to offer any problem, to go in and try to shut off water lower down in these wells where the top has been filled with cement?

A Well, to begin with I don't agree with that way of squeezing a well for solving the waterflow and to my knowledge, none of our problems have been handled

that way, but to answer your question, it will make the problem more difficult. That would probably involve perforating, squeezing, resurveying and seeing if your cement is where it belongs. If you did not have that cement cap you could just circulate -- hopefully you could circulate -- cement to the surface and you would be in good shape.

Q What about dry holes that have to offset these units by one or two locations?

A I think that a check should be made of the record to see what the record says comparing the plugging operation. A little bit of experience may have to be applied to that to decide whether that hole has to be re-entered or if it may have adequately been plugged.

MR. NUTTER: Is that the experience you get from the Willingham?

MR. NELSON: Yes. I'd say if we had another Willingham well in the area we would probably take a look at it.

MR. PORTER: Any further questions of Mr. Nelson?

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Nelson, in the question asked by Mr. Porter

he asked if our proposal would reduce pressures enough and waterflow enough to permit the cementing of these wells. Would you recommend that off-set injection wells perhaps be shut in while cementing was being done?

A Yes, sir. The question was: Would it be advisable to reduce injection or shut in the injection off-setting deep wells that needed to be recemented. In some cases there are deep wells that are inadequately cemented on the same 40-acre location as an injection well. In this case I think that it is imperative that that injection well be shut in. It might even be necessary that additional wells off-setting that one location be shut in.

Q Now, in connection with reducing injection pressures and volumes, should that be done on any injection well prior to completion of the objectivity profile survey?

A We feel that it should not be.

Q For what reason?

A We would like to continue to perform all of these profiles at the pressure and rate that they have been operating under for the last several months or years, and then after that profile has been completed,

at that time reduce the rate.

Q Is that what you have done on the wells on which you have run the profiles?

A Yes, this is what we have done already.

MR. KELLAHIN: That's all I have.

MR. PORTER: Does anyone else have a question. Mr. Ramey.

RECROSS EXAMINATION

BY MR. RAMEY:

Q Mr. Nelson, go back say to the plug well, and say for example that Intercoast and J. C. Clower Well that Mr. Sims converted to a water well or something, where the Commission file shows three strings of pipe from the well and then it just shows it plugged and abandoned and we have no information as to how the well was plugged. What would be your suggestion? We don't know whether it was plugged adequately or plugged at all, whether pipe was pulled, and I think our records show 10-3/4 pipe at the surface, the well now has like 9-1/2 at the surface. Nothing seems to add up on the well.

A Personally, I think that well, the only way that you can ever satisfy yourself that it is plugged properly is to at least re-enter it and determine that there are

plugs somewhere because you don't have records to indicate that there are any plugs; you don't have any records at all on the plugging operations. But, if it is just ignored then we could be facing a situation just like we are on this T. O. May well, making no plugs there.

MR. RAMEY: Perhaps Mr. Sims could enlighten us on this well. Do you have any information on that, Mr. Sims?

MR. SIMS: It was supposed to have been plugged back above the salt and the people that shot the casing in two before the salt and I don't know what depth now, even at the time; it has been years since it was drilled and they gave it to us that way, and they were supposed to come back to second water, which was somewhere around 4 or 5 hundred feet, and that was where we were supposed to get the water from. It doesn't produce water from shallow water, the 60-to-70-foot water, but that's as far as I know about it. Clower, he did all the work himself, and gave it to us as a water well. But as far as if it was plugged, I don't know.

MR. PORTER: If no one has any further questions of Mr. Nelson, he may be excused.

MR. KELLAHIN: I call Mr. Kernaghan.

(Witness previously sworn.)

DAN KERNAGHAN

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A My name is Dan Kernaghan.

Q By whom are you employed and in what position, Mr. Kernaghan?

A By Anadarko Production Company as Division Evaluation Engineer.

Q How long have you worked for Anadarko?

A 3 years.

Q In connection with your work at Anadarko does the Langlie-Mattix Sand Unit come under your jurisdiction?

A Yes, it does.

Q Have you testified before the Oil Conservation Commission and made your qualifications a matter of record?

A Yes, I have.

MR. KELLAHIN: Are the Witness' qualifications acceptable?

MR. PORTER: Yes, sir, they are.

BY MR. KELLAHIN:

Q Mr. Kernaghan, have you made any study of the reserves on the Anadarko project?

A Yes, I have.

Q What have you arrived at on that?

A Well, the reserves, based on continued operations from Anadarko-operated leases within the area of this hearing, are approximately 1,900,000 barrels as of 1/1/75.

Q Now you heard some questions in regard to reducing injection rates to produced water. Would that have any adverse effect on the ultimate recovery in this flood?

A Yes, sir, it would.

Q If so, what would the effect be, in your opinion?

A The effect would be substantial. I don't have any exact figures on it at this time. It would be very difficult to determine the exact extent of it at this time but I feel that the loss would be substantial.

Q Now, if all injection were stopped, what would be the effect upon this reservoir?

A If all injection were stopped and we could still

produce the wells, supposing that a reasonable source, a reasonable method of disposing of the water could be found, we stand to lose about a million and a half barrels.

Q And if you can't find a place to dispose of the water where --

A (Interrupting) We stand to lose the whole million nine.

Q You can't produce this without some disposal system, is that correct?

A That's correct.

Q And at least at present you can put the produced water back in?

A That's correct.

Q Now, do you have any recommendations to relate to the Commission as to what should be done in connection with this problem of waterflows and various zones in this area?

A Yes, I do. I would like to make the following recommendations: That we be allowed to continue current injection profiles and require similar surveys on all injection and disposal wells within the area under consideration; that the Commission require individual operators to conduct surveys of the bradenhead pressure

of all wells within this area and to collect fluid samples from these wells, from those wells in which the bradenhead flow is detected. Some of them will have pressure and still not be capable of flow, and that the Commission should require that Rule 107 for the Rules and Regulations of the New Mexico Oil Conservation Commission be complied with immediately within the area under consideration -- this rule applies to the cementing of wells and the protection of all zones below the salt; that the water-flood projects within this area be required to reduce injections to no more than reservoir voidage for a period of 90 days, and that the Commission should appoint an industry committee, chaired by Mr. Ramey, to study all available information, including the results of the above steps, and to report their progress to the Commission within 90 days.

Several of the questions aimed at Mr. Nelson would hopefully be answered by such a committee; the extent of the plugging necessary, the extent of the cementing. That's all.

MR. KELLAHIN: That's all I have of this Witness.

MR. PORTER: Anybody have any questions of the Witness? He may be excused.

MR. KELLAHIN: That completes our presentation, Mr. Porter, thank you.

MR. PORTER: Who would like to go on next?

MR. BLODGET: I will.

MR. PORTER: Fine.

(witness previously sworn.)

O.V. STUCKEY

called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BLODGET:

Q Please state your name, your occupation, and by whom are you employed?

A O.V. Stuckey, I'm employed by Skelly Oil Company as a Technical Specialist 1 Engineer, in Midland Texas.

Q Are you familiar with the area and matters pertaining to the cause that is now before the Commission?

A Yes, I am.

Q Have you testified before this Commission prior to this time and your qualifications been accepted?

A Yes.

MR. BLODGET: We move the qualifications of --

MR. PORTER: (Interrupting) The Commission considers the Witness qualified.

BY MR. BLODGET:

Q Mr. Stuckey, I hand you an instrument which has been marked as Exhibit No. A, Skelly Oil Company. Would you identify that instrument and discuss briefly what it shows?

A This plat is a portion of a current land map prepared by Midland Map Company showing updated data on well locations and lease ownership. The 36-section area covered by this hearing is outlined in red. Skelly operated leases within this area are marked in yellow. From this exhibit it can be seen that injection operations in the area in question consists of waterflooding in the Skelly Penrose "A" and "B" Units, and disposal operations by Skelly's manufacturing department in Section 27, Township 22 South, Range 37 East. We will discuss each of these operations in more detail as we proceed. The other Skelly operated leases which are indicated on this plat have no injection or disposal facilities of their own, but are served by the Agua operated Blinebry Drinkard Salt Water Disposal System. The only exception to this statement is the Ellen Sims "A" Lease which is

served for disposal purposes by the Skelly Penrose "A" Unit. Skelly-operated wells which have developed casing leaks in the 1500-2500 foot intervals, or have developed waterflows outside the casing, or have encountered waterflows during drilling operations, are circled in red on this plat.

Q Mr. Stuckey, for purposes of the record, how long have you been with Skelly and how long have you been familiar with this particular area; worked in this area of New Mexico?

A I have been with Skelly approximately six-and-a-half years, and I have worked in this area during that entire period.

Q Were you involved in the two Skelly Units when they were formed in this area?

A I have worked on each of these units during the entire period when they were placed under fluid in this State.

Q Now, I call your attention to Skelly Penrose "B" Unit. Would you give us a little history of that particular unit?

A The Skelly Penrose "B" Unit containing 63 wells became effective July 1, 1965. Injection was started

in August, 1966, into eight wells, and was expanded and lease line agreements were developed with offsetting operators. This Unit was originally placed under flood on inverted nine-spot patterns, with 5-spot modifications along the lease line, and this pattern was generally effective by July 1, 1967. Additional wells were converted to injection in September and October of 1970 to provide a complete 5-spot pattern for the unit area; except for a localized gas cap area in the southwestern portion, which was not deemed feasible to flood operations. Wells No. 59 and 61 on the south edge of the unit were converted to injection in January of 1974 for cooperative flooding with offset wells to the south. This unit now contains 26 active injection wells and 29 active producing wells.

Cumulative injection into the Skelly Penrose "B" Unit to November the 1st, 1974, was 20,309,307 barrels of water. The average injection rate during October, 1974, was 6,334 barrels at an average pressure of 1630 psi. A maximum injection on any well within this unit during this month is noted at 2100 pounds.

From the start of injection to date, injection in this unit has been monitored by temperature logs and/or selected injection profiles at irregular intervals

due to different time periods of injection for the various injection wells under service in this unit. There have been no indications from any of this data that any injections from this unit have gone outside the unitized interval. All surveys and temperature logs indicate that this water was confined to the unit interval. We have performed some remedial operations on approximately 16 wells in this unit for control of water within the unitized interval. This work was done primarily to attempt to achieve better sweep efficiency. We have only two instances where problems have been encountered with casing in this unit. On Well No. 32 in March, 1972, leaks in the casing were located in the interval 226 to 426 feet. These were squeezed off during the course of other operations on the well. This well was drilled and completed in October, 1957, and this type failure is not considered unusual or unexpected for a well of this age. Well No. 53 has now developed a waterflow between the casing string and the surface casing. Repairs to this well will be made as soon as a rig becomes available to perform this work. This water problem with this well is not believed due to injection from the Penrose "B" Unit. It is considered highly probable that the source of the waterflow

in this well is the same as the previous waterflow which had been encountered in the Skelly Penrose "A" Unit Well No. 47, which is located in the Skelly Penrose "A" Unit adjacent to this area.

Cumulative oil production from the Skelly Penrose "B" Unit area since unitization was 1,083,831 barrels of oil as of November the 1st, 1974. Response from flood operations on this unit have been relatively satisfactory. Daily production rate increased from 116 barrels of oil per day in mid-1966 to a peak of 500 barrels of oil per day by the beginning of 1969. Production rate remained relatively stable for the next two years at this rate, and then started to decrease at the beginning of 1971 down to approximately 220 barrels of oil per day by mid-1974. Recent stimulation operations on 5 wells in this unit have increased production to approximately 280 barrels of oil per day at the present time. Estimated remaining recoverable oil is 312,000 barrels for this unit under present conditions and injection pattern.

Q Could you tell us anything about future plans or recommendations that you would propose in this particular unit?

A We would propose to continue monitoring operations of bradenhead pressures and periodic surveys of injection wells, as dictated by performance data, to insure that confinement of injected fluids is maintained in this unit area.

We recommend that injection in this unit be continued. Present produced water rate is 3371 barrels of water per day in October of 1974. Production of 280 barrels of oil per day will have to be shut-in for lack of disposal facilities if injection is interrupted or terminated, since produced water is presently being recycled. Hauling of this volume of water would not be economically feasible.

Q Now, you mentioned Skelly Penrose "A" Unit. Would you give us a little short history and status of that particular unit?

A Skelly Penrose "A" Unit became effective May the 1st, 1967. Injection was started in September and October of 1967 into 24 injection wells. Two additional wells were converted to injection in this unit since that date. Injection facilities were expanded in August, 1974, by installation of a fourth pump at the injection plant.

A pilot waterflood was in operation on Skelly's H.O. Sims Lease within this unit area prior to unitization. Cumulative injection into these two wells was 2,639,018 barrels prior to effective date of the unit. Cumulative injection since unitization into the unit area was 19,410,572 barrels as of November the 1st, 1974. The daily average injection rate during October, 1974, was 9361 barrels at 1900 psi. The maximum pressure is approximately 2000 pounds within this unit. The total cumulative injection into the unit area to date is 22,049,590 barrels as of November the 1st, 1974. This includes injection prior to unitization.

This unit consisted of 60 wells on the effective date in 1967. Out of these 60 wells, 11 wells were drilled and completed after 1942. The remaining wells were drilled and completed in the time interval from 1936 through 1942. We recognized the fact that these wells had a potential for considerable problems with casing in all intervals, and particularly within the upper 900 feet where the exterior is subjected to corrosion from the Santa Rosa and upper water zones. We have diligently persued casing checks on each of these individual wells at any time we had occasion to perform operations on these wells. In

the interim period from the effective date of the unit until now, we have located and performed remedial operations on leaks within the upper 1200 foot interval in 11 wells. We recognize that this will be a continuing problem and will continue diligent monitering and checking of these wells in order to detect and remedy casing leaks in this upper 1200-foot interval as they become evident. We are also investigating and designing a cathodic protection system to combat corrosion in this upper portion. In addition, we have located and repaired or are in the process of repairing leaks or waterflows behind the pipe in the intervals from 1500 to 2500 in four wells in this unit area. These 4 leaks or waterflows have occurred within the past 18 months. From the start of injection to date, we have run selected injection profiles, temperature logs at irregular intervals. Following a series of injection profiles and temperature surveys in late 1971 and early 1972 it was decided to initiate a program of installing stub liners in some of the open hole wells which had been converted to injection in order to provide a better, more efficient means for control of injected water. Eighteen liners were installed in injection wells in this unit in 1972 and 1973. Injection

profiles run immediately following these liner installations indicated all injection water in these wells was being confined to the unitized interval. This record of casing leak repairs, repairs to waterflows behind the casing and liner installations within this unit is considered as solid evidence that we have diligently attempted to confine water to the unitized interval in this waterflood project. Cumulative oil production from the unit area since unitization was 2,259,569 barrels on November the 1st, 1974. The average daily producing rate during October, 1974, was 1588 barrels of oil. Recompletion of Well No. 62 as an infill well in May of 1973, and drilling and completion of 4 infill producers in 1974, has increased production rate from the unit area. These infill producers are now being evaluated. Additional infill drilling for 1975 may be recommended if results from this evaluation are as favorable as they now look, and if industry conditions and price structure are also favorable. Recent stimulation operations on 7 wells in this unit have also contributed to increasing and maintaining a maximum production rate. Three additional stimulation jobs are projected for this unit for the immediate future and additional work of this nature is under study. This unit

has potential for increased production rate if all other conditions are favorable and injection is allowed to continue. Estimated remaining recoverable oil is 1,715,000 barrels for this unit under present conditions and injection pattern.

The first evidence of waterflow in the Skelly Penrose "A" Unit Area was in May of 1973, when waterflow was encountered outside the casing of unit Well No. 29 and then this was repaired. Then, waterflow was encountered in July of 1971, in drilling operations on the Ellen Sims "A" No. 1 Well, which was located immediately northeast of this unit area. This well encountered waterflow at approximately 2500 feet.

MR. PORTER: I believe your date there was July of 1973, instead of 1971.

MR. STUCKEY: Yes.

A (Continuing) Then, in September of 1973, unit Well No. 9 developed a leak at 2569 feet. However, when the Ellen Sims "A" No. 2 Well, which is a north offset to the No. 1, was drilled in February of 1974, no waterflow was encountered in drilling operations on this well. Then, in March of 1974, a waterflow developed outside the casing in unit Well No. 47, and this was followed

during the next month, April, 1974, by waterflows in unit Well No. 63, which was being drilled as an infill well and had waterflows at 2200 feet and 2500 feet. Well No. 64 was drilled in August of 1974, and encountered a waterflow at 2500 feet. Drilling operations on infill wells, which was unit Wells 65 and 66 in October of 1974, encountered no waterflows at all. And since that date we have encountered waterflows in this unit in Wells No.. 3 and No. 28. These wells presently have waterflows outside the casing and will be repaired as soon as equipment can be located to perform this work. When we were requested by the Hobbs office and the New Mexico Oil Conservation Commission to perform necessary surveys in February, 1974, in order to determine whether there was any injection water leaving the unitized interval, we designed a survey program for these wells which we considered as the best possible method to determine any failure to confine water to the unitized interval. This program was undertaken and completed in March of 1974, covering 28 wells within the unit area. This included all of the wells which were active injectors in this unit at that time. Since that date we have completed 1 well in the south edge of the unit, which is Well No. 59. Analysis of the data from the injection

profiles, temperature decay, and 24-hour temperature surveys on these wells indicated 3 wells which were not confining injection to the unit interval. These wells have since been repaired. In addition, there were 7 wells which indicated channels within the unitized interval, but had no discernable channel above the unit interval. We plan to work on these wells in the immediate future as this work can be coordinated with a reservoir study in this area of the unit. It is our intention to confine all injections to the unit interval, and also to the desired flooding interval within that unitized interval, where feasible.

Now, with the unit area, still in Penrose "A" there are two wells which have been plugged and abondoned, which the Hobbs office and the New Mexico Oil Conservation Commission has requested be re-entered and re-plugged to provide sufficient cement across the Penrose Sand interval and intervals above which could be charged from strayed water so that any movement within these wells would be eliminated. We are preparing to embark upon this work as soon as possible. These wells are the R. D. Sims et al. "D" No. 2, and the Ellen Sims No. 6. The Sims "D" No. 2 Well is located in the southeast quarter of the

northwest quarter of Section 3, and the Ellen Sims No. 6 is located in the northwest quarter of the southeast quarter of Section 3. These are all located in Township 23 South, Range 37 East.

Q Would you give us a short resume of future plans and recommendations for this particular unit?

A We plan to monitor bradenhead pressures, re-plug the 2 plugged and abandoned wells in the area, develop cathodic protection installation for the wells in this unit for protection of casing strings in the upper intervals, and periodically survey injection wells to verify that injection is confined to desired intervals. We also plan to perform all remedial work as requested by the Commission or as indicated by requirements for prudent operations.

We recommend that injection in this unit be continued. Present production rates, water production rates, is 3485 barrels of water per day, and that was the October, 1974, figure. Production of 1588 barrels of oil per day will have to be shut-in for lack of disposal facilities if injection is interrupted or terminated, since produced water is being recycled in this unit. Production from the Ellen Sims "A" Lease could be maintained by hauling the 22 barrels of water per day

to an area outside the unit in question.

Q Do you plan any studies or anything like that?

A We also plan to participate in any study or investigation into waterflows or contamination problems in this area in question. We would cooperate to the fullest in the area of the Skelly Penrose "A" Unit in any investigation to determine the scope and ramifications of this problem.

MR. BLODGET: Mr. Chairman, would you care that we go ahead with this or would you want a recess?

MR. PORTER: Maybe we better recess until about 1:30.

(Whereupon, the noon recess was held.)

MR. PORTER: The hearing will come to order, please. Mr. Blodget, you may proceed with your examination of the Witness.

MR. BLODGET: Thank you.

BY MR. BLODGET:

Q Mr. Stuckey, does Skelly have any deep wells in the area in question, and if so would you give a short resume of their status?

A In addition to the secondary recovery flood units,

Skelly operates wells on primary production status in the area as indicated on Exhibit A. These wells are shown on this plat and we will not list their location and lease. Of these wells, 4 have experienced problems with casing leaks in the Penrose Sand or San Andres intervals. These are the Baker "A" No. 5, the Baker "A" No. 6, the Baker "C" No. 1 and the J.V. Baker No. 10. These leaks have occurred within the past 2-year period. Baker "A" Well No. 5 produced for a short period with a paker set to exclude extraneous water and has now been shut-in. The Baker "A" No. 6 has been recompleted higher in the Penrose Sand interval after repairing casing below this point. The Baker "C" No. 1 experienced parted casing which was repaired in late 1973. The J.V. Baker No. 10 presently has a casing leak and repairs will be performed on this well in the near future.

We were directed by the Hobbs office of the New Mexico Oil Conservation Commission on October 24th, 1974, to re-enter 7 wells which were in this deeper category and run cement bond longs, then perforate, and bring cement back either into the next casing shoe or provide sufficient cement to tie back into the base of the salt. These wells were the Baker "A" No. 1, the Baker "A" No. 4,

"A" 5, "A" 6, the J.V. Baker No. 9, the J.V. Baker No. 10 and the J.V. Baker No. 11. We concurred with the idea that it was the responsibility of the operator of the deeper wells in the area to take remedial action which would insure the placement of cement across the producing interval for shallower zones within the area of these wells. We have developed satisfactory procedures for the work on these wells with the Hobbs office of the OCC and will proceed to do this work as soon as rigs can be made available to carry on with this work. This remedial work will not only insure that these wells do not become a pipeline to transmit stray water within the area, but will also have the benefit of protecting these wells from collapsed casing due to external corrosion on the casing and pressure on the outside of the casing.

Q Do you have any other recommendations in this connection?

A Our future plans and recommendations would be to perform needed remedial work on all wells in this category in this area to prevent transmission of stray water via these wellbores. We will also participate in and cooperate fully with studies of water migration problems in the area in question.

We recommend a check of bradenhead pressures of all wells in the problem area, and any extension of this area which is determined desirable from data obtained, a search of records on P&A wells to determine if these present any problems, and a search of records to insure that all wells which penetrated the Queen Sand or deeper zones have adequate cement behind the casing to prevent migration of water.

Q Now, there has been some testimony heretofore concerning Skelly's Eunice Salt Water Disposal Well. Would you give us a short summary of the history of that well?

A The Eunice Salt Water Disposal Well No. 1, operated by the Manufacturing Department of Skelly Oil Company, is located 2580 feet from the south line and 1200 feet from the west line of Section 27, Township 22 South, Range 37 East, Lea County, New Mexico. This well was completed 11/12/61 by open hole completion 4010 feet to 4550 feet in the San Andres zone with 10-3/4 inch casing set at 300 feet and cemented to the surface, and 7 inch casing set at 4010 feet with 1750 sacks of cement and cemented back to the surface. This well is equipped with 3-1/2 inch OD tubing to 3914 feet. While the records

available to me at the present time are very incomplete, regarding injection history on this well, they indicate the average injection rate over the last 9-month period was 1974 barrels of water at 1945 pounds, that injection into this well in September, 1974, was 46,617 barrels at an average pressure of 1950 pounds, and that cumulative injection into this well to 10/1/74 was 3,875,861 barrels. Continued disposal of this water into this well is considered vital by Skelly's Manufacturing Department to continue operation of this plant for hydrocarbon extraction from casing head gas in the area.

Q What are the future plans and recommendations for this particular well?

A We plan to run injection profile and/or temperature decay surveys to determine storage interval or intervals and to check for possible casing leaks or channel behind casing and perform any remedial work indicated.

We recommend that disposal into the San Andres Zone be permitted to continue. Elimination of problems with deficient cement placement in deeper wells in the area should permit confinement of any water disposal into this zone by this well. Water handled by this disposal

well, under normal conditions, is surplus from cooling tower and boiler operations in this casinghead gas plant. This water is laden with chromates and other treating chemicals, oxygen saturated, and unsuitable for use as flood waters in any waterflood project without extensive and expensive water treatment and filtration.

Q In summary, what are your general recommendations to the Commission concerning this problem?

A In summary, we consider the Skelly Penrose "B" Unit to be free from water migration problems. The Skelly Penrose "A" Unit has experienced some waterflow problems and has contributed in some measure to this problem. We have taken measures, are presently taking measures, and will continue to pursue the problem to minimize water migration within the area in question. We are initiating action on remedial work on the deeper Skelly-operated wells to eliminate this potential source of transmission. We consider these actions as at least a step in the right direction and as solid evidence of our good faith efforts to alleviate and minimize this problem of water migration. We therefore request continuation of injection in the area to permit continued production and flood operations in the area. This would provide time

to permit a comprehensive study of this problem.

No one operator or individual company has access individually to sufficient data to determine the scope of this problem or to assess the various ramifications, and to formulate action needed by the various interests to alleviate this problem. This will require cooperative study and action by all concerned. We therefore suggest formulation of a special study group, implementation of a comprehensive study of the problem, formulation of a comprehensive coordinated plan of attack to minimize and alleviate this water migration problem.

Q Mr. Stuckey, you were present and heard the testimony of Mr. Kellahin of Anadarko Company?

A I did.

Q Mr. Kernaghan, correction.

A Yes, I did.

Q Did you hear him suggest as a possible plan to coordinate this program to try to find the problem and remedy same recommend these five, in substance, these five objectives: First, that the continued current injection profiles survey, including injection and disposal wells; two, continue bradenhead survey of all wells in the area and fluid samples if any in the bradenhead;

three, requiring all operators to comply with Rule 107 or reduce injection to match reservoir voidage; five, recommend that the Oil Conservation Commission appoint a committee, with Mr. Ramey as chairman, to make a study of the problem within the area and to report back their recommendations within 90 days. Do you concur with those recommendations?

A I concur generally with those recommendations. I noted he had stated that he felt like old injection wells in the area should be surveyed. We have some wells which have not had a recent survey but have had surveys possibly in '72 or '73 with no indication of any change in the status of this well; therefore I think that the recommendation to survey all wells should be tempered to some extent.

Q What about the size of the committee; do you have any ideas on that?

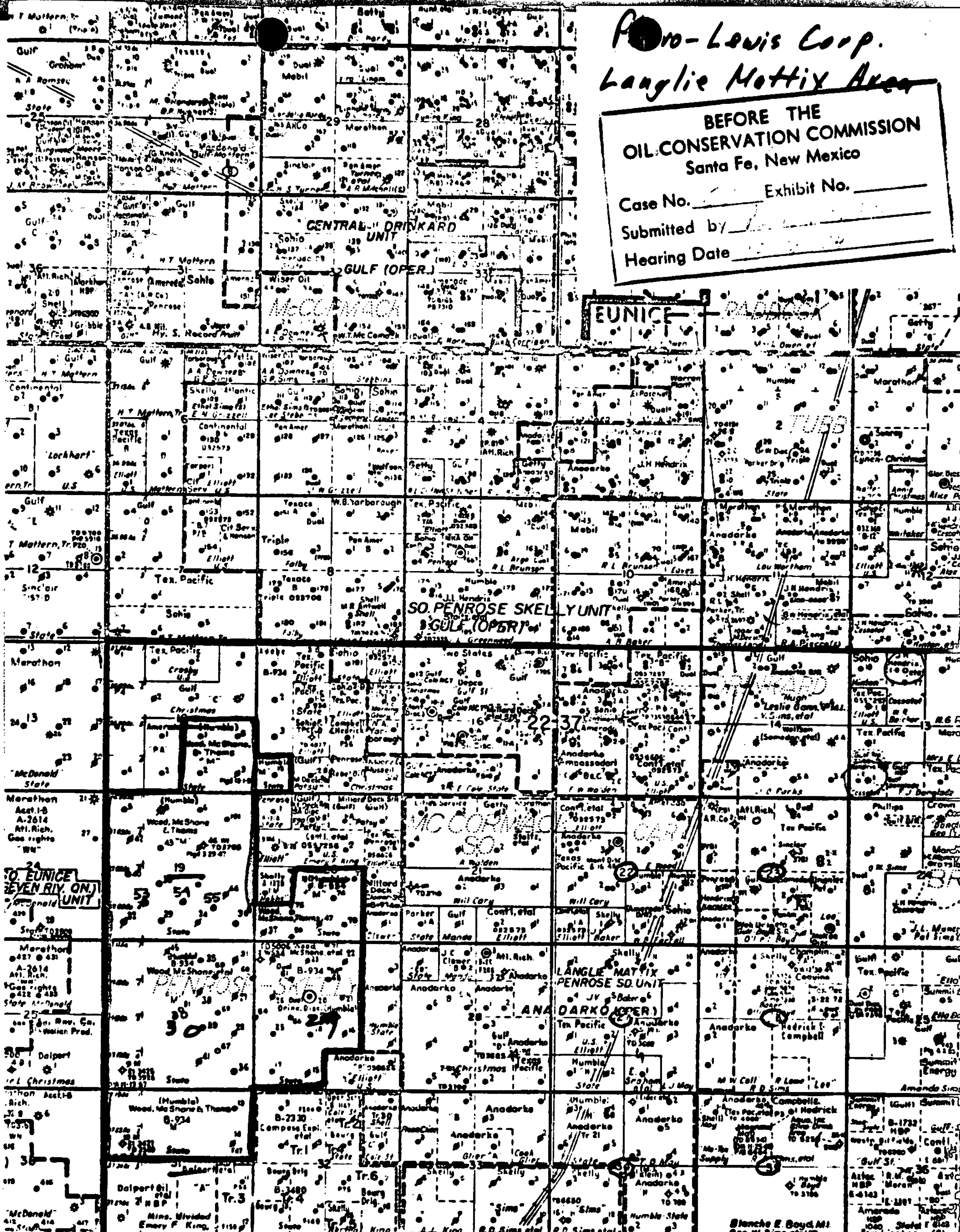
A I think it should be a small workable committee of around 6 or 7 or something on that order.

MR. BLODGET: I have no further questions.

MR. PORTER: Does anyone else have any questions of this Witness? Mr. Nutter.

P[illegible]ro-Lewis Corp.
Langlie Mattix Area

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. ______ Exhibit No. ______
Submitted by ______
Hearing Date ______



Prepared By JO 11/74
Approved By JVR 11/74

Bluebell Drinkard Salt Water Disposal Well No. H-35

	Disposed Water Barrels	Cumulative Disposed Water-Bbls	Average Injection Pressures	
[illegible] 1969	175355	175410	1400	1
[illegible]	157053	332463	1450	2
[illegible]	150150	482613	1525	3
[illegible]	149732	632345	1775	4
[illegible]	16[illegible]3	[illegible]	1500	5
[illegible]	154863	951837	1575	6
[illegible]	166849	1118180	1500	7
[illegible]	178605	1297285	1525	8
[illegible]	175655	1472940	1550	9
[illegible]	176946	1649886	1550	10
[illegible] 19[illegible]	160743	1810629	1550	11
February	170317	1980926	1570	12
March	148174	2129100	1590	13
April	144024	2273149	1990	14
May	171211	2444311	2000	15
June	176363	2640674	1600	16
July	175918	2816592	1610	17
August	169872	2984464	1630	18
[illegible]	155982	3140446	1630	19
October	177619	3318065	1640	20
November	173374	3491439	1650	21
December	171307	3662746	1655	22
January 1971	152004	3834053	1645	23
February	159143	3973196	1605	24
March	171529	4164725	1555	25
April	166425	4331150	1490	26
May	167384	4495434	1570	27
[illegible]	158905	4657339	1600	28
[illegible]	168145	482[illegible]	1620	29
August	163148	4984630	1650	30
[illegible]	171577	5159207	1660	31
October	175584	5334791	1685	32
[illegible]	178764	5513555	1690	33
[illegible]	183041	5696596	1690	34
[illegible] 19[illegible]2	173215	5869811	1690	35
February	168099	6037910	1730	36
March	191213	6229103	1745	37
April	184346	6413449	1735	38
[illegible]	194807	[illegible]	1745	39
[illegible]	183804	[illegible]	[illegible]	40
[illegible]	[illegible]	[illegible]	1695	41
[illegible]	[illegible]	[illegible]	1710	42
[illegible]	[illegible]	7405999	1715	43
[illegible]	[illegible]	[illegible]	[illegible]	44
[illegible]	[illegible]	7557912	[illegible]	45
[illegible]	[illegible]	[illegible]	[illegible]	46
[illegible] 1973	[illegible]	[illegible]	[illegible]	47
[illegible]	[illegible]	[illegible]	[illegible]	48

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Exhibit No. 3
Case No. 5372
Submitted by [illegible]
Hearing Date

Blinebry-Drinkard Salt Water Disposal Well No. H-35

	Disposed Water Barrels	Cumulative Disposed Water Bbls.	Average Injection Pressures
[illegible] 1993	186662	9069609	1700
[illegible]	15[illegible]	9226161	1700
[illegible]	149994	9375755	1700
[illegible]	149587	9525542	1700
[illegible]	145803	9671345	1700
October	151130	9822475	1700
[illegible]	138221	9960696	1655
December	149442	10110138	1700
[illegible] 1994	148416	10258554	1700
February	143103	10401657	1700
[illegible]	157580	10559237	1700
[illegible]	146775	10706012	1700
[illegible]	148527	10854539	1700
[illegible]	149363	11005902	1700
[illegible]	149154	11153056	1700
August	160658	11313[illegible]	1700
September	167296	11481040	1700
October	1688[illegible]	11649892	1700

Initials Date
Prepared By JVR 11/74
Approved By

Source of Waste Waters
[illegible] - Drinkard Salt Water Disposal Well No. 11-35

Party	Lease	Lease Description		Number of Wells
[illegible]	State "BB"	E/2 SW/4 18-22-37		2
[illegible] Prod. Co.	Grizzell "3"	S/2 [illegible] 8-22-37	6	2
	State "C"	W/2 NW/4, NE/4 NW/4 [illegible]-22-38		2
	[illegible]	[illegible]		2
Atlantic Richfield Co.	[illegible]	SW/4 25-21-36	9	1
	Annie I. Christmas	NE/4 SE/4 17-22-37		1
	State "157-[illegible]"	S/2 [illegible]-22-37		2
	[illegible]	[illegible] 3[illegible]-21-37		[illegible]
[illegible] Oil & Gas Co.	State "B"	NE/4 SE/4 36-22-37		1
[illegible]	Christmas	W/2 SE/4 17-22-37		1
Cities Service Oil Co.	State "M"	W/2 SW/4 36-21-36	9	2
	State "N"	SW/4 [illegible]-22-36		3
	State "P"	[illegible] W/2 SW/4 3[illegible]-22-38		4
Continental Oil Co.	Elliott "A-15"	S/2 SE/4 15-22-37	19	1
	Elliott "B-20"	S/2 NW/4 & SW/4 NE/4 20-22-37		2
	Lockhart "B-1"	SE/4, S/2 N/2 1-22-36		10
	State "J-[illegible]"	N/2, SE/4 2-22-36		6
[illegible] Oil Co.	P J State	SE/4 SE/4 17-22-37		1
El Paso Nat'l Gas Co.	W. Eunice Comp. Sta.	SE/4 SE/4 36-21-36		1
Exxon Co. - U.S.A.	Greenwood	S/2 9-22-37		5
Gulf Oil Co. - U.S.	Andrews	E/2 32-22-38	70	8
	Cole "A"	All of 16-22-37		13
	Drinkard "B"	E/2 SW/4, NW/4 SE/4, S/2 SE/4 30-22-38		3
	Higgins	N/2 SE/4 29-22-38		1
	Leonard "C"	N/2, E/2 SW/4 36-21-36		15
	Lineberry	N/2 SW/4 29-22-38		3
	Mattern "D"	NW/4 7-22-37		3
	Mattern "E"	SW/4 1-22-36 & N/2 11-22-36		9
	Scarborough	SE/4 NW/4, S/2 NE/4, NE/4 NE/4, NW/4 S/2 3[illegible]-22-38		8
	Vivian	N/2 30-2[illegible]-38		5
	Watkins	S/2 SE/4 29-22-38		2
Imperial-American Mgmt.	"Flat C Sheep"	NE/4 11-23-37	6.	1
	EPS-Federal	SW/4 SE/4 [illegible]-22-38		1
	Martin	All of 5, Blk. [illegible] [illegible] PSL		1
	McCallister	NE/4 NW/4 7-22-38		1
	Peterson-Federal	W/2 NW/4 4-23-38		1
	Sims-Federal	NE/4 7-22-38		1
[illegible]	McDonald	All of 13-22-36	3	2
	[illegible]	S/2 NE/4, SE/4 [illegible] SW/4 [illegible]-22-37		1
[illegible] Co.	[illegible]	NW/4 [illegible]-[illegible]-38		1
[illegible]	S. E. Long	SE/4 11-22-37		2
[illegible]	State "36"	NE/4 SW/4 36-[illegible]		[illegible]
	[illegible]	SE/4 NE/4 29-22-38		1
[illegible]	Hinton	SE/4 NW/4, S/[illegible]		1
[illegible]	Gill "A"	[illegible]		2
Phillips Petroleum Co.	[illegible] "D"	SE/4 NE/4	3	1
	[illegible]	[illegible]		2
[illegible] Management, Inc.	[illegible] "A"	NW/4 NE/4 20-22-37	[illegible]	1
	[illegible]	[illegible] 17-22-3[illegible]		1

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 3[illegible] Exhibit No. 3
Submitted by [illegible]
Hearing Date

Initials Date

Prepared By

Approved By

COLUMN NUMBER: 1 2 3 4 5 6

PARTY	LEASE	LEASE DESCRIPTION		NUMBER OF WELLS	
Shell Oil Co.	[illegible]	SW/4	11-22-37	2	1
Shell Oil Co.	Baker	SE/4 SW/4	23-22-37	5	2
	Baker "A"	NW/4	26-22-37		3
	Baker "C"	N/2 NE/4, SW/4 NE/4	26-22-37		4
	Stokes "B"	NW/4 SW/4	20-22-37		5
San Oil Co.	Christmas	SE/4 SW/4	1-23-37	5	6
	Lynch	N/2 SW/4, SE/4 SW/4	1-23-37		7
Texaco Inc.	Elinsberg "2"	S/2 SW/4	29-22-38	8	8
	Elinsberg "3"	N/2 NW/4, SW/4 NW/4, NW/4 NE/4	31-22-38		9
Texas Pacific Oil Co.	Elliott "A-15"	NW/4 SE/4	15-22-37	11	10
	Elliott "B-12"	S/2 NW/4	12-22-37		11
	Elliott "B-15"	NW/4 SE/4, S/2 NE/4	15-22-37		12
	Elliott "B-20"	SE/4 NE/4	20-22-37		13
	State "A-2"	All of	11-22-36		14
	Walden	N/2 NW/4	15-22-37		15
Union Texas Petr.	Lee	E/2 SE/4	23-22-37	1	16
				—	17
					18
					19
		TOTAL NUMBER OF WELLS		179	20
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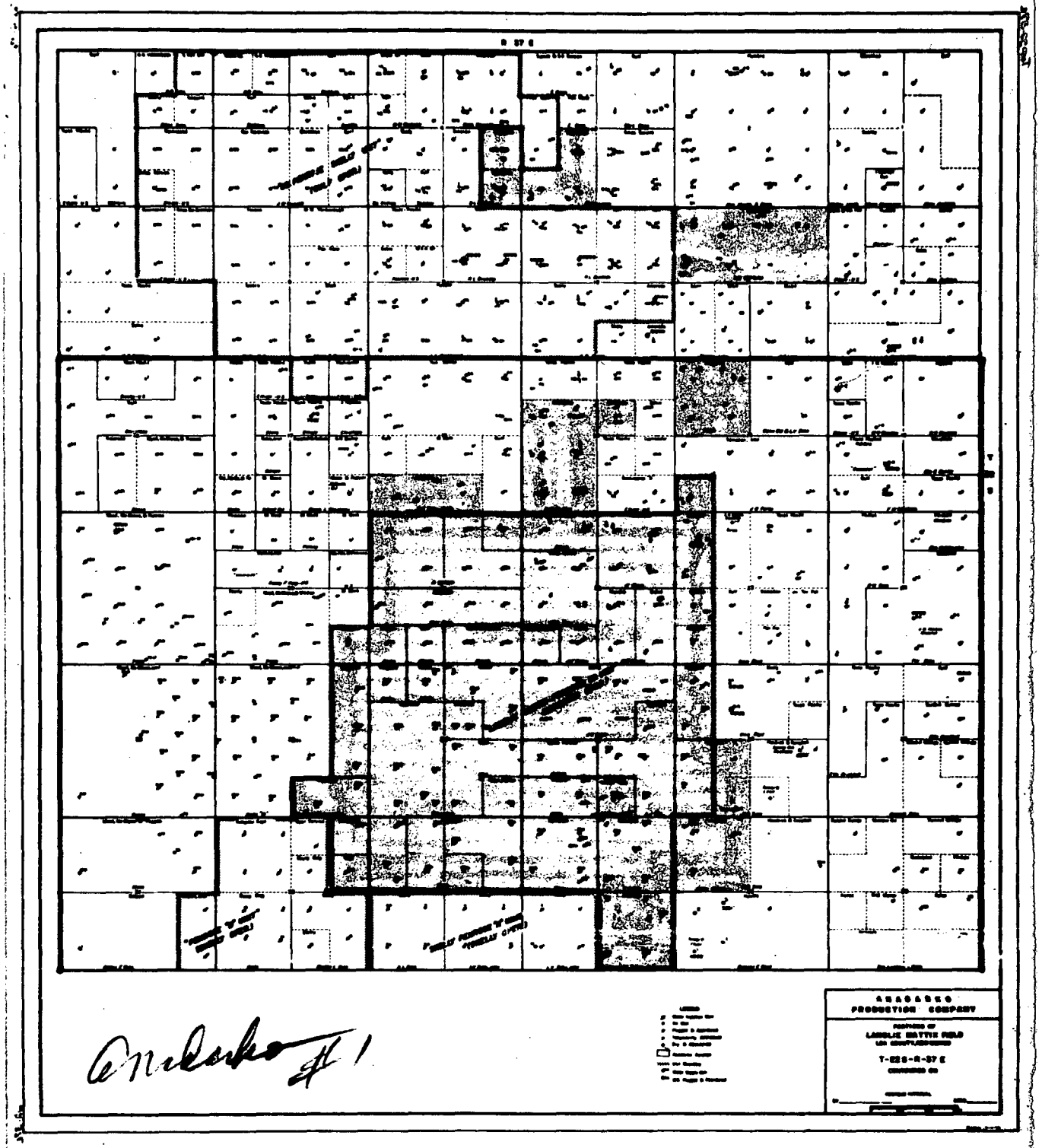
R 37 E
ANADARKO
PRODUCTION COMPANY
LANGLIE MATTIX FIELD
T-22S-R-37 E
Anadarko #1

CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

APR 21 1957

No. 33-57

MEMORANDUM:

TO: All Operators in the Hobbs, Bowers and Byers-Queen Pools

FROM: A. L. PORTER, Jr., Secretary-Director

SUBJECT: Protection of Fresh Water

1. Prior to January 1, 1958, all open bradenheads must be closed in a permanent manner with bleeder lines brought to the surface with a valve attached which should remain open at all times, Form C-103, original and two copies, must be filed with the Hobbs Commission Office upon completion of the work.

2. Beginning January 1, 1958, casing leak surveys will be conducted on a quarterly basis. The results of such tests must be filed by the 15th of each of the following months on a form prescribed by the Commission: January, April, July, and October. (The first report for 1958 will be due April 15, 1958.) The tests taken during the quarter beginning April 1, will be witnessed by a Commission representative as per published schedule. Forms for the reporting of the results of surveys will be available at the Hobbs Commission Office.

3. No oil field brines shall be disposed of in earthen pits in the Hobbs Pool area after completion of the Hobbs Pool Salt Water Disposal System.

4. No waste oil nor basic sediment shall be disposed of in earthen pits in the Hobbs Pool Area.

5. All operators are urged to institute measures for the prevention of both internal and external corrosion.

November 18, 1957
ga