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

EXAMINER HEARING

IN THE MATTER OF:

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

ORIGINAL

TRANSCRIPT OF PROCEEDINGS

BEFORE: MICHAEL E. STOGNER, EXAMINER

STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO
June 13, 1990

A P P E A R A N C E S

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

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

HEARING EXAMINER: Call for appearances.

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

HEARING EXAMINER: Are there any other appearances?

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

HEARING EXAMINER: Are there any other appearances?

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

(Witnesses sworn.)

GARY SMALLWOOD,

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

DIRECT EXAMINATION

BY MR. CARR:

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

A. My name is Gary Brooks Smallwood.

Q. Mr. Smallwood, where do you reside?

A. In Midland, Texas.

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

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

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

A. Yes, I have.

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

A. Yes, I am.

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

A. Yes, sir, I am.

MR. CARR: Are the witnesses qualifications acceptable?

HEARING EXAMINER: Are there any objections?

MR. KELLAHIN: No objection.

HEARING EXAMINER: Mr. Smallwood is so qualified.

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

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

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

A. Yes, they are.

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

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

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

A. That's correct.
Q. And it extends into Township 17 South?
A. Yes. And it also shows the location of the two subject wells, the Empire Abo Unit "J" 10 and "J" 13.
Q. Let's move on to Exhibit 1-B, and I would ask you to identify that and review it for the Examiner.
A. This is an enlargement of the area of interest. It locates the OXY-operated Citco Empire Abo Unit, and it shows the location of the proposed gas injection well "J" 13 as a dotted triangle.
Q. This is currently or a temporarily abandoned producing well?
A. That is correct.
Q. This is the well for which an exception is needed to the Empire Abo Pressure Maintenance Pool Rules?
A. Yes, it is.
Q. Would you identify what has been marked as Exhibit No. 2?
A. Yes. That's the Empire Abo Pool Rules.
Q. These are the rules that govern the Pressure Maintenance Project?
A. Yes.

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

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

Q. [redacted] 13 well is located closer than 1,650 feet to the Citco Empire Abo Unit; correct?

A. That's correct.

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

A. Yes, they do.

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

A. This is the OCD Form C-108.

Q. Was this prepared by you?

A. Yes, sir, it was.

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

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

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

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

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

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

A. That's right.

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

A. Yes, sir, it is.

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

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

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

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

Q. Basically, what does it show?

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

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

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

A. That's right.

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

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

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

A. I'm not sure without looking through some

more diagrams.

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

A. That's right.

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

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

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

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

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

A. That's right.

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

A. Six million cubic feet per day.

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

A. 2,000 psi.

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

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

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

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

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

was to improve the sweep of the reservoir?

A. That's right.

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

A. Yes.

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

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

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

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

A. That's right.

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

Examiner?

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

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

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

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

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

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

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

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

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

A. Yes, sir.

Q. Identify that and review it for the Examiner.

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

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

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

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

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

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

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

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

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

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

A. Yes.

Q. It is a sweet spot in the reservoir?

A. Yes, it is.

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

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

Q. Where is the "J" 12 located?

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

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

A. We'll recover additional NGL's.

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

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

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

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

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

the well that offsets the "J" 13?

A. That's right.

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

A. That's correct.

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

A. Yes, we could.

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

A. Yes, it will.

Q. Reserves that otherwise would not be recovered?

A. That's right.

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

A. Yes, it will.

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

A. Yes, they were.

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

HEARING EXAMINER: Are there any objections?

MR. KELLAHIN: No objections.

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

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

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

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

HEARING EXAMINER: Thank you, Mr. Carr.

Mr. Kellahin, your witness.

MR. KELLAHIN: Thank you, Mr. Examiner.

CROSS-EXAMINATION

BY MR. KELLAHIN:

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

A. Yes, sir.

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

A. That's right.

Q. You did not make that selection?

A. That's right.

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

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

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

A. February of this year.

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

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

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

A. That's right.

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

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

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

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

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

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

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

A. Yes.

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

A. How do you select?

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

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

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

A. Um-hm.

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

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

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

A. No, sir.

Q. You currently have 14 injectors?

A. There are 14 active gas injectors.

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

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

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

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

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

A. That's right.

Q. What is one of them?

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

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

A. That's right.

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

A. "D" 37.

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

A. Yes.

Q. Where's the last one?

A. "F" 31.

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

A. That's right.

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

A. We've been averaging about 48 million cubic

feet a day.

Q. 48 million a day?

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

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

A. That's right.

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

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

Q. Who's got the other 50 percent?

A. Amoco.

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

A. That's right.

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

A. No.

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

A. Approximately 38-1/2 million.

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

A. Yes.

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

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

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

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

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

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

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

A. That's right.
Q. What, in your opinion, is the time at which you will stop doing that process and in effect institute blowdown of the reservoir within the unit?
A. Our last study is now quite old that addressed that issue. It estimated it in 1995. In my opinion, the new study that we're doing will push it back a few more years from 1995.
Q. You would push it farther back from 1995?
A. That's right.
Q. Have you participated in that study?
A. We're working on that study now.
Q. "We," does that mean you included?
A. That means me included.
Q. When we look at the target area, Exhibit 7 identifies a target area. Show me on any of your displays what the boundaries are for the target area.
A. Exhibit 7 identifies -- if you look on Exhibit 4, which shows the NGL yields --
Q. Yes, sir?
A. -- we're trying to target the area in Section 2 that has the richer yields of NGL.
Q. The unit area within Section 2 then is the target area by which the calculation on Exhibit 7 is made?

A. That's right.
Q. When we look at injector "J" 12 just to the west of 13 on Exhibit No. 4, that is currently an injector?
A. Yes.
Q. This is one that is completed lower in the reef; it's towards the base of the reef?
A. Yes, it is.
Q. So it satisfies that existing criteria that you have for establishing an injector?
A. That's right.
Q. Another criteria was to evenly space out the injectors?
A. Across the unit.
Q. Any other criteria?
A. No other criteria.
Q. Wasn't one of your criteria to locate an injector in one of these sweet spots?
A. Yes, sir.
Q. That would be a criteria, wouldn't it?
A. Yes, sir.
Q. The criteria is that the average unit liquid yield is 3.8 gallons per thousand cubic feet of gas? That's the average for the unit?
A. That's the average for the unit.

Q. And you're looking for areas that are in the range of 5 gallons per thousand cubic feet of gas?
A. Yes.
Q. Have you looked for, apart from the target area in Section 2, and apart from the area around the three additional injectors you've identified on Exhibit 1-A, are there any other areas that satisfy those three criteria?
A. I have not studied that.
Q. You haven't looked for it?
A. Um-um.
Q. How many currently shut-in producers do you have in the unit?
A. I don't know.
Q. How many producers do you have?
A. Something like 200.
Q. How many total wells do you have?
A. Four hundred, roughly.
Q. You've got in excess of 100 shut-in producers?
A. Yes.
Q. More than 150?
A. I don't know.
Q. When we look at the offsetting injector to the proposed "J" 13, we've got the "J" 12, you're

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

A. Through "J" 12?

Q. Yes, sir.

A. Yes.

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

A. Yes.

Q. Low in the reef in the sweet spot?

A. Yes.

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

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

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

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

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

A. I don't know.

Q. You don't know that?

A. Um-um.
Q. When we look at "J" 12, we're currently putting 4 million a day in that well. When we look to the west to the "J" 11, that's one of those shut-in producers?
A. Temporarily abandoned producer.
Q. When was that abandoned?
A. That's been abandoned for some time. 1977.
Q. When you go clockwise around the 40-acre offsets to the "J" 12 injector, you pick up the "I" 11?
A. Um-hm.
Q. That's not currently being utilized to receive a benefit of increased liquid yield production from the injector "J" 12, is it?
A. Not at this time.
Q. When did you stop using it as a producer?
A. It's been temporarily abandoned for quite some time too.
Q. You've got the "I" 12, current liquid yield, 3.39?
A. Um-hm.
Q. What's the date of the data that's used to make this calculation?
A. I think it's 88. I supplied that to OXY.

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

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

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

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

A. No, I have not.

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

A. Um-hm.

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

A. I don't know.

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

A. No, sir.

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

A. Um-hm.
Q. When did you stop utilizing that for production?
A. I'm not sure of that either. They've been temporarily abandoned for some time now.
Q. When you look at "K" 12, that well, is that a producing well that is perforated in a lower portion of the reef?
A. Yes, I believe it is.
Q. What are the proposed perforations --
A. I have not -- I know what the perfs are. I do not have a record of where the top of the reef is there, but, like I stated, in general, all our wells are perforated in the base of the reef. All our producers are.
Q. Do you know where the perforations are in the "K" 12 as related to the perforations in the "J" 12 or the "J" 13 as you proposed to reperforate it?
A. The perforations in "K" 12 are 5766 to 5804.
Q. Excuse me; 5766 to --
A. To 5804.
Q. Where are your proposed perfs for the "J" 13 injector?
A. They are 5710 to 5724 and 5754 to 5784.

Q. What's the structural relationship between "K" 12 and "J" 13?
A. I'm not sure.
Q. Are both of those wells in the gas cap?
A. Yes.
Q. Can you approximate for me the current boundaries of the current gas cap in the unit?
A. No.
Q. Is there any mechanical or integrity problem with utilizing "K" 12 as the injector instead of the "J" 13?
A. It's a producing well. We don't like to convert producing wells to injectors if we aren't required to.
Q. Other than that --
A. Other than the fact we would lose production.
Q. -- is there anything wrong with the mechanics or the integrity of that wellbore that it cannot be utilized as an injector?
A. I'm not aware of any.
Q. The liquid yield on the "K" 12 is only 2.21 gallons per thousand cubic feet of gas?
A. Um-hm.
Q. And that's despite the fact that it is the

immediate south offset of the current "J" 12 injector?
A. That's right, which should be expected since "J" 12 has injected 15 billion cubic feet of gas.
Q. When we look at Exhibit No. 9, what is the sweet spot area that you've shown for the OXY No. 5 well?
A. The 5 gallons per thousand cubic feet that we show in Section 2.
Q. What is defined as the sweet spot area, the sweet area?
A. The area within Section 2 and the near wellbore area of "J" 13.
Q. Does that overlap your target area that's shown on Exhibit No. 7?
A. They're both located within near the wellbore area of "J" 13.
Q. What is the individual liquid yield for the No. 5 well?
A. I don't know. The No. 5 well in the Citco Unit?
Q. Yes, sir.
A. I don't know.
Q. The incremental liquid yield content on Exhibit No. 9, the 1.2 gallon, where does that number

come from?

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

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

A. Yes.

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

A. Yes.

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

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

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

A. You don't.

Q. How come?

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

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

A. Yes, there are geological boundaries.

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

A. Um-hm.

Q. -- on page No. 13, you have provided a geologic summary?
A. Um-hm.
Q. For the unit?
A. Yes.
Q. Did you do that yourself, or did it come from something else?
A. It's a published description within our company.
Q. It came from your 1985 blow-down study, didn't it?
A. Yes.
Q. You took it verbatim from that section describing the geology within the blow-down study report of 85?
A. Actually, I took it from another report, which probably took it from the study you're referring to.
Q. Are you familiar with the 85 blow-down study?
A. Somewhat, yes.
Q. It talks about vertically fracturing the reservoir?
A. Yes.
Q. Have you as a reservoir engineer examined

the fracturing in the reservoir?

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

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

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

A. Not that I'm aware of.

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

A. Okay.

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

A. That's my assumption.

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

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

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

A. Um-hm.

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

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

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

A. That could be.

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

A. Not that I'm aware of.

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

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

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

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

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

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

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

A. It's not a specific producer.

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

A. No, I don't.

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

A. Um-hm.

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

A. I think Exhibit 5 describes that.

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

A. I'm not aware of that.

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

A. No.

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

A. No.

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

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

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

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

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

A. Yes.

HEARING EXAMINER: You're referring to Exhibit 7?

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

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

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

A. That's the intent.

Q. The dry gas then picks up liquids?

A. Yes.

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

A. Um-hm.

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

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

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

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

A. No, I have not quantified it.

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

A. No, I have not done that.

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

A. To protect noncommitted tracts.

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

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

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

A. No, sir. They're not additional

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

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

A. No.

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

A. Um-hm.

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

A. Um-hm.

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

A. No, 6 million a day.

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

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

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

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

Q. Is that currently being utilized as an injector?

A. Yes, it is.

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

A. Yes, it is.

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

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

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

A. No.

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

A. Yes.

Q. What's the point?

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

Q. Is it your plan to stimulate the injectors?

A. We give them a small initial acid cleanup.

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

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

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

A. Yes.

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

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

MR. KELLAHIN: Thank you, Mr. Examiner.

HEARING EXAMINER: Mr. Carr?

REDIRECT EXAMINATION

BY MR. CARR:

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

A. That's correct.

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

A. That's right.

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

A. Um-hm.

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

A. No, none whatsoever.

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

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

Q. In your opinion, is the conversion of the

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

A. Yes, it is.

MR. CARR: That's all I have.

HEARING EXAMINER: Thank you, Mr. Carr. Are there any other questions of this witness?

CROSS-EXAMINATION

BY HEARING EXAMINER:

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

A. Yes, sir.

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

A. We request the same --

MR. CARR: For the No. 12.

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

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

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

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

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

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

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

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

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

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

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

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

MR. KELLAHIN: One question, Mr. Examiner.

HEARING EXAMINER: Mr. Kellahin.

RECROSS EXAMINATION

BY MR. KELLAHIN:

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

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

MR. KELLAHIN: No further questions.

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

MR. CARR: No further questions.

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

(Recess.)

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

MR. KELLAHIN: Thank you, Mr. Examiner.

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

JEFF SCHMUHL,

the witness herein, after having been first duly sworn

upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

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

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

Q. Have you previously testified before the Division?

A. No, I have not.

Q. Summarize for us your educational background.

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

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

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

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

A. Yes, I have.

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

HEARING EXAMINER: Are there any objections?

MR. CARR: No objections.

HEARING EXAMINER: Mr. Schmuhl is so qualified.

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

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

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

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

It also shows the other injection wells in

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

Just a little history on our unit. Our unit was formed in 1974. We began injection in 1975 into the "G" 111. We continued that type of operation until 1986, at which time we shut down our gas processing plant because the low NGL yields we were experiencing, we couldn't economically justify continuing that type of operation.

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

A. Yes, it is.

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

A. Yes.

Q. Why did you stop doing that?

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

Q. Why not?

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

Q. Give me some more background of your project.

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

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

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

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

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

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

Q. 3.2?

A. Right.

Q. That analysis is made then at the plant?

A. Right.

Q. When the production from the two producing

wells gets to the plant, they analyze it there?

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

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

A. It's typical.

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

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

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

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

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

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

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

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

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

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

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

A. Yes.

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

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

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

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

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

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

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

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

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

A. Yes.

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

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

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

A. Right.

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

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

Q. What does this show you?

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

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

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

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

A. Exhibit 4 is a graph of the injection

volumes for our gas injection well on the Citco unit.

Q. This is the "G" 111?

A. That's correct.

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

A. That's correct.

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

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

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

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

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

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

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

A. Right.

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

A. That's correct.

Q. What's happening here?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The NGL yields have increased 43 percent since November 86.

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

A. That's shown in the next exhibit.

Q. All right. Exhibit No. 8?

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

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

A. Yes, I have.

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

HEARING EXAMINER: Okay.

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

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

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

January of 1985.

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

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

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

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

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

A. Yes, I have.

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

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

Q. What is that last sentence?

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

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

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

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

A. It is the "I" 13.

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

A. Right.

Q. Immediately north of their proposed "J" 13

injector?

A. Right.

Q. What have you looked at that well for?

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

Q. All right.

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

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

A. That's correct.

Q. Have you reduced that information to a display?

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

Q. Exhibit No. 10?

MR. CARR: Which is Exhibit 10?

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

MR. CARR: No problem.

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

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

shows the gas:oil ratio.

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

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

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

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

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

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

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

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

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

A. Yes.

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

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

Q. Exhibit No. 11?

A. Exhibit 11.

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

A. That's correct.

Q. What does this show you?

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

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

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

Q. Anything else about Exhibit No. 11?

A. No.

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

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

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

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

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

A. That's correct.

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

conclude?

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

Q. For example, find one for us.

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

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

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

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

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

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

injector?

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

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

A. Yes.

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

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

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

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

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

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

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

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

A. Yes, I have.

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

A. Yes, I have.

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

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

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

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

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

A. Yes.

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

A. No, it's not.

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

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

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

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

A. Where I would find that structure?

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

A. Okay.

Q. Have you done that?

A. Yes, I have.

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

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

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

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

A. (The witness complied.)

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

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

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

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

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

Q. Describe for us --

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

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

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

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

A. Yes.

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

A. That's correct.

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

A. Right.

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

A. Yes.

Q. What does the report tell you?

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

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

A. If you apply a reasonable discount rate,

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

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

A. Yes, it would be very conservative.

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

A. Yes.

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

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

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

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

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

the unit?

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

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

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

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

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

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

HEARING EXAMINER: Are there any objections?

MR. CARR: No objections.

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

Mr. Carr, your witness.

CROSS-EXAMINATION

BY MR. CARR:

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

A. Okay.

Q. We won't go through them all.

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

A. That's right.

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

A. That's correct.

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

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

we don't object to it.

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

A. That's correct.

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

A. That's correct.

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

A. I don't know.

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

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

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

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

Q. Whereabouts is that in regard to --

A. It would be --

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

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

33, something in that range.

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

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

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

A. I don't know.

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

A. I don't have an opinion.

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

A. That's correct.

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

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

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

A. That's correct.

A. So what you actually did, when the economic

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

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

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

A. That's correct.

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

A. At a very reduced rate.

Q. Because of the allowables?

A. Right.

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

A. Yes.

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

A. Yes, it is.
Q. And that's for both wells in the unit?
A. Both producing wells.
Q. Was any effort ever undertaken by OXY to increase the natural gas liquid recovery in the wells?
A. As far as, what we attempted to do was to produce the lowest wells in our structure, which were the 13 and the No. 5, and those are the two wells were producing.
Q. No. 5 is the bulk of the production at this time?
A. Bulk of the gas production, yes.
Q. Did you testify that you felt that perhaps the area south of your unit was sweeped because of the injection from the No. 12 well?
A. What I believe I said was that the "J" 12, which already was, until some of this recent work, I believe was the only well that was perforated at the base of the reef. And the high NGL yields in this area since over approximately 15 billion cubic feet of gas have been injected into the "J" 12, that the high NGL yields in that area may be due to gas injection from the "J" 12.

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

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

A. That's true.

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

A. That's correct.

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

A. About four barrels a day.

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

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

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

A. It's the well No. 5.

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

A. Yes, it does.

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

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

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

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

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

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

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

A. Yes.

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

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

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

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

Q. Exhibit 2, ours or yours?

A. My Exhibit 2.

MR. KELLAHIN: Here you go.

MR. CARR: I've got it.

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

MR. CARR: Yes.

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

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

A. "J" 12.
Q. Into the "J" 12.
A. What I was trying to do was look at the offset well here in the same relative position to determine what happened to that well during this time period of gas injection into the "J" 12.
Q. What is the producing rate on the "K" 12 well?
A. On the "K" 12?
Q. The "J" 12, I'm sorry.
A. The "J" 12 is a gas injection well. It's injecting, I believe it's 3.9 million.
Q. The problem I'm having, I'm looking at what is the current producing rate on the "K" 12. I'm sorry.
A. Have I got the wrong graph? Excuse me.
MR. CARR: I'm looking at an exhibit. Maybe I've got the wrong number on it, Tom. I'm looking at Exhibit 13. Maybe we can make sense if we look at the same paper.
THE WITNESS: Sorry about that. "K" 12.
Q. (BY MR. CARR) Let's look at Exhibit 13. It's the "K" 12 well. Tell me what this graph shows.
A. It's a normal production graph of this well. The red line is the gas:oil ratio, and the

green line is the oil production rate.

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

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

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

A. Okay.

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

A. Approximately five barrels a day.

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

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

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

barrels from the No. 5 well?

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

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

A. We will have reduced natural gas liquid recovery.

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

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

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

A. Yes.

Q. And yet you have also testified that you

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

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

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

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

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

A. In which case?

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

A. That's correct.

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

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

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

A. That's correct.

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

A. That's correct.

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

A. Right. And also on undiscounted cash flows.

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

A. No, we haven't.

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

Thank you, Mr. Stogner.

HEARING EXAMINER: Mr. Kellahin, any redirect?

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

REDIRECT EXAMINATION

BY MR. KELLAHIN:

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

A. Yes, I have.

Q. What have you found out?

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

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

A. No, I do not.

MR. KELLAHIN: No further questions.

HEARING EXAMINER: Thank you Mr. Kellahin,.

Mr. Carr?

MR. CARR: Nothing further.

CROSS-EXAMINATION

BY HEARING EXAMINER:

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

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

Q. Oh, let's hear it.

A. Less than half a million a day.

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

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

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

MR. CARR: No, I do not.

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

you end.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

HEARING EXAMINER: Thank you, Mr. Carr.

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

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

HEARING EXAMINER: Next Wednesday? Would that be --

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

HEARING EXAMINER: Okay, a week from Wednesday.

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

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

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

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

MR. CARR: That would be fine.

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

CERTIFICATE OF REPORTER

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

DEBORAH O'BINE
CSR No. 127

My commission expires: August 10, 1990

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 9931, heard by me on 8 August 1990.

, Examiner
Oil Conservation Division

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

IN THE MATTER OF:
THE HEARING CALLED BY THE
OIL CONSERVATION COMMISSION
TO CONSIDER:

APPLICATION OF ARCO OIL & GAS COMPANY FOR PRESSURE MAINTENANCE EXPANSION AND AN UNORTHODOX GAS INJECTION WELL, EDDY COUNTY, NEW MEXICO.

CASE NO. 9931

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING

BEFORE: WILLIAM J. LeMAY, Chairman
WILLIAM WEISS, Commissioner
JAMI BAILEY, Commissioner

June 12, 1991
9:00 a.m.
Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Commission on June 12, 1991, at 9:00 a.m. at Morgan Hall, State Land Office Building, 310 Old Santa Fe Trail, Santa Fe, New Mexico, before Susan G. Ptacek, a Certified Court Reporter No. 124, State of New Mexico.

FOR: OIL CONSERVATION DIVISION

BY: SUSAN G. PTACEK
Certified Court Reporter
CCR No. 124

I N D E X

June 12, 1991
Commissioner Hearing
Case No. 9931

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A P P E A R A N C E S

FOR THE DIVISION: ROBERT G. STOVALL, ESQ.
General Counsel
Oil Conservation Division
State Land Office Building
Santa Fe, New Mexico 87504

* * *

COMMISSIONER LEMAY: Good morning. This is the Oil Conservation Commission meeting, and I will introduce my commissioners. I am Bill LeMay, on my left is Commissioner Bill Weiss, on my right Commissioner Jami Bailey. She is representing Commissioner Jim Baca, Commissioner of Public Lands.

We shall begin by calling Case No. 9931.

MR. STOVALL: Application of Arco Oil & Gas Company for pressure maintenance expansion and an unorthodox gas injection well, Eddy County, New Mexico. The applicant is requesting this case be continued to July 18 commissioner hearing.

COMMISSIONER LEMAY: Without objection Case No. 9931 will be continued to the July 18 commission hearing.

(Whereupon, the hearing was concluded at the approximate hour of 9:01 a.m.)

* * *

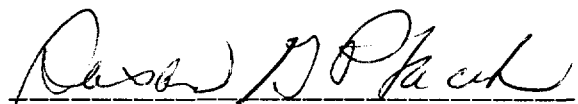
STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

REPORTER'S CERTIFICATE

I, Susan G. Ptacek, a Certified Court Reporter and Notary Public, do HEREBY CERTIFY that I stenographically reported the proceedings before the Oil Conservation Division, and that the foregoing is a true, complete and accurate transcript of the proceedings of said hearing as appears from my stenographic notes so taken and transcribed under my personal supervision.

I FURTHER CERTIFY that I am not related to nor employed by any of the parties hereto, and have no interest in the outcome thereof.

DATED at Santa Fe, New Mexico, this 19th day of July, 1991.



SUSAN G. PTACEK
Certified Court Reporter
Notary Public

My Commission Expires:
December 10, 1993