BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
November 26, 1974

EXAMINER HEARING

IN THE MATTER OF:

Application of Amoco Production Company for a unit agreement, Lea County, New Mexico.
Application of Amoco Production Company for a pressure maintenance project, Lea County, New Mexico

CASES 5371-5372

BEFORE: Daniel S. Nutter, Examiner

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I N D E X

E X H I B I T S

MR. NUTTER: Case 5371.

MR. DERRYBERRY: Case 5371. Application of Amoco Production Company for a unit agreement, Lea County, New Mexico.

MR. BUELL: Mr. Examiner, my name is Guy Buell, representing Amoco Production Company, and I would like to move that Case 5371 be consolidated for record purposes with the next case, 5372.

MR. NUTTER: We will call at this time, Case No. 5372.

MR. DERRYBERRY: Case 5372. Application of Amoco Production Company for a pressure maintenance project, Lea County, New Mexico.

MR. NUTTER: We will consolidate 5371 and 5372 for purpose of hearing and call for appearances.

MR. BUELL: For Amoco Production Company, the Applicant, Guy Buell.

MR. NUTTER: Are there other appearances? Would you proceed?

MR. BUELL: Mr. Examiner, we have several exhibits that I would like to place on the wall. I don't know whether you are ready for a break or not. It won't take us but just a few minutes to get them up.

(Whereupon, a short recess was held.)

MR. NUTTER: The Hearing will come to order, please. The Cases 5371 and 5372 will be set aside for a minute.

(Whereupon, a recess was held.)

MR. NUTTER: We will resume Cases 5371 and 5372. Mr. Buell?

MR. BUELL: May it please the Examiner, we have two witnesses, neither of which have been sworn.

(Witnesses sworn.)

MR. NUTTER: We will call for other appearances in this case at this time.

You may proceed, Mr. Buell.

MR. BUELL: May it please the Examiner, I will make a very brief opening statement.

It was the desire of everyone when unitization efforts were first initiated in the Hobbs Oil Pool to attempt to form a unit that would cover the entire pool. Unfortunately, we were unable to do that, and from a conservation standpoint, always feeling that half a loaf in the hand at this time is better than no loaf at all, Amoco and other operators in the southern portion of the field have gone forward and have put together what we

are asking for approval here today, the South Hobbs (Grayburg-San Andres) Unit. I would like to, if I may, with regard to myself and my witnesses, if we can just refer to it as the South Hobbs Unit, we will save a lot of time, and the record will show that we are referring to the South Hobbs (Grayburg-San Andres) Unit.

MR. NUTTER: Especially if we have to say all of those parentheses.

MR. BUELL: So, that, in a nutshell, Mr. Examiner, is our case that we are here for today, 5371, of course, approval of the South Hobbs Unit, and 5372, presentation and requested approval of our improved recovery program that we intend to initiate in the South Hobbs Unit.

STEVEN R. DENTON

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

DIRECT EXAMINATION

BY MR. BUELL:

Q Mr. Denton, would you state your complete name, by whom you are employed and in what capacity, and in what location, please?

A My name is Steven R. Denton. I am a Staff Engineer, Unitization Section for Amoco Production Company,

Houston Division Office, Houston, Texas.

Q In connection with your employment with Amoco, have you been engaged in negotiations, and are you familiar with negotiations that have resulted in the formation of the South Hobbs Unit?

A Yes.

Q Let me direct your attention to what has been identified as Amoco's Exhibit No. 1. What is that exhibit?

A That is a copy of the Unit Agreement for the South Hobbs Unit.

Q Is that an identical copy to that which has been signed by all of the signatory parties to the Unit?

A That is correct.

Q Does this Agreement describe the subsurface interval that we are unitizing?

A Yes. The proposed unitized interval is a subsurface portion of the unit area known as the Grayburg-San Andres Formations, Permian Age, and stratographic interval between the depths of 3698 and 5347 feet below the Kelly Bushing on the bore hole compensated sonic log gamma ray, dated July 9, 1969 for the Shell Oil Company State A No. 7, located 1930 feet from the west line and 660 feet from the east line of Section 32, 18 South,

38 East, Lea County, New Mexico.

MR. NUTTER: That was 1930 from the north line, I believe you meant?

THE WITNESS: The north line. That is correct.

BY MR. BUELL:

Q As a matter of interest, Mr. Denton, the Shell Well that is cited in the agreement, is it within the boundary of the South Hobbs Unit?

A No, it is not.

Q But it is still a representative well and representative log of the unitized interval?

A Yes, it is.

Q Looking at Exhibit 1, is it possible to look at this exhibit or any attachments to it and determine the surface area that is included within the boundaries of the unit?

A Yes. Exhibit A to the Unit Agreement is a map of the South Hobbs Unit area. In addition, a description of all lands within the unit area is included as Exhibit B to the Unit Agreement.

Q How many surface acres are in the unit?

A There are 5073 acres.

Q That has to be composed of many separate tracts.

Actually, how many separate individual tracts do we have within the unit boundary?

A There are 50 such separate tracts.

Q Let me direct your attention to Exhibit 2, a copy of which is posted on the wall directly behind the Examiner. What is that exhibit?

A That is a map of the unit area. Depicted in yellow are those tracts that are presently qualified for inclusion into the South Hobbs Unit. Those that are white are tracts that are presently not qualified under the terms of the Unit Agreement for inclusion in the unit.

Q Within this unit, do we have both fee and State land?

A Yes, we do. The State lands are stippled acreage.

Q And the fee lands just have the white background?

A Right.

Q All right, sir, as of this moment, how many tracts have not qualified?

A Eight tracts have not qualified, and those are the tracts depicted in white on the map on the wall.

Q Are you still hopeful, if not optimistic that some of these tracts will qualify prior to the effective date of the South Hobbs Unit?

A Yes, we are.

Q And, of course, if they do qualify, they will be included?

A They will be included.

Q In the unit?

A In the unit.

Q Overall, Mr. Denton, in the South Hobbs Unit, what percentage of the working interest is committed to the unit?

A As of this date, 92.5 percent of the working interest is committed.

Q Let me ask you that same question with regard to the royalty interest?

A Again, as of this date, 95.6 percent of royalty interest is committed.

Q Were all of the interests offered the opportunity to join under the same participation formula?

A They were.

Q One participation formula applies to each and every individual tract?

A That's correct.

Q Has this unit been presented to the Commissioner of State Lands for the State of New Mexico?

A Yes, and we have preliminary approval from the State Land Commissioner.

Q Does the Unit Agreement provide for any enlargement? Of course, we know that the area to the north in the Hobbs Oil Pool right now is not within the unit?

A This is correct.

Q Does it provide that this could be expanded in that direction?

A Article 12 provides for enlargement of the unit.

Q In the northern area of the pool, do you know whether or not there are efforts currently under way to form a unit, which for descriptive purposes, I will call the North Hobbs Unit?

A Yes. An Engineering study is presently under way. This study is being expedited by Shell Oil.

Q Does our Unit Agreement -- back to Exhibit 1, now -- by its very terms contemplate an improved recovery?

A Yes, it so provides for an improved recovery operation. We have a subsequent witness who will go into detail on such an operation.

Q This unit was formed for the specific purpose of conducting an improved recovery program?

A Yes, it was.

Q I am sure the Unit Agreement doesn't in any way try to have the royalty owners pay any of the cost of the unitized program?

A No. It provides that the working interest, alone, will carry the cost.

Q Is the Unit Agreement, by its terms, subject to the rules and regulations of the New Mexico Oil Conservation Commission?

A Yes, it is.

Q Do you have any further comments at this time, Mr. Denton?

A No.

MR. BUELL: That's all we have by way of Mr. Denton, Mr. Examiner.

MR. NUTTER: Are there any questions of Mr. Denton? He may be excused.

(Witness dismissed.)

MR. BUELL: We will now call Mr. Denham.

RALPH R. DENHAM

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

DIRECT EXAMINATION

BY MR. BUELL:

Q Mr. Denham, would you state your complete name, by whom you are employed, and in what capacity, and what location, please, sir?

A Ralph R. Denham. I am employed by Amoco Production Company in Houston, Texas, as a Staff Engineer.

Q Are you primarily engaged in reservoir work for Amoco?

A Yes, I am.

Q You have never testified before this Commission, so briefly, what is your educational background in the field of engineering?

A I have a Bachelor of Science in Mechanical Engineering from Oklahoma State University, 1944.

Q What have you done since graduation in the field of petroleum engineering?

A It has been primarily reservoir engineering for 30 years with this same company in the States of Arkansas, Kansas, Louisiana, New Mexico, Oklahoma and Texas.

Q Does the Hobbs Oil Pool in Lea County, New Mexico come under your reservoir engineering supervision and jurisdiction?

A Yes, it does.

Q And you are completely familiar, and have been deeply involved in the formulation of the improved recovery program which Amoco proposes to apply to the South Hobbs Unit?

A Yes, I am.

MR. BUELL: May it please the Examiner, is there any question as to Mr. Denham's qualifications with particular reference to the Hobbs Oil Pool?

MR. NUTTER: Mr. Denham is qualified.

BY MR. BUELL:

Q Mr. Denham, in connection with your testimony, would you refer, please, sir, to what has been identified as Amoco's Exhibit 3. What is that exhibit?

A This is a map of the entire Hobbs Field area which shows all of the wells in the pool, and I direct your attention to the legend at the bottom. The wells shown with a plus are Bowers Pool Wells which are shallower than the Grayburg-San Andres formations being unitized. Shown in the small blue dots are the Hobbs Pool Wells which are within the South Hobbs Unit, or the wells being unitized. Shown with an X are the Hobbs Blinebry and/or the Drinkard Pool Wells which are deeper than the Grayburg-San Andres formation. The dry holes are shown with the

usual symbol, and in addition, within the South Hobbs Unit area, we are showing with a circle around the well, the water-injection wells that are proposed for the initial project area.

Q How many are there, Mr. Denham?

A There are a total of 44 current wells in the field that are to be converted for injection, and in addition, I would like to call your attention to a well in the southwest corner of Section 3, Township 19 South, Range 38 East which is an open circle indicating that this well is to be drilled and converted to injection for injection purposes in the project.

Q Turning your attention now, if you will, Mr. Denham, to what has been identified as Amoco's Exhibit No. 4, what is that exhibit?

A That is an exhibit using the same base as the previous Exhibit No. 3 which shows the top of the Grayburg Marker which is a unitized interval. The contours are shown on a 25-foot contour interval. This represents the Grayburg structure, and, again, it has a legend that except for the indication of the injection wells to be used initially, it is the same as the legend shown in Exhibit No. 3.

The Grayburg structure is generally representative of the other structures of zones that have been identified within the unitized formation, and this map also shows the surface trace of a cross section designated as A, A-Prime going from the south to the north and on the exhibit on the wall is shown with an orange line.

Q Mr. Denham, before we go to the cross section, let's discuss the other zones of porosity that produces in the Hobbs Oil Pool. We have mapped the Grayburg and you said you mapped it because its structure was representative of the structure of all the zones of porosity that do produce. What nomenclature have you applied to the other zones of porosity that are productive?

A These other zones are San Andres Zones and are known as Zone 1, Zone 2, Upper Zone 3 and Lower Zone 3.

Q So, when we are talking about these other producing zones of porosity, actually, we are talking about a reservoir that the Commission, as far as I know since Hobbs was discovered, has regulated and prorated as one common source of supply?

A Yes, sir.

Q We are not talking about separate distinct individual oil reservoirs?

A No, sir, these are simply zones that have been identified for purposes of our engineering investigation.

Q All right, sir. Now, let's go to the cross section trace which you have already described. That cross section has been identified as Amoco's Exhibit No. 5. It is also on the board for ease of observation, Mr. Denham. Let's don't name all the wells on there because there are too many. Let's start with the southernmost well, name it, and the northernmost well.

A The southernmost well is the Texaco Norden No. 2 which is located in Section 15 at Unit M within the unit area, and the northernmost well with a log on it is the Skelly Turner No. 2, located in Section 34 at Unit C, which is also within the unit area.

Q I notice you have used what I call a stick to represent several wells on this cross section, Mr. Denham. Is that because some of these wells were drilled many years ago and the log is not available?

A That's correct.

Q I also notice that you have on your cross section an original water-oil contact of minus 614 feet. Is that the generally accepted original water-oil contact by you engineers that work with the Hobbs Oil Pool?

A Yes, it is.

Q What other data have you shown on this cross section?

A I have shown the top of the Grayburg Marker which is the same point that was mapped on the previous exhibit, and it is colored with brown at the top of the formation. The next colored line below that is the top of the San Andres Zone 1 formation which is colored with a yellow. Immediately below that is another top known as the top of Zone 2 of the San Andres which is colored with a greenish color. Immediately below that, colored in a pink is the top of the Upper Zone 3, and then over here on the right portion of the cross section, you will see a short interval where the top has been colored in a green, and that is the top of the Lower Zone 3. The green is over here on the right. Let's call that a blue. Let's call this blue and this green.

MR. BUELL: Have we confused that sufficiently for you, Mr. Nutter?

THE WITNESS: I know which one you are talking about. I don't know what somebody will think when they read the record.

MR. BUELL: They will think I have done it again.

BY MR. BUELL:

Q Mr. Denham, what does this exhibit show you from a geological standpoint in the application of improved recovery techniques?

A Of course, this section shows adjacent wells going across the unitized interval, and it shows the correlation between the tops of these various formations. It shows where the pay exists within the individual zones, and the correlation of these pays. Therefore, we conclude that it is floodable by man where a natural water influx has not occurred.

Q Actually, some of these zones of porosity have had a fairly good natural water drive, did they not, Mr. Denham?

A One of them in particular.

Q Which one is that while we are looking at this cross section, what color?

A The San Andres Zone 1 which is the yellow color.

Q This exhibit also very vividly shows the fact that the Grayburg is the zone of porosity that is the most extensive over the unit area, does it not?

A Yes.

Q I know that the others kind of come and go.

A Yes, particularly on the end is where that is shown, the end of the section.

Q Now, a subsequent exhibit is going to show the aerial extent within the South Hobbs Unit of these individual producing zones of porosity. Have you carried forward your same color legend that you used on Exhibit 5 in this next exhibit?

A Yes, sir, I have.

Q That is Exhibit 6, Mr. Denham. Would you briefly comment on it?

A Yes, sir. This is a portion of the same base map that has been utilized in two previous maps that were shown as an exhibit. I would like to call to your attention two particular things on this map that are different from the other maps. One is the star legend that is indicated at the location of the proposed initial injection wells, and if you will note under your legend portion of that map, that the point of the star to the north is identified as Grayburg, and, of course, we used a five-pointed star because we are talking about five separate zones that we are interested in. The east point of the star is designated as the San Andres Zone 1. The one to the southeast is Zone 2. The one to the southwest is the Upper Zone 3,

and the one to the west is the Lower Zone 3. What this star indicates, if the point of the star has been colored in a solid blue, then, in that injection well, we initially intend to inject water. If the point of the star has not been filled in a solid blue, we are not planning on injecting water into that zone in that particular well. For example, I would call your attention to the southernmost well on Exhibit No. 6 which is the same well, incidentally, that is on the left of Exhibit No. 5. It has the north and east points of the star colored in, indicating that we plan on injecting initially into the Grayburg and San Andres Zone 1.

Now, in addition to that, we have shown the outline of the current productive limits of the San Andres Zone since these zones have experienced various degrees of water influx.

Q When you say "current," that can mean many things to many people. Do you have a date that you can attach to that, Mr. Denham?

A Yes, I did want to identify that as being January 1, 1971, which was a point in time when our investigation was brought to a specific completion.

Q Right.

A I would point out that there have been various degrees of water influx. Again, using the same code as before, you will notice that Zone 1 is identified. Again, on the east side at least, it is indicated to be the largest zone and that line continues on around to the west side.

Q That is your yellow zone?

A That is our yellow zone. You will note where it is being pointed out along the north edge of the South Hobbs Unit, the water influx has moved through Zone 1 to the point where it has almost gone completely to the eastern edge of the productive limits, the original productive limits of Zone 1.

Q Zone 1 is the zone that has the most active water drive?

A Yes, sir, that is correct.

Q All right, sir. Let's discuss another zone.

A All right. Zone 2 is the one immediately inside of that. It is outlined in a green, and, again, you will notice near the western edge or almost to the central part is another indentation where we have better communication with the aquifer within this zone and there has been a greater degree of influx as pointed out there on

that map.

Q Go right ahead to the next zone.

Q All right. Outlined in pink is Upper Zone 3 which has not had these major indications of influx, but all of which have experienced some movement of the oil-water contact, primarily in a horizontal direction from its original position in toward the center of the field, particularly from the southwest. The Lower Zone 3 is the zone colored in blue near the northern edge of the reservoir and shows its current outline.

Q Now, I notice you don't have any brown color outlined on there indicating Grayburg. Is that because for all practical purposes, it covers the entire South Hobbs Unit?

A That is correct, generally productive.

Q Do you have a single injection well, Mr. Denham, that will not be used to inject into the Grayburg? I don't see a one on Exhibit 6.

A It appears that all of the starred wells on this exhibit will have injection into the Grayburg.

MR. NUTTER: Mr. Buell, there is one thing I am not clear on. Now, if we take any of those colored lines there, the zones shown on Exhibit No. 6, take Zone 2

which is the green line, green dashed line, does that mean that Zone 2 on the outside of the area that is enclosed within that line is watered out?

MR. BUELL: It is either not present with porosity and permeability or is watered out.

MR. NUTTER: So, the indentation that has come up from the southwest, that has been an encroachment of water coming up there?

MR. BUELL: Yes, sir.

MR. NUTTER: So, it is non-productive outside of that line?

MR. BUELL: At the present time, yes, sir.

MR. NUTTER: And this is true of all these zones. They are only productive on the inside of the line that is shown there?

MR. BUELL: Yes, for either of the two reasons that you mentioned, water encroachment or the absence of porosity and permeability.

BY MR. BUELL:

Q Do you have any other comments on Exhibit No. 6, Mr. Denham?

A No, sir.

Q Let's go now to Exhibit 7. What is that exhibit?

A Exhibit No. 7 is a graph of the historical performance of the South Hobbs Unit. In other words, this includes just the wells that are located within the outline of the South Hobbs Unit as shown in previous exhibits. I would like to describe each one of the curves that are on this exhibit. The first, starting at the top --

Q (Interrupting) Excuse me. Let me interrupt you. Before you do that, I notice your first increment of time is 1960. Would you state for the record, why you didn't go back further in time. You know, the Hobbs Pool goes way past 1960.

A Yes, actually back into the late 1920's. In the interest of time and feeling that this would show the significant portion of the performance of the field insofar as waterflood operations are concerned, we have limited it to this part of the time interval over which it has produced.

Q Because it was a tedius and time consuming job to go back in the old records and pull out just for the properties within the South Hobbs Unit and accumulate those data?

A Yes, sir.

Q And you feel that the spread of time from 1960

to, I think you have some posting to 1974, is a large enough increment of time to let the Examiner and the Staff see how this portion of the Hobbs Pool has performed?

A Yes.

Q All right, sir. Now, would you discuss each index of performance?

A Starting at the top, colored in yellow, is the bottomhole pressure over this period of time with the current pressure being between 600 and 700 pounds. I would like to note that the original pressure of the South Hobbs Field or the Hobbs Field as a whole was approximately 1500 pounds.

The second curve is the number of wells which at the present time is indicated to be 115 wells. The third curve, which is colored with a pink, indicates the gas-oil ratio presently being 1500 cubic feet per barrel. You will note that from about 1967 through 1974, there has been an increase of gas-oil ratio over this period of time, indicating that gas is coming out of solution and our water influx has not maintained the pressure sufficient to prevent this gas from coming out of solution.

Q So, Mr. Denham, while we talked about the water drive benefits in Zone No. 1, it is obvious that on

balance, the properties in the South Hobbs Unit are operating predominantly under a solution gas drive mechanism?

A That's correct.

Q All right, sir. Now, go on to your next curve.

A The next curve shows the oil producing rate which reached a peak in 1970 and has since been declining through 1974 and now has a producing rate of about 2500-plus barrels of oil per day.

The next curve shows the water production for these wells which reached a peak in 1971, and is now at a rate of approximately 3200 barrels of water per day.

The final curve is the cumulative oil curve which I would point out has its scale on the righthand side and on 1/1/60, the cumulative was approximately 45 million barrels of oil, and as of January 1, 1975, which we will mention in a future exhibit, it would appear that the cumulative oil will be approximately 63.1 million barrels.

Q All right, Mr. Denham, we have been looking now at past performance or observed performance. Let's take a look into the future, and in that connection, let me direct your attention to what has been identified as Amoco's Exhibit No. 8. What is that exhibit?

A This, again, is an exhibit for the South Hobbs Unit. It shows the predicted performance, and on this graph are two curves. I direct your attention, first, to the lower curve which is colored in green, and identified as the continued primary operation. This indicates that under continued primary operations, we have estimated a life of 27 years from January 1, 1975, and a reserve under continued primary operation of approximately 11½ million barrels from that date.

Q Looking back at Exhibit No. 7 and the oil production curve there colored in green, it would appear that your prediction for the future, that if we continue primary, if we don't do something, that we are going to observe the same decrease in productivity over the life of the pool?

A That is correct.

Q What are the other curves that you have plotted on Exhibit No. 8?

A This is the producing rate that we would expect to occur under unitized operations, utilizing the five-spot water injection program that has been shown on previous exhibits. This shows that during 1975, we would expect a reduction in oil-producing rate due to the

conversion of the 44 wells that we are going to convert to water injection, and the fact that we have no spare capacity for any of our wells to make up that reduction in oil-producing rate.

Q In other words, at this time, when we shut those wells in to covert to injection, there is no other well in the unit that has the ability to produce its current allowable and the transferred allowable from an injection well?

A I would say within the project area, we have no other well.

Q All right, go right ahead with your predicted unitized curve.

A All right. Then, the producing rate increased to a peak which is indicated to be a capacity of slightly over 9700 barrels per day, holding this capacity, then, for about two years and then declining, giving an overall life from 1/1/75 of 22 years with the total unitized oil recovery after January 1, 1975 being an estimated 39,200,000 barrels, which after deducting the estimated remaining primary would give us secondary reserves of approximately 28 million barrels.

Q Mr. Denham, let's go back again, if you will,

to the peak producing period you are predicting for the unitized program, which is starting in 1979.

A Yes, sir.

Q Quite often, the New Mexico Oil Conservation Commission, in a program of this type when response has been observed, will provide for a project area allowable which is the number of producing injection wells times the top allowable for the pool. Let me ask you whether or not allowable treatment of that nature, which I have just described, will allow you to produce at the peak rate you are predicting for 1979 and 1980?

A No, sir, not based on present wells.

Q Is it close?

A Yes. I would expect that top allowable to be 9360 barrels a day, based on 117 tracts with wells.

Q What is the peak rate -- I have forgotten -- in 1979, on the curve?

A Slightly over 9775.

Q Fairly close?

A Yes, it is fairly close.

Q Do you have any other comments on Exhibit 8?

A No, sir.

Q Let me direct your attention, then, to what has

been identified as Amoco's Exhibit No. 9. What is that exhibit?

A This is a bar graph that shows the amount of oil production that we have recovered to date, and the first bar which is colored blue, showing the 63.1 million barrels of primary production to 1/1/75 which was previously referred to.

The second bar is a bar colored green, showing the ultimate primary. This is the primary recovery to date, plus the oil that we would expect to recover from continued primary operations at approximately 11 million barrels, and this is designated as the ultimate primary of 74.6 million barrels of oil.

The last bar shows the ultimate primary plus the secondary oil that we expect to recover from our waterflood operations for a total of 102.3 million barrels of oil.

Q So, the incremental increase of ultimate recovery attributable to the unitized program will be almost 28 million barrels of oil?

A Yes, sir.

Q Turn now, if you will, to what has been identified as Amoco's Exhibit No. 10.

A Yes, sir.

Q What is that exhibit, Mr. Denham?

A This is the same base map that has been utilized in some of our previous exhibits, and the addition to this map is the requested project area which is outlined in red on the map. It also shows the injection wells.

Q Now, you were in the room when Mr. Denton testified, were you not?

A Yes, sir.

Q I believe he testified there were 8 tracts that as of this minute were not qualified to be included in the unit?

A That's correct.

Q I believe, if my memory serves me correctly, six of those eight tracts would be in what is shown as the proposed project area on your Exhibit No. 10?

A That is correct.

Q In order that the Examiner's record would be complete, why don't you go around there and draw a red "X" on his exhibit through those tracts that as of this minute are not qualified for inclusion?

(Whereupon, a discussion was held off the record.)

BY MR. BUELL:

Q Thank you, Mr. Denham. Do you recall as you were drawing your X's how many proposed initial injection wells were located on those six tracts within the project area?

A I counted five. I think that is correct.

Q That is correct. So, in the event that those tracts do not qualify by the time the program is initiated, that would still leave you with 40 initial injection wells?

A That's correct.

Q Assume for the purpose of this question -- and remember, it is just an assumption -- that these tracts never do qualify for inclusion in the unit, do you think that sufficient acreage is qualified to be in the unit such that you would have complete control over your improved recovery program and could accomplish almost the identical or nearly the same conservation results as you could with the tracts included?

A Yes, we could.

Q I didn't include in my question who would get the incremental increase oil. I just said you would accomplish the same conservation results?

A Yes.

Q Now, looking at this exhibit and your other exhibits, Mr. Denham, I noticed -- and I am looking along the northern line of the South Hobbs Unit, the line that is generally an almost true east-west direction -- I noticed that your nearest proposed injection well to that north line is at least two locations away. Why is that?

A This is to permit us to create a good cooperation injection pattern with those properties to the north as soon as we can gain cooperation from the proposed property owner.

Q If the unit is formed, it will give you flexibility in working out a property program with them and if the unit isn't formed, it will give you flexibility in working out a program with the operators of the leases adjacent to the north line?

A That's correct.

Q I notice in that portion of the South Hobbs Unit which extends north of this east-west line you and I have been discussing does not contain a single injection well on it. Why is that?

A For the same purpose, to give us the flexibility we feel like we need to get the best possible cooperative program in that area.

Q Also, that area is only two locations wide, so you need to wait to see what the program is going to be in and around it to design your program there?

A Yes.

Q Let me ask you this, Mr. Denham: Has a firm water supply been finally contracted for as of this time?

A No, sir, it has not.

Q What has Amoco been attempting to do with regard to obtaining water to use in this program? Have we been dealing with the City of Hobbs in any way?

A Yes, we have. For some time we have been negotiating and dealing with the City of Hobbs trying to work out a use of their sewage effluent.

Q About how far along have these negotiations reached? Has not the City of Hobbs adopted a policy that will make this sewage effluent available for industrial use?

A Yes, they have, and have indicated that they plan to submit to our company and other companies that might be interested in this water, bid sheets in the near future so that we can come to a firm contract with them.

Q Mr. Denham, in our overall program, what do you contemplate our daily use of water will be, or what our daily needs will be?

A 55,600 barrels of water per day, utilizing all of the wells that we have in this original area.

Q If we are successful in negotiating a contract with the City of Hobbs, to your knowledge, is there any other improved recovery program anywhere using waste water such as sewage effluent to increase the recovery of oil and gas?

A Not in these amounts.

Q Let me ask you this: Are there other commercial suppliers of injection water in this particular area?

A Yes, there are, and we have also been negotiating with them.

Q So, in the event that we do not make this contract with the City of Hobbs to use the sewage affluent, ample supplies of water are available from these commercial sources?

A That's right. We felt like it would be to the advantage of the City of Hobbs and to us to be able to use their source.

Q Where is the City of Hobbs on one of our maps, Mr. Denham, do you know?

A It is located primarily in Sections 34 and the sections immediately to the south. Now, that is the main

downtown built-up area. It extends to the west along that north line of the proposed unit area.

Q So, their sewage treatment facilities, then, would be in very close proximity to the South Hobbs Unit?

A Yes, they would. They are proposed to be in the southwest quarter of Section 2, Township 19 South, Range 38 East.

MR. BUELL: Mr. Examiner, I am not offering this as an exhibit, but just as a matter of interest, an article in the Hobbs Daily News Sun for Tuesday, November 19th that discusses the plans of the City of Hobbs to make money out of their sewage effluent.

BY MR. BUELL:

Q Can you tell us at this time, Mr. Denham, what we propose, the volumes of water we propose to inject in each injection well?

A Yes, I have that information. I would like to make a review.

Q Yes. Give us some idea of the volume that we are going to put into each well. You gave us our overall daily requirement.

A Yes, sir, and I could make a simple division and give you an average for all of these wells, but I think

it might be more meaningful if I gave it to you on how many barrels per day we would expect to inject into a zone in a particular well, because there are many classifications of zones. As you can see, the points of the star are quite varied that have been filled in indicating injection.

Q Why don't you do that as quickly as you can?

A All right. This will be for the Grayburg, 115 barrels of water per day; Zone 1, 560; Zone 2, 725; Upper Zone 3, 690; and Lower Zone 3, 465.

Q Mr. Denham, speaking of injection wells, let me direct your attention now to what has been identified as Amoco's Exhibit No. 11. What is that exhibit?

A This is a 45-part exhibit that gives a schematic diagram of each one of the injection wells in the proposed initial project.

Q I don't think we need to burden the record by discussing each one of those. Do they kind of break down into three categories so that you can discuss one well in each category very quickly?

A Yes. I have actually categorized them into five categories. We could break that down into three. There are five general characteristics that are shown here.

Q If three will cover them, why don't you use three?

A All right. I would like to point out, then, in each one of these, the information that is shown on the righthand side of the wellbore sketch is the present status, and the information that is shown on the lefthand side of the wellbore sketch is work that we expect to do or the status of the well that we will have at the time we will be doing the injecting.

The first one is the Amoco Byers A No. 29 located in Section 3, Unit E, and this shows a deepending of the well by the dash line at the bottom of the wellbore, and in this well, we will be injecting into open holes and also into perforated intervals as indicated on the sketch.

Q All right, sir. Would you pick another well and another category?

MR. BUELL: I might point out, Mr. Examiner, that although there are five proposed initial injection wells on the six tracts that will be excluded at this time or don't qualify at this time, we have gone ahead and given you the data, and we are sincerely optimistic that some of those, if not all, will be in by the time the unit is effective.

THE WITNESS: The second category I would like

to point out is the Amoco Capps No. 30 which is in Section 3 in Unit O. Actually, there is a small number in the upper lefthand corner, and this is No. 6. That means the sixth page in the exhibit. This shows a well where all of the water is to be injected into an open hole below the bottom of the 7-inch casing that has been set in that well.

The last category is on Page No. 14. This is on the Sun H. D. McKinley No. 4 in Section 5, Unit G and this shows that all of the injection will be through perforations only.

BY MR. BUELL:

Q Do you think that those three are fairly well representative of all 45 that are included in there?

A Yes, I do.

Q The Commission also likes to have a log on each proposed injection well. Have you gathered together all of the logs that were available on our 45 proposed injection wells?

A Yes, I have, and they have been placed in the hands of the Commissioner.

Q How many do we have? How many are missing. By "missing," I mean, how many wells will we convert to

injection for which no log is available? Of course, the well we are going to drill, we don't have a log on it. That is one.

A Yes, that's correct. There were five wells that we did not have logs on.

Q So, that makes a total of six including the well that we are to drill?

A That's correct. Or, there should be 39 logs.

MR. BUELL: Could we identify those 39 logs, Mr. Examiner, as Amoco's Exhibit No. 12?

MR. NUTTER: Right.

BY MR. BUELL:

Q Do you have any comments to make about the logs, Mr. Denham, or are they self-explanatory?

A I feel they are self-explanatory.

MR. BUELL: May it please the Examiner, that is all we have by way of direct testimony. I would like to offer our exhibits 1 through 12 in Cases 5371 and 5372, and I would like to briefly state what Amoco is recommending here today.

One, of course, we are recommending approval of our South Hobbs Unit by this Commission, and approval

of our improved recovery program. We would ask that you include in the Order approving the program a project area as modified by our Exhibit No. 10. We would also ask for approval of the 40 injection wells which are on qualified tracts and hopefully, by the time the Commission acts, maybe all 45, and we will certainly let you know immediately if any of the tracts that are not now qualified become qualified. We would also like for the Order to provide for administrative procedure to add injection wells as well as an administrative procedure to expand the project area. Although we do not have the capacity now to produce any transferred allowable from the injection wells, as you can tell from Mr. Denham's Exhibit 8, we do expect a fairly rapid observation of productivity increase, so, we would like for the Order to provide that allowables from the wells converted to injection could be transferred when we have the ability to produce it. We would also request a provision for the project area allowable which would be composed of the number of injection wells and producing wells times the pool top allowable.

Mr. Examiner, that is all we have.

MR. NUTTER: Thank you.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Denham, referring to your Exhibit No. 9, you show that you would expect an ultimate primary here of 74.6 million barrels. What was the original oil-in-place here, do you know?

A Yes, sir. The original oil-in-place in this area was 319,400,000 barrels.

Q So, ultimate primary, then, would be approximately a fourth of the original oil-in-place, is this correct, or what percentage do you have calculated there?

A I have not calculated it, but I see I can real quick. It is 23 percent.

MR. BUELL: May I make an observation, Mr. Examiner?

MR. NUTTER: Yes, sir.

MR. BUELL: The slide rule is now obsolete.

BY MR. NUTTER:

Q Okay. So, you expect on this flood or enhanced recovery project to recover 102.3 million total barrels. So, this would be what percent of the original oil-in-place, Mr. Denham?

A 33 percent.

Q Actually, isn't this a rather poor performance to be a secondary recovery project to only recover 33 percent on primary and secondary?

A It would be if this were only a solution gas drive reservoir, but this reservoir has experienced some water influx which has been rather efficient in its displacement of oil.

Q Well, if it has been an efficient primary recovery, why is the primary only going to be 23 percent?

A Because it is only a portion of the oil reservoir that has experienced this good water influx. The remainder of the reservoir, which is within the colored outline on Exhibit No. 6, has not had that water drive mechanism, and has primarily a solution gas drive reservoir, and in that portion of the reservoir, we have high secondary to primary ratio expectations.

Q Well, now, if we look at the production curve for this area from the '30's on to the '60's and into the '70's, won't we find that there has never been any decline from the area until the producing rates were increased in the late '50's up to 1970? Weren't they rather uniform and depended solely upon allowables?

A The allowable history in this field has, over

that period of time, been quite varied and initially was based on the potential of the wells to produce, and in the area life, the potentials were extreme, and there was a very high producing rate during the early part of the '30's which dropped off or tapered off, and then, we were able to determine that the principal producing interval in many of the wells of this Zone 1 that was experiencing this water influx, and so, we were able to repair the wells by shutting off that water and then going to these other zones that were not experiencing the water influx and we began getting more level-type performance.

Q But there was never a decline in production, an actual decline in production until after 1970, is this correct?

A I don't think what you would call a "normal decline," no, I think that is true. In many instances, on a lease in particular, from time to time, as a particular zone that had been opened declined or water moved in, and you go in and attempt to squeeze off the water and perforate higher in that zone or perforate in another zone, and come back to full top allowable, then, it would tend to decline to a point to where you felt like you had some other opportunities in that well, so you would go to another zone

and produce it, again, creating the top allowable that you had at that time, and that has been, I think, particularly true since the 1940's.

Q So, you were able to maintain the productivity by working on the well?

A Yes, sir.

Q Now, actually, the green line that is shown on your Exhibit No. 8 there is a continuation of the green line on Exhibit 7, is it not?

A Yes.

Q It shows that it would be carried out to an economic limit there sometime in 19 --

A (Interrupting) 2001.

Q Through 2001?

A Yes, sir.

Q Now, with respect to your Exhibit 11 which shows all these schematic diagrams of the wells, is it true in each case that injection of the water will be down through tubing and under a packer?

A Yes.

Q And that the annulus in each case would be loaded with inhibited water?

A That is correct.

Q Now, you mentioned that the right side shows the present set-up of the well, and the left side would show the future perforated or open-hole interval. Some of the perforations that are shown on the right side would be squeezed, but would some of them be left open?

A Yes. Generally speaking, all of them that are on the right side would be left open for injection in the future. I am not saying that anything on the left side is deleted in connection with the perforation.

Q So, the left side is what you would be doing to the well, but also, on the right side, unless it is shown squeezed, would also be open?

A Yes.

Q So, the future is the left and the right?

A Yes, sir.

Q It is not the left only?

A That is correct. Of course, we show plug-back total depth. For instance, on this first one, we show a plug-back total depth on the righthand side of 4210 and on the lefthand side, you will see that we are going in and deepen the well from its actual total depth of 4213, approximately 30 feet. So, that portion of what is shown on the righthand side would no longer be there. We would

no longer have a total depth of 4213. It would be 4213 plus the 30 feet that we plan to deepen so that we can fully inject into that Lower 3 Zone.

Q Now, if any well has more than one injection zone, these injection figures that you gave for each of the various zones would be put into that well,the sum of all of them that it has, is this correct?

A Yes, sir, that is our plan.

Q Do you have any idea what your injection pressures are going to run?

A We think they will be fairly low, particularly in connection with the San Andres Zone, probably in the order of 500 to 1000 pounds.

Q How about the Grayburg?

A We think it will be somewhat higher.

Q The Grayburg is the one that you said had been rather efficiently produced as a result of a natural water drive?

A No, sir. It is Zone 1 that has been more efficiently produced. The Grayburg, actually, is the tighter of all of the zones and is basically, in its entirety, a solution-gas type of depletion mechanism.

Q That is the yellow zone on the cross section?

A The brown. The brown is the Grayburg and Zone 1 is the yellow.

Q The yellow is the one that had the natural water drive?

A That's right.

MR. NUTTER: Are there any questions of Mr. Denham?

CROSS EXAMINATION

BY MR. PORTER:

Q Do you know how many dry holes -- I mean, plugged and abandoned wells are in this area that you plan to operate your flood in?

A No, sir.

Q Depleted wells, perhaps?

A Well, let me say this: I have a tabulation that indicates that there were a total of 125 usable wells in this area, yet, at the same time, I have another tabulation indicating that as of September 1, 1973, there were only 110 active wells.

Q That would indicate that perhaps 15 had been abandoned?

A Temporarily.

Q You don't know if they have been plugged or not?

A My understanding is that they have not been

plugged and abandoned. It has been anticipated for several years now that there could be some time that a secondary recovery program in this area would come, and to my knowledge, in the full 125 wells. I looked into that, and the full 125 wells would be available.

Q Now, you are aware of the water problem in some shallow sand and the oil problem in some shallow water sands there in the Hobbs Pool, aren't you, or perhaps in the northern part? It may not extend down into this part. I am talking about Mr. Walton's operation?

A No, sir, I am not familiar with his operation.

Q Where perhaps 300,000 barrels of oil have been recovered from 30 to 50-foot sands?

A No, sir, I am not familiar with that.

Q My interest here is that we don't want to stimulate that production.

MR. BUELL: The shallow production?

MR. PORTER: Yes, sir.

THE WITNESS: I understand.

BY MR. PORTER:

Q You realize that there is a quarterly casing leak survey conducted in the Hobbs Pool, aren't you?

A I can't say I was aware of that, but I can

understand because of its proximity to the City of Hobbs that something like that would certainly be advisable.

Q What I was wondering, would you anticipate any problem with his injected water and/or oil, getting back up into this shallow water sand? Of course, we know that the oil that is there came from somewhere. It didn't occur there naturally. It reasonably came from casing leaks when some of the casing leaks were repaired to stop the flow of oil to the water sand. As I say, my concern is, Mr. Examiner, in this case it would be inadequate casing in so many programs, in the protection in these old abandoned wells that this would not occur, so, I just wanted to make you aware of that, Mr. Denham.

A Thank you.

Q I don't know what could be done about it except to give you an idea you could think about.

MR. NUTTER: Mr. Buell, prior to instituting a secondary recovery project in this area in which you will be injecting pressures from 500 pounds to 1000 pounds in the San Andres, and in the witness' words, pressures in excess of that into the Grayburg formation, do you think it would be remiss of the Commission not to include a provision in the Order that these wells should have their

casings tested before being placed on injection?

MR. BUELL: I think that would be a wise provision, Mr. Examiner.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Denham, in your examination by Mr. Buell, you were talking about these tracts that are not at the time being qualified to enter, and that you are going to lose 5 of your would-be injection wells?

A Yes, sir.

Q Now, you stated that the efficiency of the operation, you did not think would be affected, that the oil would be recovered, although you didn't say by whom. Now, as much oil won't be recovered, will it, actually, if you don't have all these injection wells on the program?

A I would say that there is a possibility that some small amount would not be recovered because we don't have all of the injection wells.

Q For example, we take a look over here in the Byrom area in Section 6 of the project area.

A Yes, sir.

Q You will lose that injection well which normally would be on injection in the northeast quarter of the

southeast quarter of Section 6?

A Yes, sir.

Q Then, there is no injection well and you will also lose the injection well in the southwest of the northeast of Section 6?

A Yes.

Q So, there is no injection well offsetting Well No. 2 out there in the southeast of the northwest and there is no injection well offsetting the well in the southwest of the southeast. Of course, I realize that is marked "T.A." but I fail to see how you can say with leaving out five injection wells, you are going to get as much oil out.

A As I suggest, there is a possibility that there would be some small amount of reduction in our oil recovery.

Q What do you think of the philosophy that the injection of wells, in order to be effective, have to have back-up injection wells, injecting on the other side of them, or producing wells would have to have injection wells on both sides to be effectively produced?

A I think that is the best method, yes.

Q Of course, the matter of correlative rights certainly enters into it too when a tract is not participating

and the oil goes off the tract.

MR. NUTTER: Are there any other questions of Mr. Denham? He may be excused.

(Witness dismissed.)

MR. NUTTER: Do you have anything further, Mr. Buell?

MR. BUELL: Just this observation, Mr. Examiner: The five initial injection wells that are located on tracts that do not qualify, four of those were destined for injection into the Grayburg only.

MR. NUTTER: All right. Does anyone else have anything they wish to offer in Cases 5371 and 5372?

MR. LYON: I would like to make a statement.

MR. NUTTER: Mr. Lyon?

MR. LYON: Victor Lyon with Continental Oil Company. Continental Oil Company is the operator of one of the tracts which has not qualified for this unit. I would like for the Commission to know that we have participated in all of the activities, both in the proposed unit for the entire reservoir, and in this area of the reservoir, and in good faith have negotiated with Amoco in the deliberations. Fortunately, from Continental's viewpoint as an operation, within the past year we have

been able to do remedial work on our two wells on our lease and have succeeded in increasing the producing rates quite substantially. The work that we have done causes us to place a slightly different interpretation on the information shown on Exhibit 6, which would be more favorable to our lease. We feel that this enhances the value of this lease. We have been unable to persuade Amoco that the peramaters should be adjusted because of the work that has been done, and we do not quarrel with their decision to do this, but it does place us in a position that we are not able to commit our lease at this time. However, we are still going to negotiate with them on a continuing basis until we can find some mutually acceptable basis for participation. We do not want to obstruct the formation of the unit or installation of the waterflood project, and we would like to commend Amoco for the work that they have done in making the reservoir study and expediting this unit, and we would urge the Commission to approve their application.

MR. NUTTER: Thank you, Mr. Lyon.

MR. BUELL: Thank you.

MR. PORTER: Mr. Examiner, I have one more question of Mr. Denham.

CROSS EXAMINATION

BY MR. PORTER:

Q Did you testify as to how many wells Amoco operates in the Hobbs Pool?

A No, sir, I didn't.

Q Do you know?

A I think it is about 70.

Q Out of the 115?

A Yes.

MR. PORTER: Thank you.

MR. NUTTER: Are there any other statements in these cases? If not, we will take the cases under advisement.

(Whereupon, Applicant's Exhibits Nos. 1 through 12 were marked for identification, and were admitted into evidence.)

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

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

COURT REPORTER

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 5371-72 heard by me on 11/26, 1974.

, Examiner
New Mexico Oil Conservation Commission

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