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STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

EXAMINER HEARING

IN THE MATTER OF:

Application of ARCO Oil & Gas Case 9931
Company for pressure maintenance
expansion and an unorthodox gas
injection well, Eddy County,
New Mexico

TRANSCRIPT OF PROCEEDINGS

BEFORE: MICHAEL E. STOGNER, EXAMINER

STATE LAND OFFICE BUILDING

SANTA FE, NEW MEXICO

June 13, 1990

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1 HEARING EXAMINER: This hearing will come
2 to order. Call next case, No. 9931.

3 MR. STOVALL: Application of ARCO Oil & Gas
4 Company for pressure maintenance expansion and an
5 unorthodox gas injection well, Eddy County, New
6 Mexico.

7 HEARING EXAMINER: Call for appearances.

8 MR. CARR: May it please the Examiner, my
9 name is William F. Carr with the law firm of Campbell
10 & Black, P.A., of Santa Fe. I represent ARCO Oil &
11 Gas Company, and I have one witness.

12 HEARING EXAMINER: Are there any other
13 appearances?

14 MR. KELLAHIN: Mr. Examiner, I'm Tom
15 Kellahin with the Santa Fe law firm of Kellahin,
16 Kellahin & Aubrey, appearing on behalf of OXY USA,
17 Inc., and I have one witness to be sworn.

18 HEARING EXAMINER: Are there any other
19 appearances?

20 Will the witnesses please stand and be
21 sworn at this time?

22 (Witnesses sworn.)

23 GARY SMALLWOOD,
24 the witness herein, after having been first duly sworn
25 upon his oath, was examined and testified as follows:

1 DIRECT EXAMINATION

2 BY MR. CARR:

3 Q. Will you state your full name for the
4 record?

5 A. My name is Gary Brooks Smallwood.

6 Q. Mr. Smallwood, where do you reside?

7 A. In Midland, Texas.

8 Q. By whom are you employed and in what
9 capacity?

10 A. I work for ARCO Oil & Gas Company of
11 Midland as a petroleum engineer.

12 Q. Have you previously testified before the
13 Oil Conservation Division and had your credentials as
14 a petroleum engineer accepted and made a matter of
15 record?

16 A. Yes, I have.

17 Q. Are you familiar with the application filed
18 in this case on behalf of ARCO Oil & Gas Company?

19 A. Yes, I am.

20 Q. Are you familiar with the Empire Abo Unit
21 and the area in particular which is involved in this
22 application?

23 A. Yes, sir, I am.

24 MR. CARR: Are the witnesses qualifications
25 acceptable?

1 HEARING EXAMINER: Are there any
2 objections?

3 MR. KELLAHIN: No objection.

4 HEARING EXAMINER: Mr. Smallwood is so
5 qualified.

6 Q. (BY MR. CARR) Mr. Smallwood, would you
7 just briefly summarize what ARCO seeks with this
8 application?

9 A. ARCO proposes to convert two wells to gas
10 injection in order to recover natural gas liquids that
11 would otherwise not be recovered.

12 Q. And these wells are located in the Empire
13 Abo Unit?

14 A. Yes, they are.

15 Q. Could you refer to what has been marked for
16 identification as Exhibit 1-A, identify that and
17 review it for the Examiner?

18 A. This is an outline of the Abo area. It
19 shows the ARCO-operated Empire Abo Unit. It shows as
20 shaded areas noncommitted tracts in that unit. In
21 other words, these are different units within the same
22 pool. The large shaded area is the OXY-operated Citco
23 Empire Abo Unit.

24 Q. The bulk of that is located in Township 17
25 South, Range 27 East?

1 A. That's correct.

2 Q. And it extends into Township 17 South?

3 A. Yes. And it also shows the location of the
4 two subject wells, the Empire Abo Unit "J" 10 and "J"
5 13.

6 Q. Let's move on to Exhibit 1-B, and I would
7 ask you to identify that and review it for the
8 Examiner.

9 A. This is an enlargement of the area of
10 interest. It locates the OXY-operated Citco Empire
11 Abo Unit, and it shows the location of the proposed
12 gas injection well "J" 13 as a dotted triangle.

13 Q. This is currently or a temporarily
14 abandoned producing well?

15 A. That is correct.

16 Q. This is the well for which an exception is
17 needed to the Empire Abo Pressure Maintenance Pool
18 Rules?

19 A. Yes, it is.

20 Q. Would you identify what has been marked as
21 Exhibit No. 2?

22 A. Yes. That's the Empire Abo Pool Rules.

23 Q. These are the rules that govern the
24 Pressure Maintenance Project?

25 A. Yes.

1 Q. Is ARCO in need of an exception to the
2 provisions of Rule 7 of this rule?

3 A. Yes. On the last page, Rule 7 states that:
4 "No well shall be approved for gas or water injection
5 when such well is located closer than 1,650 feet to a
6 tract which is not committed to the unit and on which
7 is located a well producing from the same common
8 source of supply."

9 Q. The "J" 13 well is located closer than
10 1,650 feet to the Citco Empire Abo Unit; correct?

11 A. That's correct.

12 Q. And they have wells on that unit that are
13 producing from the same reservoir?

14 A. Yes, they do.

15 Q. If you could move on to what has been
16 marked ARCO Exhibit No. 3 and identify this, please.

17 A. This is the OCD Form C-108.

18 Q. Was this prepared by you?

19 A. Yes, sir, it was.

20 Q. Would you refer to this exhibit? I direct
21 your attention first to pages 18 and 19 of the exhibit
22 and ask you to identify those and explain what they
23 are.

24 A. Pages 18 and 19 are the land plats which
25 show the two mile radius drawn around each of the two

1 wells and the half mile area of interest radius drawn
2 around each of two wells.

3 Q. I'd like you now to move on in this exhibit
4 to pages 5 to 11, identify those, and explain to the
5 Examiner what they show.

6 A. Five through 11 are the tabulation and data
7 of the wells -- 5 through 11 are the tabulation of
8 data from the wells in the area of review.

9 Q. Does this include those wells which
10 penetrate the Abo formation?

11 A. That's right.

12 Q. Does this include all the information
13 required on each of these wells as required by Form
14 C-108?

15 A. Yes, sir, it is.

16 Q. Are there plugged and abandoned wells
17 within the area of review?

18 A. There is one plugged and abandoned well in
19 the area of review.

20 Q. Does Exhibit No. 3 include a schematic
21 drawing of that well?

22 A. Yes, it does. Page 12 of Exhibit 3 is a
23 schematic drawing of that well.

24 Q. Basically, what does it show?

25 A. This is the Hondo State No. 1. It shows

1 this well was plugged with something in excess of 350
2 sacks of cement. This well was drilled in the late
3 1920's. It has been abandoned since before the
4 initial start of injection in this Pressure
5 Maintenance Project back in 1974. So it's been
6 abandoned throughout the whole period of this
7 injection project and does not appear to present any
8 problems.

9 Q. The way it is plugged and abandoned should
10 not permit the migration of any injected fluid or
11 substance into any other zone?

12 A. That's right.

13 Q. Would you identify what has been marked
14 pages 14 through 17 of Exhibit No. 3?

15 A. These are schematic drawings of the
16 proposed injection well that show a present and
17 proposed completions. Page 17 is the proposed
18 configuration of the well of conflict, well "J" 13.
19 It shows 2-3/8 inch tubing with the internal plastic
20 coated tubing bottom lift 5600 feet and perforations
21 from 5710 to 5724 and 5754 and 5784.

22 Q. Do you know approximately when this well
23 was drilled or how long it has been in a temporarily
24 abandoned state?

25 A. I'm not sure without looking through some

1 more diagrams.

2 Q. It has been, however, a producing well from
3 the Empire Abo Unit?

4 A. That's right.

5 Q. What is exactly the injection formation
6 that you're proposing to utilize?

7 A. The Abo formation. The Abo formation
8 averages about 300 feet of thickness across this unit.

9 Q. What is the source of the gas you propose
10 to inject?

11 A. The source of the gas is produced gas that
12 is sent to two plants. The produced gas goes to the
13 Amoco plant and the Phillips plant. The liquids are
14 shrunk out of the gas and returned back to the unit,
15 and it is injected as essentially dry, uncontaminated
16 methane gas.

17 Q. This gas though does originate from the
18 Empire Abo Unit itself?

19 A. That's right.

20 Q. What volumes are you proposing to inject in
21 the Unit "J" 13 well?

22 A. Six million cubic feet per day.

23 Q. What is the maximum injection pressure that
24 you propose to utilize?

25 A. 2,000 psi.

1 Q. Could you just explain to the Examiner what
2 it is that ARCO is hoping to accomplish by converting
3 these wells to injection?

4 A. We hope to improve the efficiency of the
5 sweep of this Pressure Maintenance Project by
6 improving the sweep of the gas through the reservoir.
7 We expect to recover additional natural gas liquids
8 which doing this.

9 You might refer back to the very first
10 exhibit, the map of the entire unit. There are 14
11 active gas injection wells in the ARCO-operated Empire
12 Abo Unit, and only three of those wells have taken
13 over 45 percent of all the injected gas. That
14 intuitively tells us that we have not distributed gas
15 effectively throughout this reservoir. And what we're
16 trying to do is move gas out of those three wells and
17 move it farther west in this unit and contact more
18 natural gas liquids in the reservoir.

19 In addition, we are also proposing,
20 separate from this matter, to do a similar operation
21 on three other wells, and they are circled and
22 highlighted on the first exhibit there as "G" 24, "F"
23 27, and "F" 31. We're proposing to perforate all
24 three of those deeper like we are doing "J" 13 also.

25 Q. What your objective is, I think you said,

1 was to improve the sweep of the reservoir?

2 A. That's right.

3 Q. This will increase your recovery, you hope,
4 of natural gas liquids?

5 A. Yes.

6 Q. Let's go to what has been marked ARCO
7 Exhibit No. 4. I'd ask you to identify that and
8 review it for Mr. Stogner.

9 A. Exhibit No. 4 is a land plat that shows,
10 written by the wells, NGL would yield in gallons per
11 thousand cubic feet. These are measure points where
12 we've taken samples from these wells and had the
13 gallons of liquid per thousand cubic feet measured.

14 And you can see that in Section 2, they
15 average about 5 gallons per thousand cubic feet. This
16 is considerably richer than the rest of the
17 Arco-operated Empire Abo Unit. The rest of the unit
18 only averages 3.8 gallons per thousand cubic feet.
19 The target area, once again, is 5 gallons per thousand
20 cubic feet.

21 Q. That's what you're hoping to be able to
22 achieve?

23 A. That's right.

24 Q. Let's go now to Exhibit No. 5. Would you
25 identify that and review this information for the

1 Examiner?

2 A. Exhibit No. 5 is my interpretation of the
3 stripping mechanism that has occurred in the reservoir
4 and also my interpretation of conditions in the
5 reservoir.

6 If you'll look at the drawing in the upper
7 left-hand part of Exhibit 5, it shows conditions at
8 the time the Pressure Maintenance Project was started,
9 or, in general, there was a rather small gas cap, a
10 very thick oil column on top of a water column.

11 What's important about this schematic is
12 that the perforations that are shown for the gas
13 injection well and the production well are in general
14 what was done in the field. The gas injection wells
15 were perforated near the top of the reef, and the oil
16 wells were perforated near the base of the reef. This
17 would help to force the oil down and also help prevent
18 gas from coning down to the producers.

19 If you look in the lower -- let's move to
20 the upper right-hand side to see what we think what my
21 interpretation is of the current reservoir
22 conditions. This is what has happened after 16 years
23 of producing oil and reinjecting gas. We now have
24 essentially a very large column of gas on top of a
25 thin column of oil, and we still have the same

1 situation where the gas injection wells are perforated
2 near the top of the reef and the oil wells are
3 perforated near the base of the reef.

4 The associated stripping pattern that we
5 believe that has occurred with that is shown in the
6 lower left-hand corner. And it shows that throughout
7 this Pressure Maintenance Project life, we have been
8 injecting gas in the top of the reef, and we think
9 that it has channeled across the top of the reef and
10 down to the producers.

11 What we're proposing to do now that is
12 different than what has been done before in this unit
13 is to perforate the gas injection wells deeper in the
14 reef and try to contact previously uncontacted natural
15 gas liquids.

16 We think that this will be a more efficient
17 stripping mechanism and will lead to the recovery of
18 additional natural gas liquids.

19 Q. Are you ready to go to Exhibit No. 6?

20 A. Yes, sir.

21 Q. Identify that and review it for the
22 Examiner.

23 A. Exhibit No. 6 is a tabulation of data from
24 gas injection well "M" 6. And it attempts to
25 illustrate how we think that we've already identified

1 the stripping -- how the stripping mechanism has been
2 occurring that I just described.

3 Gas injection well "M" 6 was perforated at
4 the top of the reef like the other gas injection wells
5 and the old perfs are identified as 5330 to 5420. The
6 well was only injecting 71 Mcf per day. We came in
7 and perforated deeper in the reef, 5540 to 5584, and
8 the new injection rate at the same injection pressure
9 of 2,000 pounds was nearly 3 million cubic feet per
10 day. We think this indicates it has not seen the
11 sweep of gas that we previously had expected was going
12 on.

13 Q. And the "M" 6 well is indicated on Exhibit
14 No. 1; is that correct?

15 A. It's shown on the first exhibit and is
16 located to the west.

17 Q. Why don't we move on now to your Exhibit
18 No. 7. Would you identify this, please, and review it
19 for the Examiner.

20 A. Exhibit No. 7 shows what we expect to gain
21 by converting the well at the temporarily abandoned
22 producer "J" 13 to gas injection.

23 I previously mentioned the rich target area
24 of NGL content which had 5 gallons per thousand cubic
25 feet, and I also mentioned that the unit only has 3.8

1 gallons per thousand cubic feet of natural gas
2 liquids. We think that by moving the injection gas
3 from the unit in the 3.8 gallon area to the 5 gallon
4 area, we'll recover an additional 1.2 incremental
5 gallons per thousand cubic feet. Based on the 6
6 million a day cubic feet injection rate, that's 170
7 barrels per day of natural gas liquids that we expect
8 to gain.

9 Q. Mr. Smallwood, you indicated that the area
10 that is the subject of this hearing is what you
11 called, I believe, a target area?

12 A. Yes.

13 Q. It is a sweet spot in the reservoir?

14 A. Yes, it is.

15 Q. Do you have any opinion as to what might
16 cause this portion of the pool to produce natural gas
17 liquids at a rate higher than other portions of the
18 unit?

19 A. We think one reason is, I've mentioned all
20 along that the majority of the gas injection wells are
21 perforated near the top of the reef. One of the wells
22 is not. It is well "J" 12. It is perforated near the
23 bottom of the reef. And we think that it's sweeping
24 more effectively like we're proposing.

25 Q. Where is the "J" 12 located?

1 A. The "J" 12 is located one location west of
2 "J" 13. We think that because it is sweeping better,
3 we're seeing a richer area of NGL's around that.

4 Q. What impact upon the correlative rights of
5 ARCO will granting this application have?

6 A. We'll recover additional NGL's.

7 Q. Do you have an opinion as to what impact it
8 would have on OXY operations to the north?

9 A. Yes. If it has any impact, it will allow
10 them to recover additional NGL's like it will the ARCO
11 unit.

12 Q. Would you refer to what has been marked as
13 ARCO Exhibit No. 9, identify that, and review it for
14 the Examiner?

15 A. Yes. That's my exhibit that attempts to
16 define what we expect the benefit to be to the Citco
17 Empire Abo Unit to the north. Once again, we had the
18 sweep area that averages 5 gallons per thousand cubic
19 feet of natural gas liquids. The average in the unit
20 area is only 3.8 gallons per thousand cubic feet. The
21 incremental difference is 1.2 gallons per cubic feet.
22 They are producing approximately 700 Mcf per day from
23 their producer, which will yield a gain of 20 barrels
24 per day of natural gas liquids.

25 Q. That producer being the No. 5 well, that is

1 the well that offsets the "J" 13?

2 A. That's right.

3 Q. These are general assumptions; isn't that
4 correct?

5 A. That's correct.

6 Q. But even if you're off a substantial
7 amount, still you could anticipate a substantial
8 increase in the natural gas liquids that would be
9 produced in an offsetting well?

10 A. Yes, we could.

11 Q. In your opinion, will granting this
12 application enable ARCO and other interest owners to
13 recover additional volumes of natural gas liquids from
14 the reservoir?

15 A. Yes, it will.

16 Q. Reserves that otherwise would not be
17 recovered?

18 A. That's right.

19 Q. Will the application otherwise be in the
20 best interests of conservation and the protection of
21 correlative rights?

22 A. Yes, it will.

23 Q. Were exhibits 1 through 7 and 9 prepared by
24 you?

25 A. Yes, they were.

1 MR. CARR: At this time, Mr. Stogner, we
2 move the admission of ARCO Exhibits 1 through 7 and 9.

3 HEARING EXAMINER: Are there any
4 objections?

5 MR. KELLAHIN: No objections.

6 HEARING EXAMINER: Exhibits 1 through 7 and
7 9 will be admitted into evidence.

8 MR. CARR: I would also move the admission
9 of ARCO Exhibit 8 which is an affidavit from Campbell
10 & Black confirming that notice of today's hearing has
11 been provided in accordance with the provisions of OCD
12 Rule 1207.

13 HEARING EXAMINER: Exhibit No. 8 will be
14 admitted into evidence also.

15 MR. CARR: That concludes my direct
16 examination of Mr. Smallwood.

17 HEARING EXAMINER: Thank you, Mr. Carr.
18 Mr. Kellahin, your witness.

19 MR. KELLAHIN: Thank you, Mr. Examiner.

20 CROSS-EXAMINATION

21 BY MR. KELLAHIN:

22 Q. Let me ask you, Mr. Smallwood, to turn back
23 to your Exhibit 1-A, which is the plat of the Empire
24 Abo Unit. Do you have that?

25 A. Yes, sir.

1 Q. The selection of the "J" 13 as a potential
2 new injector for the project was not one made by you,
3 was it?

4 A. That's right.

5 Q. You did not make that selection?

6 A. That's right.

7 Q. You also did not make the selection of the
8 "J" 10 well as an injector, did you?

9 A. That's right. Both of these were proposed
10 by the engineer who worked this job previous to me
11 coming to it.

12 Q. When did you first come to the project, Mr.
13 Smallwood?

14 A. February of this year.

15 Q. In your review of potential areas and wells
16 to be identified as new injectors based upon your
17 studies, you're proposing the use of the "G" 24, the
18 "F" 27, and the "F" 31 as injectors?

19 A. In addition. They are injectors now, and
20 we're proposing to perforate them deeper, similar to
21 what the proposals are here.

22 Q. The "J" 13 is a shut in former producer --

23 A. That's right.

24 Q. -- that you're now proposing to utilize for
25 injection?

1 A. Yes. And as a formerly shut-in producer,
2 it is already perforated near the base of the reef.

3 Q. The "G" 24, "F" 27, and "F" 31 are current
4 injectors perforated too high, apparently, in the
5 structure?

6 A. They are perforated high by design like has
7 been the process in this all along. We propose to
8 squeeze those, go in, and perforate deeper.

9 Q. It's not necessary then in order to get a
10 new injector to take a former producer. What you need
11 to do is find a suitable wellbore, either an existing
12 or former injector or producer, and perforate it lower
13 in the reef?

14 A. If suitable wellbores exist, that's what
15 you need to do, yes.

16 Q. One of the criteria then for selecting an
17 injector is one where you can perforate the zone of
18 injection lower in the reef?

19 A. Yes.

20 Q. Is there a footage component or a way to
21 quantify that criteria? How do you select?

22 A. How do you select?

23 Q. Yes. How do you select where you are in
24 the well to know that you are at the base of the reef
25 where you want to be?

1 A. You pick the base of the reef and then
2 perforate above the base of the reef.

3 Q. You get the geologist to make some
4 correlations, draw you a map, and find out where it
5 is, and that's what you do?

6 A. Um-hm.

7 Q. What else? Any other criteria for
8 selecting an injector?

9 A. We try to locate them evenly spaced
10 throughout the reservoir the best we can so we can
11 contact and sweep as much residual oil as we can.

12 Q. Is there a minimum distance between
13 injectors then that you're proposing in order to get
14 them more evenly spaced within the unit?

15 A. No, sir.

16 Q. You currently have 14 injectors?

17 A. There are 14 active gas injectors.

18 Q. Only three of which are taking some 40
19 percent of the gas that's injected back into the unit?

20 A. Three of them have taken 45 percent of the
21 total gas that was injected into the reservoir.

22 Q. Where are the three that are taking 40
23 percent of the gas?

24 A. They are written down here. They are "C"
25 39.

1 Q. You're going to have to help me. The code
2 I see on the vertical axis is the letters; on the
3 horizontal axis are the numbers?

4 A. That's right.

5 Q. What is one of them?

6 A. "C" 39, and it is located east of that
7 well, that injector that is shut in.

8 Q. "C" 39; there is two injector well
9 symbols. There's one shut in on "C" 38. Is the next
10 one "C" 39?

11 A. That's right.

12 Q. That's one of the good ones. Where's
13 another good one?

14 A. "D" 37.

15 Q. Just to the southwest of the shut-in
16 injector?

17 A. Yes.

18 Q. Where's the last one?

19 A. "F" 31.

20 Q. Which is one you're proposing now to
21 recomplete lower in the reef?

22 A. That's right.

23 Q. What is the total volume of gas that you're
24 required to reinject into the unit?

25 A. We've been averaging about 48 million cubic

1 feet a day.

2 Q. 48 million a day?

3 A. Yes. And we hope it will go up. The Amoco
4 plant has not performed up to their requirements, and
5 they typically don't take quite as much gas as we'd
6 like for them to.

7 Q. The Amoco plant, does ARCO have any
8 interest in the liquids in the Amoco plant?

9 A. That's right.

10 Q. What interest would you have in the liquids
11 in the Amoco plant?

12 A. We own a half interest in the Amoco plant
13 50 percent.

14 Q. Who's got the other 50 percent?

15 A. Amoco.

16 Q. When we look at the Phillips plant, that's
17 another plant that strips the liquids?

18 A. That's right.

19 Q. And you receive back the dry gas for
20 injection? Does ARCO have a percentage interest in
21 that?

22 A. No.

23 Q. What volume of gas of the 48 million
24 available a day goes to the Amoco plant?

25 A. Approximately 38-1/2 million.

1 Q. And then the rest goes to the Phillips
2 plant?

3 A. Yes.

4 Q. What's the capacity of the Amoco plant?

5 A. 38-1/2 million right now. If we could get
6 them to take more -- we're always under allowable
7 because of them.

8 Q. The concept is, I guess, under the orders
9 that will approve the project is that ARCO is
10 precluded from selling the stripped gas? It's
11 supposed to reinject it?

12 A. I'm sorry. Would you say that again?

13 Q. Yes. The mechanics, the regulatory
14 framework for the unit, gives you a rule that says you
15 can't sell the gas; you're supposed to put it back in
16 the reservoir?

17 A. That's what the rule says. We do that so
18 we can maintain the reservoir pressure and recover
19 more hydrocarbons. That's voluntary.

20 Q. I was going to ask you the purpose of the
21 rule. At some point in the life of the project, your
22 liquid yields are going to be at such a point that it
23 is no longer economically justifiable to continue to
24 recycle the gas, pick up the liquids, and operate in
25 that fashion; right?

1 A. That's right.

2 Q. What, in your opinion, is the time at which
3 you will stop doing that process and in effect
4 institute blowdown of the reservoir within the unit?

5 A. Our last study is now quite old that
6 addressed that issue. It estimated it in 1995. In my
7 opinion, the new study that we're doing will push it
8 back a few more years from 1995.

9 Q. You would push it farther back from 1995?

10 A. That's right.

11 Q. Have you participated in that study?

12 A. We're working on that study now.

13 Q. "We," does that mean you included?

14 A. That means me included.

15 Q. When we look at the target area, Exhibit 7
16 identifies a target area. Show me on any of your
17 displays what the boundaries are for the target area.

18 A. Exhibit 7 identifies -- if you look on
19 Exhibit 4, which shows the NGL yields --

20 Q. Yes, sir?

21 A. -- we're trying to target the area in
22 Section 2 that has the richer yields of NGL.

23 Q. The unit area within Section 2 then is the
24 target area by which the calculation on Exhibit 7 is
25 made?

1 A. That's right.

2 Q. When we look at injector "J" 12 just to the
3 west of 13 on Exhibit No. 4, that is currently an
4 injector?

5 A. Yes.

6 Q. This is one that is completed lower in the
7 reef; it's towards the base of the reef?

8 A. Yes, it is.

9 Q. So it satisfies that existing criteria that
10 you have for establishing an injector?

11 A. That's right.

12 Q. Another criteria was to evenly space out
13 the injectors?

14 A. Across the unit.

15 Q. Any other criteria?

16 A. No other criteria.

17 Q. Wasn't one of your criteria to locate an
18 injector in one of these sweet spots?

19 A. Yes, sir.

20 Q. That would be a criteria, wouldn't it?

21 A. Yes, sir.

22 Q. The criteria is that the average unit
23 liquid yield is 3.8 gallons per thousand cubic feet of
24 gas? That's the average for the unit?

25 A. That's the average for the unit.

1 Q. And you're looking for areas that are in
2 the range of 5 gallons per thousand cubic feet of gas?

3 A. Yes.

4 Q. Have you looked for, apart from the target
5 area in Section 2, and apart from the area around the
6 three additional injectors you've identified on
7 Exhibit 1-A, are there any other areas that satisfy
8 those three criteria?

9 A. I have not studied that.

10 Q. You haven't looked for it?

11 A. Um-um.

12 Q. How many currently shut-in producers do you
13 have in the unit?

14 A. I don't know.

15 Q. How many producers do you have?

16 A. Something like 200.

17 Q. How many total wells do you have?

18 A. Four hundred, roughly.

19 Q. You've got in excess of 100 shut-in
20 producers?

21 A. Yes.

22 Q. More than 150?

23 A. I don't know.

24 Q. When we look at the offsetting injector to
25 the proposed "J" 13, we've got the "J" 12, you're

1 successfully injecting some 4 million cubic feet of
2 gas a day in that well, are you not?

3 A. Through "J" 12?

4 Q. Yes, sir.

5 A. Yes.

6 Q. Does that well continue to qualify as an
7 injector that meets your criteria?

8 A. Yes.

9 Q. Low in the reef in the sweet spot?

10 A. Yes.

11 Q. How long have you been utilizing it as an
12 injector?

13 A. I'm not sure. For a long time.

14 Q. Have you done any liquid yield analysis or
15 displays to show us whether or not using "J" 12 has
16 been a success in improving the liquid yields in the
17 area?

18 A. Yes. As I've testified, we think the ones
19 that are presented on Exhibit 4 illustrate that.

20 Q. I didn't make myself clear. When we look
21 at the "J" 12 as an injector, before that area was
22 being injected with the "J" 12, what was the average
23 liquid yield for the producing wells?

24 A. I don't know.

25 Q. You don't know that?

1 A. Um-um.

2 Q. When we look at "J" 12, we're currently
3 putting 4 million a day in that well. When we look to
4 the west to the "J" 11, that's one of those shut-in
5 producers?

6 A. Temporarily abandoned producer.

7 Q. When was that abandoned?

8 A. That's been abandoned for some time. 1977.

9 Q. When you go clockwise around the 40-acre
10 offsets to the "J" 12 injector, you pick up the "I"
11 11?

12 A. Um-hm.

13 Q. That's not currently being utilized to
14 receive a benefit of increased liquid yield production
15 from the injector "J" 12, is it?

16 A. Not at this time.

17 Q. When did you stop using it as a producer?

18 A. It's been temporarily abandoned for quite
19 some time too.

20 Q. You've got the "I" 12, current liquid
21 yield, 3.39?

22 A. Um-hm.

23 Q. What's the date of the data that's used to
24 make this calculation?

25 A. I think it's 88. I supplied that to OXY.

1 I brought it with me. I think it's 88. If you want
2 me to look it up, it will take a little while to find
3 it here.

4 Q. Your best estimate or best recollection of
5 the date that you utilized to generate the conclusions
6 on the exhibit? Approximately 88 date?

7 A. It looks like most of those samples that
8 were reported there were taken during the first
9 quarter of 1988.

10 Q. On the "I" 12 well just north of the "J" 12
11 injector, have you plotted the gas:oil ratio on that
12 well to see what happened?

13 A. No, I have not.

14 Q. When you look at the next one over, it's a
15 TA'd well; it's the "I" 13?

16 A. Um-hm.

17 Q. Approximately when was that well abandoned
18 for production, TA'd?

19 A. I don't know.

20 Q. Have you plotted the gas:oil ratio on that
21 well to see what has happened over time in response to
22 the injection with the "J" 12?

23 A. No, sir.

24 Q. When we look at the "J" 13, that's your
25 proposed injection well?

1 A. Um-hm.

2 Q. When did you stop utilizing that for
3 production?

4 A. I'm not sure of that either. They've been
5 temporarily abandoned for some time now.

6 Q. When you look at "K" 12, that well, is that
7 a producing well that is perforated in a lower portion
8 of the reef?

9 A. Yes, I believe it is.

10 Q. What are the proposed perforations --

11 A. I have not -- I know what the perms are. I
12 do not have a record of where the top of the reef is
13 there, but, like I stated, in general, all our wells
14 are perforated in the base of the reef. All our
15 producers are.

16 Q. Do you know where the perforations are in
17 the "K" 12 as related to the perforations in the "J"
18 12 or the "J" 13 as you proposed to reperfurate it?

19 A. The perforations in "K" 12 are 5766 to
20 5804.

21 Q. Excuse me; 5766 to --

22 A. To 5804.

23 Q. Where are your proposed perms for the "J"
24 13 injector?

25 A. They are 5710 to 5724 and 5754 to 5784.

1 Q. What's the structural relationship between
2 "K" 12 and "J" 13?

3 A. I'm not sure.

4 Q. Are both of those wells in the gas cap?

5 A. Yes.

6 Q. Can you approximate for me the current
7 boundaries of the current gas cap in the unit?

8 A. No.

9 Q. Is there any mechanical or integrity
10 problem with utilizing "K" 12 as the injector instead
11 of the "J" 13?

12 A. It's a producing well. We don't like to
13 convert producing wells to injectors if we aren't
14 required to.

15 Q. Other than that --

16 A. Other than the fact we would lose
17 production.

18 Q. -- is there anything wrong with the
19 mechanics or the integrity of that wellbore that it
20 cannot be utilized as an injector?

21 A. I'm not aware of any.

22 Q. The liquid yield on the "K" 12 is only 2.21
23 gallons per thousand cubic feet of gas?

24 A. Um-hm.

25 Q. And that's despite the fact that it is the

1 immediate south offset of the current "J" 12 injector?

2 A. That's right, which should be expected
3 since "J" 12 has injected 15 billion cubic feet of
4 gas.

5 Q. When we look at Exhibit No. 9, what is the
6 sweet spot area that you've shown for the OXY No. 5
7 well?

8 A. The 5 gallons per thousand cubic feet that
9 we show in Section 2.

10 Q. What is defined as the sweet spot area, the
11 sweet area?

12 A. The area within Section 2 and the near
13 wellbore area of "J" 13.

14 Q. Does that overlap your target area that's
15 shown on Exhibit No. 7?

16 A. They're both located within near the
17 wellbore area of "J" 13.

18 Q. What is the individual liquid yield for the
19 No. 5 well?

20 A. I don't know. The No. 5 well in the Citco
21 Unit?

22 Q. Yes, sir.

23 A. I don't know.

24 Q. The incremental liquid yield content on
25 Exhibit No. 9, the 1.2 gallon, where does that number

1 come from?

2 A. That's the difference of 5 gallons per
3 thousand cubic feet and 3.8 gallons per thousand cubic
4 feet.

5 Q. 3.8 is the unit average, and 5 is your
6 wells in Section 2 in the target area?

7 A. Yes.

8 Q. And you've applied that then to the Citco
9 Well No. 5?

10 A. Yes.

11 Q. And you've done that without knowing the
12 individual liquid yield for the No. 5 well?

13 A. That's right. It's very possible that the
14 yield we send them could be much higher than 5 gallons
15 per thousand if we improve the sweep like we expect
16 to. This is more of a baseline case.

17 Q. How do you control the sweep of the gas?

18 A. You don't.

19 Q. How come?

20 A. I don't know the answer to that.

21 Q. There's a geologic component to the
22 reservoir, is there not?

23 A. Yes, there are geological boundaries.

24 Q. In your C-108, your Exhibit No. 3 --

25 A. Um-hm.

1 Q. -- on page No. 13, you have provided a
2 geologic summary?

3 A. Um-hm.

4 Q. For the unit?

5 A. Yes.

6 Q. Did you do that yourself, or did it come
7 from something else?

8 A. It's a published description within our
9 company.

10 Q. It came from your 1985 blow-down study,
11 didn't it?

12 A. Yes.

13 Q. You took it verbatim from that section
14 describing the geology within the blow-down study
15 report of 85?

16 A. Actually, I took it from another report,
17 which probably took it from the study you're referring
18 to.

19 Q. Are you familiar with the 85 blow-down
20 study?

21 A. Somewhat, yes.

22 Q. It talks about vertically fracturing the
23 reservoir?

24 A. Yes.

25 Q. Have you as a reservoir engineer examined

1 the fracturing in the reservoir?

2 A. Yes. As I mention in my Exhibit 5, it's
3 commonly thought that this reservoir has vertical
4 fracturing equal to its horizontal permeability. And
5 that's why the wells have commonly been completed like
6 this, perforated with injection wells in the top of
7 the reef, and the oil wells occurring at the base of
8 the reef because of that vertical fracturing.

9 What we found out, because of the examples
10 I gave you with well "M" 6 and well "J" 10 and another
11 one, we think that that's not necessarily the case,
12 and that we're seeing indications of things different
13 than that.

14 Q. Other than vertical fracturing, is there
15 any other fracture component to the reservoir?

16 A. Not that I'm aware of.

17 Q. Look at your Exhibit No. 4 on the liquid
18 yield.

19 A. Okay.

20 Q. You've got the "K" 12 to the south with a
21 liquid yield of 2.21, and you say that's a reduced
22 liquid yield because we're seeing the injector 12
23 providing support for that well to increase the liquid
24 yield?

25 A. That's my assumption.

1 Q. When you look at "K" 13, you don't have a
2 liquid yield number on there. What's the number for
3 the 13?

4 A. I don't know. There wasn't one measured.

5 Q. When you look at the one to the south,
6 that's 4.95?

7 A. Um-hm.

8 Q. If the number "J" 12 injector is being
9 successful, how come the liquid yield on the "K" 13 is
10 still about 5 versus the 2.2 on the other one?

11 A. Because we need another injection well over
12 there to sweep it like "K" 12.

13 Q. Could it also be explained by the fact that
14 there's a fracture component to the reservoir, and the
15 gas being injected in the "J" 12 is preferentially
16 connected to the "K" 12 well?

17 A. That could be.

18 Q. Is there a particular orientation to the
19 fractures in the reservoir?

20 A. Not that I'm aware of.

21 Q. When we look at the Exhibit 5, the
22 schematics of this cartoons, when we look at the last
23 one on the lower right, it's GIW, the gas injection
24 well, has this been specifically drawn as to the "J"
25 12 injector?

1 A. You'll have to clarify your question a
2 little more.

3 Q. Yes, sir. Is this schematic intended to be
4 representative of the "J" 13 injector?

5 A. Not specifically. It's more general in
6 nature. We're trying to perforate near the base of
7 the reef.

8 Q. How would you change the drawing in terms
9 of the structure so it would more accurately reflect
10 the "J" 13?

11 A. I'm not sure. I haven't studied that, and
12 I haven't thought about it.

13 Q. When we look at the producer on the lower
14 right-hand side, where you say "proposed pattern," the
15 same cartoon we're looking at, where is that producer?

16 A. It's not a specific producer.

17 Q. Where would the Citco No. 5 well fall on
18 that schematic; do you know?

19 A. No, I don't.

20 Q. One of the objectives is to improve the
21 sweep efficiency of the reservoir?

22 A. Um-hm.

23 Q. Describe for me how that's supposed to
24 work.

25 A. I think Exhibit 5 describes that.

1 Q. When we attempt to correlate any of the
2 wells in the target area, can we correlate those wells
3 by porosity zones?

4 A. I'm not aware of that.

5 Q. Do you know how the fractures are connected
6 with these porosity zones?

7 A. No.

8 Q. Do you know whether or not they are
9 parallel to or perpendicular to the structure?

10 A. No.

11 Q. How can you as an engineer predict where
12 the gas injected will go and what it will contact over
13 several well distances if you don't know the direction
14 it's going from the injector?

15 A. We haven't been able to do that.

16 Q. Describe for me your calculation that you
17 used to predict the increased liquid yield. Have you
18 done it on an individual well basis?

19 A. Which increase? Which one are you speaking
20 about?

21 Q. Is this your only calculation to
22 demonstrate increased liquid yield?

23 A. Yes.

24 HEARING EXAMINER: You're referring to
25 Exhibit 7?

1 Q. (BY MR. KELLAHIN) Exhibit No. 7. This is
2 it?

3 A. Yes. As I described in my testimony, we're
4 trying to move the injected gas from the dry gas areas
5 into the richer gas areas.

6 Q. And the assumption then in the calculation
7 is that the dry gas injected at the injector is going
8 to be in contact with areas that have higher liquids
9 in them. The dry gas then --

10 A. That's the intent.

11 Q. The dry gas then picks up liquids?

12 A. Yes.

13 Q. And is produced then out of producing wells
14 located in the general area?

15 A. Um-hm.

16 Q. Am I correct in understanding that your
17 entire presentation does not consider the fractures
18 and their orientations?

19 A. No, I don't think so. I think Exhibit 5
20 addresses that. We have said that we have originally
21 felt that we had vertical perm and vertical fracturing
22 that allowed us to perforate these wells at the top,
23 in the injection wells at the top of the reef, and
24 because of what we've seen since then, we are now
25 realizing that that's not the case; that by

1 perforating wells deeper, we are seeing benefits to
2 doing that.

3 Q. Have you attempted to quantify how much
4 natural gas liquids are lost if you don't utilize the
5 "J" 13 as an injector?

6 A. No, I have not quantified it.

7 Q. Have you attempted to determine if there is
8 any ultimate liquid lost to the unit if you utilize
9 the "K" 12 as an injector rather than the "J" 13?

10 A. No, I have not done that.

11 Q. What is your understanding of the purpose
12 of Rule 7 that established the 1650 distance between
13 an injector and property not in the unit of the
14 producing well?

15 A. To protect noncommitted tracts.

16 Q. And your "J" 13 is how far from the OXY
17 unit?

18 A. It's approximately 1,000 feet from the
19 unit. And the same rule provides for exceptions to
20 that.

21 Q. Other than finding the "G" 24, the "F" 27,
22 the "F" 31 as additional injectors, do you have any
23 other additional injectors that satisfy your criteria
24 that you've identified at this time?

25 A. No, sir. They're not additional

1 injectors. They're just changes in existing injectors
2 or proposed changes in existing ejectors.

3 Q. Have you identified any other wells that
4 you're going to either change or convert to injection
5 to help your sweep efficiency?

6 A. No.

7 Q. When we look at -- our daily volume of gas
8 that's reinjected is about 48 million a day?

9 A. Um-hm.

10 Q. I think that's what you told me?

11 A. Um-hm.

12 Q. Your plan, if approved by the Division
13 then, would give you the regulatory approval to put in
14 up to 12 million a day in the "J" 12?

15 A. No, 6 million a day.

16 Q. I'm sorry, 6 million a day into the "J"
17 12. Six million a day into the "J" 13. So that total
18 area could be impacted by as much as 12 million a day?

19 A. Excuse me; we've got to back up a minute.
20 "J" 12 is already on injection, and injects
21 approximately 4 million a day. You said "J" 12. I
22 think you meant either "J" 13 or "J" 10.

23 Q. When we look at Exhibit 1-A, there's an
24 injector north of the "J" 10. What's that one?

25 A. Well, it would be "I" 10.

1 Q. Is that currently being utilized as an
2 injector?

3 A. Yes, it is.

4 Q. Is the "I" 18 over just east of the OXY
5 unit, is that currently being utilized as an injector?

6 A. Yes, it is.

7 Q. You've got five injectors within the area
8 of the OXY unit?

9 A. Actually, what we have is about a
10 mile-and-a-half between existing injectors because of
11 the OXY unit. With "J" 12 located where it is and no
12 injection between it and the next well to the east of
13 the OXY unit, which is "I" 18, it's about a
14 mile-and-a-half, and that's not very easily
15 distributed and spread out. That's one of the other
16 reasons we have a sweet spot located where we do.

17 Q. Have you used any numerical simulation to
18 attempt to determine the volumes of gas to be injected
19 in these particular areas and their resulting increase
20 or decrease in liquid yields?

21 A. No.

22 Q. When you were talking about the "M" 6 on
23 Exhibit No. 6 --

24 A. Yes.

25 Q. What's the point?

1 A. The point is it was perforated near the top
2 of the reef like the majority of the gas injection
3 wells are as shown in Exhibit 5. It injected at that
4 position for a long time. We came back, perforated
5 deeper in the reef. We quadrupled or we increased
6 injection from 71 to 3 million a day at the same
7 injection pressure, indicating that the top of the
8 reef has not communicated with the base of the reef,
9 showing the need to perforate deeper and sweep more
10 fluids.

11 Q. Is it your plan to stimulate the injectors?

12 A. We give them a small initial acid cleanup.

13 Q. Was that done with the "M" 16?

14 A. With the "M" 6? I think it was.

15 Q. "M" 6, yes, sir. How much gas is being --
16 your new injection rate is 3 million a day into that
17 well?

18 A. Yes.

19 Q. What's your anticipated injection rate into
20 the "J" 10?

21 A. It injects 6 million a day at 1,500 pounds,
22 which also indicates an area of unswept gas contact,
23 and it too is located, as you pointed out earlier,
24 near "J" 12.

25 MR. KELLAHIN: Thank you, Mr. Examiner.

1 HEARING EXAMINER: Mr. Carr?

2 REDIRECT EXAMINATION

3 BY MR. CARR:

4 Q. Mr. Smallwood, I believe you testified that
5 ARCO's intent in this case and with this program is to
6 improve the sweep of natural gas liquids from the
7 Empire Abo Unit; is that correct?

8 A. That's correct.

9 Q. You also testified that you did not know
10 exactly where the gas that was injected would go?

11 A. That's right.

12 Q. You further testified that in your opinion
13 the purpose of Rule 7 of the special rules governing
14 this project were to protect offsetting tracts from
15 harm?

16 A. Um-hm.

17 Q. If you inject this gas, and it does not
18 move from the injection well toward the OXY unit, do
19 you see any way in which it could harm that unit?

20 A. No, none whatsoever.

21 Q. If you inject this gas, and it moves toward
22 the OXY unit, do you believe it will harm that unit?

23 A. We think they will recover additional NGL's
24 because of that.

25 Q. In your opinion, is the conversion of the

1 "J" 13 to injection an appropriate place to convert a
2 well to improve the effect of the sweep of this
3 reservoir?

4 A. Yes, it is.

5 MR. CARR: That's all I have.

6 HEARING EXAMINER: Thank you, Mr. Carr.

7 Are there any other questions of this witness?

8 CROSS-EXAMINATION

9 BY HEARING EXAMINER:

10 Q. Mr. Smallwood, I'm going to refer to page 4
11 of your Exhibit No. 3. Your average daily rate is
12 6,000 Mcf a day; is that correct?

13 A. Yes, sir.

14 Q. What is the average injection rate for the
15 No. 12 again?

16 A. We request the same --

17 MR. CARR: For the No. 12.

18 THE WITNESS: I'm sorry. Four million a
19 day.

20 Q. (BY HEARING EXAMINER) Is there any kind of
21 a reason why there's a discrepancy of 2,000 Mcf?

22 A. Because "J" 10 has gone on and will inject
23 6 million a day at a lower injection pressure,
24 indicating a need to inject gas. We expect to see the
25 same thing in "J" 13.

1 Q. If I wanted to see where the oil/gas
2 contact was for this area, where would I go?

3 A. To the -- you would need a map the size of
4 the very first exhibit that I show that shows more of
5 the unit, and it would be down structure from these
6 locations that we're talking about. I'm afraid I
7 can't tell you exactly where that is right now, Mr.
8 Stogner.

9 Q. But the producing wells that are to the
10 west of your proposed injection well or "J" 13, are
11 those gas producers?

12 A. They're high GOR oil producers, higher, and
13 they vary from 15,000 to 50,000 GOR's.

14 Q. The producing wells in the Citco unit, I
15 assume, are the same type?

16 A. No. One of them has a GOR of 300,000, I
17 believe, very gassy.

18 Q. That would be near the oil and gas contact?

19 A. I believe it's above the gas/oil contact,
20 but the OXY unit is located near the crest of the
21 structure, and contact is well below their unit and
22 our nearby wells.

23 HEARING EXAMINER: Are there any other
24 questions of Mr. Smallwood?

25 MR. KELLAHIN: One question, Mr. Examiner.

1 HEARING EXAMINER: Mr. Kellahin.

2 RECROSS EXAMINATION

3 BY MR. KELLAHIN:

4 Q. Of the 48 million a day you need to
5 reinject into the unit, if the examiner disapproves
6 the injection of the "J" 13, what will your capacity
7 be for reinjection if you get the "G" 24, the "F" 27,
8 the "F" 31 added?

9 A. We don't know. We don't know how they'll
10 perform when they're changed and added.

11 MR. KELLAHIN: No further questions.

12 HEARING EXAMINER: Are there any other
13 questions of this witness?

14 MR. CARR: No further questions.

15 HEARING EXAMINER: Let's take a ten-minute
16 recess.

17 (Recess.)

18 HEARING EXAMINER: This hearing will come
19 to order. Mr. Kellahin?

20 MR. KELLAHIN: Thank you, Mr. Examiner.

21 I'd like at this time to call OXY's
22 reservoir engineer, Jeff Schmuhl. Mr. Schmuhl has
23 already been sworn.

24 JEFF SCHMUHL,
25 the witness herein, after having been first duly sworn

1 upon his oath, was examined and testified as follows:

2 DIRECT EXAMINATION

3 BY MR. KELLAHIN:

4 Q. Mr. Schmuhl, for the record, would you
5 please state your name and occupation?

6 A. My name is Jeffrey Schmuhl. I'm employed
7 in the reservoir engineering department for OXY USA.

8 Q. Have you previously testified before the
9 Division?

10 A. No, I have not.

11 Q. Summarize for us your educational
12 background.

13 A. I have a Bachelor of Science Degree in
14 petroleum engineering from the University of Tulsa in
15 1977. I've worked for OXY in various engineering
16 positions since 1981.

17 Q. What were you specifically asked to do as a
18 reservoir engineer for your company concerning this
19 application by ARCO?

20 A. To review ARCO's proposed injection wells
21 and to attempt to determine if there's any damage that
22 would result to the OXY-operated Citco Empire Abo
23 Unit.

24 Q. Have you completed that review and have you
25 reached certain conclusions?

1 A. Yes, I have.

2 MR. KELLAHIN: We tender Mr. Schmuhl as an
3 expert reservoir engineer.

4 HEARING EXAMINER: Are there any
5 objections?

6 MR. CARR: No objections.

7 HEARING EXAMINER: Mr. Schmuhl is so
8 qualified.

9 Q. (BY MR. KELLAHIN) Let's turn to Exhibit
10 No. 1. Mr. Smallwood has already identified some of
11 these displays, and if they're not identical, they're
12 very similar. Describe for the record, though, the
13 OXY-operated unit that's adjacent to the ARCO unit.

14 A. This is the Citco Empire Abo Unit, and it's
15 the area shaded in yellow, and it's directly northeast
16 of the proposed "J" 13 injection well.

17 Q. Let's look at Exhibit No. 2. Identify that
18 for me.

19 A. This is a blow-up of the area near our
20 unit. The dashed triangles show the proposed "J" 10
21 and "J" 13 wells that are the proposed injection
22 wells. Highlighted on this is our No. 5 well, which
23 is an offset to the "J" 13, which is a well we're
24 particularly concerned about.

25 It also shows the other injection wells in

1 this area as well as the abandoned wells and the
2 current producing wells.

3 Just a little history on our unit. Our
4 unit was formed in 1974. We began injection in 1975
5 into the "G" lll. We continued that type of operation
6 until 1986, at which time we shut down our gas
7 processing plant because the low NGL yields we were
8 experiencing, we couldn't economically justify
9 continuing that type of operation.

10 Q. Excuse me, Mr. Schmuhl, isn't the original
11 plan of operation for your unit very much like ARCO's
12 plan of operation?

13 A. Yes, it is.

14 Q. Whereby the idea was to take the gas, strip
15 the liquids out of the gas, reinject the gas back into
16 the reservoir?

17 A. Yes.

18 Q. Why did you stop doing that?

19 A. We no longer feel it was economically
20 justified for us.

21 Q. Why not?

22 A. Because of the low NGL yields we were
23 experiencing and the low oil production.

24 Q. Give me some more background of your
25 project.

1 A. We tried to inject unprocessed gas for a
2 short period of time, and we had some problems with
3 that, and it became uneconomical for us to continue
4 that. We stop injection altogether in 1988.

5 In early 1989, we obtained a gas contract
6 with Phillips who operates another plant, and we're
7 now selling our gas through the Phillips plant, and
8 they're processing the gas for us.

9 We have two wells producing now, the No. 5
10 and No. 13. The No. 5 well produces about 740 Mcf per
11 day, which is about two-thirds of the gas production
12 from our unit.

13 OXY is also a working interest owner. We
14 have a very small interest in the ARCO-operated Empire
15 Abo Unit. We have three-quarters of one percent.

16 Q. What's the liquid yield on your No. 5 well
17 in terms of gallons per thousand cubic feet of gas?

18 A. The only gas analysis data we have is from
19 our unit, and it's 3.2 gallons per thousand cubic
20 feet.

21 Q. 3.2?

22 A. Right.

23 Q. That analysis is made then at the plant?

24 A. Right.

25 Q. When the production from the two producing

1 wells gets to the plant, they analyze it there?

2 A. That's correct, but two-thirds of that gas
3 is produced from the No. 5 well.

4 Q. Any doubt in your mind that 3.2 is anything
5 other than accurate?

6 A. It's typical.

7 Q. Give us your ultimate conclusions based
8 upon your study as to why you're opposed to having the
9 Division approve the "J" 13 as an additional injector
10 for the ARCO unit.

11 A. We feel like based on our review of some of
12 the geologic data that there's a fracture trend that
13 parallels the reef structure.

14 If you refer back to Exhibit 1, it's not
15 just vertical fractures. They tend to parallel the
16 reef structure, basically, a northeast-southwest type
17 of direction. And that is the direction of the
18 location of the well No. 5 from the proposed injection
19 well.

20 We've also kind of looked at what the
21 injectors surrounding our unit that ARCO has. And
22 they currently have, as shown on our plat, I believe
23 four active injection wells that are injecting about
24 14.1 million, based on the latest data I have, which I
25 believe is December data, 14.1 million cubic feet per

1 day. With the "J" 10 and the "J" 13, that would add 6
2 million a day each, another 12 million, for a total of
3 over 26 million cubic feet per day.

4 Q. That would give them the potential to
5 inject within the immediate vicinity of your unit what
6 percentage of the total dry gas available for
7 reinjection by the ARCO unit?

8 A. I estimated it was 58 percent based on the
9 December data when they had a total available gas
10 injection of 45 million per day. So almost 60 percent
11 could be injected in this immediate area, which would
12 appear to me as not really disbursing the gas out
13 throughout the entire unit.

14 Q. If the gas injected into "J" 13 as ARCO
15 proposes is fracture connected to the Citco Empire
16 Unit, what will happen to your production?

17 A. We believe that we would see a rapid
18 increase in our GOR. Since we're restricted on a
19 reservoir voidage limit, we would be forced to lose
20 oil production. We also expect that we would see a
21 very drastic decrease in our natural gas liquid yields
22 because the dry gas would come in and, in effect,
23 dilute the gas that's in our reservoir right now.

24 Q. One of Mr. Smallwood's criteria for
25 selecting an area to put an injector was to identify

1 areas of high liquid yield potential, and he was using
2 3.8 average for the unit and then pegging areas where
3 there was 5 gallons per thousand cubic feet of gas
4 potential?

5 A. Yes.

6 Q. Have you also analyzed the ARCO unit to
7 determine whether or not you can identify alternative
8 areas where they could put this gas?

9 A. In their -- recently they submitted an AFE
10 package which identified -- the three wells were shown
11 further of this unit.

12 Q. Those were the wells Mr. Smallwood referred
13 to at the "G" 24, the "F" 27, and the "F" 37?

14 A. Yes, that's correct. And in some of the
15 correspondence that accompanied that AFE package, they
16 identified a target area of 5.25 gallons per thousand
17 cubic feet that existed in that area of the field, and
18 that's with gas injection at the top of the reef.

19 In the area directly south of our unit, the
20 "J" 12 has already been perforated near the base of
21 the reef, and the high yields there may be indicative
22 of the sweep from the "J" 12 already sweeping that
23 area and contacting additional NGL's.

24 Q. Any other ultimate conclusions you've
25 reached about your engineering study other than the

1 adverse economic impact to OXY of the injection,
2 alternative places to put the gas, anything else?

3 A. We reviewed some of their previous studies,
4 and our review of those indicates at the time that
5 study was done in 1985 that the value of the field
6 would have been maximized by halting gas injection at
7 that point in time and starting to sell the gas, and,
8 in effect, blowing down the reservoir, and that
9 continued injection of gas on a present value basis is
10 actually reducing the ultimate value of the field,
11 which brings into question any reason to continue
12 injection anywhere.

13 Q. You dispute then Mr. Smallwood's conclusion
14 that the use of "J" 13 as an injector will increase
15 liquid gas yields from the reservoir and be economic
16 for the unit owners?

17 A. Yes.

18 Q. Let's go through some of the specific
19 reasons and details that support your three ultimate
20 conclusions.

21 A. Okay. First, the third exhibit here is a
22 cross-section. It's through A-A' on Exhibit 2. This
23 is the plat of our area.

24 Q. Let us get oriented now. When we look at
25 Exhibit 2, the blue pen line connects the three wells?

1 A. Right.

2 Q. That is the line of cross-section shown for
3 the Exhibit 3?

4 A. That's correct. It's through the "G" 111,
5 our No. 5 well, and the "J" 13.

6 Q. What does this show you?

7 A. Basically it shows that all the wells
8 penetrate the same Abo formation. It also indicates
9 the relative structural position of all the wells. It
10 also in red shows the perforations existing in the
11 wells, and for the "J" 13, those that are proposed for
12 gas injection.

13 Q. Mr. Smallwood concluded that there would be
14 pressure support provided to the No. 5 well in your
15 unit by the gas injection in the No. 13. Do you see
16 any geologic evidence from looking at No. 3 exhibit
17 that that is other than correct?

18 A. Well, I think what will happen is there's a
19 fracture trend that's oriented in that direction, and
20 that the injected gas, the dry gas, will move in the
21 direction of our unit and result in reduced NGL and
22 oil yields to us.

23 Q. Turn to Exhibit 4 and identify and describe
24 that display.

25 A. Exhibit 4 is a graph of the injection

1 volumes for our gas injection well on the Citco unit.

2 Q. This is the "G" 111?

3 A. That's correct.

4 Q. And this is plotted throughout the entire
5 period of injection in that well?

6 A. That's correct.

7 Q. Show us what your company has done with
8 that well for gas injection.

9 A. Basically, our unit was formed in 74. In
10 75, we began gas injection and injected at a fairly
11 constant rate until 1986 when we shut down our natural
12 gas processing plant. We continued injection of the
13 unprocessed gas for a short period of time after that,
14 but in 1988 we halted gas injection altogether.

15 Q. Let's turn to Exhibit No. 5. When we look
16 at Exhibit No. 5, identify for us what data we're
17 looking at.

18 A. That is a production graph for our well No.
19 5 on the OXY-operated unit. It shows the oil
20 production rate on the green curve, and the gas:oil
21 ratio is shown on the black curve.

22 The No. 5 produces about two-thirds of the
23 gas from our unit. At the time when we were --

24 Q. Let's line up both displays, Exhibit 4 and
25 Exhibit 5, so that we get them both lined up, and

1 we're using the same time interval. We've got the
2 injector stopping injection in March of 88?

3 A. Right.

4 Q. And you look up at your No. 5 producer, and
5 there is a period of no production?

6 A. That's correct.

7 Q. What's happening here?

8 A. We didn't really have a gas contract or a
9 way to move the gas, and essentially during this time
10 period, the well was produced maybe one day a month,
11 very low amounts, until we could make arrangements to
12 sell the gas.

13 Q. Go backwards in time from March 88 and draw
14 us your engineering conclusions comparing the
15 production to the injection.

16 A. In March of 88, of course, we halted gas
17 injection altogether. The other significant time
18 period is in 1986.

19 In 1986, we shut down our gas processing
20 plant. Prior to shutting down our plant, we were
21 injecting dry gas back into our dry gas injection
22 well. A review of the trend of the gas:oil ratio
23 shows that the GOR on this well increased steadily
24 over the entire producing period, reaching a peak in
25 86 of over \$400,000.

1 Since we've halted injection of dry gas and
2 then totally halted injection about a year later of
3 gas altogether, our GOR has been reduced to about
4 180,000, and the oil rate has increased slightly.

5 Q. What does that tell you as a reservoir
6 engineer concerning the liquid yields and the need to
7 inject the dry gas into your unit?

8 A. We weren't really seeing any benefit from
9 gas injection on this particular unit.

10 Q. Let's go to Exhibit No. 6. Would you
11 identify that for us?

12 A. Exhibit 6 is an estimate of the economic
13 impact of the reduced oil production from our well No.
14 5. I based this on the March 1990 rates, which at the
15 time I prepared this exhibit was the most recent
16 data. We made 122 barrels of oil and 23 million cubic
17 feet of gas, and it was 188,000 GOR.

18 Since we're on a reservoir voidage limit,
19 we really cannot increase our gas production without
20 exceeding that limit; so we're restricted on a voidage
21 basis. So if the GOR were to go back up to the
22 historic level we saw, with our gas injection on our
23 property, production would drop to 58 barrels,
24 resulting in a loss of 64 barrels per month. Just the
25 economic impact of this, estimating the oil price at

1 \$18 a barrel, was \$1,152 a month or almost \$14,000 a
2 year in lost oil production.

3 Q. Let's go to Exhibit No. 7. Would you
4 identify and describe that information?

5 A. Exhibit 7 summarizes the analyses of
6 natural gas liquids that have been run on our gas
7 stream from our unit. At the time we were preparing
8 to shut our plant down, our yields had declined to
9 2.187 gallons per thousand cubic feet.

10 In August 88 time period, when we had very
11 little production, we were trying to negotiate a
12 contract, the yield was tested, and it was 2.56
13 gallons per thousand cubic feet.

14 In January 1990, the yield was 3.135
15 gallons per thousand cubic feet, showing a steady
16 increase over the entire period of time since we've
17 halted injection of dry gas.

18 The NGL yields have increased 43 percent
19 since November 86.

20 Q. If, as a result of gas injected by ARCO
21 into the "J" 13 well, your production in No. 5, liquid
22 production is reduced, what is the impact on OXY of
23 that?

24 A. That's shown in the next exhibit.

25 Q. All right. Exhibit No. 8?

1 A. Yes. Basically I just took the percentage
2 loss from our March values, and we showed 92,000
3 gallons with a value of almost 21,000. If we returned
4 to, just based on our experience, the reduced yields
5 we saw with offset gas injection, it shows a value of
6 14,000. So we have a loss in value of \$6,200 a month
7 or almost \$75,000 a year. This represents about 31
8 percent of the total value of the gas stream.

9 Q. As a reservoir engineer, have you attempted
10 to compile and study available reports and information
11 by which to determine the extent and magnitude of
12 potential fracture communication in this immediate
13 area?

14 A. Yes, I have.

15 Q. Let me direct your attention to what is
16 marked as -- this should be Exhibit No. 9, Mr.
17 Examiner, the one you're holding in your hand right
18 now?

19 HEARING EXAMINER: Okay.

20 MR. KELLAHIN: I failed to mark that. It
21 should be No. 9.

22 Q. Let me direct your attention to that
23 exhibit and ask you what it is.

24 A. It is the blow-down evaluation of the
25 Empire Abo Unit reservoir that was prepared by ARCO in

1 January of 1985.

2 Q. In searching for available information to
3 describe the geologic character of the reservoir, in
4 examining this document, what did you find?

5 A. I found the geological interpretation,
6 which I've reviewed and don't dispute. I agree with
7 their interpretation here, and that's shown on pages 5
8 and 6 of this report.

9 And essentially the key points I think on
10 this is that the porosity development in the reservoir
11 is erratic and it cannot be correlated between wells.

12 The other point is that the fracture
13 orientation is parallel to the reef trend, which is
14 essentially a southwest-northeast direction, which is
15 the orientation between the "J" 13, the proposed
16 injection well, and our well No. 305, the producing
17 well, and that the fractures link up the erratic
18 porosity development and provide excellent pressure
19 communication in the reservoir.

20 Q. Let me hand you a copy of ARCO's Exhibit
21 No. 3 for this hearing, and I will direct your
22 attention to Page 13 of that report. Have you
23 reviewed that information contained on the C-108
24 supplied by ARCO?

25 A. Yes, I have.

1 Q. How does that information compare to the
2 geologic report shown on the blowdown in 85 study?

3 A. It is essentially identical. The only
4 difference is the last sentence in the geological
5 study was not included in the C-108.

6 Q. What is that last sentence?

7 A. It says, "These fractures apparently link
8 up the erratic porosity development and provide
9 excellent pressure communication in the reservoir."

10 Q. What else have you done to satisfy yourself
11 as a reservoir engineer that there is a realistic,
12 probable adverse impact to OXY by the injection of gas
13 into the "J" 13 and its ability to communicate with
14 the No. 5 well?

15 A. We tried to look at some of the other wells
16 in this area. We looked at well "I" 13 -- can you
17 refer back to Exhibit 2 -- is the west offset to our
18 No. 5.

19 Q. Let me find that. I'm looking at your
20 Exhibit No. 2 now. You were beginning to describe
21 which wells?

22 A. It is the "I" 13.

23 Q. The "I" 13 on the ARCO project?

24 A. Right.

25 Q. Immediately north of their proposed "J" 13

1 injector?

2 A. Right.

3 Q. What have you looked at that well for?

4 A. It is in the same relative position to the
5 "J" 12 as our No. 5 well is to the "J" 13, the
6 northeast offset to those wells.

7 Q. All right.

8 A. And the "J" 12 is the current active
9 injector which is injecting about 3.9 million cubic
10 feet of gas per day.

11 Q. So you've looked at the performance of the
12 "I" 13 well?

13 A. That's correct.

14 Q. Have you reduced that information to a
15 display?

16 A. Yes, I have. It's the next exhibit.

17 Q. Exhibit No. 10?

18 MR. CARR: Which is Exhibit 10?

19 MR. KELLAHIN: It's this display here. I'm
20 sorry, Bill. I forgot to mark these.

21 MR. CARR: No problem.

22 Q. (BY MR. KELLAHIN) What have you plotted
23 here, Mr. Schmuhl?

24 A. The green rate on the bottom graph shows
25 the oil producing rate, and the red graph on the top

1 shows the gas:oil ratio.

2 Q. What does it tell you as a reservoir
3 engineer?

4 A. It appears to show preferential flow along
5 the orientation of the fracture. The "J" 12 began
6 injection in 1979.

7 Q. The "J" 12 is the injector, and it began in
8 what year?

9 A. 1979. This well wasn't produced after that
10 time until 1982. So there was relatively no gas
11 production from the well. But after that well was
12 brought on, it showed a very dramatic increase in the
13 gas:oil ratio.

14 Q. What do you conclude or attribute the
15 increase in the gas:oil ratio in the "I" 13 well to?

16 A. To movement of gas injected in "J" 12 along
17 the fracture orientation towards that well.

18 Q. What does that tell you then about the
19 potential risk to your No. 5 well with the use of the
20 "J" 13 as an injector?

21 A. Since they are in the same relative
22 positions, I think it is very likely we'll see the
23 same thing happen with gas injected into the "J" 13
24 moving up to our well and increasing our gas:oil
25 ratio.

1 Q. Let's turn to the subject of alternate
2 places in the unit to place the gas within the ARCO
3 unit.

4 A. Yes.

5 Q. Describe for us any information you've
6 received or evaluated or analyzed to locate other
7 areas of the reservoir.

8 A. The next exhibit is an AFE package that was
9 received in May, and it is --

10 Q. Exhibit No. 11?

11 A. Exhibit 11.

12 Q. All right, sir. And this is the package
13 you received from ARCO?

14 A. That's correct.

15 Q. What does this show you?

16 A. Well, it proposes to perforate towards the
17 base of the reef three existing gas injection wells
18 which are located several miles to the east. And in
19 their write-up on this thing, they indicate that the
20 target area in the area of these three injection wells
21 has a NGL contact at 5.2 gallons per Mcf.

22 It would seem the area immediately south of
23 our unit is not unique as far as the high NGL yields
24 there. In fact, they have not, in this target area,
25 have not received any of the benefits from injecting

1 at the base of the reef, where they have in our area.

2 Q. Anything else about Exhibit No. 11?

3 A. No.

4 Q. Let's to go Exhibit No. 12, Mr. Schmuhl,
5 and ask you to identify and describe what you've done
6 on that display.

7 A. This is essentially a blow-up of the area
8 around our unit, and on this I've displayed the
9 estimated NGL yields for various wells in the area.
10 Most of this data was provided by ARCO.

11 Q. Let's compare that now to Mr. Smallwood's
12 Exhibit No. 4. Let me give you one of those if you
13 don't have it (indicated). The liquid yields he's
14 shown on his Exhibit No. 4 are a little different than
15 the liquid yield number you show on your Exhibit No.
16 12?

17 A. Yes. Basically, I've rounded my numbers
18 off, and he shows some data for values that I was not
19 provided when I requested data.

20 Q. And, as well, on your No. 5 well, then you
21 provided the 3.2 that he didn't have on his display?

22 A. That's correct.

23 Q. From examining the liquid yield information
24 available for this target area that ARCO proposes to
25 utilize this "J" 13 injector for, what do you

1 conclude?

2 A. It looks like there could be other wells in
3 this area that are more than 1,650 feet from our lease
4 line that could be converted to gas injection.

5 Q. For example, find one for us.

6 A. "K" 12 is an example. It has a low NGL
7 yield right now of 2.2, and it is in the area, the
8 target area that they have described as of high NGL
9 yields.

10 Q. That would be a distance of more than 1,650
11 from your unit?

12 A. Yes, that's correct. It's also in the same
13 relative structural position as the "J" 13, the
14 proposed injector. There's a small crest in the
15 structure in between these two wells, and the "K" 12
16 is already perforated lower than the proposed
17 perforations for the "J" 13.

18 Q. If you were utilizing Mr. Smallwood's
19 criteria for selecting an injector, would you as a
20 reservoir engineer select the "K" 12 as an injector as
21 opposed to the "J" 13?

22 A. I believe it's a candidate for injection.
23 It should be considered.

24 Q. Can you reach any conclusions or analysis
25 about the current utilization of the "J" 12 as an

1 injector?

2 A. The "J" 12 has already been perforated near
3 the base of the reef, and it's injecting close to four
4 million cubic feet of gas a day. It appears the sweet
5 spot or the target area may be experiencing higher
6 than average NGL yields because the "J" 12 is already
7 sweeping a larger area of the reservoir, and so
8 they're already seeing that benefit in Section 2.

9 Q. Let's turn now to I think your last exhibit
10 that we had in the package, it was exhibit No. 13?

11 A. Yes.

12 MR. KELLAHIN: I again apologize, Mr.
13 Examiner, for not numbering that one.

14 Q. Describe for us what you've done here, Mr.
15 Schmuhl.

16 A. This is a graph of the production from well
17 "K" 12. The oil producing rate is shown in green.
18 The gas:oil ratio is shown in red.

19 Q. What do you conclude from examining the "K"
20 12 gas:oil ratio and oil production rates?

21 A. I conclude that the production has declined
22 and is currently little bit less than five barrels a
23 day, and it would not appear to be a large loss of oil
24 production if that well were to be converted to
25 injection.

1 Q. Mr. Smallwood has attempted to examine the
2 impact on the OXY Unit No. 5 well. Let me show his
3 exhibit. It's ARCO Exhibit No. 9. Do you have any
4 comments or observations about the method or
5 conclusions Mr. Smallwood has reached when he provided
6 that for the examiner earlier this afternoon?

7 A. I disagree with the conclusion he reached
8 that we would see an increase in NGL production from
9 our well. I think that, in fact, just the opposite
10 will occur with the fracture orientation from "J" 13
11 is oriented in the direction of our producing well,
12 and I would expect gas injected into the "J" 13 would
13 move in that direction and be produced as dry gas from
14 our well.

15 Q. Mr. Smallwood referred to Exhibit 5 as a
16 method to schematically represent the reservoir. Have
17 you seen a copy of this?

18 A. Yes, I have.

19 Q. Have you compared those schematics to the
20 information available from ARCO in their 1985
21 blow-down study?

22 A. Yes, I have.

23 Q. Turn us to that portion of the blow-down
24 study that shows us the numerical simulation of the
25 reservoir.

1 A. In Appendix B to the study, I believe it's
2 page B-3.

3 Q. Let's find it. What does Appendix B-3
4 show?

5 A. It shows that the gas/oil contact is tilted
6 in the reservoir. The left of this figure would be to
7 the north, moving in that direction or updip along the
8 reservoir.

9 Q. If we were taking his schematic Exhibit No.
10 5 and looking at the lower right corner --

11 A. Yes.

12 Q. -- where he attempts to demonstrate the
13 results of implementing the proposed recompletion of
14 wells lower in the reef, is that an accurate depiction
15 of the occurrence of -- the position of the "J" 13 in
16 the structure of the reservoir?

17 A. No, it's not.

18 Q. Would you redraw for us what in your
19 opinion would be a more accurate representation of a
20 depiction of the reservoir?

21 A. To the left of the gas injection well,
22 let's propose they are assuming that that's well "J"
23 13, structurally what you'll have is a little low
24 where we have our well No. 5, which is a producing
25 well, and then there was another high, moving further

1 over this way, which is where our "G" 111 gas
2 injection well was located.

3 Q. Let me have you do that on an extra copy of
4 that Exhibit No. 5. Use my red pen, if you will, so
5 it will show, and show us where in your opinion you
6 would find the structural shape at the "J" 13
7 location?

8 A. Where I would find that structure?

9 Q. Redefine, if you will, the contour and
10 shape of the structure if it was drawn to, in your
11 opinion, accurately reflect the reservoir at the "J"
12 13 location?

13 A. Okay.

14 Q. Have you done that?

15 A. Yes, I have.

16 Q. Now, would you locate for us where the
17 producing No. 5 well would be for the OXY property?

18 A. That would be just to the left of the gas
19 injection well.

20 Q. Let me have what you've done. Thank you.
21 Show that to Mr. Carr.

22 While Mr. Carr is examining what you've
23 done, would you do it again for me as best you can
24 duplicate what you've done on another copy?

25 A. (The witness complied.)

1 MR. KELLAHIN: We're going to mark that as
2 Exhibit No. 14, Mr. Examiner.

3 Q. If you accurately depict the reservoir as
4 you've shown, explain to us what's happening if they
5 use the "J" 13 as an injector as they propose.

6 A. I believe what will happen is that gas
7 injected there will move, since it's lighter, will
8 move preferentially up in the reservoir towards our
9 well No. 5. And it's also along the fracture trend of
10 that reservoir, would also cause the gas to move in
11 that direction. So I think the gas would tend to move
12 towards our well.

13 Q. Let's go now to have you explain the
14 reasons and your analysis of the ultimate conclusion
15 you gave us earlier that it is no longer economically
16 justifiable to continue to inject gas as ARCO is doing
17 in this project, and that rather than reinject the
18 produced gas into the reservoir, it ought to be sold?

19 A. Yes. Again, I'd like to refer to the 1985
20 blow-down evaluation, and there's a graph that is a
21 summary of the economic analysis that was prepared at
22 this time, and that's shown as Figure 11 on page 22.

23 Q. Describe for us --

24 A. The recommendation of the report was to
25 continue residue gas injection until 1995.

1 Q. What was the basis for the recommendation
2 of the continued gas injection until 1995?

3 A. That was based on the maximum undiscounted
4 value of the future cash production from the
5 hydrocarbons produced from the reservoir. It was also
6 the maximum energy recovery.

7 Q. When we look then on Figure 11 on page 22
8 to the point to start blowdown --

9 A. Yes.

10 Q. -- and we look at the top curve, the
11 undiscounted curve --

12 A. That's correct.

13 Q. -- you follow that plot from left to right
14 until you get to the highest point?

15 A. Right.

16 Q. When it breaks over and starts declining,
17 that point of decline is 1995?

18 A. Yes.

19 Q. What does the report tell you?

20 A. Based on undiscounted economics which
21 ignore the time value of money, the report recommended
22 that blowdown be initiated in 1995.

23 Q. If you apply a discount rate to that
24 analysis, what does it do to the date of blowdown?

25 A. If you apply a reasonable discount rate,

1 the current prime rate is 10 percent, and the discount
2 rates in this study do not even go that high. The
3 maximum rate they showed was 7 percent. It indicated
4 any rate above 5 percent, that blowdown should have
5 begun in 1985.

6 Q. Let's use -- would a discount of 5 percent
7 be a conservative discount?

8 A. Yes, it would be very conservative.

9 Q. If we follow the second plot up then on the
10 display, that would be the curve of the 5 percent
11 discount?

12 A. Yes.

13 Q. At what point does that curve begin to
14 decline?

15 A. It's about 1990, but what this showed is
16 there was no increase in value. The value remained
17 basically unchanged from the period of 1985 to 1990 at
18 a 5 percent discount rate.

19 Q. Having reviewed the study, what conclusion
20 do you reach?

21 A. I believe the blowdown should have been
22 initiated in 1985 based on the results of this study.

23 Q. What happens with the continued reinjection
24 of the stripped gas back into the unit? Does it
25 result in an economic benefit to the participants in

1 the unit?

2 A. No, it does not. It actually reduces the
3 present value of the future cash flows from the
4 production of hydrocarbons.

5 Q. What have you found in your own unit about
6 the reinjection of gas?

7 A. We stopped reinjecting gas and quit
8 processing it and are selling our gas at the reduced
9 rates permitted under the reservoir voidage
10 limitation.

11 Q. Summarize for us then, Mr. Schmuhl, your
12 objections to approval by the Division of the "J" 13
13 as an injector for ARCO in the Empire Abo Unit.

14 A. I believe that we're going to be adversely
15 affected by gas injection into the "J" 13, reduced oil
16 production and reduced NGL production. I also believe
17 that there are other opportunities that ARCO has
18 to inject gas in other areas more than 1,650 feet away
19 from our lease line. And also reviewing their own
20 study, the economic analysis in that study indicates
21 they really don't have a need to continue injection of
22 gas into the reservoir at all.

23 MR. KELLAHIN: That concludes my
24 examination of Mr. Schmuhl. We would move the
25 introduction of Exhibits 1 through 14.

1 HEARING EXAMINER: Are there any
2 objections?

3 MR. CARR: No objections.

4 HEARING EXAMINER: Exhibits 1 through 14
5 will be admitted into evidence.

6 Mr. Carr, your witness.

7 CROSS-EXAMINATION

8 BY MR. CARR:

9 Q. Mr. Schmuhl, let's just start working
10 through some exhibits. Go back to No. 1, please.

11 A. Okay.

12 Q. We won't go through them all.

13 Exhibit No. 1 is just a plat of the Empire
14 Abo Unit; is that correct?

15 A. That's right.

16 Q. And also highlighted is the OXY-operated
17 Citco unit?

18 A. That's correct.

19 Q. Two wells are involved in this case, the
20 "J" 10 and the "J" 13. Does OXY have any objection to
21 the injection that is proposed by ARCO in the "J" 10
22 well?

23 A. We have no basis to dispute that. We feel
24 like there's going to be a concentration of gas
25 injection, but since the well is more than 1,650 feet,

1 we don't object to it.

2 Q. You're not objecting to that. The
3 objection is centered on the "J" 13 well?

4 A. That's correct.

5 Q. And the objection is based on the proximity
6 to the Citco-operated unit?

7 A. That's correct.

8 Q. Both of these are voluntary units, are they
9 not?

10 A. I don't know.

11 Q. Let's go now to Exhibit No. 2. Initially
12 on your operated unit, the Citco Empire Abo Unit, you
13 were injecting in the "G" 1; is that right?

14 A. The "G" 111, that's correct.

15 Q. In that well what interval were you
16 injecting at? Were you at the top of the structure or
17 were you down in the structure comparable to the "J"
18 12?

19 A. We were near the -- the perforations are
20 shown on Exhibit 3 for that well.

21 Q. Whereabouts is that in regard to --

22 A. It would be --

23 Q. What is the depth on that? I can't read it
24 on this exhibit.

25 A. Oh, it appears to be about 5480 to 5330,

1 33, something in that range.

2 Q. How deep was that well actually drilled, do
3 you know? Does the cross-section show the total
4 depth?

5 A. I think it shows the total depth of the
6 well.

7 Q. So you did not have an option to perforate
8 deeper into this formation?

9 A. I don't know.

10 Q. Do you have an opinion if you'd been able
11 to do that, you could have had a more effective sweep
12 of your unit?

13 A. I don't have an opinion.

14 Q. You removed your own processing facility
15 because of the low NGL yields; is that correct?

16 A. That's correct.

17 Q. But you continue to have the gas processed
18 by Phillips?

19 A. The gas has to be processed in order to be
20 sold.

21 Q. And you are receiving revenue from the
22 liquids that are extracted from this gas; isn't that
23 correct?

24 A. That's correct.

25 A. So what you actually did, when the economic

1 limit declined, you just changed the actual way you
2 were stripping those liquids out? You had Phillips do
3 it instead of doing it through your own facility?

4 A. No. We stopped gas injection to recover
5 additional liquids from the reservoir and are just
6 producing the gas and selling it. There is
7 contaminants in the gas that need to be removed, and
8 also the plant that does that is equipped to remove
9 natural gas liquids.

10 Q. At that time when you ceased injection, you
11 however have still continued to receive the revenue
12 from the natural gas liquids?

13 A. That's correct.

14 Q. Since the time you ceased injection, you
15 have, within allowable limits, been effectively at
16 blowdown in the Citco Abo Unit; isn't that right?

17 A. At a very reduced rate.

18 Q. Because of the allowables?

19 A. Right.

20 Q. Without allowables, I suspect you would
21 even produce at a higher rate; isn't that correct?

22 A. Yes.

23 Q. The liquid recovery, the natural gas liquid
24 recovery in your unit is 3.2 gallons per Mcf. That's
25 an average?

1 A. Yes, it is.

2 Q. And that's for both wells in the unit?

3 A. Both producing wells.

4 Q. Was any effort ever undertaken by OXY to
5 increase the natural gas liquid recovery in the wells?

6 A. As far as, what we attempted to do was to
7 produce the lowest wells in our structure, which were
8 the 13 and the No. 5, and those are the two wells were
9 producing.

10 Q. No. 5 is the bulk of the production at this
11 time?

12 A. Bulk of the gas production, yes.

13 Q. Did you testify that you felt that perhaps
14 the area south of your unit was swept because of the
15 injection from the No. 12 well?

16 A. What I believe I said was that the "J" 12,
17 which already was, until some of this recent work, I
18 believe was the only well that was perforated at the
19 base of the reef. And the high NGL yields in this
20 area since over approximately 15 billion cubic feet of
21 gas have been injected into the "J" 12, that the high
22 NGL yields in that area may be due to gas injection
23 from the "J" 12.

24 In other words, these wells may already be
25 receiving the benefit from that gas injection.

1 Q. If they are receiving benefit from that gas
2 injection, they are receiving benefit in a direction
3 which is almost perpendicular to the fracture trend in
4 the reservoir?

5 A. That's true.

6 Q. Your concern is loss both of oil and of
7 natural gas liquids; is that right?

8 A. That's correct.

9 Q. The oil production rate in the No. 5 well
10 alone is approximately what, two barrels a day?

11 A. About four barrels a day.

12 Q. How much are you producing out of the No.
13 13 well?

14 A. No. 13 is about seven barrels a day.

15 Q. If we look at your Exhibit No. 5, my
16 question simply is, I'm having a hard time determining
17 what this is. Does this graph depict production from
18 the unit, or is this limited to the No. 5 well?

19 A. It's the well No. 5.

20 Q. So this confirms the four-to-five barrel
21 per day oil rate that you're seeing in the well at
22 this time?

23 A. Yes, it does.

24 Q. Let's go to your Exhibit No. 8. I'd ask
25 you to run through this with me. Your current yield,

1 the natural gas volume, 92,200 gallons, for a net
2 value of 20,695. These are figures per month?

3 A. Yes. This was based on March 1990
4 volumes. It was taken from a statement provided by
5 Phillips, who's the gas processor.

6 Q. Then we have a November 1986 yield. It
7 says 70 percent of current. Explain that column to
8 me.

9 A. What I'm showing, it refers back to Exhibit
10 7. In November 86, we shut down our plant shortly
11 after that. This was the last gas analysis prior to
12 our plant shutdown. The yield was 2.187, which is a
13 value of 7 percent of the current value.

14 So what I'm attempting to estimate the
15 economic impact based on our experience on our lease.
16 If the NGL yield from our unit is reduced similar to
17 what we historically have seen by gas injection into
18 the "J" 13 well, this is what would happen. Actually,
19 that well is closer, and it's along the fracture
20 trend; so the reduction in yield would likely be
21 higher than that.

22 Q. And actually the well that you were
23 shutting in was farther up structure, was it not,
24 farther toward the crest?

25 A. Yes.

1 Q. So what you're doing is projecting the
2 response that you saw in that situation with one where
3 you're talking about a well actually farther south?

4 A. It's farther south, but it's closer to our
5 well.

6 Q. Let's go to Exhibit No. 13. If I
7 understand Exhibit 13, this is your recommendation or
8 what you understand or believe would be the impact of
9 use of the "K" 13 as an injection well in lieu of the
10 well proposed by ARCO?

11 A. No. Let me just restate. If we have
12 Exhibit 2 handy?

13 Q. Exhibit 2, ours or yours?

14 A. My Exhibit 2.

15 MR. KELLAHIN: Here you go.

16 MR. CARR: I've got it.

17 THE WITNESS: Here's the "I" 13, which is
18 the well we have a graph for?

19 MR. CARR: Yes.

20 THE WITNESS: And here's the "J" 12, the
21 current injection well that's active. These wells are
22 in the same relative position as the "J" 13 which is
23 the proposed injector in our No. 5. So we've already
24 had, since 1979, injection into this well.

25 Q. (BY MR. CARR) Into the --

1 A. "J" 12.

2 Q. Into the "J" 12.

3 A. What I was trying to do was look at the
4 offset well here in the same relative position to
5 determine what happened to that well during this time
6 period of gas injection into the "J" 12.

7 Q. What is the producing rate on the "K" 12
8 well?

9 A. On the "K" 12?

10 Q. The "J" 12, I'm sorry.

11 A. The "J" 12 is a gas injection well. It's
12 injecting, I believe it's 3.9 million.

13 Q. The problem I'm having, I'm looking at what
14 is the current producing rate on the "K" 12. I'm
15 sorry.

16 A. Have I got the wrong graph? Excuse me.

17 MR. CARR: I'm looking at an exhibit.
18 Maybe I've got the wrong number on it, Tom. I'm
19 looking at Exhibit 13. Maybe we can make sense if we
20 look at the same paper.

21 THE WITNESS: Sorry about that. "K" 12.

22 Q. (BY MR. CARR) Let's look at Exhibit 13.
23 It's the "K" 12 well. Tell me what this graph shows.

24 A. It's a normal production graph of this
25 well. The red line is the gas:oil ratio, and the

1 green line is the oil production rate.

2 Q. And you have recommended that the "K" 12 --
3 suggested that as a possible alternative for an
4 injection well?

5 A. It's one possibility that I believe should
6 be considered.

7 Q. If that is done, I've got a figure on
8 Exhibit -- our Exhibit No. 4, which shows a natural
9 gas gallons per Mcf volume of 2.21.

10 A. Okay.

11 Q. I'm asking you if you can tell me, if you
12 know what the producing rate in terms of barrels of
13 oil is on the "K" 12 well.

14 A. Approximately five barrels a day.

15 Q. Was it your testimony that you thought that
16 this would not be a significant loss of oil, and that
17 would be a likely choice for conversion?

18 A. Well, this is a low rate relative to some
19 of ARCO's other wells, and injection into this well
20 would not be loss by ARCO. It would tend to push the
21 oil that would have been produced from that well
22 downdip to other producing wells.

23 Q. You don't think the loss of the five
24 barrels in that well would be comparable to the loss
25 of the five barrels if, in fact, you lost the five

1 barrels from the No. 5 well?

2 A. They're the ones that expect to receive the
3 benefits from gas injection. I would prefer them to
4 affect their own wells rather than affect ours.

5 Q. The basis of your assumption in this case
6 is that the injection is going to, if I understand it,
7 move through fractures, that you will then be
8 receiving dry gas in the No. 5, and as a result of
9 that, you're not even going to have a natural gas
10 liquid recovery; is that right?

11 A. We will have reduced natural gas liquid
12 recovery.

13 Q. It's your opinion that what you're going to
14 see is from the proposed "J" 13 well is a direct
15 migration through a fracture towards your No. 5 well?

16 A. That would be a path of least resistance,
17 if the fractures are oriented in that direction, and
18 gas would tend to move preferentially in that
19 direction.

20 Q. You're saying that's the same thing you
21 believe happened between the injection in the "J" 12
22 and the well that offsets it to the northeast, the "I"
23 13?

24 A. Yes.

25 Q. And yet you have also testified that you

1 believe that injecting at a deeper interval in the "J"
2 12 has been a factor in causing the sweet spot in the
3 wells that are not northeast but are in fact southeast
4 from it?

5 A. I believe that there is a fracture system
6 that is oriented in that direction, but not all of the
7 gas will move that way. The gas will move out
8 radially also from the well.

9 Q. I gather from your testimony that what
10 you're doing is rejecting the theory that has been
11 advanced by ARCO that by going deeper into the
12 formation and injecting the dry gas at a deeper
13 interval will in fact increase the natural gas liquid
14 recovery; is that right?

15 A. Yes. Reviewing our data, the continued
16 injection seemed to hurt us, and I think that's a
17 reasonable conclusion.

18 Q. You're looking at only the impact on OXY,
19 or are you looking at the impact on total ultimate
20 energy recovery from the reservoir?

21 A. In which case?

22 Q. You're saying that you do not believe --
23 you believe that going in and injecting at a deeper
24 interval in the "J" 13 is going to be harmful to ARCO?

25 A. That's correct.

1 Q. My question is were you looking just on the
2 impact on OXY or did you consider the ultimate energy
3 recovery from the reservoir?

4 A. When you review the 1985 blow-down study,
5 what that study shows is that the present value of the
6 future cash flows from that field are not maximized
7 starting blowdown at the same point in time as maximum
8 energy recovery. So that's ignoring the time value of
9 money if you assume a maximum energy recovery.

10 Q. So when you're talking about blowdown,
11 you're talking about on a present value basis; isn't
12 that right?

13 A. That's correct.

14 Q. And you were not considering it from a
15 maximum energy recovery basis?

16 A. That's correct.

17 Q. And ARCO's recommendations were based on
18 the maximum energy recovery basis; isn't that correct?

19 A. Right. And also on undiscounted cash
20 flows.

21 Q. Has OXY independently mapped the reservoir
22 and determined where the gas/oil contact would be
23 located?

24 A. No, we haven't.

25 MR. CARR: I think that's all I have.

1 Thank you, Mr. Stogner.

2 HEARING EXAMINER: Mr. Kellahin, any
3 redirect?

4 MR. KELLAHIN: I have a couple of
5 questions, Mr. Examiner.

6 REDIRECT EXAMINATION

7 BY MR. KELLAHIN:

8 Q. In your conversations with ARCO personnel,
9 have you determined from them whether or not they
10 continue to use the 1985 blow-down study to guide them
11 in their operational decisions about how they'll
12 produce the hydrocarbons in the reservoir?

13 A. Yes, I have.

14 Q. What have you found out?

15 A. I was told by Mr. Smallwood when I was
16 attempting to gather data to prepare for this hearing
17 that they were still guided by the 1985 study.

18 Q. You've sat here and listened to Mr.
19 Smallwood's presentation and examined his exhibits.
20 Do you as a reservoir engineer find any justification
21 in granting ARCO an exception to Rule 7 which would
22 provide an injector closer than 1,650 to your unit?

23 A. No, I do not.

24 MR. KELLAHIN: No further questions.

25 HEARING EXAMINER: Thank you Mr. Kellahin,.

1 Mr. Carr?

2 MR. CARR: Nothing further.

3 CROSS-EXAMINATION

4 BY HEARING EXAMINER:

5 Q. Mr. Schmuhl, is the fact that they're
6 injecting 6,000 Mcf of gas at 2,000 psi what you're
7 objecting to or just any gas in general? How about if
8 they injected a smaller amount?

9 A. I think we are objecting to the location of
10 the gas injection. And amounts that would be
11 acceptable to us I think are probably so low that ARCO
12 would not be interested in injecting in the location.

13 Q. Oh, let's hear it.

14 A. Less than half a million a day.

15 HEARING EXAMINER: Are there any other
16 questions of this witness? If not, he may be
17 excused. I believe we're ready for --

18 MR. KELLAHIN: That concludes our
19 presentation, Mr. Examiner.

20 HEARING EXAMINER: Do you wish to recall
21 your witness at this time, Mr. Carr?

22 MR. CARR: No, I do not.

23 HEARING EXAMINER: I believe we're ready
24 for closing arguments or closing statements. Mr.
25 Kellahin, I'll let you go first. Mr. Carr, I'll let

1 you end.

2 MR. KELLAHIN: I know you have another case
3 to do this afternoon, Mr. Examiner. I'll be very
4 brief.

5 The burden of proof is not on OXY to prove
6 ARCO's case for them. One of the few things I've
7 learned from Mr. Carr over the years is that the
8 burden of proof is always on the applicant. You can
9 look to see the framework with which they must meet
10 that burden of proof. You can look directly at Rule 7
11 of their own operations. They have not sought to
12 change that rule.

13 What they do now is seek to have an
14 exception to that rule. That rule for years has
15 served a viable realistic practical justification.
16 It's a justification that Mr. Smallwood told us
17 earlier this afternoon is that it's there to keep the
18 offsetting correlative interest owners not
19 participating in the unit from being damaged. And
20 with that in the rule, it becomes ARCO's obligation to
21 sustain their burden of proof that they're not going
22 to damage us.

23 They have provided nothing this afternoon
24 to tell you that that exception is justified. To the
25 contrary, it appears that meeting Mr. Smallwood's

1 criteria for wells, there are other wells in this unit
2 that can satisfy his needs.

3 He is unable to quantify for us the
4 direction or the magnitude of impact on OXY. The fact
5 that he might have to take a producing well, the "K"
6 12, and convert that to injection in order to satisfy
7 that rule is an alternative that he hasn't examined,
8 and we suggest in the immediate area he's got a
9 solution. And the fact that they won't postpone
10 production from that well and capture it from an
11 immediate offsetting well, I think is inexcusable.

12 The question here is not the oil production
13 out of the OXY unit. It's the fact that they've got
14 gas production that has high Btu content in
15 significant liquid yields. And you don't have to be a
16 reservoir engineer to figure out that the dry gas
17 injected back into this reservoir is going to go to
18 the path of least resistance. Mr. Schmuhl has shown
19 you that he's very concerned that there's reservoir
20 data to document, the path of least resistance is
21 towards his well.

22 We recommend to you that the applicant has
23 failed to sustain the burden of proof to justify the
24 exception. In fact, his own blow-down studies
25 demonstrate that there probably is not a need to

1 continue to reinject this gas in the volumes they
2 propose to inject at all, and what they ought to be
3 here for is to change the rules so they can start
4 selling dry gas like OXY does.

5 We believe that there's no justification in
6 granting this as a exception, and we would recommend
7 that this application be denied.

8 HEARING EXAMINER: Thank you, Mr.
9 Kellahin. Mr. Carr?

10 MR. CARR: May it please the Examiner, ARCO
11 is before you seeking authority to convert two wells
12 to injection in the Empire Abo Unit. There is no
13 objection to what ARCO is proposing in the "J" 10, and
14 we submit to you that that one should be approved.

15 We submit to you that in the "J" 13 also on
16 this record should be approved. It is part of a
17 larger program that's going to result, we believe, in
18 a more effective sweep of this unit, but on its own,
19 we submit we have carried the burden of proof.

20 I think it's encouraging to know that after
21 15 years, Mr. Kellahin has accepted something from me,
22 and that is that the applicant carries the burden of
23 proof.

24 The next lesson I would hope to teach him
25 is that you are a creature of statute. I tell him

1 over and over again, and your powers and duties are
2 defined and limited by the Oil and Gas Act. And it
3 talks about preventing waste and protecting
4 correlative rights.

5 As to waste, I think we've shown that what
6 we're trying to do is not focus on the time value of
7 money but the ultimate energy recovered from this
8 reservoir. And we have a proposal before you today
9 that's going to do it.

10 How have we shown that? We've shown what
11 happens in the "M" 6 well when we go in and start
12 reworking it. We showed you what happens in the "J"
13 12 when we inject at a lower interval.

14 We submit to you we've carried the burden
15 of proof. What we are proposing will result in the
16 increased ultimate recovery of energy from this
17 reservoir, and therefore waste will be prevented. The
18 Act provides as to correlative rights that each
19 operator has an opportunity to produce his just and
20 fair share of the reserves so far as that may be done
21 without causing waste. What Mr. Kellahin suggests we
22 do is start looking for another well when in fact we
23 have an acceptable well for injection purposes.

24 They suggest we go down and use the "K"
25 12. But, in fact, every well they propose and in

1 every well that is available directly south of the
2 Citco Abo Unit is a producer well, and to inject in
3 those wells will cause waste.

4 I think what is important to note is that
5 field experience shows that where you're deeper in the
6 reservoir at reinjecting dry gas, that you do get a
7 better sweep, that you do produce more in terms of
8 natural gas liquids, and that ARCO's correlative
9 rights would be impaired, and we submit the testimony
10 supports the conclusion that even OXY's correlative
11 rights would be impaired.

12 They contend that there's a fracture
13 system. That's based on extremely limited evidence.
14 They say the "I" 13 well is north and east of the "J"
15 12 injector, and that shows there's a fracture
16 system. The very same witness, the only witness, the
17 person that draws that conclusion also says that
18 injection in the "J" 12 well is not what will cause a
19 sweet spot in the area absolutely perpendicular to
20 what he says is a trend of the fractures.

21 The fractures are a nice theory based on
22 the fact that you've got one well that has been
23 plugged and abandoned offsetting an injector, but on
24 this record alone even their testimony supports the
25 conclusion that injection in a lower interval over a

1 wide area in the reservoir can improve natural gas
2 liquid sweep.

3 The bottom line is we stand before you
4 proposing something that will increase ultimate
5 recovery, will improve the effective sweep of this
6 reservoir, it will prevent waste, and the application
7 should be granted.

8 HEARING EXAMINER: Thank you, Mr. Carr.

9 Does anybody else have anything further in
10 Case No. 9931? Gentlemen, I'd like rough draft orders
11 from each of you. When can you get them to me?

12 MR. KELLAHIN: We could ask for one of Mr.
13 Hall's expedited orders and have them in by December
14 31?

15 HEARING EXAMINER: Next Wednesday? Would
16 that be --

17 MR. CARR: Could we do it a week from
18 Wednesday?

19 HEARING EXAMINER: Okay, a week from
20 Wednesday.

21 MR. CARR: I mean that's two weeks from
22 today.

23 HEARING EXAMINER: That's two weeks from
24 today, a week from next Wednesday, whatever the case
25 may be.

1 MR. CARR: That's true, 14 days from today.

2 MR. STOVALL: The next hearing date; is
3 that what you're saying, Mr. Carr?

4 MR. CARR: That would be fine.

5 HEARING EXAMINER: Thank you, gentlemen.
6 This case will be taken under advisement.

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CERTIFICATE OF REPORTER

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STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Deborah O'Bine, Certified Shorthand Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Division was reported by me; that I caused my notes to be transcribed under my personal supervision; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

WITNESS MY HAND AND SEAL August 1, 1989.


DEBORAH O'BINE
CSR No. 127

My commission expires: August 10, 1990

I do hereby certify that the foregoing is a correct record of the proceedings in the Oil Conservation Division of Case No. 9931, heard on 8 August 1990.


Examiner
Oil Conservation Division