BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE 1756

TRANSCRIPT OF HEARING

SEPTEMBER 16, 1959

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BEFORE THE
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IN THE MATTER OF:

CASE 1756 Application of Union Oil Company of California for an order promulgating special rules and regulations for the Tatum-Wolfcamp Pool in Lea County: New Mexico. Applicant, in the above-styled cause: seeks an order promulgating special rules and regulations for the Tatum-Wolfcamp Pool in Lea County, New Mexico, to provide for 80-acre proration units.

BEFORE:

Gov. John Burroughs
A. L. Porter
Murray Morgan

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: The meeting will come to order, please. The Commission will consider Case 1756.

MR. PAYNE: Case 1756. Application of Union Oil Company of California for an order promulgating special rules and regulations for the Tatum-Wolfcamp Pool in Lea County, New Mexico.

MR. COOLEY: May it please the Commission, William J. Cooley, appearing for Union Oil of California.

MR. PORTER: Any other appearances to be made in this case?

MR. ERREBO: If it please the Commission, Burns Errebo,

Modrall, Seymour, Sperling, Roehl & Harris, appearing on behalf of the Magnolia Petroleum Company. We will have a statement later on.

MR. PORTER: No testimony?

MR. ERREBO: No.

MR. PORTER: Any other appearances?

MR. COOLEY: As the advertisement in this case would indicate, we have made application herein for 80 acres in the Tatum-Wolfcamp Pool in Lea County, New Mexico. In support of that application, we will present three witnesses, a geological witness, an engineering witness, and landman. The first witness will be Mr. David Dunn. However, to save time, I would like to have all witnesses sworn in at the same time.

(Witnesses sworn)

DAVID A. DUNN,

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

DIRECT EXAMINATION

BY MR. COOLEY:

Q State your full name, please.

A David Arthur Dunn.

Q Where do you reside, Mr. Dunn?

A Roswell, New Mexico.

Q And by whom are you employed?

A Union Oil Company of California.

Q And how are you employed, Mr. Dunn?

A I'm employed as District Geologist for Southeastern New Mexico district.

Q Mr. Dunn, do you have any degrees of higher education?

A Yes, sir. I was graduated from the Texas Technological College in 1936 with a degree of Bachelor of Science in science and majored in geology.

Q Would you briefly tell the Commission what your experience has been since the time of your graduation?

A In 1936 I was employed by the Gulf Oil Corporation, Roswell, New Mexico as a geologist. Remained with them in that capacity in Roswell until 1938 when I went out as a consultant in Lubbock, Texas doing work in Southern New Mexico and West Texas. In 1941 I entered the Air Force where I served until 1946 as a photo officer. 1946 I was employed with Phillips Petroleum Company in Midland, Texas as a geologist. Remained with them until 1952. In this capacity, I was in charge of core hole, pool analysis and subsurface studies. In 1952 I was employed by the Union Oil Company as District Geologist in Roswell, and have remained in that capacity since.

Q In your position as District Geologist in Southeastern New Mexico for your employer, Union Oil Company of California, does it fall within the purview of your duties to study the geology of the actual Wolfcamp area in Lea County, New Mexico?

A It does.

Q Mr. Dunn, have you prepared a structure map of the

Tatum-Wolfcamp pay zone in the pool area?

A I have.

Q Mr. Dunn, I hand you what has been marked and identified as Union Oil Company's Exhibit No. 1, and ask you to explain to the Commission what is shown thereon.

A Mr. Cooley, if I may, I will explain on the large copy of this map that the small copy is a photo reproduction from.

Q Proceed.

A This map is a structure contour map drawn on the top of the Tatum-Wolfcamp pay, utilizing a 50-foot structural contour interval. The heavy lines are designated with a subsea datum. The total amount of relief shown on the map by the datum on the contours from a minus 6300 to a minus 6400. The area covered by the map is the area immediately surrounding the Tatum-Wolfcamp Field. It covers acreage located in four Townships, Township 12 South, Township 13 South, Ranges 35 and 36 East. The pool boundary of the Tatum-Wolfcamp Field as designated by the Oil Commission is shown in orange outlined on the map. The three producing wells in the Tatum-Wolfcamp Field are designated with solid circles. One dry hole adjacent to the Field, drilled by Union, is designated by the appropriate dry hole symbol. The only other well control on the area is the Skelly West Tatum unit located in Section 26. The red arrow points to a proposed location within the pool boundary. The scale of the map and the appropriate symbols of such structure map are shown.

Q What are the vertical red lines shown contained in the pool?.

A The red lines designated here as AA,A Prime, BB,B Prime indicate Sections that will be presented in evidence in this case.

Q Mr. Dunn, what control did you have available in the preparation of this structure map?

A There were two types of control available in the preparation of the map, seismic and subsurface control. The seismic control, of course, was the basis on which prospect was first oriented. The subsurface control developed as the wells were drilled. Each has modified the others throughout the history of the drilling in the immediate area. This is a subsurface map but the dips are controlled to a large degree by the seismic information which has been improved upon as we have gotten additional subsurface information.

Q What are the particular wells in the immediate pool area for which you have used as control?

A The Union No. 1 "B" Duncan 6, Union's "B" 1 "A" Duncan 6, Union No. 1-7 Anderson, the Union No. 1, Atwood and Bradley. In addition to these wells, this control, we have the Skelly West Tatum Unit which is approximately two miles northwest and beyond the limits of the map. The Sinclair No. 1 Anderson which is approximately four miles north of the pool area.

Q Mr. Dunn, I can understand how you can use the four wells in the immediate area as control for this structure map, but

isn't it somewhat far removed to be using the Sinclair and Skelly wells, being respectively five miiles and two miles from the area?

A Generally speaking, in many cases, control that far away is not very reliable. However, in the case of the Wolfcamp, correlations are very accurate and continue over extremely long distances. Actually, in drilling the Duncan 1 "A" 6, which was the discovery well and the first well drilled in the pool area, we had correlated the well to such a degree that we were able to core the entire pay section with the exception of a small stringer in the lower part of the Wolfcamp without waiting to encounter it, based on core analysis made from the Skelly West Tatum Unit.

Q Did you find it to a high degre in the Sinclair and Skelly wells in this pool?

A Yes, it was extremely remarkable.

Q Mr. Dunn, will you please tell the Commission what you feel to be the productive limits, that is, the area which contains some oil, as shown on this, in the Wolfcamp formation, as shown on this structure map as Exhibit No. 1?

A In the drilling of the Union's No. 1 No. 5 Atwood Bradley, we found water as will be explained later at minus 6350. I have every reason to believe that oil will be contained within the area out to the minus 6350 contour as shown on this map.

Q What do you feel to be the commercial productive limits of the Tatum-Wolfcamp Pool, Mr. Dunn?

A On the basis of the performance of the wells and the

information we've obtained from cores and electric logs, I feel that the commercial limits of the field will be the area contained between the minus 6300 contour in the area of the map.

Q Now, approximately how many acres are contained within that contour?

A Approximately a thousand and forty acres.

Q And how many 80-acre well locations does that represent?

A That represents thirteen 80-acre well locations, three of which have been drilled, ten of which remain to be drilled.

Q Now, Mr. Dunn, you don't mean to say by your testimony that all of these ten undrilled locations will eventually be drilled on the basis of the information you know have, do you?

A No, Mr. Cooley, I can't make that statement at this time. Our information at the present time which we consider very reliable, indicates the certain area that should be commercially productive. At the present time I have recommended to my company the drilling of one location shown here as the proposed location. The information --

Q What is the location?

A The information gained from this well can confirm the picture and lead to an orderly development. Now, the area might be slightly reduced; on the other hand, it might be enlarged by the drilling of these wells. On the basis of the present information, it appears that a thousand and forty acres is within

the commercial limits of the pool area.

Q Would you tell the Commission what the location of the proposed well is which you have recommended?

A The location of the proposed well is 1980 feet from the East line and 660 feet from the North line of Section 6, Township 13 South, Range 26 East.

Q Mr. Dunn, have you prepared a cross section of the productive wells in the Tatum-Wolfcamp Pool?

A I have.

Q Is the cross section which is posed on the board as Exhibit No. 2 the cross section to which you refer?

A It is.

Q Referring to the cross section, please, Mr. Dunn, tell the Commission what this cross section purports to show.

A This cross section is prepared from electric log -- detailed electric log and core information. The large scale electric logs of the three producing wells, the Union No. 1-6 Duncan "B," the Union No. 1-6 Duncan "A," the Union No. 1-7 Anderson are all shown in a proper line of correlation based on structure. The blue line through here is a minus 6,000 subsea datum. The blue line through here is a minus 6,500 subsea datum. On this cross section in green we have shown lines of correlation. In order to save space, we started with the formation marker in the Wolfcamp which is the top of the Burson, extended the section up to take in that portion of the Wolfcamp up slightly above the Burson to show

correlation. The grey line shows correlation in the Burson formation of the Wolfcamp. We also have the formation marker at the top of the Pennsylvanian as we described it, labeled the top of the Cisco which is the formation of the Pennsylvanian. For the sake of clarity and because our Exhibit No. 1 is contoured on the top of the pay section, we have shown on this section in a green line a correlation line at the top of the Wolfcamp pay, also shown on the section, using colors to graphically illustrate it is the pay sections as encountered in the Tatum-Wolfcamp Field, with the solid red indicating continuous good porosity. The dashed red in this case indicates broken porosity in the continuous zone from the top of the pay into the good porous section. The cores have been plotted in the center of the electric log with the shows encountered in the cores shown by blocked solid lines to the right of the core. The discrepancy between where the red line crosses the cored section and the electric log section is brought on by difference in depth measurements after running the electric log. For the sake of correlation of core analysis data, it was felt it was better to use the actual cored depth that was used when it was cored so that there could be no misunderstanding or discrepancy. However, these cores can be moved and adjusted exactly with the electric logs. The correlation with the shales, the correlation of the pay section here is similar again, and the correlation of pay section is very clear and very continuous in all cases.

Q Moving from well to well, Mr. Dunn, what degree of correlation do you find between the wells with regard to each individual pay stringer?

A Moving from the Duncan "B" south to the Anderson and the Duncan 1-6 "B," we have a broken zone of porosity shown. In our core interval through here is a very minor thin streak of pay and they show the same way on the electric log, and we have approximately -- I might mention, Mr. Cooley, that each of the small lines represent two feet on this log, which I had neglected to mention before. So we have approximately six feet of good porosity broken only by one slight six-inch tight zone. This line of continuous porosity is definitely correlatable to the Union No. 1-6 Duncan "A," where again approximately six feet of continuous pay section with very minor type breaks are noted. Again, the broken streaks of pay on the log are noted here. In this case the offset is approximately seven feet, or there was a depth correction of seven feet that would have been applied had we corrected the core to the log measure. This same zone correlates exceptionally well in the Union No. 1 Anderson as a solid zone of six feet of permeability and porosity with thin broken pay streaks above, which again was indicated by the core. In this case again, approximately a six-foot error in depth correction was used or was necessary to tie the log and the core together. Each of the zones here are a maximum of three and a half feet in thickness.

Q Now, is that the middle zone to which you refer?

A We will call -- for the sake of description -- we will call this the middle zone of the Wolfcamp pay. This is a one solid line unit with only two zones, actually two zones of pay encountered in it, and all of the wells in the area. This zone again is continuous and it rests directly on a thin shale break that is very clear-cut and is present in all wells. The thickness remains constant throughout the line of the section and is definitely correlatable. The lower Wolfcamp pay is only producing from one well. It is shown and correlated, however, from the 1-6 Duncan as a two and a half foot pay zone overlying a shale -- again a streak shale, and it can be correlated as the zone of porosity and permeability from the electric log on the No. 1 "A" Duncan above the same shale body, and it can be correlated on the Union No. 1 Anderson again above the same shale break. In the case of the 1-7 Anderson and the 1 "B" Duncan we have coes, and in the 1 "A" Duncan we do not have cores.

Q Do both of the cores that we are taking through this area show the zone to be productive of oil?

A They do.

Q Would you tell the Commission in what order the three wells shown on Exhibit No. 2 were drilled and why this lower zone is perforated only in one well?

A The Duncan 1 "A" 6 was the discovery well, the first well drilled, and on this section, the No. 1 -- Anderson -- and the No. 1-6 Duncan is a second well drilled, and the 1-7 Anderson is the third well drilled. In the 1 Duncan this zone was not recognized

at the time of completion as a possible productive zone.

Q This is the lower zone to which you refer?

A The lower zone was not recognized definitely as a possible producing zone. It was noted as having a show inasmuch as the analysis from the electric log did indicate that it might be potential pay. However, such a thin zone did not seem to warrant testing. That would be expressive and possibly complicate the completion of the well at that time. After drilling the 1-6 Duncan and we will have to continue to the next --

Q That's the 1-6 Duncan "A?"

A That's right, 1-6 Duncan "A." In order of sequence of wells in this section, the 1 Duncan "B" was the next well -- deep well drilled, and this time we cored to evaluate the section, and from the evaluation of it we found definitely that the core indicated that zone should be productive. It was somewhat doubtful from the electric log analysis, so this zone was perforated, individually treated with 500 gallons of mud acid, after which treatment it flowed 27.5 barrels of oil in one hour on a quarter inch choke.

Q Why was the lower zone not perforated in the last well drilled?

A On the No. 1-7 Anderson, again the zone was cored. The core indicated that the well should be productive, have a productive capacity. The electric log indicates that it should have a productive capacity. However, we have had apparently excellent pay zones appearing in the upper Wolfcamp. In addition, this well,

being structurally higher, it was felt from the electric log analysis that this zone should be productive that is shown here. These three zones were perforated together, and in this case this zone was found to contain water. In an attempt to complete the well -- I might point out that here we have all of the various treatments that we have conducted on this well on attempting to complete it. They were perforated, these three zones.

Q Now, the three perforations to which you have just referred, the two upper ones were productive of oil, and the lower being productive of water?

A Yes, and in the course of attempting to shut the water off from here, which should have been easy, we squeezed the zone individually, and found that we had communication behind the pipe. We made three separate attempts to shut the water off from this zone. After the three attempts and over a period of over a month of working on the well, we finally managed to shut the water off behind the pipe even though we had not been able to shut it off in perforations. We set a bridge plug, plugging the well back to ten thousand three twenty-four, and had we attempted to drill out the plug and perforate this zone as we had originally intended from the core analysis, we might have run the pay zone that we finally brought in on the well. We decided it was not economically feasible to perforate a two-foot zone at the risk of destroying this thin pay section which had finally been completed, even though it has been completed as a relatively poor well.

Q You say "relatively poor well." The permeability seems to be constant there, and the question arises in my mind, why is it a poor well, mechanical failure?

A Mr. Cooley, as I pointed out, we squeezed it with a hundred sacks. We made three other squeeze jobs with a hundred sacks each. That cement could not be kept out of the pay section. We do not know the degree that the cement damaged the pay section. We have every right to assume damage. We had many difficulties in this narrow zone from the water zone. We had communication behind it. Had we followed with a strong acid treatment, that might have corrected the damage done by the cement; we would have simple acidized,backed into the water and would have been back at it all over again. It is my opinion that this well was definitely damaged in completion due to mechanical difficulties beyond our control.

Q Now, on Exhibit No. 1, Mr. Dunn, you show a dry hole to the immediate east of the field. Have you prepared a cross section which also includes that well?

A Yes, sir, I have. Cross section B, BB Prime.

Q Is the cross section to which you refer the same cross section that is shown here on the Exhibit Board as Exhibit No. 3?

A It is.

Q Would you please explain to the Commission what the significance of this Exhibit is?

A This Exhibit is drawn on the same matter as Exhibit

No. 2, utilizing the electric log and the cores, and showing the same logs used as the center well of Exhibit No. 2, the Union No. 1-6 Duncan "A." And it extends -- this is called an east-west cross section -- extends more northeast than east, extends northeast to the Union No. 1 Atwood 1-5, Atwood Bradley. The same lines of correlation are shown, the top of the Burson, the top of the pay. The top of the Cisco is not shown because the No. 1 Atwood and Bradley was not carried to a depth sufficient to reach the Cisco. It did not penetrate to a point sufficient to reach this zone. Now, I might point out that the No. 1-5 Atwood Bradley was the second well drilled after the 1-6 Duncan, and this zone had not been evaluated at that time. We did not know what its potential would be; it was still in the suspect column.

Q The dry hole was the second well in the pool, then?

A That is correct. We did not carry it to that depth because the well was running slightly low to the No. 1-6.

Q From --

A From the cores, we considered this zone doubtful.

Q Which zone is that to which you refer?

A The middle zone, the middle pay of the Wolfcamp. However, the electric log indicated that it could and should be productive, and we perforated the two zones, the same two zones we had successfully perforated here. We had very little reason for perforating those zones since this middle zone was only five feet low to the zone in the No. 1 Duncan, which was producing prolifically.

However, after treating the well with acid -- and again we have the data -- after treating the zone with acid, we found that this zone, the lower zone, was water productive, definitely water productive. Five hundred gallons mud acid treatment. We swabbed thirty-seven barrels of salty water in six hours. We squeezed off this zone and attempted to complete from the upper perforations. After having squeezed the perforations, reperforated, treated, we tried a disel squeeze job and again had to use acid, we had the well flowing, well, we had the well flowing briefly at one time, and we had it at a point where we were swabbing a hundred barrels of oil in forty-eight hours. We reacidized in order to try to make it a commercial well with 1295 percent sulphur water. We had spent a considerable period of time and money, and it was decided that this could not be made into a profitable well because of the near proximity to water of the pay zone. It would be impossible to complete this zone and shut the water off and make a well from the completion that would be commercial. However, the presence of oil in this zone is definitely proved by our test as well as by the cores and the electric logs.

Q And again you do find a continuity in the upper zone?

A A definite continuity in both zones, the only difference being that here we have water as indicated by blue in the middle zone, where we have oil as indicated by red in the middle zone on the 1-6 Duncan. The zone is continuous. It simply contains water in this zone in the Atwood Bradley.

Q Mr. Dunn, does the encounter of water in the Atwood Bradley Well give you any indication, from a geological standpoint only, the type of drive that this pool might have?

A Yes. It is a definite indication that it has water or should have a water drive.

Q Mr. Dunn, have you made studies of the Bough Pool approximately fifteen miles to the north of this area?

A I have.

Q Are you familiar with the type of drive contained in that pool?

A Yes, I am. It has a definite water drive or had a definite water drive. It is practically -- completely depleted at the present time.

Q Have you attempted to construct a cross section showing the correlation of the Bough zone, the Bough pay zone all the way down to the Tatum-Wolfcamp pay zones?

A I have.

Q Is the Exhibit here on the board marked as Exhibit No. 4 the Exhibit which you have prepared a cross section to which you have just referred?

A It is.

Q Will you please explain to the Commission the significance of this Exhibit?

A This is a Wolfcamp correlation section from the Bough Field which is located in Township 19 South, Range 35 East, south

to the Tatum-Wolfcamp Field which is located in Township 13 South, Range 36 East. The insert map on this section shows the line of section and the well controlled used along this line. This point No. 6 is the point in the Bough Field where the section starts. The next point of control is the Phillips No. 1. Cross the next point of control is the Mid-Continent Dirkin zone. The next point of control, No. 3, is the Tennessee Gas No. 1 Gulf State. The next point of control is the Sinclair No. 1 Anderson, which I have mentioned previously. This we used as a control when we drilled the well, and it ties to our discovery well, the last control on the section, the Union No. 1-6 Duncan "A." On this we have shown the top of the Waco or Wolfcamp formation in correlation inasmuch as generally this zone is indicated by a change from the overlying Abo dolmite to a white crystal line limestone. This zone is not a perfect correlation marker. However, it is widely used in the industry and is a point of correlation that is carried and is frequently used in subsurface work. As I mentioned previously, the top of the Burson, the unit of the Wolfcamp, is a much better correlation marker, and we have drawn a correlation marker on the top of the first one,which is almost a perfect point of correlation. Over the larger part of Northeast New Mexico,along this line of section,it can be considered actually as a perfect zone. Each individual unit with its accompanying shales and limestone have a remarkable uniformity of thickness porosity and general overall characteristics that can be traced over this entire distance of over twenty miles north and

south into the Tatum-Wolfcamp Pool. Again we have used the top of the Tatum-Wolfcamp pay zone as a line to show the correlation is continuous from the Bough Field to the Tatum-Wolfcamp Field. This Tatum-Wolfcamp pay zone, the top of the pay zone corresponds with the top of the Bough zone in the Bough Field. In the Bough Field locally, they use the term Bough A, Bough B, Bough C and Bough D. The Tatum-Wolfcamp pay is representative of the Bough A, that is the upper pay. The lower pay as I have shown in the other section correlates with the Bough C, which is the main producer in the Bough Field.

Q Mr. Dunn, did you in your analysis of the intervening wells between the Tatum-Wolfcamp Pool and the Bough Pool encounter any anomolous from a geological standpoint that would indicate any different geology from the Tatum-Wolfcamp Pool from the Bough Pool?

A None whatsoever. There is a difference in the porosity and permeability, a slight difference in porosity and permeability through the line of section, but there is no difference in the characteristics of the formation, and its overall characteristics. A conclusion I might draw from it is that both fields would have to be structural; there is no evidence whatsoever of stratographic characterization of oil.

Q Mr. Dunn, if we assume that there is a water drive as the active drive mechanism in the Bough Pool, can you draw any geological conclusions, and again I stress geological conclusions only as to what type of water drive you might expect to -- what

type of drive you might expect to encounter in the Tatum-Wolfcamp Pool?

A The drive in the Tatum-Wolfcamp Pool should be a water drive. Again the continuity in the zone is obvious to the extent, from north to south, of the water drive in the Bough, which is structurally higher. A water drive should be effective in the Tatum-Wolfcamp Field.

Q Did you observe, Mr. Dunn, anything in the geological analysis that you made of the Tatum-Wolfcamp Pool that would give any indication whatsoever that one well would not be able to drain 80 acres in that Pool?

A None whatever.

Q Did you observe any indicia that might lead you to believe that it would drain 80 acres in that Pool?

A Yes, definitely, the pay zones are continuous, the zones of permeability and porosity being interconnected, as far as we can connect any point in geology. There is no reason why the zones should not be continuous, and as such, capable of producing over extremely wide areas, and with a water drive and a confined pay zone, it should definitely produce at least 80 acres and possibly more.

MR. COOLEY: Thank you, Mr. Dunn.

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

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Dunn, after you were able to look at some logs on these various wells in this pool, did it materially change the seismic picture that you had of this formation before you started drilling?

A Not materially. It definitely changed it as frequently happens, Mr. Nutter. We found, of course, we were attempting to drill our discovery well at the optimum position. Now, you must remember one thing, and that is that the Duncan 1-A was drilled as a Devonian test, and the location was selected on the basis of its structural position from seismic work on the Devonian, not on the Wolfcamp. So, from our seismic work this did not appear to be the highest possible point on the Wolfcamp, a point that is frequently encountered. We have made some minor changes in our seismic interpretation brought on by corrections after we obtained a velocity survey from the Duncan No. 1-A. Since that time we have been able to tie our well systematically.

Q Hasn't the tendency been to adjust the seismic pictures to decrease the size of the structure or enlarge it?

A It has been a tendency, actually, in zone, to enlarge it.

Q So you may have a larger and flatter structure than you originally anticipated?

A That is correct.

Q Well, now, we have two wells on these two cross sections that have made substantial quantities of water. I guess the

Atwood Bradley made so much water you plugged and abandoned it, and the Anderson No. 1-7 made so much water you plugged it off. Are those two zones comparable zones that made the water?

A May I refer to the Exhibit so that I can be sure I have your question correct? I'll get the small scale of the large scale copy. Your question, as I understand it, is that is the water zone from the 1-7 Anderson the same as the water zone from the No. 1 Atwood and Bradley.

Q Yes, sir, that lower water zone?

A No, it is not. Now, there is a continuous water zone that is present in the Atwood and Bradley that is the same water zone that was encountered in the No. 1 Anderson, but that is not the zone that was perforated. May we refer back to the large section. Frist, let me correlate a little more clearly, Mr. Nutter, the zones here. This is in the No. 1 Atwood and Bradley. This zone and the No. 1 Duncan which we are calling the middle pay zone of the Wolfcamp correlate definitely with the zone here which is permeable, porous and contains water; it was the zone that was perforated. We tried to squeeze off the water, it caused our difficulty, and we were unable to complete the well.

Q Why do you think --

A Now, this zone down slightly below this middle zone here which shows porosity and permeability carried considerable water in the core and indicates from the electric log on the No. 1 Duncan, that zone is present here, and was cored and also carried

water, was porous and permeable in the No. 1 Atwood and Bradley. It was clearly water; we made no attempt to perforate. That is the zone that we perforated that caused our difficulty and from which we obtained water in the No, 1 Anderson. It is this zone here. This zone was structurally high at this point, and we felt that it could contain oil, where this same zone definitely contained water here. I have made no attempt to show how these zones of porosity and permeability carry definitely across from well to well unless they contain oil, but they all do, the water zones and the oil zones, the shale zones. The continuity is perfect.

Q Now, have you picked water-oil contact for this pool as being at minus 6350?

A The only statement I could make about a water-oil contact in an extremely thin zone is where we have definitely encountered it. Again, for purposes of illustration, this upper and middle is one gross unit. The water -- the entire porous element in the No. 1 Atwood and Bradley contains water, the lowest --

Q Now,would that include the red shading on that Atwood Bradley?

A No, only the blue shading. Since this is tight -- since this zone is tight above that zone of porosity, I cannot say that there is not water in it. However, with this zone containing oil in the gross zone and we see no shale break that will separate what we are calling the middle Wolfcamp from the upper Wolfcamp pay, it must be considered a gross limestone zone, and any section

in here that carried water, we would not expect to find until we passed the seal to find oil below it, so we can assume that we had oil down to a minus 6350 in the No. 1 Duncan, as shown here. And we can assume that we have only water below minus 6350 from a correlation point in the Atwood and Bradley, which is as clear-cut a case of identifying in an extremely thin bed an oil-water contact that I've encountered.

Q Now, is the blue line on the Atwood Bradley Well on your Exhibit No. 3, is that 6350?

A The top of that is 6350.

Q I see. Now, why --

A The bottom of this, Mr. Nutter, is also minus 6350.

Q Why is the red section in the Atwood Bradley Well not productive of oil?

A The red section here?

Q Yes, sir.

A It would be productive of oil, Mr. Nutter. I have testified that we actually produced oil from it. We could not make a commercial producer from it because of the mechanical difficulties. We had gone as far as we could go in attempting to complete that as a commercial producer in the proximity of the zone. We have a maximum tight zone here between us and water of two, four, six, eight, ten, twelve, fourteen feet. And that fourteen feet was not sufficient after we had perforated. Had we been aware that this was a water zone, we would have probably been able to complete

the well satisfactorily if we got a good cement job. It is all the same danger, always adherent, in completions of this type of pay.

Q Is the permeability less in that red section of the Atwood Bradley than it is in the other well?

A Let me check that, sir. I didn't consider it any less from visual analysis. In the No. 1-6 Duncan, in that zone, the maximum permeability was -- by analysis -- was twelve milladarcies, and I have no -- the engineering witness will later give averages, and I would prefer to wait for that. In this zone we had a maximum permeability of five milladarcies. However, the averages, Mr. Nutter, would be very close to the same. We didn't have as high a maximum permeability, but we had close. The zone looked comparably definitely.

Q You didn't feel that the failure of the Atwood Bradley No. 1 could be attributed to poor permeability?

A No. It can be attributed to low pay section and mechanical difficulties.

MR. NUTTER: I see. Thank you.

MR. PORTER: Mr. Utz.

QUESTIONS BY MR. UTZ:

Q Mr. Dunn, if you have a water table at 6350, then wouldn't it be reasonable to assume that you have oil out to that point, the 6350 contour?

A I testified to that, sir.

Q Well, you testified that you only had a balance of 80 acres, I believe it was, that was commercial?

A No, sir. I testified that there was only a thousand and forty-eight acres that I considered to be commercially productive. I also testified that production would extend -- that the oil limits would extend, in my opinion, to a minus 6350 and be included in this line, but the limit of commercial production, as I defined it, was included within the minus 6300 contour.

Q Well, if you could have completed without mechanical difficulty, your Atwood Bradley 1-5, you think it would have made a productive well?

A It would have made a productive well, sir, and it would have had a definite salvage value, but it would not, in my opinion, represent the type of a well that I would recommend we drill to 10,300 feet to obtain. I would certainly want to produce it for all the salvage since we had already drilled a well that we could get.

Q Then, between the 6300 and 6350 contour, you don't feel it is commercial or productive?

A No, sir. Now, the additional information brought on by future development indicates that zones of permeability and porosity can be developed here, and I have no reason to assume that they will be.

MR. UTZ: That's all I have.

MR. PORTER: Does anyone else have a question of the

witness? The witness may be excused.

Mr. Cooley, before he is excused, do you desire to offer the Exhibits?

MR. COOLEY: I was going to offer all of them at the end.

Mr. Stanley, will you take the stand?

WILLIS M. STANLEY,

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

DIRECT EXAMINATION

BY MR. COOLEY:

Q State your full name, please.

A Willis M. Stanley.

Q Where do you reside, Mr. Stanley?

A In Roswell, New Mexico.

Q And by whom are you employed?

A By the Union Oil Company of California.

Q And in what capacity are you employed by the Union Oil Company of California?

A As a district landman.

Q As district landman for Union Oil Company of California, does it fall within the purview of your duties to take care of the landman activities in the Tatum-Wolfcamp Pool in Lea County, New Mexico?

A It does, sir.

Q Are you familiar with the ownership of the land within the Tatum-Wolfcamp Pool as defined by the Commission?

A I am.

Q Have you prepared an Exhibit, Mr. Stanley, which would portray this ownership graphically?

A I have, Mr. Cooley.

Q Is this Exhibit, which is posted here on the wall as Exhibit No. 5, the Exhibit to which you refer?

A It is.

Q Would you please come up here and explain this Exhibit as to what the different colors mean?

A This is a lease and royalty ownership plat designed to show a common ownership of royalty and of lease under each particular tract. The orange, the part in 35, is one ownership. It refers to royalty only. The green is royalty. All the colors are royalty. The notes on it are lease ownership.

Q Now, Mr. Stanley, referring to the orange diagram on Exhibit No. 1, which shows the pool limits, would you tell the Commission whether there is available within the Tatum-Wolfcamp field an additional forty acres of identical ownership which could be dedicated to each of the three producing wells in that pool at the present time?

A There is, definitely. This E/2 of 6 and the NE of 7 here compare with the pool outline as designated by the Conservation Commission. This entire S/2 is owned by one royalty owner;

the SE of 6, and the yellow is one royalty owner, and NE of 6 is a separate royalty owner.

Q Then, Mr. Stanley, would it be possible to dedicate an 80-acre tract running either east-west or north-south to each of the three producing wells in the present pool limits without changing the distribution of royalty or working interest income in any degree whatever?

A It would be.

MR. COOLEY: Thank you. That's all.

MR. PORTER: Any questions of Mr. Stanley? The witness may be excused.

(Witness excused)

JACK SCHRINKEL,

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

DIRECT EXAMINATION

BY MR. COOLEY:

Q Will the witness state his full name, please?

A Jack Schrinkel.

Q And where do you reside, Mr. Schrinkel?

A Midland, Texas.

Q By whom are you employed?

A Union Oil Company of California.

Q In what capacities are you employed?

A Reservoir engineer for West Texas Division.

Q Do you hold any degrees of higher education, Mr. Schrinkel?

A Yes, sir. Bachelor of Science in petroleum engineering from the University of Texas, 1950.

Q Are you a registered professional engineer in the State of Texas?

A Yes, sir. I have been a registered professional engineer in the State of Texas for four years.

Q Would you please state to the Commission what your experience has been since the date of your graduation?

A From March, 1950 to March, 1951 I was employed by the Pure Oil Company in an engineering capacity. From March, 1951 to October, 1953 I was employed by the Standolin Oil & Gas Company as an engineer in Andrews and Midland, Texas. Since that time I have been employed by the Union Oil Company of California.

Q And in what capacity did you say you were employed, Mr. Schrinkel?

A As a reservoir engineer for the West Texas-New Mexico Division.

Q And does this West Texas - New Mexico Division for which you are the reservoir engineer include the Tatum-Wolfcamp Pool in Lea County, New Mexico?

A Yes, it does.

Q And in the course of your work for Union Oil Company, has it been your duty to prepare certain studies with regard

to this pool?

A It has.

Q Would you tell the Commission,first,the number of wells that have been drilled in the immediate pool area, Mr. Schrinkel?

A To date, there have been four wells drilled in the Tatum-Wolfcamp Field, one of which is now flowing, two which are pumping, and one which is a dry hole.

Q Were all or any of these wells cored at the time they were drilled, Mr. Schrinkel?

A A portion of the pay section has been cored in each of the four wells.

Q Have you had an opportunity to study these cores?

A Yes, sir, I have.

Q And have you made a tabulation of data shown by these cores together with certain other data available to you and placed it in a tabular form?

A Yes, sir, I have.

Q I hand you, Mr. Schrinkel, what has been identified as Union Oil Company's Exhibit No. 6, and ask you if this is the tabulation to which you referred?

A It is.

Q Would you go through this tabulation and explain to the Commission the significance of the data shown thereon?

A Exhibit 6 consists of pertinent information in a tabular form on the Tatum-Wolfcamp Field. The discovery well and date

was the Union Oil Company, et al No. 1-6 Duncan "A," which was completed September 26, 1957. The average producing depth of this field is 10,320 feet. The weighted average porosity is 6.7 percent. The weighted average permeability is six milladarcies. The connate water saturation is 22 percent. There is no gas-oil contact.

Q No gas-oil contact?

A No, sir.

Q You mean gas cap?

A There is no gas cap, I'm sorry. No gas-oil contact, no gas contact. The oil-water contact is indefinite because of the thin pays. And the possibility of separate oil-water contacts for each of the porous zones which have previously been brought out, the gravity of the oil is 43 degrees API. The solution gas-oil ratio is 1200 cubic feet per barrel. The bubble point from correlation charts is 3,000 PSIG. The formation volume factor, also from correlation charts, is 1.69. The reservoir fluid viscosity is 0.4 centipoise. The original reservoir pressure at datum of minus 6350 was 3904 PSIG. The predominant drive is believed to be water. The average pay thickness is nineteen feet. The oil in place per acre foot in stock tank barrels is 240 barrels per acre foot. And the cumulative oil production through August 31, 1959 is 156,794 barrels. The current water production is less than 1 percent.

Q Mr. Schrinkel, I note that you have indicated the predominant drive in the Tatum-Wolfcamp Pool to be a water drive.

On what factors have you based this conclusion?

A Well, there are several reasons. The first reason is that it correlates very well geologically with the Bough Pool. The second reason is that we have obtained water production in the Atwood Bradley and also in the well to the south here, the Anderson -- No. 1 Anderson. Also, there has been no increase in -- no significant increase in the gas-oil ratio of the pool, and most significantly is the character of the pressure plotted versus cumulative production.

Q What significance do you see in this pressure plotted against cumulative production?

A It gives as an indication that it is flatteningwhich is characteristic of water drive fields.

Q Your apparent estimated recovery is going to be greater than it would be if it were solely a solution gas drive?

A Yes, it will.

Q Mr. Schrinkel, I hand you four core analyses which have been marked respectively as Exhibit 6-A, 6-B, 6-C and 6-D. Are these the cores from which the tabulations identified as Exhibit 6 were made?

A Yes, sir, they are.

Q Mr. Schrinkel, have you had an opportunity to study the production history of the Tatum-Wolfcamp Pool?

A Yes, sir, I have.

Q And have you prepared a tabulation of the production

history of that pool?

A Yes, sir.

Q I hand you Exhibit No. 7, and ask you if this is the tabulation to which you refer?

A It is. Exhibit No. 7 sets out the monthly production of each of the producing wells in the Tatum-Wolfcamp Field since their completion, and also lists the cumulative field production and the monthly field production. You'll note that Anderson No. 1 in August produced 364 barrels for a cumulative production as of August 31st, 1959 of 8020 barrels. Duncan "A" No. 1-6 in August of this year produced 1,429 barrels for a cumulative production to the end of the same period of 68,475 barrels. The Duncan "B" No. 1-6 in August of this year produced 3,984 barrels for a cumulative production of 80,299 barrels. The cumulative production from these three wells as of August 31st, 1959 was 156,794 barrels.

Q Looking at this tabulation of oil production from the Tatum-Wolfcamp Pool, Mr. Schrinkel, which of the three producing wells is the best well?

A Well, it's evident when examining this Exhibit that Duncan "B" No. 1-6 has a cumulative -- has a cumulative production higher than the sum of the other two wells, and is also producing roughly three times the sum of the other two wells.

Q Now, is there any explanation for the extremely low production of the Anderson No. 1 Well, the 80,299 barrels?

A Yes, sir, there is.

Q What is that explanation, sir?

A Well, as Mr. Dunn has previously brought out, there was considerably difficulty encountered in attempting to complete this well, and we feel that poor performance of this well is due to that completion difficulty that we had, and that it is not representative of the field as a whole.

Q Of the three wells -- the three producing wells shown on this, which of the three do you feel is the most representative?

A Well, I feel that the Duncan "A" No. 1-6 and the Duncan "B" No. 1-6 represent most nearly what we might expect and/or representative of this field.

Q Mr. Schrinkel, have you tabluated the various well tests that have been taken in the Tatum-Wolfcamp Pool since the date of discovery of this pool?

A Yes, sir, I have.

Q I hand you what has been marked as Exhibit No. 8, and ask you if this is the tabulation to which you refer?

A Yes, it is.

Q Would you please explain to the Commission what the significance of this Exhibit is?

A At the top of Exhibit No. 8 is a summary of the twenty-four hour well tests which have been obtained on each of the wells in the Tatum-Wolfcamp Field. You'll notice that starting at the top the production tests for the Anderson No. 1 and the R.W.Duncan No. 1-6 and the Duncan "B" 1-6 had been tabulated showing their

tubing pressures, or if they are pumping, their strokes per minute, length of stroke and the oil production percent, water and gas-oil ratio at each of these periods. The bottom portion of Exhibit 8 consists of a summary of the bottom hole pressure tests which have been taken at a datum of minus 6300 feet for these same wells in the Tatum-Wolfcamp Field.

Q How many of the three producing wells, Mr. Schrinkel, are presently on artificial lift?

A Two of the wells are now on artifical lift, the Duncan "A" 1-6 and the Anderson No. 1.

Q Mr. Schrinkel, have you prepared a graphic illustration of the various pressure tests that have been taken on the producing wells in the Tatum-Wolfcamp Pool together with the production history of these wells?

A Yes, sir, I have.

Q I hand you what has been marked as Exhibit No. 9, and ask you if that is the graphic illustration to which you refer?

A It is.

Q Will you please explain the significance of this Exhibit?

A Exhibit 9 sets out the bottom hole pressure history by well and the production history by well of each of the wells in the Tatum-Wolfcamp Field. Starting at the top, you'll note that the pressures for the Anderson No. 1 are denoted by the squares. The bottom hole pressures for the Duncan "A" No. 1-6 are denoted by the

"X", and the Duncan -- and the bottom hole pressures for the Duncan "B" No. 1-6 are denoted by the circles. In slant lettering to the left of each pressure point well to the left and in some instances to the right are the actual measured bottom hole pressures, and the number in the parenthesis indicates the number of hours each well was shut-in prior to obtaining pressure. At the bottom of the graph is the monthly oil production for each well plotted on a semi-log rhythmic scale, to which sets out the monthly production from each well, and also enables us to make some estimate of the future trend of production.

Q Now, have you also plotted the gas-oil ratios on this graphic illustration?

A Yes, sir, I have. The gas-oil ratios are -- the average field gas-oil ratio is the dotted line which appears in the lower one-third of the graph, in this maze of points, you see, using the same symbols as appear at the top of the graph, each -- the gas-oil ratio for each well can be obtained from that.

Q Have you also indicated the point at which artificial lift equipment was installed on the two wells which are now using artificial lift?

A Yes, sir, I have. Those are set out -- you'll notice that the -- this is rather hard to read, but the Anderson No. 1 pumping equipment was installed in January of 1959, and that pumping equipment was installed on the Duncan "A" No. 1-6 in February of 1959.

Q I note in the lower portion of Exhibit No. 9 that you have a dotted extrapolation of the production of the two better wells, that being the Duncan "B" No. 1 and the Duncan "A" No. 1. Would you please explain how you arrived at that particular extrapolation of production?

A Well, the dotted lines represent my interpretation of what the future producing rate of these two wells will be. You'll notice that on the upper curve for the Duncan "B" No. 1-6, that for the last six months period the production has been declining from this well at approximately the same rate as the extension of this dotted line. Based on this information, I felt that the decline of the Duncan "A" No. 1-6, or the lower dashed line,would follow the same trend as the stronger producer.

Q Now, did you have any other aid in establishing the slope of this decline?

A Yes. I examined the production history of the Bough Pool to the north. The Bough Pool in 1957 produced 326,322 barrels. In 1958 this production had declined to 224,650, for a decline of 101,672 barrels compared with the previous period, or a decline of 35 percent yearly.

Q Do you feel that the producing characteristics of the Bough Pool and the Tatum-Wolfcamp Pool are sufficiently similar as to use the decline in the Bough Pool as an aid to estimating the ultimate recovery from the wells in the Tatum-Wolfcamp Pool?

A I certainly do.

Q Upon what similiarities have you found to exist?

A Well, the -- of course, the indicated decline rate here was from the Duncan "B" 1-6 which checks within engineering accuracy the decline of the Bough Pool that has been observed in the past. Also, in my opinion, there was strong evidence that both of these fields are water drive fields which are connected through a common aquifer in the Wolfcamp. Other characteristics are that the Bough Pool also has thin porous streaks in the Wolfcamp formation, and the similiarity in my opinion, is very great.

Q What is the estimated ultimate recovery for the Duncan "B" No. 1 well, as shown by your Exhibit No. 9?

A Mr. Cooley, I don't have that right here in front of me. I combined the two in my estimate, actually. That was the Duncan "B" 1-6?

Q Yes.

A From an extrapolation of the decline curve on this Exhibit, my estimate of the ultimate recovery for the Duncan "B" No. 1-6 is 206,000 barrels. Using the same method, my estimated recovery from the Duncan "A" No. 1-6 is an ultimate recovery of 107,000 barrels, which is a total of 313,000 barrels for these two wells.

Q Now, is that based upon a 300 pound abandonment pressure?

A No. That is based on a 300 barrel per month abandonment pressure. And the reason for selecting that particular

abandonment pressure is the fact that I felt like the economic limit would be 300 barrels per month per well, due to the fact that it is anticipated that we will have to pump large volumes of water along with the oil in the future, and, therefore, we would have a high economic limit.

Q Your lifting cost at the depth which you are now dealing, averaging 10,300 feet, would be as great at that late life of the pool?

A That's true.

Q Mr. Schrinkel, have you attempted to construct a pressure production decline curve for the Tatum-Wolfcamp Pool?

A Yes, sir, I have.

Q I hand you what has been marked as Exhibit No. 10, and ask you if this is the decline curve to which you refer?

A It is, yes, sir.

Q Would you please explain what is shown on this Exhibit?

A Exhibit No. 10 is a plot of bottom hole pressure and gas-oil ratio tests versus the field cumulative oil production. Immediately under the legend is again the symbols used to designate the various wells, the square for the Union Oil Company, et al's No. 1 Anderson, the "X" for the Union Oil Company, et al's No. 1 "A" Duncan, and the circle for the Union Oil Company, et al's No. 1 "B" Duncan. Near the top of the graph is a red dashed line which indicates the initial field pressure of 3,904 PSIG as measured in the discovery well, the Duncan "A" No. 1-6 on October 19,

1957 before any production had been obtained from the pool. This is the initial field pressure, approximately three-fourths of an inch on this well. Well, I might clarify that a little bit. This black declining line here represents my interpretation of what the true reservoir pressure in the Tatum-Wolfcamp Field is. This point, approximately three-quarters of an inch down the line, represents the initial field -- the initial pressure as measured in the Duncan "B" 1-6 before any production had been obtained from this well. And you'll note that the pressure in this well was 300 -- I mean 3,684 pounds per square inch after a shut-in time of one hundred two hours, and represents a drawdown of 220 pounds from the initial field pressure of 3,904 PSIG. Now, the other points which appear underneath this black line are measured pressures and their corresponding shut-in times for the Atwood Bradley No. 1 and the Duncan "A" No. 1-6.

Q Is that the Anderson instead of the Atwood Bradley?

A I beg your pardon. It is the Anderson. The Atwood Bradley is a dry hole, therefore, it has no pressure. The reason that -- now, these points, in my opinion, are not representative of what the true field pressure was at the particular time that they were taken. Now, the reason for that, in the case of the Anderson No. 1,is the fact that we had this completion difficulty, which we have previously referred to, and it is simply due to the fact that we had destroyed the capacity of the well so much in our completion procedure or remedial procedures that, in my opinion,

the pressures were not building up to the true pressure at the end of that time. Now, the pressures denoted by the "X" which are those obtained on the Union Oil Company's No. 1 "A" Duncan, or the subsequent pressures after the initial field pressure also fall below this line which I believe to be representative. On this bottom hole pressure obtained September 27, 1959, on the Duncan "B" No. 1, which is in the center of Exhibit 10, with a pressure of 1982 pounds, on that particular point we had a pressure buildup curve. In other words, we measured the pressure. We had a continuous recording of the bottom hole pressure in this well and we found that at the end of 74 hours the pressure in this particular well was still building up at the rate of approximately 30 PSIG. So we don't feel like that pressure is representative. And, although, on this subsequent pressure, in the same well of 2119, we had not been producing the well as hard, if you'll look back at the previous Exhibit, and we feel like it is a little bit closer to what the true formation pressure is. Now, on going back to the Duncan "B" 1-6, on July 27, 1959 -- 27th, 1959 -- we obtained a bottom home pressure at the end of a 72-hour shut-in period of 2,752 PSIG.

Q Is this the point that is shown along your decline curve as being the next to the last point?

A Yes, it is, Mr. Cooley. Now, on September the 11th, 1959 we obtained a pressure in this same well, the Duncan "B" 1, of 2,740 PSIG at the end of the shut-in time of 108 hours, This

point also was at the end of a pressure buildup test, and although the pressure was not completely built up, it had gained only 8 pounds in a 24-hour period and within the limits of accuracy on the equipment itself, reaching very near the stabilized bottom hole pressure, so that is the reason that we chose this line as we did.

Q Then, to recapitulate the pressure decline as you have shown on Exhibit No. 10, is a point drawn between the initial field pressure in the "A" 1 Well, the initial pressure in the "B" 1 Well, and two subsequent pressures at later dates on the "B" 1 Well?

A That is correct.

Q Does this pressure curve as you have constructed it, also conform to the estimated recoveries which you have, which you believed you were going to get from these two wells?

A No, sir, it does not. In a water drive field it is impossible to forecast the ultimate recovery from a simple extrapolation of the pressure decline curve.

Q The replacement of the produced oil with the incoming water tends to hold the pressure up, does it not?

A That is correct.

Q Have you also shown on Exhibit No. 10 the GOR history of the Tatum-Wolfcamp Pool?

A Yes, sir, I have. The significance of the --

Q How is that portrayed,first?

A Well, the gas-oil ratio history is portrayed by the green line near the bottom of the graph, and is, the legend for this graph or the scale for this graph, appears at the right of Exhibit 10. The significance of this curve is that the initial gas-oil ratios in each of the wells were with the limits of accuracy of measurements very very or practically identical and have not increased any significant amount.

Q Mr. Schrinkel, in a pool of the comparatively smallness of the one with which we are dealing here, also taking into consideration the thickness of the pay, would this gas-oil ratio performance be characteristic of the pool if it had a solution gas drive solely rather than a water drive?

A No, sir. Considering the small amount of oil in place, I would say that we would have a much more rapid gas-oil ratio increase if it was producing on a gas drive.

Q The pressure in all of the wells that are now producing in the Tatum-Wolfcamp Pool are all below the bubble point, are they not?

A Yes, sir, that is correct.

Q Mr. Schrinkel, from the pressure performance that is portrayed here on Exhibit No. 10, can you draw any conclusions as to the ability of the production from one well to affect the pressure in other areas of the pool, or in plainer words, the degree of communication in the Tatum-Wolfcamp Pool?

A Well, the fact that the initial pressure in the Duncan

"B" 1-6 was 220 pounds lower than the initial reservoir pressure of 3904, after a cumulative production of only approximately 17,000 barrels, in my opinion, definitely indicates that there is communication between these two zones which are some 3300 feet apart.

Q You say these three wells are some 3300 feet apart?

A Yes, sir.

Q Was the initial pressure on the No. 1 "B" Well taken over a longer period of time and thus given a greater opportunity to build up than was the initial pressure for the pool?

A Yes, sir, it was. That is correct.

Q Now, in comparing the permeabilities found in the three producing wells in the Tatum-Wolfcamp pool, which of the three wells has the worse permeability?

A Well, our core analysis data indicates that the discovery well, the Duncan "A" 1-6, had the poorest permeability from the information that we have.

Q And that's from the core analysis?

A From the core analysis data, it indicates that it has much poorer capacity than the Duncan "B" 1.

Q But dispite this fact, in a relatively short period of time with the very comparatively small amount of oil production, the pressure was drawn down to a considerable degree before the drilling of the "B" 1 Well, is that correct?

A Yes, sir, that is correct.

Q Can there be any other engineering explanation for this

draw down on the Duncan "B" 1 other than the conclusion which we have reached, being that there must be communication between the Duncan "A" 1 and the Duncan "B" 1?

A Well, in my opinion, there could be no other explanation, in this particular case.

Q In this particular case?

A Yes, sir.

Q There could be other explanations in different types of pools where there were anomalous conditions occurring throughout the pool, could there not?

A Yes, sir, that's correct, or we could have equipment difficulties if qualified people were not obtaining these tests, which was not the case in this particular instance.

Q Do you feel that both of these pressures are definitely accurate?

A Yes, sir, I do.

Q That is, within the degree of error of the machinery used?

A Yes, sir.

Q From the core analyses which have been made available to you on the four wells in the Tatum-Wolfcamp Pool area, have you been able to construct a volumetric estimate of the amount of oil that can be recovered from this entire pool?

A Yes, sir, I have.

Q I hand you what has been marked as Exhibit No. 11, and

ask you if that is the calculation on the volumetric basis to which you refer?

A It is.

Q Will you please go through in some detail and explain to the Commission the significance of this calculation?

A The volumetric recoverable oil reserves for the Tatum-Wolfcamp Field have been calculated by the standard volume method. The oil in place for each acre foot is equal to the constant 7,758 barrels per acre foot, times the average porosity, times 1 minus the connate water saturation, all of which is divided by the formation volume factor. This works out to be the constant 7,758 multiplied by the porosity of 6.7 percent.

Q Where was this porosity obtained again, sir?

A This porosity value is the weighted average porosity from the core analysis data.

Q And as you proceed through the reserves estimate, please inform the Commission the source of all of your other variables.

A The connate water saturation of 22 percent was calculated from the electric logs obtained in the field, and the formation volume factor of 1.69 was obtained from Standolin's correlation charts, using the initial gas-oil ratio of 1200 cubic feet per barrel and other information. All of this works out to indicate that we have in the Tatum-Wolfcamp Field 240 barrels of stock tank oil in place originally per acre foot. Now, based on analogy with the Bough Field and the ranges of recoveries which can be

reasonably expected from a water drive field, I estimated the recovery factor for this field to be 45 percent of the oil which was originally in place.

Q Mr. Schrinkel, what is the recovery factor in the Bough Pool?

A I believe that fifty percent was, in that range, the range of recovery that myself and others have previously arrived at.

Q Now, you have said that there are strong similiarities between the Bough Pool and the Tatum-Wolfcamp Pool. Why is it that you have not used a 50 percent recovery factor rather than the 45 percent which you select?

A Well, it's a matter of judgment, in my opinion. I felt like this field was maybe not quite the quality of the Bough Pool, which we have used for analogy, and it's strictly based on experience and looking at the information is what I believe it is reasonable to recover.

Q And I take it, from the comparison of all the known factors in both pools, it is your opinion that the recoveries will be somewhat but slightly less than, in the Tatum-Wolfcamp Pool, than they would be in the Bough Pool?

A Yes, sir, that's correct.

Q Will you proceed, then, with your estimate?

A Well, as has been previously testified to, it is believed that the productive area of the field will be 1,040 surface acres. Using the average pay thickness of 19 feet, gives us a

volume or the estimated volume of the South Tatum-Wolfcamp Field of 19,760 acre feet.

Q Now, where did you obtain the average pay thickness of 19 feet, Mr. Schrinkel?

A From the core analysis and electric log information.

Q Proceed.

A Then, to estimate the recoverable oil in the Tatum-Wolfcamp Field, we take the recovery in the -- recovery per acre feet, which was 108 barrels per acre feet and multiply this times our estimate or volume of the field, or 19,760 acre feet and arrive at the recoverable oil for the South Tatum or for the Tatum-Wolfcamp Field to be 2,140,000 barrels.

Q Now, this calculation is, of course, necessarily based on the assumption of the exact correctness of the estimate that Mr. Dunn made, that there would be 1,040 productive surface acres?

A That's true.

Q And if that figure varied, this would necessarily vary?

A That's very true.

Q In order to check the accuracy of your volumetric calculation of recoverable oil in the Tatum-Wolfcamp Pool, have you attempted to make a production decline estimate, using the production decline method of calculation, rather than the volumetric calculation?

A Yes, sir, I have.

Q I hand you what has been marked as Exhibit No. 12, and

ask you if this is the calculation to which you refer?

A It is.

Q Would you explain this Exhibit to the Commission, please?

A Exhibit 12 is a recoverable reserve estimate by the production decline method for the Duncan "A" No. 1-6 and the Duncan "B" No. 1-6. The total estimated ultimate recovery for these two wells is 313,000 barrels, which was obtained from the production versus versus time decline in Exhibit No. 9. If we further dedicate 160 acres to these two wells and use the average pay thickness of 19 feet, we get an estimate recovery per acre foot for these two wells of 103 barrels per acre foot.

Q Thank you, Mr. Schrinkel. Mr. Schrinkel, as reservoir engineer for your company, does it also fall within the purview of your duties to attempt to determine with the greatest degree of accuracy possible the development from an economic standpoint of any particular prospect that your company might drill?

A It certainly does.

Q Have you attempted to evaluate from an economic standpoint the possible prospect of drilling the Tatum-Wolfcamp Pool on 40-acre space as compared with the drilling of the same pool on 80-acre spacing?

A Yes, sir, I have.

Q I hand you what has been marked as Exhibit No. 13, and ask you if this is the calculation to which you refer?

A It is.

Q Will you please proceed to explain what is shown thereon?

A Exhibit 13 is an economic comparison of 40-acre spacing versus 80-acre spacing for this field. Using information that has been previously developed, the area which we reasonably expect to be productive is a thousand and forty acres. If it is required to drill this well on 40-acre spacing, we will -- it will be necessary to drill twenty-six wells. If the field is developed on 80-acre spacing, it will be necessary to drill only thirteen wells. Now, before we get to the investment cost here, the actual well cost on the development to date on this field is as follows: The Union Oil Company et al No. 1 Anderson cost $242,499 to drill. The Union Oil Company et al No. 1 Atwood Bradley cost $197,317 to drill. The Union Oil Company et al No. 1-6 Duncan "A," the discovery well, cost $429,365 to drill. The Union Oil Company et all No. 1-6 Duncan "B," the most recent well, cost $187,078 to drill, for a total investment of the field of $1,056,259 to date. Now, these figures do not include geophysical and land costs which would make the investment in the field even greater. These figures were obtained from our accounting records, Mr. Cooley.

Q Now, Mr. Schrinkel, isn't there in those figures you have just read one more or less inherent error in charging the entire expense of the discovery well to the Tatum-Wolfcamp Pool?

A That is correct. The discovery well was a Devonian test, and that is why the well cost is so much out of line with the

others. Although --

Q Disregarding that well, then, the other three wells cost in the neighborhood of $200,000 apiece to drill?

A That is correct, Mr. Cooley.

Q Well, I note on Exhibit No. 13 you have used a figure of $180,000 per well for the future wells that are to be drilled in this pool?

A That is correct. We believe on the fact that as we gain experience in the field that we can drill the wells for that sum. I mean, making use of the knowledge that we obtained in the drilling of the other wells.

Q As development wells, you wouldn't expect to core quite as much as you would on the earlier discovery wells?

A Well, that is possibly true.

Q Then proceeding with the estimated cost of $180,000 for each additional development well, will you continue with your analysis?

A Yes. For 80-acre spacing or twenty-six wells, it would require an investment of $4,680,000.

Q I believe for 80-acre spacing, Mr. --

A I'm sorry. For 40-acre spacing and twenty-six wells it would require an investment of $4,680,000 for 80-acre spacing or thirteen wells, it would require an investment of $2,340,000. The estimated ultimate oil reserves, as have been previously calculated for this producing area, are 2,140,000 barrels, and we

have assigned no gas reserves to this particular field because of the lack of gas -- of a gas connection, and the gas volumes are not large enough to justify the installation of any gathering system in this field.

Q Now, is the 2,140,000 barrels, the volumetric calculation that you made earlier --

A Yes, sir.

Q -- rather than the production decline method --

A That is correct.

Q -- and it was slightly the higher of the two, was it not?

A Yes, sir, that is correct.

Q Then, would you proceed to tell us what operating income you would expect to receive on the basis of this production?

A Well, we are receiving three dollars and one cent for this oil and no value assigned to any gas production, so the gross revenue is three dollars and one cent per barrel. Under costs, we have severance and ad valorem taxes at eighteen cents per barrel. Royalty is sixty cents per barrel, trucking to the pipeline is twenty-six cents per barrel, and the lifting cost is very conservatively estimated at twenty-six cents per barrel. We feel like over the life of this property, if we have to or when we start lifting these -- artifically lifting these large volumes of water, the twenty-six cents per barrel is going to be a pretty optimistic lifting cost, and those figures total up to be $1.30 per barrel,

which leaves as net operating income for gross barrels of $1.71. Now, if we apply this net operating income for gross barrel of $1.71 to the total estimated recoverable oil of 2,140,000 barrels, we get a net operating revenue of 3,660,000 barrels.

Q Dollars?

A I'm sorry, dollars. Get a net operating revenue of $3,660,000. If we subtract the investment of $4,680,000 for development on 40-acre spacing from this revenue, we incur a loss of $1,020,000, or a loss of $39,200 per well. Going further, if we develop this field on 80-acre spacing, we will show a profit of $1,320,000, or a profit of $101,500 per well on an investment of $2,340,000.

Q In light of the conclusions that you have reached as a result of your economic study as a reservoir engineer for Union Oil Company responsible for recommendations for future activity in this pool, could you recommend to your management that this pool be developed on 40-acre spacing?

A I could not. I would definitely recommend that Union Oil Company do no additional development on this field if 40-acre spacing were the pattern.

Q Do you feel that any company could economically enter into this pool and develop on 40-acre spacing?

A No, sir, I certainly don't.

Q What would be the result, then, Mr. Schrinkel, if you were to stay on 40-acre spacing on this pool?

A Well, I think it is obvious that development would cease.

Q Mr. Schrinkel, in light of all of the knowledge and data which has been made available to you, as a result of your study in the Tatum-Wolfcamp Pool, I would like to have your opinion as to whether or not you feel that one well can efficiently and economically drain and develop 80 acres in the Tatum-Wolfcamp Pool?

A Well, in my opinion, the information that we presented here today indicates to me that one well will drain at least 80 acres. Now, the reasons for these are: first,the difference in the initial pressures before production between the Duncan "A" 1-6, which was the discovery well, and the subsequent pressure after production of approximately 17,000 barrels in the Duncan "B" 1-6 before any production. This indicates that we have communication or interference over a distance of at least 3300 feet. And, secondly, the production performance of these wells indicates to me that they will produce far in excess of the actual recoverable oil in place under a 40-acre tract as determined from core analysis. And third, the correlation of an active,or the idea that we have an active water drive in the field coupled with these pay sections which are isolated by limestone barriers,indicates to me that we will get very high flushing efficiency over long distances, which is characteristic of a frontal drive displacement, what we call a frontal or more nearly could be described as a loose fitting

piston, pushing this oil to these wells.

Q Well, in view of these factors, Mr. Schrinkel, do you feel that development of this pool on 80-acre spacing as compared with the development on 80-acre spacing would result in any significant quantity of oil?

A I do not.

Q You feel that the ultimate recovery of the pool on 80-acre spacing would be just as great as it would be on 40-acre spacing for all practical purposes?

A Yes, sir, I do.

MR. COOLEY: No further questions.

MR. PORTER: Anyone else have a question of Mr. Schrinkel?

CROSS EXAMINATION

BY MR. PAYNE:

Q Mr. Schrinkel, I believe you testified that the casinghead gas was being vented at the present time, is that correct?

A That is correct.

Q How much casinghead gas do these wells make, is it substantial?

A Well, our current gas-oil ratio -- if you'll note, the Exhibit is approximately 1500 cubic feet per barrel, so we can multiply that volume by our August production. I'd say this is approximately 7,000 MCF per month, which is not a significant quality.

Q So in all probability, there wouldn't be any connection, then?

A That is true.

Q This proposed location, is this a drilling well or just staked or just proposed?

A I believe that we have applied for the location. I don't know.

Q Do you propose to drill this well no matter what spacing the Commission establishes, whether 40 or 80?

A Yes, sir, that's true.

Q Now, why are you going to do that when you are going to lose $39,000? You don't have an offset obligation, do you?

A No, sir. We might feel that we might be able to drain even larger areas than 80-acre spacing.

Q In other words, while you don't believe in developing this field up on 40, the fact that you drill at 40, you still feel that that particular well will drain more than 40?

A Yes, sir, I certainly do.

Q Now, did you take any bona fide interference test?

A No, sir, we have not. We have not taken conventional type interference test. Now, the drawdown of this initial pressure on the Duncan "B" 1 is an interference test. You get more conclusive test than you do the conventional where you flow one and try to --

Q You feel that shutting in one well and flowing the other

one wouldn't give you any additional valuable data on drainage radius?

A Well, it would be very helpful. We would see that, the pressure decline in the shut-in well while we produce the other one.

Q Now, I believe you testified that this pressure indicates -- this pressure drawdown indicates that one well, your 1 "A" is affecting your 1 "B" and vice versa?

A Yes, sir.

Q Now, the fact that it is affecting is not the same, is it, as saying that the one well can drain efficiently all the intervening acreage between the two?

A Well, that's a rather difficult question to answer with the type of geology we have, where we have these thin pay sections isolated between these limestone stringers or isolated between impervious limestones; we get what we call a frontal advance type displacement. In other words, the water, wherever it may be out here, is pushing the oil into the areas of lower pressure, and a characteristic of that type producing mechanism is that it is very efficient. In other words, as we get out from the wells, this front tends to become a circle,in a case like this, where we have no permeability barriers in the area.

Q Well, now, is this an edge water drive you are talking about?

A Well, it's -- a frontal advance type displacement is

not.- It can be an edge water drive or it can be a circular drive. In this case it's similar to a displacement mechanism. In other words, if we had a, oh, let's say a pipe and our fist was about the same size of this pipe, and filled with water, and we pushed it in there, we would get a pretty effective displacement. If you translate this to a plane where you have this pistonlike force on the edge of the field, you get what's known as frontal advance, which has characteristically very effective flushing efficiency. In my opinion, this field would be much blacker than it is if we weren't getting highly efficient recovery. It may be even greater.

MR. PAYNE: Thank you.

QUESTIONS BY MR. NUTTER:

Q Mr. Schrinkel, we've heard quite a little bit about the Bough Pool today; you compared it on several occasions. How does this porosity of 6.7 compare with the porosity in the Bough?

A Well, Mr. Nutter, we had some work done by our Roswell geologic -- our Roswell geologic office, which they sent to our Midland office a good number of core analyses, which they were able to obtain in the Bough Pool, and as I recall, the average porosity values in this field ranged from three to a high of thirteen percent. Now, I believe that's right, and it's more or less of a matter of how you want to weigh those porosities to obtain what you think is the average field porosity. My own particular interpretation of this data was that the porosity was somewhere between five to eight percent, and that's about as close as I could tell

you what I think it might be.

Q Didn't you say that this 6.7 percent porosity was derived from the logs?

A That was derived primarily from core analysis data, adjusting the intervals for electric logs. You take a zone of this meager porosity, it is very difficult to make accurate electric log calculations when you start getting down in the lower porosity ranges. These represent the core porosity permeabilities.

Q These are core porosities?

A Yes, sir.

Q What was the range of those porosities?

A Well, we'll have to look at those Exhibits.

Q I will withdraw that question, sir. We've got that here, the core analysis. I hadn't looked at those.

A Yes, sir.

Q Now, on this Exhibit No. 9, Mr. Schrinkel, you have extrapolated the decline for your Duncan "B" Well No. 1-6 --

A Yes, sir.

Q -- based on the production for the last five or six months, I believe, primarily, is that correct?

A That is true. The Duncan "B" 1-6, yes, sir.

Q How long has it been since that well was capable of making the top allowable,for the pool, I should say?

A Well, I don't know, Mr. Nutter. I would assume that that

occurred in May of 1959.

Q Since May it hasn't been able to make top allowable?

A Yes, sir. This is -- each of these leases are one-well leases.

Q So since May this represents the capacity of the well to produce?

A Yes, sir.

Q Now, is that -- on one of the Exhibits I notice tubing pressure, Exhibit No. 8 for the Duncan 1-6. Is that the flowing tubing pressure there, that 630 pounds, or is that shut-in pressure?

A That's flowing pressure. Now, I might qualify that point, that that flowing test was the day after we obtained this most recent bottom hole pressure for this hearing. In other words, the well had a built-up pressure, and this represents a flush test.

Q Well, now, this -- in other words, this well is -- it made 178 barrels on the test?

A Yes, sir, which is certainly capable of making the allowable based on this test, but like I say, this test was obtained the day after we had had the well shut-in for a hundred and eight hours.

Q So there had been a buildup of fluids in the vicinity of the well bore?

A Yes, sir.

Q What is the normal flowing pressure for the well?

A Well, I really don't know other than what information we have here. I understood from our foreman in telephone conversations that the flowing tubing pressure was in the order of about 420 pounds before this period -- before this shut-in period. In fact, I believe that I have that.

Q Isn't that rather unusual, Mr. Schrinkel, for a well to have such a high flowing pressure and still not be able to make the allowable?

A Well, not necessarily. All these things are a matter of degree. The only way I can answer that question is that we have a field over in West Central Texas there that some of the wells have flowing pressures of 75 and 100 pounds per square inch, and yet they'll only make 3 and 4 barrels of oil per day. I mean it is a function of permeability of the formation and how effective the completion is, or the PI to get back to its function of how great the PI is and what the gas-oil ratio is.

Q And do you think there is a possibility that these allowables in this pool may not be too high?

A No, sir, I don't think that from the way our bottom hole pressure has tended to level out that they are.

Q Well, now, there is only one well that has had bottom hole pressure level out?

A That's true, but in any field -- in any field, in fact, I would say that in the West Texas-New Mexico area, that probably 75 percent of the wells don't build up in the end of a three-day

shut-in period, regardless of how they may be weighted and interpreted, and so forth, it is probably likely that less than 75 percent of the wells, except in formation, like the Devonian.

Q The virgin pressure of the pool was 349 pounds, and at the end of 17 barrels' production, the second well was brought in for 3684?

A Yes, sir.

Q And you mentioned that that drawdown from the virgin pressure in the second well was probably due to communication between wells?

A Yes, sir. I think that's the only interpretation I could make from the facts.

Q Well, now, do you think that this failure of all of these various points on Exhibit 10 to fall on the black decline line represents a lack of communication in the rest of the pool?

A No, sir, I don't. These pressure buildups are relatively thin -- I mean, we go from extremely tight fields to fields that are like turning on a water faucet. East Caprock Field, for instance, they build up almost immediately. And the buildup time is a function of several factors; the oil viscosity, and the compressibility of the oil, and the porosity that we have existing, and permeability of the formation, it is proportional to the permeability.

Q Is there any possibility that the buildup time on the initial pressure of the Duncan of 172 hours, was sufficient?

A Like I stated in my testimony, Mr. Nutter, there was an

80-pound pressure increase in the 24 -- comparing it with the pressure obtained in the previous 24-hour period. Now, the accuracy of this equipment is in the order of one-tenth of 1 percent or one part in a thousand. So, we are getting down near the range of where if we had the arrow working against us both ways we are just about built up, you see.

Q Now, on your Exhibits 11 and 13, you assume a productive area of 1040 acres. Now, Mr. Dunn testified that he thought there was oil production all the way up to that minus 6350 line, although it may not be of sufficient quantities to justify drilling a well out there. Do you think some of this oil may come out with this frontal advance piston movement that you were discussing a while ago?

A Yes, I think so.

Q You haven't taken that into consideration in your economics, have you?

A No, sir. These economics are based on our best interpretation of data, as is anything.

Q That area outside that 6300 foot line is probably twice as big as the area inside the 6300 foot line, isn't it?

A Well, I would say it increased the size of the area 25, 30 percent. Just looking at the map here. Geology, as well as engineering, is an interpretative science.

Q There are wells inside that can be produced from that inside, that 1040 acres, is that right?

A There is a possibility. If it is out there, there is a possibility that we will produce a portion of it.

MR. PAYNE: That just shows they are draining 80 acres, doesn't it, Mr. Schrinkel?

A Well, I suppose. I didn't quite understand.

Q Well, some of this oil, if it should move in would help the Commission's picture of wells?

A We certainly hope so.

Q You stated also, Mr. Schrinkel, that you didn't have any gas connection in the field and that you were only venting or flaring about 7,000 MCF per month. Now, that's with the three existing wells?

A Yes, sir.

Q As time goes on and more wells are drilled, there will probably be more gas produced?

A That's true.

Q How far is it to the nearest gas gathering facility?

A I'm not too familiar with the area, to be truthful. Actually, I think Mr. Dunn here might. Do you know?

MR. DUNN: I believe that it is within ten miles of the El Paso -- I think it is within four miles of the pool area, the El Paso high pressure line. That would require high compression to inject gas into that system.

A The nearest gasoline plant that I know of, I am not familiar with the plants at all, is the Denton or I believe Townsend

has a plant.

Q Now, this 7,000 MCF per month from the three existing wells amounts to $700 a month, does it not?

A That's true, yes, sir.

MR. NUTTER: I believe that's all. Thank you.

REDIRECT EXAMINATION

BY MR. PAYNE:

Q Mr. Schrinkel, are any of these wells capable of producing top unit allowable?

A Well, the only one that could be would be the Duncan "B" 1-6, that would have any possibilities, and as Mr. Nutter has asked me about, I believe that we recently had a restricted allowable on it.

Q So that generally speaking, at least if your application is granted, it wouldn't have any effect on the allowable?

A No. If we had a larger allowable from the three wells that we have here, we are capable of producing.--

Q I mean the wells are not capable of producing the allowable now, so even if you had an 80-acre allowable, it wouldn't change the production?

A Not on these three wells. In the event that the well to the north had a greater capacity to produce, we certainly could produce an increased allowable.

MR. PAYNE: Thank you. That's all.

MR. PORTER: Anyone else have a question of Mr.Schrinkel?

You may be excused.

REDIRECT EXAMINATION

BY MR. COOLEY:

Q Mr. Payne seemed concerned that you were willing to go ahead regardless of the outcome of this case, and drill on the location as shown up there as a proposed location. I ask you, Mr. Schrinkel, is that what you might call an 80-acre location, regardless of what the spacing is at the pool at the present time?

A Yes.

Q And would you recommend to the management drilling any inside location or any 40-acre location?

A I previously made that recommendation.

Q That you would or would not?

A Would not recommend 40-acre development.

Q Also some question concerning interference tests. I believe you testified that two -- that three producing wells at the present time are now on pumping units. It would be impossible to conduct an interference test between those two wells, would it not?

A Well, we could pull the rods and conduct an interference test if it were required.

Q What would such a test cost?

A Well, as far as dollar expenditure, I would say that an interference test between the Duncan "A" 1 and the Duncan "A" 1-6 would cost in the neighborhood of $1500, not counting the loss of production.

Q What would the loss of production amount to?

A Well, the -- if we saw fit to put the pressure bomb in the Duncan "A" 1-6, which is currently producing approximately 1400 barrels per month, that would be a net operating loss of 1400 barrels a month times a dollar and seventeen cents a barrel times the amount of time it would be necessary for us to show interference, which may be a few days or it may be a couple of weeks, to get this drawdown.

Q It would be a considerably expensive venture to try to run pressure interference tests in the pool in the three existing wells?

A Yes, it would.

Q Now, the inquiry was made as to whether this was an edge drive, and you said it was a frontal type of drive. It definitely is not a bottom water drive, is it?

A No, it is not. I think if we keep the geologic Exhibits in mind, that we see it is impossible for us to see a bottom water drive.

Q Mr. Nutter inquired if possibly the allowables might not be too high in this pool. Is there any possibility of hurting a well where there is no bottom water? In other words, where is there no possibility of coning?

A In my mind, there is no coning problem at all in this field.

Q If there is no coning problem, are these type of wells very sensitive?

A No, sir.

Q Now, the economic picture that you portrayed in Exhibit No. 12 was based on the calculated oil in place under an 80-acre tract, was it not?

A Yes, sir. Did you mean Exhibit 12?

Q Well, Exhibit No. 12. What I'm getting at is the calculations; comparison between 40-acre spacing and 80-acre spacing was based on oil in place in the pool based on the information that we now have?

A Yes, sir.

Q And if by some fortuitous event we should recover more oil through either a 40-acre well or an 80-acre well, it would of necessity have to come from somewhere outside the 80-acre tract on which it was drilled, would it not?

A Yes, sir. That would indicate drainage of even larger areas than 80 acres.

Q And do you not expect that there will be some of this oil in the area that is not commercially productive to drill that will be recovered through the wider acreage pattern?

A Yes, sir, we will recover some of that oil.

Q And to whatever extent the additional recovery is in excess of 80 acres,we will just be that much better off,won't we?

A Yes, sir.

Q Mr. Nutter calculated for you that the 7,000 MCF of gas that we are now producing to be seven hundred dollars at ten cents

an MCF. It isn't worth anything unless you have a market, is that right?

A That's true. Unless we have pipeline connections and are able to sell, it has no present or future value.

Q Until somebody sees fit to construct a gathering system in this pool, this gas is for all practical purposes worthless?

A That's true.

MR. COOLEY: No further questions.

QUESTIONS BY MR. PORTER:

Q Has any attempt been made to make a gas connection?

A We are selling it to one of our mineral owners there for irrigation gas, so it is not completely going to waste.

Q Run irrigation engine?

A Yes, sir, but to my knowledge, from what I know about the gas industry, I believe that a person would be extremely reluctant to construct a gathering system into this field from the probable gas reserve that he has unless he was near --

Q Considering expansion of the area now, a gas line, it is not entirely improbable to expect a gas connection at some time in the future?

A If the field drilled out this way, if we are currently producing 7,000 MCF per month and we had roughly eight times that amount of wells, it would make us produce about six or seven million a day.

Q It would be more attractive?

A Yes, sir.

MR. PAYNE: Did you list in your economic calculation the volume of the sale of this gas to the land owners?

A I believe he has the right to take that in time, and he is being charged nothing whatsoever. He is just -- we are making use of something that would otherwise be wasted.

Q (By Mr. Porter) Wouldn't your royalty payments, then, be less than the sixty cents?

A Well, unfortunately he has a 20 percent royalty on our properties, so he is getting his fair share.

Q In other words, this is a royalty owners gas?

A Royalty owner is using his other gas.

MR. NUTTER: Mr. Schrinkel, in response to a question by Mr. Cooley, you said that in an edge water drive field, you don't have any coning problem. There can exist such a thing as a fingering problem in an edge water drive, can't there?

A That's very true, Mr. Nutter, but as we have -- if we have a large periphery or a large -- oh, how shall I say it -- circumference to this area, our oil withdrawals from the total area are not so large, we don't have a series of fingering problems as if the water was moving in very fast. In other words, if we had a well of over five acres and we are just taking every drop we could out of this area, we would be more likely to have a fingering problem at the edge of the field.

Q Now, you also mentioned that if you had some oil moving into this 1040-acre from outside of the area, that that would indi-

cate communication and drainage of a larger radius than an 80-acre location has, but would that be any indication necessarily of the efficiency with which a well was draining a larger area?

A Would you state that question again, please?

Q Well, in response to a question on redirect by Mr. Cooley, you said that if the oil was coming in from outside of that 1040-acre area that that would indicate that the wells were draining a larger area than the location radius. Would that be any indication of the efficiency with which that well was draining a larger radius?

A Well, I don't know whether I can answer that directly. I can answer it in this fasion, that the thing that we are always driving for in any oil field is a minimum residual oil saturation when we get through. In other words, we hope that in a water drive field that nearly all of the oil will be displaced by water, and that in a solution gas drive field that we will end up with a very high gas saturation in the porous or the rock, indicating that we have most all of the oil out. And it really, fortunately, I say fortunately in this particular Wolfcamp area or the field, that it appears to me that considering the low porosity and the thin pay sections, that we have a very fortunate producing mechanism in our favor, where we are more or less getting this pistonlike effect. And so if we conceive this thing as one big low porosity thin disc with water on the edge of the thing, it boils down to a fact of how fast can we take the oil out of the center of it before we have

any serious fingering problem. As you pointed out there, instead of -- well, it really doesn't matter from the standpoint of efficiency whether you take all that oil out of one well in the center of this disc. If you had the capacity to produce it or if you had a number of wells, you would still, as water encroached, you would have more or less the same residual oil saturation.

Q I see.

A I hope that makes it clear.

MR. PORTER: Anyone else have a question? The witness may be excused.

(Witness excused)

MR. COOLEY: This concludes our case, Mr. Commissioner. I have closing remarks if there are no other witnesses.

MR. PORTER: You may proceed, Mr. Cooley.

MR. COOLEY: May it please the Commission, we feel that the presentation of the evidence that we brought forward to you today, considering the geology of the pool, the thin pay zones, and the -- in light of the water drive that we are certain exists here, that we have an extraordinary flushing action that will assure the recovery of substantially an equal quantity of oil regardless of the spacing pattern, whether it be 40 or 80. In light of the economics that have been presented, regardless of what little additional oil might be obtained from this periphery, certainly this can't be claimed to be a very rosey economic picture. And we feel very definitely that development of this pool on 40-

acre spacing is just too great a risk from an economic standpoint. Thank you.

MR. PORTER: Anyone else have any statements to make in this case? Mr. Errebo.

MR. ERREBO: If it please the Commission, Magnolia Petroleum Company is the owner of leasehold interests in two of the wells in this pool and recommends the adoption of 80-acre spacing.

MR. PORTER: Anyone else have any comments?

MR. PAYNE: Mr. Commissioner, we received a communication from Sinclair Oil & Gas Company who urges that Union's application in this case be granted.

MR. PORTER: Nothing further, case will be taken under advisement and take up next Case 1757.

MR. PAYNE: Off the record.

(Discussion off the record.)

MR. COOLEY: Let the record show that I move the introduction of all Exhibits, 1 through 12.

MR. PORTER: Let the record show that the Exhibits were admitted.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, J. A. Trujillo, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in Stenotype and reduced to typewritten transcript by me, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this, the 2nd day of October, 1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Joseph A. Trujillo
NOTARY PUBLIC

My Commission Expires:

October 5, 1960