STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

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| IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING: | ) | CASE NO. 12,512 |
| APPLICATION OF EXXON MOBIL CORPORATION TO CERTIFY A WATERFLOOD PROJECT FOR A POSITIVE PRODUCTION RESPONSE PURSUANT TO THE ENHANCED OIL RECOVERY ACT, EDDY COUNTY, NEW MEXICO | ) | ORIGINAL |



REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: MICHAEL E. STOGNER, Hearing Examiner

October 19th, 2000

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Division, MICHAEL E. STOGNER, Hearing Examiner on Thursday, October 19th, 2000, at the New Mexico Energy, Minerals and Natural Resources Department, Porter Hall, 2040 South Pacheco, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

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# I N D E X

October 19th, 2000
Examiner Hearing
CASE NO. 12,512



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A P P E A R A N C E S

FOR THE APPLICANT:

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* * *

WHEREUPON, the following proceedings were had at 1:30 p.m.:

EXAMINER STOGNER: This hearing will come to order. I believe at this time we will call Case Number 12,512, which is the Application of Exxon Mobil Corporation to certify a waterflood project for a positive production response pursuant to the Enhanced Oil Recovery Act, Eddy County, New Mexico.

At this time I'll call for appearances.

MR. BRUCE: Mr. Examiner, Jim Bruce of Santa Fe, representing the Applicant. I have three witnesses to be sworn.

EXAMINER STOGNER: Any other appearances?

Will the witnesses please stand to be sworn?

(Thereupon, the witnesses were sworn.)

WILLIAM T. DUNCAN,

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

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Mr. Duncan, would you please state your full name and city of residence?

A. My name is William Thomas Duncan, Jr., and I reside in -- well, in The Woodlands, Texas, which is just north of Houston, Texas.

Q. Who do you work for and in what capacity?

A. I work for Exxon Mobil Corporation as a regulatory and reservoir engineer.

Q. Have you previously testified before the Division?

A. Yes, I have.

Q. And were your credentials as an expert admitted as a matter of record?

A. Yes, they were.

Q. And are you familiar with matters related to the Avalon-Delaware Unit?

A. Yes, I am.

MR. BRUCE: Mr. Examiner, I tender Mr. Duncan as an expert engineer.

EXAMINER STOGNER: Mr. Duncan is so qualified.

Q. (By Mr. Bruce) Mr. Duncan, could you identify Exhibit 1 for the Examiner and briefly discuss what we're here for today?

A. Exhibit Number 1 is a map of the Avalon-Delaware Unit in Eddy County, New Mexico. It shows an outline of the unit, and then within that outline a color-coded key of the operators of leases that were included in the unit.

In 1995, October of 1995, this unit became effective and an enhanced oil recovery project was implemented in this particular unit waterflood. We're here

today to report on the results of that waterflood today.

Q. Okay. What is Exhibit 2?

A. Exhibit Number 2 is a copy of Order Number R-6368-B for the Avalon-Delaware Pool, which established a gas-oil ratio limit of 7500 standard cubic feet per barrel in 1990. This was the maximum producing gas-oil ratio during the latter part of the pre-unitization producing life of the field and is evidence of the higher GOR that was exhibited by wells in the field.

Q. Mr. Duncan, you did say 7500. Actually, that's what Yates requested in this case. Actually, I think the Division granted a 4000-to-1 GOR?

A. I'm sorry, I didn't -- I was mistaken, you're right.

Q. Okay. But that's the only special pool rules that apply to the unitized interval for the Avalon-Delaware Unit; is that correct?

A. That's correct, with the exception of the order, Order 6368, which created and defined the pool.

Q. Okay.

A. The order does note that the maximum producing GOR that was noted at the time of the hearing was approximately 4000 standard cubic feet per barrel. Of note is that after implementation of the waterflood in 1995, the GOR for the Avalon-Delaware Unit, which includes the entire

pool, is now about 1600 standard cubic feet per barrel, and there will be more testimony later in our presentation about that.

Q. What is Exhibit 3?

A. Exhibit 3 is a copy of NMOCD Order R-10,460-B, which created the Avalon-Delaware Unit, approved the waterflood project, qualified it for the oil tax rate pursuant to the Enhanced Oil Recovery Act and approved various nonstandard well locations in the unit.

Of note is on page -- beginning on page 15, Order portions (1) through (7) approve the unit, Order portions (8) through (10) approve the waterflood, Order portions (11) through (17) approve the injection and UIC applications, Order portions (18) through (22) approve the enhanced oil recovery project.

And in Order portion number (20) it's specified that in order "to be eligible for the EOR credit, prior to commencing injection operations the operator must request from the Division a Certificate of Qualification, which ...will specify the proposed project area as described..." and that is attached as Exhibit Number 4.

And Order portion number (21) stated that at the time of positive production response "...and within five years from the date of the Certificate of Qualification, the operator must apply to the Division for certification

of a positive production response..." and that "...application shall identify the area actually benefitting from enhanced recovery operations, and identifying the specific wells which the operator believes are eligible for the credit."

That is the purpose of our Application and filing today.

Q. And that Application was filed, I believe, on September 26th, Mr. Duncan?

A. That is correct, which was within the five years specified.

Q. Okay. And then again, finally, Exhibit 4 is just the certification letter from the Division?

A. That is correct, and it shows a certification date of October 15th, 1995.

Q. Were Exhibits 1 through 4 prepared by you or compiled under your direction?

A. Yes, they were.

Q. And in your opinion, is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes, it is.

MR. BRUCE: Mr. Examiner, I'd move the admission of Exhibits 1 through 4.

EXAMINER STOGNER: Exhibits 1 through 4 will be

admitted into evidence.

EXAMINATION

BY EXAMINER STOGNER:

Q. Mr. Duncan, your Exhibit Number 3, now, this was the final Commission order that granted this project?

A. Yes, it was.

Q. Okay. Now, wasn't there an order or two prior to this time?

A. There were. There was an order pursuant to the June hearing, the Division hearing, and then there was also a *nunc pro tunc* order, which I'm not sure whether it was after the December hearing or before. Mr. Bruce may be able to help me on that.

MR. BRUCE: I believe it was -- I think it was the -A order, which was probably before this order.

THE WITNESS: That would make sense.

Q. (By Examiner Stogner) Now, was there anything -- Let me rephrase that.

The original order authorized this project from the Division. Did this Commission Order change anything with respect to the EOR portion of this order?

A. To be honest, I didn't check it. I don't think it did, but I didn't check specifically that point. I'd be happy to compare the language.

MR. BRUCE: And Mr. Examiner, from what I recall

from being involved in there, the Division's order did approve the EOR project, which is why the certificate of qualification was issued in October, which is obviously before this Commission order was entered. And the Division order was not stayed during the pendency of the appeal to the Commission.

Q. (By Examiner Stogner) So October of 1995 was when injection started or when the project was approved?

A. October 1st of 1995 is when the unit became effective. October 15th of 1995 is the certification date by the NMOCD, and injection began after that. And I don't have the exact date that injection began.

There had been injection into the Delaware for disposal for several years prior to that, but wells were not converted to injection pursuant to the waterflood -- or for the waterflood project until after October 15th of 1995.

EXAMINER STOGNER: I'll take administrative notice at this time of both Cases 11,297 and 11,298 in this matter, and I believe I've already accepted the Exhibits 1 through 4.

I don't have any other questions of Mr. Duncan at this time. I may later on, once we hear some testimony --

MR. BRUCE: Okay.

EXAMINER STOGNER: -- additional testimony.

Thank you, sir.

STEVEN R. KROHN,

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

DIRECT EXAMINATION

BY MR. BRUCE:

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

A. Steven R. Krohn.

Q. How do you spell your last name, sir?

A. K-r-o-h-n.

Q. Who do you work for and in what capacity?

A. I work for Exxon Mobil Corporation as a senior petroleum geologist.

Q. Have you previously testified before the Division?

A. No, I have not.

Q. Would you please summarize your educational and employment background?

A. I'm a graduate of the University of Wisconsin, Milwaukee, with a degree in geological sciences. I've been employed by Exxon Mobil or its predecessors since 1980, with nearly all of my experience being in the domestic United States. Since 1986 I've worked exclusively in the production department, which deals with the development and exploitation of existing fields and properties.

I've worked west Texas/New Mexico properties since 1996 and have been involved either in a primary or backup sense with the Avalon-Delaware Unit since 1996.

I also have presented at technical hearings for both the Texas Railroad Commission and the State of Texas General Land Office, and I am a Certified Petroleum Geologist by the American Association of Petroleum Geologists, Number 4822.

Q. Are you familiar with the geology of the unitized interval in the Avalon-Delaware Unit?

A. Yes, I am.

MR. BRUCE: Mr. Examiner, I tender Mr. Krohn as an expert petroleum geologist.

EXAMINER STOGNER: And how long have you been responsible for this unit or worked with it?

THE WITNESS: I have worked with this particular unit for over four years.

EXAMINER STOGNER: You weren't involved in the original case, were you?

THE WITNESS: In 1995, no, I was not. I assumed partial responsibility in the fall of 1996.

EXAMINER STOGNER: Did you help prepare it?

THE WITNESS: No, but I know the people who were involved, so.

EXAMINER STOGNER: Yes, Mr. Krohn is so

qualified.

Q. (By Mr. Bruce) Mr. Krohn, could you refer to your first exhibit, Exhibit Number 5, and discuss its contents for the Examiner?

A. Exhibit Number 5 is a structure map on the top of the Lower Cherry formation, and the map is at a scale of one inch equals 2000 feet. I would point out several identifying features of the map. The section lines are in cyan color, the township and range line are in green, and the unit outline is in red, surrounding the Avalon-Delaware Unit.

The structure map is contoured at a 2500-foot contour interval, and I also have annotated on here a type log, which I will show as my next exhibit, and that will be Type Log Avalon-Delaware Unit 522. If you notice on the structure map, it defines the unit, but the unit is defined by the structure.

Q. And you picked out as the type log the 522. That is what, one of the highest wells, highest structural wells in the pool?

A. Correct, it is. It is also one of the best producers in the field.

Q. Okay. Now, just one final question on this map. does the unit and the structure as you've mapped it include basically the entire productive portion of this structure?

A. Yes, it does.

Q. Okay. Let's move on to your type log, Exhibit Number 6, and go through that.

A. Okay, my type log is Avalon-Delaware Unit 522. The vertical scale is one inch equals 50 feet, and the well was drilled to a total depth of 4,700 feet. On the type log, if you look at it, on the left is a track which has a gamma-ray scale of zero to 100 in API units. There is also color in that track, and the colors are designated blue for limestone, yellow for sandstone and brown or tan for shales.

Annotated on the log are also the stratigraphic tops for the five horizons that we have listed for this hearing. They are the Goat Seep, the Upper Cherry, the Middle Cherry, the Lower Cherry -- the mapped horizon which the structure map is based on, and the Upper Brushy and the Lower Brushy.

The center track on the log is the depth track, with the annotated perforations and depths and comments as to whether those perforations are open or squeezed.

The next track is the resistivity response, with three curves recorded in that track. The LLD is the lateral log deep, it is a deep resistivity tool; the LLS is the shallow curve resistivity tool; and the MLL, micro-lateral log, is also a tool which reads a shallow depth of

investigation.

The final track records porosities, the green curve is the neutron porosity, and the blue curve is the density-derived porosity. Both identify porous from nonporous zones. The DPHI curve is colored in red to show zones in excess of 11-percent porosity, which is the net-pay cutoff used for most of the reservoirs in the Avalon-Delaware unit.

Also located in this track is the PEF curve, which stands for photoelectric factor, which is used as a lithology indicator.

Q. Before we move off of this exhibit, in looking at this, what are the primary injection zones in the unit?

A. The primary zones are fairly easy to see by the perforations on this particular log. They are the Upper Cherry, from about 2600 feet down to about, oh, 2750; and the Upper Brushy, just around a depth of 3550 to 3620. These are the primary reservoirs in the Avalon-Delaware Unit.

Q. And maybe one final question. There are some perforations here in the Middle Cherry, but that is not one of the primary producing or injection zones, is it?

A. No, it is not.

Q. Next, Mr. Krohn, we have a series of Exhibits 7 and 7A, 8 and 8A. I'd ask you to maybe just one at a time

go through Exhibits 7 and 8 and describe those for the Examiner, and then we'll move on to our final exhibits.

A. Okay. Exhibit 7 is a west-to-east structural cross-section through the Delaware section of the Avalon-Delaware Unit. The vertical scale on these logs is one inch equals 100 feet, and the curves and tracks and nomenclature are the same as we have previously discussed on the type log.

The index map on the bottom right of the exhibit shows the actual direction of section and the wells used in the construction of this cross-section.

Well ADU, the type log, is the second well from the left and shows the mapped interval, Lower Cherry, as the red line, and it shows it to be in a structurally high position.

Well 530, also on this cross-section, is the third well from the left, and it is common to both the north-south and east-west sections.

Also on this particular section, you will notice the red perforation intervals in the center depth track, and you will notice that most of these perforation intervals are in the Upper Cherry and in the Upper Brushy. There are some additional perforations down in the Lower Brushy, and these were in our previously mentioned disposal water zone for water prior to waterflooding. There also

were some perforations, minor, in the Middle Cherry, depending on the quality of the mud-log shows in that interval.

Exhibit 8 is a north-south cross-section at the same scales as previously mentioned, one inch equals 100 feet, same log curves and same presentation style as before. And again, well 530 is the fourth well from the left.

Again, I might point out the stratigraphic units that are listed on this cross-section and that they are continuous across the field. Again, the perforation intervals are mostly in the Upper Cherry and Upper Brushy intervals.

Q. Maybe one other thing off this map. I think we were -- it's kind of unclear what -- On the second well from the right --

A. Yes, sir.

Q. -- there is a solid blue line. What is that?

A. The blue line represents an interval that was cored in this particular well, and the solid blue interval is the interval that was recovered by core, and there's a small ten-foot section at the bottom which showed no recovery. So we recovered approximately, oh, I would say of the 350 feet of core, we recovered 340 feet of rock in this particular cored interval.

Q. Based upon your mapping here, are the Upper Cherry and Upper Brushy zones continuous across the unit?

A. Yes, they are continuous stratigraphic units across the Avalon-Delaware Unit.

Q. Now, let's move on to your final two exhibits which you've also place on the wall, Mr. Krohn, and if you'd sit or stand, whatever is more comfortable with you, and go through those two exhibits and tell the Examiner what they show.

A. Okay, in Exhibit --

EXAMINER STOGNER: Mr. Krohn -- before you do that --

THE WITNESS: Yes, sir.

EXAMINER STOGNER: -- everything you're saying is being recorded, so try to keep from pointing at something and saying "as you see this", "as you see that".

THE WITNESS: I understand.

EXAMINER STOGNER: That will not come across on the transcript.

THE WITNESS: All right. Exhibit 7A is a west-to-east geocellular model section, which is identical to the direction of the Exhibit 7, which I previously described. It is the porosity attributes of the entire Delaware section throughout the Avalon-Delaware Unit. It has the same wells as listed on the previous cross-section

and runs along the same line of section.

There are two main reservoirs listed on this particular section, and I'll point these out. The upper 10 percent of the section is what we have annotated as the Upper Cherry reservoir, and we see a differentiation between a white line below and another white line above, which divides out the stratigraphic unit.

The other reservoir that we have identified at the Avalon-Delaware Unit as being most prolific, or most productive, is the Upper Brushy horizon. It is in the center of the display, and it is listed as Upper Brushy, and it is again divided by the two white lines.

The two reservoirs, again, the Upper Cherry has an average of 131 feet of net thickness in its interval, and it has an average porosity of 14.4 percent and a permeability of 2.3 millidarcies.

The Upper Brushy has an average well thickness, or interval thickness, of 272 feet with an average porosity of 14.9 percent and an average permeability of 1.1 millidarcies.

These geocellular model sections are actually created from the well log data and the variability between that well log data. This particular model has about 2 million cells of data that are created in a three-dimensional sense to model the underground reservoir

sections in this particular field. By doing this, we can determine a little bit more about continuity and flow between wells and patterns.

The additional section I've also listed here is the Exhibit 8A, and it again is porosity attributes, and the porosities are again the warmer colors, go up to about 25 percent, red, and the blue colors are about 1 and 2 percent porosity in blue.

Again, the Upper Cherry interval is listed in the upper 10 percent of the plot. There is a fair bit of discontinuity in the Upper Cherry on this north-south section, particularly in the northern part of the section.

The Middle Cherry in this particular section carries quite a bit of the warm, higher porosity numbers. However, that is not our reservoir section at the Avalon-Delaware Unit.

And then the Upper Brushy section, which I previously described, is comprised mainly of yellows and green colors in the center section of the plot, and it is a quite distinctive and continuous-looking unit across the field.

Q. (By Mr. Bruce) So in looking at this, certainly the Upper Brushy is easy to trace along this map?

A. It certainly is, yes.

Q. Whereas the other -- And that is one of the

primary injection zones, is it not?

A. Right, that is true.

Q. And then the other main injection zone, the Upper Cherry, is much more heterogenous, isn't it?

A. Heterogeneous, yes, sir.

Q. And again, based on what you've just presented, are the injection zones continuous across the unit?

A. Certainly most continuous in the Upper Brushy. I would say less continuous in the Upper Cherry. However, there are points in the Upper Cherry which do provide good continuity from well to well and pattern to pattern.

Q. Okay. Were Exhibits 5 through 8A prepared by you or under your supervision?

A. Yes, they were.

Q. And in your opinion, is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes, it is.

MR. BRUCE: Mr. Examiner, I'd move the admission of Exxon Mobil Exhibits 5 through 8A.

EXAMINER STOGNER: Exhibits 5 through 8, subparts 7A and 8A, are admitted into evidence.

EXAMINATION

BY EXAMINER STOGNER:

Q. Referring to Exhibit Number 8, you stated that

the primary injection interval was the Upper Cherry and the Upper Brushy; is that right?

A. Yes, sir.

Q. Okay, now when I look on the far side, on the right side of this map, I'm assuming that the Number 362 well is an injection well?

A. Number -- Are you on Exhibit 8, sir?

Q. I'm on Exhibit Number 8.

A. Yeah, I think it's Well 562.

Q. 562, okay.

A. Yes, sir.

Q. Now, then, I go down there -- I don't even see any perfs in the Upper Brushy.

A. That's probably because there were not many -- not much mudlog show pay in that particular well.

Q. So --

A. It is a well on the fringe of the field, and it probably did not contain any pay in the -- based on the log response of the mud logs when we drilled the well. It does have porosity, it appears continuous; however, the well right next to it, Well 538 -- 536 immediately to the north of it also only has one small interval of perforations. And if you look, both of those wells are structurally downdip from the center of the field.

Q. I take it this is not a typical injection well,

then?

A. It is not. It does inject almost -- Well, it will inject almost all of its water into the Upper Cherry, and some of the zones are unique in that respect, in that they inject only into the Brushy or only into the Cherry, depending on their position, structural position in the field, and the amount of pay in those respective intervals.

I believe Well 562 also was a disposal well. there are some perfs quite far down in the Lower Brushy.

Q. Okay, that would make sense, because it's out there by itself.

A. Right. I think we have some other exhibits that will show where the disposal wells were located and how much water was disposed of by well.

Q. Okay. Referring to Exhibit Number 7A --

A. Yes, sir.

Q. -- now, between the Upper Cherry and the Middle Cherry, is that the red line that goes across there in a zig-zig manner, or do I look at the white line?

A. You look at the white line, sir. The red line is actually a three-dimensional view of what the -- a partial view of what the unit outline looks like in the surface position.

If you would refer to the structure map, just see how the unit outline has several indentations in it. That

would be Exhibit 5, particularly on the southern edge. That red line is actually a surface projection of the unit outline on this three-dimensional view. And then it zig-zags up here to the north around the E. On the section you'll see the unit outline, and you will observe that the unit outline appears up in that corner of the plot also.

I did not put it on the north-south Exhibit 8A, and I probably should have left it off here, because it is somewhat confusing.

The white lines are the actual stratigraphic unit boundaries in both Exhibit 8A and 7A.

Q. Again referring to Exhibit Number 7A --

A. Yes, sir.

Q. -- when I look on the left side, between the -- in the diagram itself, or the plot --

A. Right.

Q. -- the first two panels, there appears to be several structures, actually. Is that what is going on underneath there as being depicted --

A. Right.

Q. -- is some unconformities or something?

A. Yes, sir, that is exactly what's happening. We have some truncation and some onlap of existing formations. This Avalon-Delaware sand section is quite close to the shelf slope margin in Permian time, and it saw some

dramatic changes in stratigraphy going on in these units.

It's also observed in the north-south section, Exhibit 8A, where the Middle Cherry onlaps the Lower Cherry, and it's quite dramatic in that particular location also.

Q. Does that act as a trapping mechanism in this area?

A. It appears that the accumulation is somewhat controlled by topseal here and that the unit above the Upper Cherry, the Goat Seep, actually provides a topseal trap, and why most of the oil is reservoired in the Upper Cherry.

We also believe that the Lower Cherry/Upper Brushy interval on Section 8A, you'll see some intervals that are quite dark blue, very low porosity, right at that surface. That actually provides the reservoir topseal for the Upper Brushy. So that's where most of the oil appears to be reservoired.

I would say when you look at Exhibit 8A, you would observe that it appears that most of this porosity appears to be in the Middle Cherry, and that's true. It is not very continuous through the field area, and there appears to be very little hydrocarbon reservoired in that interval. Most of the oil that came into the Middle Cherry probably migrated vertically up into the Upper Cherry where

it is trapped today.

This entire section, if you would refer back to Section 7 or 8, if you look at those cross-sections, both of them show a colored section, and most of what you see through here is that the Delaware section is almost all sandstone. There are very little shales, very few carbonates in that section, and the porosity is almost continuous from top to bottom.

So there are small stratigraphic breaks that are apparently causing the topseal to trap.

Q. Were you involved in picking out the perforations, or was that done prior to your getting involved?

A. For the most case, this was done prior to my getting involved. Most of the wells were drilled prior to my involvement. We have, however, done several workovers in these wells where we have squeezed off zones or added perforations to improve conformance between injectors and producers.

Q. What was the stimulation method in these wells on the perfs?

A. I would refer that question to my reservoir engineer who will be speaking next.

EXAMINER STOGNER: Thank you, sir. You may be excused.

Mr. Bruce?

RICARDO PEÑA, JR.,

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

DIRECT EXAMINATION

BY MR. BRUCE:

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

A. My name is Ricardo Peña, Jr.

Q. Where do you reside?

A. The Woodlands, Texas.

Q. Who do you work for and in what capacity?

A. I work for Exxon Mobil as a staff reservoir engineer.

Q. Have you previously testified before the Division?

A. No, sir.

Q. Would you outline your educational and employment background for the Examiner?

A. I graduated in 1983 with a BS degree in petroleum engineering from the University of Texas in Austin. I've worked for Exxon Mobil and its predecessors for 17 years. Eleven of those years I've worked in west Texas properties, primarily in the -- as a production engineer and reservoir engineer, and six of those 11 years I've worked as a reservoir engineer, primarily in the Delaware Basin.

Q. Does your area of responsibility include the Avalon-Delaware Unit?

A. Yes, sir.

Q. And are you responsible for and familiar with engineering matters related to the unit?

A. Yes, sir.

MR. BRUCE: Mr. Examiner, I'd tender Mr. Peña as an expert petroleum engineer.

EXAMINER STOGNER: Mr. Peña is so qualified.

Q. (By Mr. Bruce) Let's move to your first exhibit, Mr. Peña, and just briefly discuss the current status of the unit.

A. Okay, Exhibit Number 9 is just a fact sheet. We have well statistics, production numbers, reservoir fluid data and information on the producing formation. Currently we have 31 producers, 16 water injection wells, three water-source wells, one disposal well. We do have one well shut in and six that are temporarily abandoned.

As of August 31st of this year, we're currently making about -- close to 700 barrels a day, with a little over a million cubic feet of gas per day, and just under 4000 barrels of water are produced, of which, of that, 1600 barrels a day is from water-source wells.

We are injecting about -- a little over 4600 barrels of water, of which 900 barrels is from freshwater

makeup.

To date, we have injected a total of a little over 6 million barrels of water in the Delaware. The primary zones of injection are the Upper Cherry and the Upper Brushy.

Q. And data on those formations is given on this exhibit, correct?

A. I'm sorry?

Q. Just some basic information on the formations and fluid data is given in the exhibit; is that right?

A. That's correct, yes, sir.

Q. Okay. What is Exhibit 10?

A. Exhibit 10 is just a list of the wells that we currently have. We detail all the producers, the water injection wells, the water source wells, and this contains a list of the producers that we believe should be qualified.

Q. Okay. Now let's move on to your Exhibit 11 and just briefly discuss the wells in the unit.

A. Okay, Exhibit 11 is just a plat, and the main purpose of this exhibit is just to depict the implementation of the waterflood. On the right-hand side of the plat map we have the legend. In green we have the current producers, the active producers. The water-injection wells are denoted by the open circle with an

arrow through it.

And then the third item in the legend -- I just wanted to point out, we do have three pre-producing injectors. Those are wells that we drilled as injectors, and they're currently producing right now.

Q. So they haven't yet been converted to injection?

A. That's correct.

Q. Okay. One final thing on this exhibit, the Hearing Examiner asked Mr. Krohn about the 562 well, and maybe it's a little clearer on this exhibit. What is the status of that well?

A. That is currently a water-source well.

Q. Okay, used to produce water for the other injectors?

A. That's correct.

Q. Okay. Now we've got a bunch of charts, Mr. Peña, and I think we need to go over these a little more slowly, but we have Exhibits 12A through 12E. Why don't you just start with 12A and maybe give a little background of production in the unit and what has happened recently?

A. Okay. This is a production plot with the Y axis being barrels per day in MCF per day, and time on the X axis. And most of these plots, on the X axis we have the time on all these plots that we're about to go over.

What I merely try to do here is annotate the

major events during the development of the Avalon-Delaware Unit. The primary development occurred between 1982 and 1984, and as testified earlier by Mr. Bill Duncan, the field was unitized in October, 1995, at which time we did drill additional producers to become injectors, and some that became injectors immediately. And some of those wells that pre-produced were converted -- have also been converted.

We believe that the first waterflood response occurred in April of 1996, and that was on the Avalon-Delaware Unit Number 657.

Q. Okay. Now, looking at this as a whole, is it fair to say that over the last few years production from the unit as a whole has flattened out and even increased over that period?

A. Yes, sir.

Q. Okay. And it also looks -- The red line is the gas rate. That has decreased, has it not?

A. That is correct.

Q. Why don't we move on, then, and maybe discuss that in a little more detail. If you'd take your Exhibits 12B and 12C together, Mr. Peña and maybe put them one on top of the other, and could you discuss the gas-oil ratio in the unit since injection has begun?

A. Okay. Exhibit 12B is the GOR plot for the unit,

and Exhibit 12C is the injection-to-withdrawal ratio of the unit. And one of the things that is promising to us has been the continual decrease of the gas-oil ratio since we started injection in the unit, and that correlates very well with the continued increase of our injection-to-withdrawal ratio since we started injection as well.

Q. Okay. Now, what is the current unitwide GOR?

A. It's around 1600.

Q. And when injection first began it was closer to 4000, wasn't it?

A. That's correct.

Q. Okay, and there's been virtually a steady decline since then?

A. That is correct.

Q. And also you continued to increase your injection-to-withdrawal ratio?

A. That's right.

Q. In looking at that -- and maybe leave 12C, Exhibit 12C, in front of you -- Mr. Peña, and pull out Exhibit 12D and maybe discuss the injection and the injection increases in the unit, and maybe highlight a few of the matters on Exhibit 12D for the Examiner.

A. 12D is the plot that shows the total unit water injection, and we've annotated specific events, and this is our efforts to continue to bring in and increase our water

injection rate in the unit.

We have -- Things to point out, in early 1997 we converted a couple of water wells to water-source wells, and then we had some additional conversions in 1998 and in 1999. And then most recently, in late 1999 and early 2000, we've been able to secure some fresh water from Bill Taylor and from the City of Carlsbad.

Q. The water from Bill Taylor is from a shallow Yates formation?

A. That is correct.

Q. Now, injection water is hard to come by out here, isn't it?

A. That is correct.

Q. Exxon Mobil has put a lot of effort into securing water supplies; is that a fair statement?

A. That's a fair statement.

Q. Okay. Anything else on these two exhibits that we need to discuss?

A. That's all I have.

Q. Okay. Oh, maybe just one thing, just to mention, Mr. Peña. You have to be careful about injecting too much fresh water or mixing too much fresh water with the salt water; is that correct?

A. That's right, we have done analyses, and the analyses tell us that we do not want to inject more than --

or we do not want to mix in more than 20 percent of fresh water with our produced water. So that's our limited factor for fresh water.

Q. Okay. And then finally, Exhibit 12E, is this simply a tabulation of the data that is shown on Exhibit 12A?

A. That is correct. And as well as 12B and --

Q. -- 12C?

A. -- 12C.

Q. Okay. Could you move on to your Exhibit 13. And we might be referring back to this over the next few exhibits too, I believe, Mr. Peña --

A. That is correct.

Q. -- and just describe the pattern in the Avalon-Delaware Unit, the injection pattern.

A. Exhibit 13 is the same plat map, and all we've done is drawn in the current patterns that we have in the unit. We have fairly regular fivespot patterns, and so it's pretty much as -- what we had planned to do initially.

Q. Okay. Now, leaving this one aside for a minute, could you just briefly go through your Exhibits 14A through D and just tell the Examiner what these show.

A. Okay, this is a series of cumulative bubble maps. Exhibit 14A is cumulative oil production, and Exhibit 14B is cumulative gas production, 14C is cumulative water

production, and Exhibit 14D is cumulative water injection.

Q. On these, certainly the first one, 14A, the production correlates with the structure, does it not? The better production is higher structurally?

A. That's right, the main message for these exhibits is to show that the better production does seem to correlate with the structure. As we can see on the cum oil bubble map, the better wells do fall on the crest of the structure.

Q. And then on Exhibit 14D, I think one thing we want to point out is the cumulative water injection, that the biggest bubbles are down in the southern end of the unit. What is the reason for that?

A. Those three wells were previously water disposal wells. That's the well 562, that's in the bottom part of Section 31; and the ADU 816, that's in Section 5, the top part of Section 5; and the Yates C Federal Number 22.

Q. So this would include pre-unitization disposal?

A. That's correct.

Q. Okay. Now, let's move on to your final exhibit, which is kind of a thick one, Mr. Peña, and let's go through that, maybe not every single line item on it, but could you take the first two pages of this exhibit, which have to do with pattern P-258, explain for the Examiner what is shown on the first page of this exhibit, and show

the type of response you had in this injection pattern.

A. Okay. Exhibit 15 is a series of what we call pattern plots, and I'd like to go through some of them and show when water injection first started and then the corresponding response from the producing well.

If you would take Exhibit 13 and lay it there next to you, P-258 is the well that is located on the southwest corner of Section 30, and that well right currently is being supported by injection well 254 and 507. So that constitutes one pattern for that well.

And what we have here is, the top graph is oil rate, gas rate, water and injection, the oil rate being the green curve, the gas in red, the water rate the dashed blue, and then the solid blue is the water-injection rate.

The bottom graph denotes the gas-oil ratio for this particular pattern.

And in this well, water injection started around early 1997, around April, 1997, and we can see where the GOR has decreased in the late 1997 time frame, second half of 1997, and we have seen a gradual oil increase starting in June of 1998. So the injection, water volume, has continued to increase since we started injection. GOR has decreased, and we have seen an oil response from this particular well.

Q. Okay. What is indicated on the second page

concerning pattern 258?

A. The second page on pattern 258 is the injection-to-withdrawal ratio for this particular pattern, and we can see on this particular pattern the injection-to-withdrawal ratio is high.

Q. Okay.

A. One thing that I want to point out is, if you look at the gas rate on the first page, on P-258, the red curve, the gas rate doesn't really go to zero in August of 2000. That is just the way our database -- that gas is reported one month behind the oil. So it artificially puts a zero there. It's not --

Q. It's just an artifact --

A. Right.

Q. -- of how it plots out things?

A. Right.

Q. Okay. Let's move on to the second one, go through a few of these, just to show the type of response you've had. So move on to your pattern P-259.

A. Okay, Pattern 259 is the well just east of 258, and it is supported by four injection wells. This was a fully developed pattern. Water injection started in April of 1997. We have seen GOR decreased in June of 1998 and oil-production response in July of 1998. Again, the water-injection volume has continued to increase as water source

becomes more available, water volumes become more available.

And again, the second page of Pattern 259, the injection-to-withdrawal ratio, the injection-to-withdrawal ratio continues to increase and is also a high currently --

Q. Okay, and let's move on to the next one, Pattern 262.

A. Pattern 262, again, is just east of Pattern 259, and this well is supported by three injection wells. And this well -- this pattern, injection, started in around June of 1997, GOR decreased around March of 1998, and we had oil response around April 1998.

Q. Now, on this one as with the past ones, shortly after you increased the injection volumes, the GOR really decreased, did it not?

A. That's correct.

Q. Okay, go ahead, Mr. Peña.

A. The injection-to-withdrawal ratio on this one is also high.

Q. Let's do just a couple more, Mr. Peña, and then just point out a few things on the next couple ones.

A. Okay. This next one is Pattern 657, and this one is located on the southwest corner of Section 32. And on this particular pattern, this well is supported by two injection wells. And injection started around April of

1996, and we believe that we started seeing waterflood response almost immediately after water injection started. The oil response we see ramping up pretty continually for about two years. GOR drops off around the second half of 1996.

Q. It has a very low GOR in this well?

A. That is correct. In fact, the GOR in this one is below the solution gas-oil ratio.

Q. And again, this one has a fairly high I-W ratio?

A. That is correct.

Q. Let's try one more, which is Pattern 210. Now, this one is on the north end of the unit, is it not?

A. Pattern 210 is the northernmost well in the unit. It's in Section 30, and currently, right now, it is supported by only one injection well. And this was a little more difficult to see.

One of the things that we do see on this particular pattern is, we do see -- We feel that there has been possible early water breakthrough as the -- you see water response almost correlating with when injection started in February of 1997. But we also see a decrease in the GOR starting in around early 1998.

So it's more difficult, but what's more clear is the water response.

Q. Now on this one, this well is really on the --

say, the fringe of the productive limits of this pool, is it not?

A. That's correct.

Q. And it only has that one support well, or one injection support well; is that correct?

A. That is correct.

Q. But still when you're looking at this, back when unitization began, or shortly after, it was producing -- I can't tell exactly off this, but say a barrel or two a day; is that correct?

A. Right, right.

Q. And currently it's -- Especially during the year 2000 it's been producing -- what, three to four to five times that amount?

A. That's correct, and you do see a slight oil increase at the beginning of this year commensurate with a GOR decrease as well.

Q. And so even though it may have taken a little bit longer, you're still seeing the same type of response as you have with the other wells, which is an increase in production, plus a decrease in the GOR?

A. That is correct. The injection-to-withdrawal ratio on this particular well is not as high as the other ones; it's low.

Q. Now, as part of Exhibit 15, you have these

pattern maps for every producing well in the unit; is that correct?

A. That is correct.

Q. And if the Examiner so desires, you can answer more questions on these maps, if he so desires?

A. Yes.

Q. Overall, unitwide, since the unit began, you have been increasing water injection into the two primary zones?

A. That is correct.

Q. And unitwide, you've seen a decrease in the GOR on a unitwide basis?

A. Unitwide, we continue to see an increase in the GOR; that is correct.

Q. And there has also been a unitwide increase in production?

A. Yes.

Q. Now, in your opinion is the unit area benefitting from advanced recovery operations?

A. Yes, it is.

Q. And in your opinion, are the producing wells benefitting from the water injection?

A. Yes, they are.

Q. And -- Oh, Mr. Duncan just mentioned to me, you know, why we are seeing a decrease in GOR; is that --

A. That's correct.

Q. Okay. And your general conclusion is that the unit has seen a positive production response from the waterflood portion of the waterflood operations in this unit?

A. Yes, sir.

Q. Were Exhibits 9 through 15 prepared by you or under your supervision?

A. Yes, they were.

Q. And in your opinion, is the granting of Exxon's Application in the interests of conservation and the prevention of waste?

A. Yes.

MR. BRUCE: Mr. Examiner, I'd move the admission of Exxon Mobil's Exhibits 9 through 15.

EXAMINER STOGNER: Exhibits 9 through 15 will be admitted into evidence at this time.

EXAMINATION

BY EXAMINER STOGNER:

Q. Okay, Mr. Peña, let me make sure I understand this packet on 15. For simplicity's sake I'll refer to the first, P-258.

Now, you show, or penciled in, an oil increase of June of 1998. Why June of 1998 and not January of 1998?

A. Well, it just seems to me that when I look at this plot, the ramping of the oil starts around -- I see

the oil increase in early 1998, and then it drops off, and then you see a more consistent, gradual increase of the oil around June, so that was my judgment on that.

Q. According to your Exhibit Number 14A, it looks like your Well Number 522 is probably a more prolific one; is that about right?

A. Yes, sir.

Q. And according to the general information that you gave me, it looks like average production per well is about 22; does that sound about right, 22 barrels a day? Because you said it was about 683.

A. Well, I divided by the 31, yeah.

Q. Thirty-one. That's how I came up roughly about 21.

A. Okay.

Q. Now, this particular well looks like it's averaging -- and I'm referring now to Pattern P-522 on Exhibit Number 15 -- this one is holding up there around 40 -- hold it --

A. Yeah it's about 50.

Q. -- yeah, it looks like about 40, 50, 50 barrels a day, give or take?

A. Yes, sir.

Q. What makes this well in particular so good? Is it placement or fracture, or what kind of stimulation did

it have?

A. All the wells have been completed by hydraulically fracturing, even the injection wells. And the only thing I can think of is, this well did have very good mud-log shows, it is in the top of the structure.

Q. Let's see now, did we talk about -- Yeah, we did talk about 657, didn't you?

A. Yes, sir.

Q. Pattern Number 2. Now, this is the key well that Exxon first saw a response; is that correct?

A. Yes.

Q. Okay, when I refer to Exhibit Number 13, now, you show two additional producers over on the far west side. Are these not to be included as wells that showed any kind of response?

A. On the far west side, right.

Q. Yeah, Number 401 and 433.

A. 401, there are on that well list -- those wells have no adjacent injection wells, and it's really hard to say whether or not they have responded. It's a lot more difficult to see on those two wells. But with the evidence that we have, the fact that we've seen some response from the wells in the unit, I believe that they could respond.

Q. You mentioned something about a water cut or a freshwater cut of about 20 percent?

A. Yes, sir.

Q. What happens when you're over 20 percent? What's the problem?

A. Well, it has to do with scaling tendencies, and you inject too much fresh water, then you start creating some skin effects in the formation, you may start plugging up some of the pores. So based on the analysis that our research department has done, the call that we made is, they said do not go over 20 percent of the total injection volume of fresh water.

Q. What's been the average injection pressure out here on this project?

A. Right now we're pretty close to injecting -- close to our allowable injection pressure. Our allowable is 490 p.s.i., and most of our wells are around 440, 450.

Q. Do you think Exxon will have to come in and get an increase later on or in the near future?

A. Well, that's what we're working on right now. We've run some step-rate tests, and we're currently looking at that right now.

EXAMINER STOGNER: Okay, I have no other questions of this witness.

MR. BRUCE: I have nothing further of Mr. Peña.

EXAMINER STOGNER: Mr. Bruce, this is one of the first ones I've had, first -- I've approved a bunch of

these when they've come, but I've never heard a positive production response certification request before. Could I get you to provide me a draft order --

MR. BRUCE: Yes, sir.

EXAMINER STOGNER: -- of that? And prior to this hearing, I did discuss with Mr. Bruce in a general sense, not with this particular Application, but I have a call from Taxation and Revenue, and if you can make that rough draft order as comprehensive as possible --

MR. BRUCE: Yes, sir.

EXAMINER STOGNER: -- to satisfy their needs, it will probably work better.

MR. BRUCE: Yes, sir.

EXAMINER STOGNER: Is there anything further in Case Number 12,512?

Then this matter will be taken under advisement.

And Mr. Bruce, when do you think you might have a rough draft?

MR. BRUCE: Toward the end of next week.

EXAMINER STOGNER: Okay, end of next week it is. Thank you, sir. Thank you, gentlemen.

MR. BRUCE: Thank you.

(Thereupon, these proceedings were concluded at 2:36 p.m.)

* * *

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 12512 heard by me on 19 October 2000

Examiner
Oil Conservation Division

CERTIFICATE OF REPORTER

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

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Division was reported by me; that I transcribed my notes; 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 October 26th, 2000.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 2002