BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
December 13, 1961

REGULAR HEARING

IN THE MATTER OF:

Application of The Ohio Oil Company for the establishment of 80-acre oil proration units in the Lea-Devonian Pool, Lea County, New Mexico. Case No. 2118 will be reopened pursuant to Order No. R-1826 to permit the applicant and other interested parties to appear and show cause why the Lea-Devonian Pool should not be developed on 40-acre proration units. — Case 2118

Application of The Ohio Oil Company for 160-acre spacing, Lea-Devonian Pool, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order requiring 160-acre proration units and 160-acre spacing for the Lea-Devonian Pool, Lea County, New Mexico. Applicant further seeks the establishment of special rules for said pool which would include an oil allowable factor in excess of the 80-acre allowable factors provided by the statewide rules. Said Lea-Devonian Pool is currently governed by temporary 80-acre rules. — Case 2459

BEFORE: Mr. A. L. Porter, Chairman
Mr. E. S. Walker
Honorable Edwin L. Mechem

TRANSCRIPT OF HEARING

MR. PORTER: The next case on the docket is Case 2118.

MR. WHITFIELD: In the matter of the application of The Ohio Oil Company for the establishment of 80-acre oil proration units in the Lea-Devonian Pool, Lea County, New Mexico.

MR. COUCH: Mr. Porter, and members of the Commission, we are prepared, if it suits the Commission's pleasure, to proceed in the Devonian case first, or in the Bone Springs case first.

MR. PORTER: Case 2118, I believe, refers to the Devonian, Mr. Couch, so we'll proceed with that.

MR. COUCH: In the presentation of 2118 we would like to consolidate that, then, with Case 2459, also pertaining to the Devonian Pool.

MR. PORTER: Are there any objections to counsel's motion? The cases will be consolidated. Mr. Couch, do you have some exhibits to post?

MR. COUCH: No, sir, we don't have any to post. We have them prepared in sufficient copies to pass them out for those people following the case, and sufficient for those people in the audience to follow the case.

MR. PORTER: We're going to take a short break anyway.

(Whereupon, a recess was held.)

MR. PORTER: The hearing will come to order, please.

MR. COUCH: Are you ready to proceed?

MR. PORTER: Yes.

MR. COUCH: I am J. O. Terrell Couch appearing for The Ohio Oil Company in this consolidation of Cases 2118 and 2459. The records of the Commission will reflect the appearances have been entered in both of these cases by Atwood, Malone, our New Mexico counsel, verifying that I'm associated with them in the presentation of this case.

I would like to make a preliminary statement in connection with this matter. To go back just a bit and realize that when the Ohio requested temporary 80-acre proration units for this Lea-Devonian Pool last year the discovery well had just been completed in the pool not many months before. It was the only well in the pool and the deepest oil production then or since then in the State of New Mexico.

The Commission, recognizing the significance of this discovery and the importance of the matters involved there, promptly provided appropriate rules to guide the development of the pool in its early stages and established the temporary 80-acre proration units as we requested.

That order, entered under those circumstances, was to me an appropriate step in the exercise of this Commission's statutory duty to insure the conservation of oil and gas in this state. The effective discharge of that duty involves not only the

prevention of waste, but also the encouragement of non-wasteful production of oil and gas.

We all recognize this can be done only by preserving to each owner, each oil and gas operator, his statutory right to a realistic opportunity to produce his just and equitable share of the oil and gas. Inherent in the preservation of this statutory right is the establishment of a proration unit for each separate pool, which unit must be the area that can be efficiently and economically drained and developed in that pool by one well.

In fixing the size of the proration unit in each pool, the statutes, of course, require the Commission to consider the economic loss caused by the drilling of unnecessary wells, the prevention of waste and the protection of correlative rights, prevention of reduced recovery from the drilling of too few wells and the avoidance of adding to the risks of development which necessarily accompanies the drilling of an excessive number of wells.

This language, of course, as you gentlemen realize, is a paraphrase of the statue, in many instances an actual quote from the statute. This is not an easy task; to properly perform it, there must be continuing reconsideration and evaluation, from time to time change in past policies in order to give adequate recognition to advancement and development and changed conditions

within the oil and gas industry. This the Commission and its Staff have done in the past. For example, the revision of the rules on multiple completions, the authority to commingle, the recognition and approval of automatic custody transfer, the special consideration given in the case of water flooding operations; two examples pertaining directly to this case, the first the temporary 80-acre proration unit order issued as it was on the limited information available, and the second, the prompt addition by this Commission on its own motion of an additional depth factor in the allowable rule to recognize and provide extra allowable for this deepest production in the state.

I feel certain that the Commission and its Staff will continue in the future to move forward in step with scientific knowledge and economic reality and will, where necessary, depart from past policies and past restrictions wherever the facts justify such action.

So much for the past, and so much for the future, I'm equally certain that the Commission and its Staff will afford the same objective to the problem facing it today and us today. The Case 2118 and the order issued called on the Ohio to obtain additional information concerning the Devonian Pool and to return at this time prepared to establish a proper size of the proration unit for this pool. We have obtained, and are prepared to present

that evidence. It's our conclusion that the evidence justifies and requires the establishment of a hundred sixty-acre proration units for the Lea-Devonian Pool. I believe this Commission will agree with our conclusion when the evidence is in.

Gentlemen, we'll have two witnesses in this case, Mr. Roy Young and Mr. J. D. Wheeler.

MR. PORTER: Let's have both witnesses sworn at this time, please.

(Witnesses sworn.)

ROY M. YOUNG

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

DIRECT EXAMINATION

BY MR. COUCH:

Q Will you please state your name, by whom you are employed, and what capacity?

A My name is Roy M. Young. I'm employed by the Ohio Oil Company in the capacity of a reservoir engineer.

Q Mr. Young, have you previously testified before this Commission?

A Yes, sir, I have.

Q Have your qualifications as to educational training as a petroleum engineer been contained in the records of previous

hearings?

A Yes, they are.

Q Mr. Young, will you, for the record, identify yourself with respect to the pool in question here and your past connection with it in Commission hearings?

A Yes, sir. I was the same Roy M. Young who testified in the original hearing of Case 2118 which resulted in Commission Order R-1826 which granted temporary 80-acre spacing and 80-acre proration units in the Lea-Devonian Pool. I also testified in Case 2206 which resulted in Order R-1906, which permitted shutting in of certain wells and the transferring of their allowables to other wells for the purposes of taking interference tests.

I have continued to study all the available engineering and geological data relative to this pool for the purposes of determining, in my opinion, the proper well spacing that should be supplied to the Lea-Devonian Pool to, one, prevent waste and protect correlative rights; two, to encourage the rapid development of the pool and to aid in the prevention of the drilling of unnecessary wells.

(Whereupon, Ohio's Exhibit No. 1 was marked for identification.)

Q Mr. Young, would you please refer to what has been marked Ohio's Exhibit 1 in this consolidated case? Would you state, Mr. Young, what Exhibit 1 is and give us a brief

description of what it contains?

A Exhibit 1 is a map of the Lea Unit Area located in Township 20 South, Ranges 34 and 35 East, Lea County, New Mexico. The Ohio Oil Company is the operator of this unit and owns approximately 45% of the working interest. The Lea Unit, on Exhibit 1, is outlined by the hashed line. It contains approximately 2,560 acres. All the acreage in the unit is Federal acreage except one 160-acre tract in the Southeast portion of the unit which belongs to the State.

Q That's actually in the Southeast corner of the unit, is it not?

A Yes, sir, it is.

Q All right. Now, I observe that you show five colored spots on that exhibit in the Lea boundary.

A They indicate the five unit wells which have been completed in the Devonian. Each well has been shown in a different color. The purpose of this is to simplify the presentation of some of the other exhibits. Each well has been assigned a separate color and will be used throughout in the exhibits presented here today.

Q What are the five wells, what are the designations in the Commission records?

A The five wells currently producing from the Devonian

are the Unit Lea ones 1, 2, 4, 5 and 6. Each one of these, except No. 6, is an oil-oil dual, dualed into the Devonian and Bone Springs formations. The Devonian production in this pool is the deepest oil production in the State of New Mexico.

Q All those wells, except No. 6, are Devonian-Bone Springs oil producers, are they not?

A Yes, sir, they are.

Q With respect to Well No. 6, have we requested Commission approval of that well as a dual completion?

A Yes, sir, that was done in an Examiner Hearing on December 11, 1961.

Q What dual are we requesting approval of there?

A Requesting permission to effect the dual in the Lea-Devonian Pool and the Lea-Pennsylvanian Gas Pool.

Q Actually asking for an approval of that dual?

A Yes, sir.

Q Now, there are two wells shown on Exhibit 1 which offset the Lea Unit. Will you identify those and give us the pertinent information about them?

A Yes. Those are the United States Smelting Federal No. 1 located in the Southeast Quarter, Northwest Quarter of Section 11 and the Sinclair Federal Lea No. 1 located in the Southwest Quarter, Northwest Quarter of Section 7, Township 20 South,

Range 35 East.

Q That's one on the East side of the unit, the Sinclair well, and one on the West side, the Smelting well?

A Yes. Both of those were unsuccessful in obtaining Devonian production.

Q Now, the symbols underneath the colors show the No. 6 to be a drilling well and No. 7 to be a drilling well. Number 7 is actually still drilling, is it not?

A Yes, sir, it is drilling below 12,000 feet at the present time.

Q No. 6 has been completed as a Devonian producer, you have testified. Will you give us the pertinent information on that completion?

A Yes, No. 6 was completed as a Devonian producer on December 2, 1961. On a seven and a half hour flow test it flowed 1165 barrels per day on 11-64 choke.

Q Exhibit 1 shows some contour lines. Will you give us some information about those, please?

A Yes, Exhibit 1 is contoured on top of the Devonian structure. These contours depicted on Exhibit 1 are based on the original seismic contours corrected by 265 feet to reflect the information obtained from the drilling of the seven wells.

Q The 265-foot correction was a general correction throughout

these contours, was it not, Mr. Young?

A Yes, sir.

Q Merely showing the seismic reflection had indicated this to be at a slightly different subsea depth?

A Yes, sir.

Q Is it your opinion that these contours accurately represent configuration of the Devonian structure in this area?

A Yes, sir, it is.

Q What is the area you have shown in yellow on Exhibit 1, Mr. Young?

A The yellow area containing 2280 acres is the proposed first revised Devonian participating area. The application for approval of this participating area has been approved by the State Land Commissioner and is now pending approval with the United States Geological Survey.

Q Have the productive limits of the Devonian Pool been defined?

A No, sir, they have not.

Q Do you have any gas-oil or water-oil contacts encountered in any of the present wells?

A No, sir.

Q What are the present horizontal pool limits as defined by the Commission in the Devonian Pool?

A They include the Northeast Quarter of Section 11, the West Half and the Southeast Quarter of Section 12.

Q You also have shown on Exhibit 1 a heavy line marked X-X^1 and some lines going from the wells to that line. What does that indicate, please?

A The cross section of the Devonian formation has been prepared along the line denoted X-X^1 and has been prepared as Ohio's Exhibit 2.

(Whereupon, Ohio's Exhibit 2 was marked for identification.)

Q Mr. Young, in the preparation of Exhibit 2, what information did you use?

A Exhibit 2 was prepared with the use of the gamma ray neutron logs of the five unit wells and the gamma ray electrical log of the Sinclair Federal No. 1. These logs have been aligned on a subsea depth of minus 10,700 feet.

Q These are all the logs, are they not, of wells completed into the Devonian or drilled into the Devonian formation in this area?

A Yes.

Q All the electric logs?

A These are all the gamma ray logs that are available. The United States Smelting Federal No. 1 was drilled into the Devonian, but was not logged.

Q I see. And that, of course, there's no showing of that on this cross section?

A No, sir, there is not.

Q How are these logs arranged on Exhibit No. 2?

A They are aligned on a subsea depth of minus 10,700 feet.

Q And they go from West to East across the field?

A Yes.

Q From the left to the right of the exhibit?

A Yes, sir.

Q After each of these wells, above these wells on the cross section, do you give the pertinent information identifying the well?

A Yes, included in the information is the name of the well, the elevation, location and completion date.

Q Is the top of the Devonian formation indicated on this Exhibit 2?

A Yes, sir. It is shown as a solid heavy line across Exhibit 2.

Q Do you have a little thinner line also shown on that exhibit, what does that represent?

A That's the top of the Woodford shale.

Q On each log you have certain symbols shown there, what do those represent, please?

A Indicated on each log is the perforation or open hole

producing interval of each well.

Q The Well No. 1 has penetrated more of the Devonian formation than any other producing well in the field, is this not right?

A That is correct.

Q What about the depths to which the other four unit wells have been drilled?

A The other four unit wells were drilled to a total depth equal to or to a shallower depth to the bottom perforations in No. 1.

Q Two of those wells being 5 and 6, you don't show perforations on those, why not?

A Those are open hole completions.

Q I see some red coloring on Exhibit 2. Will you please state what that is for and what it indicates?

A The red coloring shows, in my opinion, the location and the amount of the net pay encountered in each well.

Q Mr. Young, I happened to observe my copy of the exhibit doesn't show any red coloring on Well No. 5. Does yours?

A Yes, sir.

Q There's some there anyway?

A Yes, sir, net pay of 33 feet.

Q Have you computed the average net pay encountered in

those five unit wells?

A Yes.

Q What does that figure? A Fifty-five feet.

Q Is that intended to be all of the pay in the Devonian formation in those wells?

A No, sir, this figure represents only that net pay exactly penetrated by the drilling operations in the respective wells.

Q Do all the wells except No. 1, in your opinion, have some additional net pay that was not penetrated?

A Yes, sir, they do.

Q This method of completion was followed for conservation practices, was it not?

A Yes, sir.

Q You didn't consider it essential to penetrate all of the available pay in order to effectively complete the well?

A No, sir.

(Whereupon, Ohio's Exhibit No. 3 was marked for identification.)

Q Mr. Young, please look at Exhibit 3. This is entitled the "Production History Graph, Lea Devonian Pool, Lea County, New Mexico". Mr. Young, will you tell us briefly what is shown on Exhibit No. 3?

A Yes, sir. Exhibit No. 3 is a production history graph

of the Lea-Devonian Pool. It shows the monthly oil production, the cumulative oil production, the number of wells and some bottom hole pressure data. As of November 1st, 1961 four wells were producing from the Lea-Devonian Pool. The cumulative production of those four wells was 335,446 barrels.

Q The bottom hole pressure information is plotted on this Exhibit 3. Can you tell us what bottom hole pressures those are?

A The bottom hole pressures plotted on Exhibit 3 are the bottom hole pressures of the individual wells and shows only the initial and most recent bottom hole pressure that have been measured in the individual wells. Additional bottom hole pressure data for wells 1, 2 and 4 will be given in a later exhibit.

Q And there's no additional bottom hole pressure data on No. 5 except what's shown here?

A That is correct.

Q Before we get through, all the bottom hole pressure data will be before the Commission?

A Yes, sir.

Q What is the significance of the pressure data as shown on Exhibit 3 in your opinion?

A The pressure data shown shows that the Lea-Devonian has not experienced any appreciable pressure decline.

Q This is after production of over 300,000 barrels of oil?

A That is correct.

Q Do you have an opinion as to why there has been no appreciable pressure decline in this pool?

A In my opinion the reason there has been no appreciable pressure decline is that the Lea-Devonian, like most other Devonian Pools in Southeast New Mexico, has an excellent water drive.

Q Does that lead you to any conclusion with respect to drainage in this pool?

A Yes, sir. Therefore, it is my opinion that effective and efficient drainage will occur from wide areas within the structure shown in Exhibit 1.

Q Now, the pressure in No. 5, the second pressure taken there and the initial pressure, seem to be lower than the pressures in those other wells. Do you have an opinion as to why that situation exists?

A Yes, sir. Well No. 5 is on the eastern part of the pool. The eastern part of the pool is sealed by a fault; therefore, it's my opinion that the water drive active upon the Lea-Devonian Pool is moving in from the West and North. The movement of this water into the reservoir creates a pressure gradient. Therefore, we would expect a pressure gradient from West to East across the Devonian pay.

Q Would this result, or would you expect that the pressure in the well near that sealing fault would be lower or higher than the other well?

A I would expect it to be lower.

Q So that that information on Well No. 5 as shown on Exhibit 3 is reasonable, in your opinion?

A Yes, sir.

Q And would be expected in a reservoir of this kind?

A Yes, sir.

(Whereupon, Ohio's Exhibit No. 4 was marked for identification.)

Q Would you please look at Exhibit 4? Mr. Young, please identify Exhibit 4.

A Exhibit 4 is a copy of the coregraph through the Devonian section in Well No. 2.

Q The Commission has, in its prior orders, requested that we obtain core data, did they not?

A Yes, sir.

Q And we, of course, wanted that information for ourselves?

A Yes, sir.

Q The core analysis from No. 2 shows certain information about that well. Will you tell us what information it shows?

A Yes, this core analysis shows that Well No. 2 has 81

feet of net pay with the porosity of 5.49% and a permeability of 47.8 millidarcys.

Q Is this the only coring that has been done in this field?

A It's the only coring that has been done in the Devonian Pool.

MR. PORTER: What was that porosity figure you gave?

A 5.49%.

MR. PORTER: Thank you.

Q (By Mr. Couch) Now, the Commission Order R-1826, authorizing temporary 80-acre proration units for this pool, also required that interference tests be taken before the permanent rules were authorized, is that right, Mr. Young?

A Yes, sir, it did.

Q Were these tests conducted?

A Yes, sir. They were begun in April, 1961 following the Commission order permitting the shut-in of wells and transferring their allowable.

Q Now, in April, 1961, when No.2 and 4 had been completed, did you have any indication at that time with regard to the likelihood of declines in reservoir pressure in this pool?

A Yes, sir. It became apparent at that time that no measurable pressure decline had been experienced to that date.

Q What was your thought about the possibility of pressure

drawdown and interference testing with the strong water drive?

A With the strong water drive as indicated, the chances were slim of obtaining any substantial pressure drawdown in a shut-in well during an interference test.

Q So, what did you conclude to do in effecting to obtain information?

A Instead of making a single long term conventional test, the interference tests were designed to determine whether the small pressure changes expected from transient or unsteady state flow would recur. This basically consists of accurately measuring the early bottom hole pressure behavior of flowing and shut-in wells after the entire reservoir has been shutin and then repeating the procedure.

Q The next four exhibits, beginning with Exhibit 5, are designed to present this information to the Commission?

A That is correct.

(Whereupon, Ohio's Exhibits Nos. 5, 6, 7 and 8 were marked for identification.)

Q With regard to the first testing, will you describe the beginning of that, referring here to Exhibit 5?

A The first test was begun by shutting in the three existing wells for 37 hours. The allowable for Wells No. 1 and 4 was transferred to Well No. 2. Amerada pressure recording gauges

were placed in Wells 1 and 2.

Q Now, Mr. Young, you mentioned in connection with Exhibit 1 that certain color coding would be followed. Is this where you are now beginning to follow it as well as on the production history graph?

A Yes.

Q Are you beginning to use it again?

A Yes, sir.

Q What does the blue spot indicate?

A The blue dots always indicate the pressure data measured in Well No. 2.

Q And the red?

A The pressure data as measured in Well No. 1.

Q And for convenience have you included a little chart on the right side of this interference test exhibit and the subsequent ones to show the location of the wells and their status during the tests?

A Yes, sir, I have.

Q Again following the same color coding?

A Yes, sir.

Q Now, you had, I believe, stated that Amerada pressure gauges were placed in Wells 1 and 2?

A Yes, sir.

Q And then from the shut-in conditions, what did you proceed to do with respect to Well No. 2?

A Well No. 2 was then opened to flow at a rate approximately equal to three times the normal well allowable.

Q How long was it produced at that rate?

A This rate was produced for a twenty-four hour period.

Q As shown by Exhibit 5? A Yes, sir.

Q The initial pressure of Well No. 2 was at what amount?

A 6073 psi.

Q And the flowing pressure was then measured during the flow period and at the end of the twenty-four hours what was it?

A 5099 psi.

Q What was the initial pressure measured in Well No. 1?

A 6065 psi.

Q This was the shut-in well?

A Yes, sir.

Q What was the pressure measured in that well at the end of the twenty-four hour period?

A 6043 psi.

Q What did that indicate, Mr. Young?

A That indicated a pressure change or pressure decline of 22 pounds in that shut-in well. This, in my opinion, established pressure interference and therefore, drainage between

these two wells which are 1867 feet apart.

Q What happened to the pressure in No. 2 when it was shut-in at the end of the twenty-four hour period?

A The bottom hole pressure in No. 2 built up in six hours to substantially its initial pressure.

Q That is substantially the pressure it had at the start of the flow test?

A Yes, sir.

Q In your opinion is that a rather rapid buildup?

A Yes, sir.

Q Now, following this interference test on April 27, 28, what was done with Well No. 2 after it built up?

A Well No. 2 was shut-in for a period of seventy-two hours, Wells No. 1 and 4 remained shut-in.

Q No. 4 had been shut-in back there at the same time No. 1 had been, had it not, prior to the commencement of this April 27 test?

A Yes, sir.

Q So 1 and 4 remained shut-in?

A Yes, sir.

Q And when did the next interference test start?

A On May the 1st a twenty-two day interference test was begun. This test basically consisted of flowing the Well No. 2

again at three times the allowable with Wells 1 and 4 shut-in.

Q Looking at Well No. 6, you again have the diagram to the right of the exhibit showing the three wells involved in the test. These were the only three wells then completed in the pool, were they not?

A Yes, sir.

Q Do you have No. 2 after a seventy-two hour shut-in period producing at three times an 80-acre allowable with 1 and 4 shut-in, is that right?

A That's correct.

Q Which wells had the Amerada pressure gauges in them during the first seventy-two hours of this test?

A Again, Wells 1 and 2.

Q And the same color coding follows?

A Yes, sir.

Q And is shown on the exhibit?

A Yes, sir.

Q What was the initial pressure of Well No. 2 at the commencement of this test as measured here and shown on this report?

A 6065 psi.

Q At the end of seventy hours what was the measured bottom hole pressure in the flowing Well No. 2?

A 5094 psi.

Q The pressure at the beginning of the test in Well No. 1 was how much?

A 6072 psi.

Q What happened to the pressure in Well No. 1 during this time?

A The pressure declined to 6044 psi in seventy hours. This was a measured change of 28 psi.

Q As compared with 22 pound decline measured on the first test?

A Yes, sir.

Q These same two wells are the ones we discussed a while ago, they are how far apart?

A 1867 feet apart.

Q What did this test indicate to you, Mr. Young?

A This test indicated that pressure interference and therefore drainage was occurring between Wells 2 and 1.

Q Over a distance of 1867 feet at least?

A Yes, sir.

Q You attempted to maintain the flow rate of Well No. 2 during this period May 1st to May 22nd at approximately three times the allowable of the normal well as a practical operational matter. Were you able to do that?

A No, sir, this could not be done. These tests were made before the installation of LACT Unit. Therefore, tank storage problems entered into the test and the flow rate for No. 2 had to be changed periodically.

Q The flow rate for Well No. 2 is also indicated on this interference test as shown in Exhibit 6, right?

A Yes, sir.

Q Flow rate had also been indicated on the previous exhibit?

A Yes, sir.

Q Did you run Amerada gauge in Well No. 4 during this time?

A Yes, sir. On May the 12th an Amerada gauge was run in Well No. 4 to record that well's bottom hole pressure behavior during the period May 12 to 15. The data obtained during that test are shown on the right side of Exhibit No. 6.

Q Starting in about the middle of Exhibit No. 6?

A Yes, sir.

Q Moving over to the right. What was the initial pressure recorded in Well No. 4 at that time?

A 6087 psi.

Q And that pressure occurred at what point in time from the commencement?

A That occurred at 268 hours.

Q That is, the well had been shut-in for that period of time?

A No, sir, the well had been shut-in much longer than that. This 268 hours is the time that Well No. 2 had been flowing from the commencement of this test on May 1st.

Q When was the maximum pressure decline observed in Well No. 4 during the time this Amerada gauge was in the hole?

A The maximum pressure decline was measured at 307 hours. That decline was 14 psi.

Q You show the hours along the bottom of each of these exhibits, do you not?

A Yes, sir, along with the actual days involved.

Q That was at 307 hours; now at 309 hours of the test what occurred with respect to Well No. 2?

A Because of tank storage problems at that time, Well No. 2 was shut-in for an hour and a half.

Q When it was placed back on production, were you able to place it back at the same flow rate?

A No, sir, it was placed on flow rate of 775 barrels of oil per day, whereas in the prior forty-eight hours it had flowed 1110 barrels of oil per day.

Q And that production flow rate was because of the tank storage problem, as you told us?

A Yes, sir.

Q Moving on from the period of 309 hours where No. 2 was shut-in and then placed back at reduced rate, what occurred insofar as Well No. 4 is concerned at the end of 335 hours of the test?

A The pressure measured in Well No. 4 at the end, or at 335 hours, was 6079 psi, which indicated a measured pressure change of 8 psi during the time that the bomb was in Well No. 4.

Q That's an 8-pound differential between the beginning measurement and the final measurement?

A Yes, sir.

Q And in the intervening period of 307 hours there was a decline measured up to 14 psi, is that right?

A Yes, sir.

Q Did you deem further testing advisable to continue to check the results you were obtaining?

A Yes, sir.

Q What did you do then with Wells 1 and 4 at the end of this test on May 15?

A Wells 1 and 4 remained shut-in throughout this test, and on May 22, Well No. 2 was shut-in. This meant, then, all three of the existing wells were shut-in on May 22.

Q Then, starting on May 23, was Well No. 2 opened up again after having been shut-in for a period?

A Yes. Additional tests similar to the one we've just described were conducted on May 23 to 26. During that period Well No. 2 was opened on an 18/64" choke to flow 1218 barrels of oil per day.

Q Are the results of this test during the period May 23, 26, 1961 shown on your Exhibit No. 7?

A Yes, sir.

Q What does that exhibit show with reference to the bottom hole pressure measured in Well No. 1 during that period?

A The bottom hole pressure in Well No. 1 declined from a measured 6028 to 5999 psi, which indicates a pressure change of 29 psi and substantiates within 1 psi the change recorded in the test on May 1 through 4.

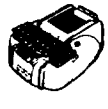
Q And also with reference to the 22-pound drop measured in the very beginning test, is that right?

A Yes, sir.

Q What happened insofar as the measurements were concerned with respect to Well No. 4 to the bottom hole pressure of Well No. 4 during this period?

A The bottom hole pressure in Well No. 4 during this test showed no decline. During the 69-hour period the pressure measurements actually showed an increase from 6096 to 6106 psi.

Q That's in Well No. 4? A Yes, sir.



Q Which is a considerable distance there from Well No. 2?

A Yes.

Q Mr. Young, in presenting this interference test data to this Commission, we are furnishing them all the data we obtained in running these tests, right?

A Yes.

Q This doesn't especially help us, does it?

A No, it sure doesn't.

Q But they're facts? A They're facts.

Q Considering all these facts in the tests conducted up to now that we have discussed, what, in your opinion, has been established with regard to pressure interference between Wells 2 and 1?

A It is my opinion that we have definitely established pressure interference between Wells 2 and 1.

Q Now, these tests that we have run there between Wells 2 and 4 have been considered by you too, haven't they?

A Yes, sir, these results did not conclusively establish interference between these two wells.

Q What's your viewpoint about that? Does it surprise you that it didn't conclusively establish interference?

A This is not surprising when analyzed in the light of fluid flow consideration within porous media. The pressure draw-

down at any point removed from the well bore of a producing well is a logarithmitic function of distance from the well. Since the distance between Wells 2 and 4 is 2640 feet, or 773 feet further than the distance between Wells 2 and 1, the pressure drawdown between Wells 2 and 4 would be much smaller than the pressure drawdown between Wells 2 and 1.

Q By that logarithmitic function, you mean it just works a little faster or the ratio increases the further you get away?

A The amount of drawdown gets smaller and smaller as you get away from the producing well.

Q Insofar as actual pressure drop is concerned?

A Yes, sir.

Q And it increases at some sort of a ratio in there?

A Yes, sir.

Q I believe that helps me understand. In a reservoir such as this one, with a strong water drive, did you really expect to find any substantial pressure drawdown in Well No. 4?

A No, I did not. If we could measure it, it would be extremely small.

Q Now, the type of test that you used here in conducting these, obtaining this data, do they seem to you to be the only way to attempt to obtain a pressure interference data in this pool at this time?

A Yes, sir.

Q What is your opinion concerning the test as shown here on Exhibits 5, 6 and 7?

A It's my opinion that these tests clearly show interference established between Wells 2 and 1 and are inconclusive in showing interference between Wells 2 and 4.

Q Does that mean there's no pressure interference occurring between 2 and 4 at all?

A No, sir, it does not, and in my opinion means that the pressure interference that is occurring is of small magnitude principally because of the high permeability, the size of the reservoir, and the effectiveness of the water drive.

Q All this testing you have shown so far was made using Amerada pressure gauges, is that right?

A That's right.

Q Are those gauges standard for measuring bottom hole pressures in the industry?

A Yes, sir.

Q What's your opinion as to their accuracy?

A They are the most accurate means of measuring bottom hole pressure available.

Q In conducting these tests and attempting to obtain this information, did the Ohio consider some other method of

recording this bottom hole pressure?

A Yes, sir, there has been a surface recording bottom hole pressure gauge developed by the Shell Development Company. That gauge is available commercially through the Petroleum Engineering Service, Inc. in Houston, Texas. The Ohio engaged these people to use their equipment to repeat, to attempt to repeat these interference tests that we have thus far shown.

Q Mr. Young, those people that have that surface recording bottom hole pressure gauge, what do they contend its accuracy is?

A The published information of the instrument shows that the instrument has a repeatability of .01%.

Q What is the advantage of that type of pressure recording over the Amerada gauges that we use in these bombs?

A The greatest advantage of this bomb is the fact that it is surface recording and can be left in the hole for an indefinite period, whereas in most cases we are limited in the Amerada pressure bomb to a seventy-two hour period. The longer that we could leave these bombs in the hole, the longer pressure behavior we would record, and therefore, would show a greater pressure change.

Q We didn't consider we were going to get more accurate measurement with the surface recording equipment specifically,

did we?

A No, sir.

Q We were trying to get some equipment that we could obtain continuous pressures from, without having to pull the bomb and change the chart at the end of seventy-two hours?

A Yes, sir.

Q We did bring those people out there to attempt to use their surface recording equipment, did we not?

A Yes, sir.

Q Do you have still another exhibit for presentation of interference test data, marked Exhibit 8? Will you look at that exhibit, please, Mr. Young? In running this test using this surface recording equipment, and the fellow had only one of them, isn't that right?

A That's correct.

Q Pretty expensive equipment, isn't it?

A Yes, sir.

Q We were going to use Amerada gauges along with this, were we not?

A Yes, sir.

Q What were your plans, in general, to run this test?

A The plan in this test was to run the surface recording equipment in Well No. 1 and use Amerada gauges in Wells 2 and 4.

Q Wells 1 and 4 were to be kept shut-in?

A Yes, sir.

Q And No. 2 to be flowed at a triple allowable?

A Yes, sir.

Q And this diagram on the right side of this exhibit now shows the green spot, Well No. 5. Is that the interval it was completed in?

A Yes, sir.

Q That well to be in a flowing or shut-in condition?

A It was to be a flowing condition, flowing a single allowable.

Q Did you actually put the surface recording equipment on Well No. 1?

A Yes, sir, we did.

Q And Amerada gauges in Wells 2 and 4?

A Yes, sir.

Q What did you do then with Wells 2 and 5, flow them as you had planned?

A Yes, sir.

Q Looking at Exhibit 8, will you give us the information shown on that exhibit, bringing the results of the interference test of October 2 through 7 to the Commission here?

A Well, after three and a half hours of flow time,

mechanical troubles developed in the surface recording bottom hole pressure gauge. These difficulties could not be corrected. Therefore, the use of this equipment was terminated. Shown in Exhibit 8, however, is the first three and a half hours' data that was recorded with that instrument. It shows that Well No. 1--

Q These are the red spots?

A Yes, sir. -- declined from 6070.2 to 6066.8 psi. This was a pressure change of 3.4 psi.

Q At that time No. 2 was flowing at the triple allowable, No. 5 flowing at single allowable?

A Yes, sir.

Q For a combined production rate of, according to this exhibit, how much, how many barrels of oil?

A 1502 barrels of oil per day.

Q This surface recording thing just had trouble with the line going down to it and they were unable to record any additional pressures?

A That's correct.

Q And were then released from the job?

A Yes, sir.

Q What did you do then, Mr. Young, in order to get some benefit from the interference test?

A We went ahead with our plans without that instrument

and used regular Amerada pressure gauges to continue the interference test of October 2 through 7.

Q During the first forty-two hours of this test what was the pressure information measured in Well No. 4?

A The pressure information measured was that the initial pressure of your Well No. 4 was measured as 6085 psi and declined to 6070 psi, indicating the pressure change of 15 psi.

Q These are the two wells that are farthest apart, are they not?

A Yes, sir.

Q But here we were, in effect, flowing four allowables per day out of the reservoir at the time this was being done?

A Yes, sir.

Q Did you change the charts, then, the Amerada charts in Wells 4 and 2 at about this point in your test?

A Yes, sir, they were changed at about forty-seven hours.

Q And that is indicated on Exhibit 8?

A Yes, sir.

Q Did you rerun the Amerada charts in those two wells?

A Yes, sir, we did.

Q And what was the absolute pressure measured in Well No. 4 at the time that you reran the Amerada bomb with the new chart in it?

A 6081 psi.

Q Observing the readings, then, from that chart, what pressure information did you obtain from Well No. 4?

A The pressure in that chart declined to 6068 psi at the end of ninety-six hours of flowing time of the two flowing wells.

Q At that time were the flowing wells shut-in?

A Yes, sir, both of them were shut-in.

Q No. 1 was also shut-in all during this time, was it not?

A Yes.

Q After we moved the surface equipment off we did not immediately rerun the chart in No. 1?

A No, sir.

Q Did you put it back in No. 1 at the time that you shut-in the two flowing wells?

A Yes, sir.

Q What pressure information did you obtain from the readings there in Well No. 1?

A The pressure readings showed that Well No. 1 built up 1 psi from 6058 to 6059.

Q This was after the shut-in?

A Yes, sir.

Q What occurred according to the measurements in Well No. 4 following the shut-in after the pressure change of 13

pound drawdown, what occurred after that?

A Well No. 4 showed a build-up of 2 psi from 6068 to 6070 psi.

Q You had slight increase, then, in No. 4 and in No. 1 after the producing wells were shut-in?

A Yes, sir.

Q Mr. Young, will you summarize your opinion as to the pressure interference information and what it establishes?

A It's my opinion that pressure interference, and thus drainage, has occurred over the minimum 1867 feet, which is the distance between Wells 2 and 1. It is also my opinion that interference does occur between Wells 2 and 4, but that the interference is of such small magnitude that it can not be conclusively measured by these tests in this reservoir.

Q What is the acreage within a circular drainage area having a radius of 1867 feet?

A 251 acres.

Q And is that radius I just gave you the distance between Wells 1 and 2?

A Yes, sir.

Q Does this pressure interference data, with all other available data, indicate to you whether a well in the Lea-Devonian Pool can effectively and efficiently drain substantially

the excess of 80 acres?

A Yes, sir, it does.

Q Which way does it indicate that it will or it won't?

A It indicates that a well in the Lea-Devonian will effectively and efficiently drain substantially in excess of 160 acres.

Q Now, Mr. Young, you've also prepared, or had prepared under your supervision, a document marked Exhibit 9. What does that document present?

(Whereupon, Ohio's Exhibit No. 9 was marked for identification.)

A Exhibit No. 9 shows my volumetric calculations for the recoverable oil per acre for the Lea-Devonian Pool.

Q Mr. Young, in making these calculations, have you based them on certain factors that you have available to you pertaining to this pool?

A These calculations were based on the factors shown under the section Basic Data in Exhibit 9.

Q Starting at the top you show the net pay of how much?

A 65 feet.

Q You previously testified about Well No. 1 being the only one to penetrate the entire Devonian pay, that's correct, isn't it?

A Yes, sir, it has a net pay of 98 feet.

Q In your opinion is that the maximum net pay that will be encountered in wells in this pool?

A Yes, sir.

Q And you've also testified that you computed the average net pay penetrated by the five wells shown on the cross section that is presented here as Exhibit 2?

A Yes, sir. The average net pay of those five wells is 55 feet.

Q You have chosen here, for purposes of calculating recoverable reserves, to take the figure that's in between those two, have you not?

A Yes, sir. The average net pay used here is to represent what one would expect as the average net pay over the entire pool. I would expect it to be on the order of approximately two-thirds the maximum, which is 98 feet.

Q Is that what your 65 feet comes out to?

A Yes, sir.

Q Moving to the next factor there, the porosity in the Lea-Devonian Pool, you show that to be how much?

A The porosity is 5.49, and measured in the core analysis from cores taken from Well No. 2.

Q What about connate water saturation?

A Connate water saturation is 43%, as measured by special

capillary tests made by cores from Well No. 2.

Q The formation volume factor?

A 1.185 from the fluid analysis of crude produced from Well No. 1.

Q Do you have one estimated factor, the recovery factor, what did you use for that?

A I have used a recovery factor of 50%, which is consistent with my opinion that the producing mechanism is a water drive.

Q In using standard engineering formula, have you made, then, a calculation, volumetric calculation as to the number of barrels per acre in the Lea-Devonian Pool average?

A The average recoverable oil reserve from Lea-Devonian Pool will be 6,658 barrels per acre.

Q Using this data of recoverable reserves, have you had prepared under your supervision a document showing the comparative economics for development of this pool?

A Yes, sir, that is Exhibit 10.

(Whereupon, Ohio's Exhibit No. 10 was marked for identification.)

Q Will you look over that exhibit for a moment, please? I observe that you have headed this 40-acre spacing versus 80-acre spacing versus 160-acre spacing. Have you made calculation to reflect comparative economics for each of those proration sizes?

A Yes, sir, I have.

Q What area have you used to make these calculations for, Mr. Young?

A I have used an area of 2280 acres, which is the proposed participating area for the Lea-Devonian Pool.

Q Mr. Young, do you think in a situation of this kind it is more reasonable to use a substantial area in determining the economic facts of life rather than to take just one proration unit and figure economics on it?

A Yes, sir.

Q Why do you feel like that, Mr. Young?

A In presenting economics for the development of a pool such as this it seems to me to be more realistic to present the economics for an area rather than on a per well basis. The economics, which any operator would consider in developing any pool, must be based on the overall area and then extended to an average well cost and profit.

Q Using that 2280 acres, how many wells would be required for 40-acre spacing?

A 57 wells.

Q For 80-acres? A 29 wells.

Q And 160? A 15 wells.

Q What is the investment cost per well that you have determined from calculations of your costs, Mr. Young?

A The average cost to drill and complete a Devonian well would be $510,000.00.

Q And have you, then, extended that figure to show the total cost to invest to develop the 40-acre spacing on this area you are talking about?

A Yes, sir.

Q All these figures are shown on Exhibit 10, are they not?

A Yes, sir, they are.

Q What is the figure for 40 acres?

A $29,070,000.00.

Q And 80-acre spacing? A $14,790,000.00.

Q And 160-acre?

A $7,650,000.00.

Q You have included, then, your calculation of your ultimate reserves. How did you arrive at that 15,180,240 barrel figure?

A That is the 2280-acre area times the expected recovery per acre which was shown in Exhibit No. 9.

Q Have you, then, taken into account the value of the oil at the price we are currently receiving?

A Yes, sir. Shown in Exhibit 10 is the, my calculation for the working interest net operating income per gross barrels of oil produced, including income from gas produced with the oil.

This amounts to $2.06 per barrel.

Q And your gas computation is shown above under ultimate reserves, is it not?

A Yes, sir.

Q Based on 300 cubic feet per barrel produced over the life of the field?

A Yes, sir.

Q Then, applying this net working interest operating income, what would you anticipate the total operating income from this field to be?

A $31,271,294.00.

Q Have you computed profit figures based on these computations?

A Yes, I have.

Q What does it show for 40-acre proration units in the Devonian?

A The net profit for 40-acre is $2,201,294.00, which is a net profit per well of $38,619.00, or a profit to investment ratio of .08 to 1.

Q And for 80 acres?

A The net profit for 80-acre spacing would be $16,481,294.00 for a net $568,320.00. This is a profit to investment ratio of 1.11 to 1. In my opinion it is not particularly attractive

considering the risk involved in drilling 14,500 foot wells at a half a million dollars each.

Q You have also, then, computed the total net profit for the development to 160-acre density. Will you briefly review the figures?

A The total net profit for 160-acre spacing would be $23,621,294.00 or a net profit per well of $1,574,753.00. This is a profit to investment ratio of 3.09 to 1. In my opinion this profit to investment ratio is justified when considering the risk in this deep drilling and the amount of investment required.

Q Mr. Young, we have been talking about profit figures here. Are these computed before or after income taxes?

A These are profits before income taxes.

Q Income tax comes out of that. Now, you have treated this working interest income as 7/8ths of the production, haven't you?

A That is correct.

Q And that doesn't take into account the overriding royalties that some of these cases are subject to?

A It does not include that. Neither does it include any royalty in excess of 1/8th.

Q In some of these Federal Government leases they have sliding scale royalty in some instances?

A Yes.

Q So that these excess as well as overriding royalty as well as income tax all have to come out of the profit you are talking about here?

A Yes, sir.

Q Mr. Young, in attempting to further analyze the available data that we have, and moving now from the realm of economics and cost and the problems of risk of drilling these deep wells, have you attempted to make an analysis of what should have happened in Well No. 1 during the time that it produced the amount of oil it did produce up to October 1st, 1961?

A Yes, sir, I have.

(Whereupon, Ohio's Exhibit No. 11 was marked for identification.)

Q Will you please look at what's been marked Ohio's Exhibit 11? Mr. Young, as of October 1, 1961, what was the cumulative production from Well No. 1?

A 133,719 barrels.

Q My copy of this exhibit has that figure on it in ink. Did you make a mistake in this exhibit?

A Yes, sir. That was a reproduction error.

Q That's the only mistake in it, isn't it?

A Yes, sir.

Q Mr. Young, you have a schematic diagram there of a

cylinder. Describe to us what that represents.

A This cylinder represents a production area of 251 acres about Well No. 1.

Q That 251 acres is the area that would be included within a radius of 1837 feet, is it not?

A 1867 feet.

Q 67 feet. That's the distance between Wells 1 and 2?

A Yes, sir.

Q Are you assuming, then, that this Well No. 1, for the purpose of this calculation, was producing only from that area and from nowhere else?

A Yes. Exhibit No. 11 is a calculated pressure decline for Well No. 1 to October 1, 1961, based on a maximum radial drainage of 251 acres.

Q That shows here that cylinder is 98 feet high. That is the net pay that was encountered in Well No. 1?

A Yes, sir, it is.

Q You have taken that into account?

A Right.

Q Attached to the front page of the Exhibit 11 there are two pages of engineering formulae symbols and data. Describe this briefly, these computations for us, and state whether they result in an accepted engineering formulae.

A Page 2 shows the material balance equation for an oil reservoir which is producing when the reservoir pressure is above the bubble point pressure of the reservoir fluid. This is true in the Lea-Devonian Pool. This is an accepted reservoir engineering equation and takes into consideration water influx and produced water.

Q In using this equation, since the equation took into account water influx and produced water, there hasn't been any such production from No. 1, what did you do about those two factors in the equation?

A I have, in using this equation, for this presentation, assumed that water influx is zero and that we have no produced water. Then the equation on page 2 reduces to the simple relationship shown at the bottom of page 2.

Q All right. That's simple to an engineer?

A Yes, sir.

Q And accepted by engineers generally?

A Yes, sir.

Q You have also, then, on page 3, shown your calculation for original oil in place, is that right?

A That's the original oil in place calculated using the basic data for Lea Unit No. 1 in the 251 acres surrounding Well No. 1.

Q Let's go back to that front page. Based on these calculations, and assuming that Well No. 1 was producing from no greater area than the 251 acre limit just to that area of 98 feet of pay, what should have been the pressure drop in that well as of October the 1st?

A The pressure decline in that well should have been 1153 psi, based upon the calculation made, assuming that No. 1 is producing from only the radial 251 acres surrounding that well.

Q What was the measured pressure change from the initial pressure at the time of completion until October 1 of '61?

A The measured pressure change was actually a 12 psi increase.

Q The significant thing there is what?

A The significant point is that the measured pressure showed no decline in bottom hole pressure.

Q Since there has apparently been no pressure decline in Well No. 1, and since that pressure decline would have been over a thousand pounds per square inch, if the drainage area of that well had actually been limited to this 251 acres, what is your opinion as to the conclusion to be drawn from these calculations?

A It is my opinion that No. 1 is draining an area substantially in excess of 251 acres. The fact that there has been no measurable pressure decline further establishes, in my opinion,

that the drainage is efficient and effective.

Q Well, then, is it still your opinion that these wells can drain efficiently and effectively in excess of 160 acres?

A Yes, sir, it is.

Q How about in excess of 251 acres, now that we have the consideration of this exhibit?

A Yes, sir, it is.

Q Have you prepared another exhibit, designated Exhibit 12, using this same radius, the same 251 acres, and applying it to the actual locations of the wells previously drilled and to some assumed locations?

A Yes, sir, I have.

(Whereupon, Ohio's Exhibit No. 12 was marked for identification.)

Q Describe that exhibit for us, will you please?

A The area used in Exhibit No. 12 is the same area that was used in the economic consideration. As shown in Exhibit 10, fifteen wells would be required to develop the Lea-Devonian to a density of 160 acres per well. The development plans of the Lea Unit operators have not been determined for the entire unit, and the undrilled locations I have shown on Exhibit 12 are purely speculative.

The locations, however, do serve to demonstrate how effectively

the Lea-Devonian Pool could be developed and completed on 160-acre spacing. Exhibit 12 was prepared by constructing a 251-acre minimum radial drainage area about each suggested location. The most outer boundary of the total minimum drainage area of the indicated wells is shown as a heavy outline and vividly demonstrates the minimum radial drainage area that might be expected under the suggested drilling program.

Q Each of those 251-acre minimum areas, in effect, represents that same 251 acres you showed as the cylinder on your Exhibit 11?

A Yes, sir.

Q Mr. Young, since there's no oil pool in the State of New Mexico that's been granted 160-acre spacing and 160-acre proration units, have you any thought concerning the provision for an allowable for wells on these proration units?

A Yes, sir. During the interference test of Well No. 2, that well was produced at three times the allowable of an 80-acre well.

Q How much was that figure, Mr. Young?

A The maximum rate, as I recall, was 1218 barrels per day, which is in excess of the three times the 80-acre allowable.

Q It's over a thousand barrels?

A Yes, sir, it was.

Q All right.

A During a seventy-two hour drawdown test in August of 1960, the No. 1 well was produced at 600 barrels of oil per day. In my opinion these high rates of production in these two wells demonstrate the capabilities of the Lea-Devonian wells to produce large volumes without causing damage or waste in the reservoir.

Q Do you have a recommendation as to what the Commission should do with regard to allowables for these wells?

A It is my recommendation that the Commission not only adopt 160-acre spacing and 160-acre proration units for this pool, but that the allowable be one and one-half times the normal allowable assigned an 80-acre well for this depth.

Q Mr. Young, in order to effectively understand the effect of such an allowable as you propose and compare it with other allowables, have you had prepared Exhibit 13?

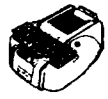
A Yes, sir.

(Whereupon, Ohio's Exhibit No. 13 was marked for identification.)

Q What does Exhibit 13 present, Mr. Young?

A It shows the relationship of total daily withdrawals for Lea-Devonian Pool for 40-acre spacing versus 80-acre spacing versus 160-acre spacing.

Q Will you run through those figures and point out the methods that you have used there to show that?



A The data included in this exhibit is based on a normal unit allowable of 34 barrels of oil per day, the same 2280-acre area that you used in the economic calculation. For 40-acre spacing the allowable factor at this depth is 9.33, which would result in a top well allowable of 318 barrels of oil per day. The number of wells required for 40-acre spacing would be 57; if the entire pool was developed would result in a top field allowable of 18,126 barrels per day.

Q Now, how about 80 acres?

A With 80-acre the allowable factor is 10.33, a top well allowable of 352 barrels per day. For full development, 29 wells would be required, resulting in a top field allowable of 10,208 barrels per day.

Q That is if the pool is developed on the 80 acres that's authorized by the temporary order?

A Yes, sir.

Q And assume that normal unit allowable of 34 barrels a day, the daily production after full development would be slightly over 10,000 barrels of oil?

A Yes, sir.

Q Now, on 160-acre development with 15 wells, what would be the per well allowable assuming 34 barrels as a normal unit allowable?

A The per well allowable, using the allowable factor which I have recommended to the Commission, would be 527 barrels of oil per day.

Q That means by applying your one and a half times an 80-acre allowable, applying that factor to the 10.33 --

A Yes, sir.

Q -- you get an allowable factor of how much?

A 15.50.

Q And with 15 wells at total development, what would then be the daily allowable production from this field?

A 7,905 barrels of oil per day.

Q So in the aggregate, with total development daily allowable, daily takes would be less--

A Yes.

Q -- than either under 40 or 80 acres?

A Yes, sir.

Q What would be your thought about the relationship of the smaller total daily withdrawals from this pool after full development?

A Since the Lea-Devonian is a water drive reservoir, and since water drive reservoirs are rate sensitive, it is possible that the lower daily withdrawals with the wider well spacing might result in a more efficient depletion of the reservoir.

Q In your opinion, would producing that smaller amount each day after this total development cause any waste?

A No, sir, it certainly would not.

Q It might prevent waste, might it?

A Yes, sir, it might.

Q What about the correlative rights of the parties, including the royalty owners, would they be protected under the allowable that you have recommended?

A Yes, sir.

Q Mr. Young, we've come to Exhibit 13 on December 13, will you summarize your conclusion, based on the information that you have, and make your final recommendations, or your recommendations to the Commission here?

A In summary, it is my opinion that one well completed in the Lea-Devonian Pool is capable of efficiently, effectively and economically draining substantially in excess of 160 acres. This opinion is supported by my interpretation of the pressure interference tests and the material balance calculations, as well as by other factors I have presented.

It is also my opinion that the development of the Lea-Devonian Pool on 160-acre spacing will not cause any measureable decrease in the recovery from the drilling of too few wells. On the contrary, 160-acre spacing will result in uniform development

of a wider area within a shorter period of time, resulting in more effective depletion of the reservoir. I strongly recommend to this Commission that pool rules be established for the Lea-Devonian Pool requiring 160-acre proration units, and 160-acre spacing pattern. Each proration unit to consist of a single Governmental quarter section.

Furthermore, it is my recommendation that the well on each proration unit be located in the approximate center of the Northwest Quarter, or Southeast Quarter of a Governmental quarter section. I further recommend that the pool rules permit a tolerance of 150 feet in the location of any well.

As to oil allowable for the wells in the Lea-Devonian Pool, I recommend that the allowable be established by applying 150% to the 80-acre proportional factor as provided for in Statewide Rule 505, as amended, with the allowable for any non-standard proration unit which has been proved to be increased or decreased in the proportion that the number of surface acres included in such unit bears to 160 acres.

It is my opinion that the recommendations which I have made will not cause waste, but on the contrary, will prevent economic waste and will also protect correlative rights of all interested parties.

Q Were Exhibits 1 through 13 prepared under your

direction and supervision or by you, Mr. Young?

A Yes, sir, they were.

MR. couch: At this time we offer in evidence Ohio's Exhibits 1 through 13 and state that this concludes the direct testimony from this witness.

(Whereupon, Ohio's Exhibits Nos. 1 through 13 were offered in evidence.)

MR. PORTER: Any objections to the admission of the exhibits? They will be admitted. The hearing will recess until 1:30, at which time Mr. Young will take the stand for cross examination.

(Whereupon, the hearing was recessed until 1:30 P.M.)

AFTERNOON SESSION

(Whereupon, the hearing was resumed at 1:30 P.M. on Wednesday, December 13, 1961.)

MR. PORTER: The hearing will come to order, please. Anyone have a question of Mr. Young?

MR. NUTTER: Yes, sir.

MR. PORTER: Mr. Nutter.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Young, this Exhibit No. 1 of yours, these contour maps are from the seismic survey, I believe you said, is that

correct?

A It's based on the original seismic.

Q Then you adjusted the vertical height of the contours by 265 feet as a result of encountering the Devonian or Woodford shale?

A Yes, sir. From the drilling of the seven wells, the average correction between the actual log tops and what the original seismograph contour showed was 265 feet.

Q Has there been any lateral change in the structure, as the original seismic picture showed it, as compared with what you have found by the drilling of the seven wells?

A No, sir, I don't believe so, Mr. Nutter.

Q The same structure, just vertical adjustment?

A Yes. Actually, it was taken and I took the original seismograph contours and contoured 65 feet, or two-thirds, between contour lines, and then those contour lines were immediately put on to this map.

Q I see. Now, on the Exhibit No. 1 you show the Sinclair well out to the East and the United States Smelting well to the West, neither of which was productive in the Devonian. What did those wells encounter in the Devonian, Mr. Young?

A The Sinclair well was wet, it was across the fault and it's about approximately four to five hundred feet low to the

unit wells.

Q And there was porosity, but the porosity was filled with water?

A I believe that's correct.

Q How about the United States Smelting well?

A The United States Smelting well was not logged, it was drilled into that. My information is that it did have porosity.

Q Did it make water in the Devonian?

A They did not complete in it. They did not set pipe.

Q Did they take a drill stem test?

A Not that I know of.

Q Well, what did they find?

A I would like to correct that last answer, Mr. Nutter. There were two drill stem tests taken in the United States Smelting well.

Q In the Devonian? A Yes, sir.

Q What were the depths of those two tests, please?

A The first one was 14,295 to 530.

Q What did they recover?

A 525 feet of mud, thirty minute shut-in pressure, 390 psi.

Q What about the second test, they didn't recover any salt water on that?

A No, sir. The second test was taken at 14,548 to 619,

recovering 14,000 feet of sulphur water.

Q The first well that Ohio drilled is the only one that has penetrated the Devonian formation to any depth, is that correct?

A That is correct, of the producing wells. Now, the Sinclair well, and possibly the Smelting well, penetrated more than the other producing wells.

Q But, on the six wells that Sinclair or that Ohio has drilled, you have six or five?

A Five.

Q On the five wells that you have drilled, after going deep into the Devonian on the first well and finding that the pay was in the upper part of the Devonian, you've refrained from drilling deep into the Devonian on any of the remaining four, is that correct?

A That's correct.

Q No porosity down there in the lower Devonian?

A Not in the No. 1 well.

Q Did you encounter any water at all in that well?

A I don't believe we did, Mr. Nutter.

Q So there isn't anything on any producing well as yet to help determine the existence of an oil-water contact, and the only thing you would have would be the No. 1 well, and the United States

Smelting well?

A Yes, I believe my testimony showed that the productive limits had not been defined.

Q There must be a water table in here somewhere?

A Yes, sir, there is.

Q The No. 1 well has three main portions of net pay, as I interpret your Exhibit No. 2, Mr. Young, being in the range from 14,350 down to about 370 and 75, and then the second group being the next three kicks that are colored red and the lowermost section of net pay, which is continuous there. Do any of these other wells of this third and lowermost section have net pay in them?

A In my opinion they do, but it's unpenetrated.

Q You just haven't penetrated it at this time?

A Yes, sir.

Q Do you have any evidence that there's any vertical communication that's going to enable you to drain that lower pay from these remaining four wells?

A Other than possible fractures within the Devonian formation, which core analysis shows does exist, those fractures, I believe, would give you your vertical communication.

Q Did Exhibit No. 4 demonstrate vertical fragmentor fracture?

A You will notice the center column right next to the graph on Exhibit No. 4 is a sample description that gives an

indicated fractured vuggy porosity.

Q Although this doesn't specifically state the direction of the fractures or that they would be vertical or horizontal?

A No, sir, it doesn't.

Q You used in your computations of reserves in a later exhibit, 65 feet of net pay, is that correct?

A Yes, sir.

Q Although the average of the wells on your cross section No. 2 would be 55?

A Yes, sir.

Q Because, I presume, that you feel the major part of the structure lies North and South rather than East and West, and you don't have a really true representation of the structure by the East-West cross section?

A I don't follow the question.

Q If you use 65 feet of net pay, would that indicate that you think more of the structure could be depicted on a North-South cross section than can be depicted on the East-West cross section?

A I use the 65 feet because the maximum pay that we've seen is in the No. 1 well, this 98 feet. The average net pay for the entire pool, in my opinion, has to be something less than 98 feet. The existing five wells show a penetrated net pay of 55.

Now, there is going to be areas in the pool which will have even less than the 55.

Q Yes.

A So, there has to be an average somewhere. Right now we can't really pinpoint.

Q You don't think that the East-West cross section right now with its 55 feet is representative of the pool or the structure?

A Well, I would think it would be representative, but there again, there is some unpenetrated pay even in these wells. Also to the East and West on the outside of these five wells your pay is becoming more thin and, therefore, when you average it over the entire pay you'd still have something less than the maximum.

Q In arriving at the 55 feet of net pay, you have only taken the penetrated portion of the porosity here?

A The penetrated, yes, sir.

Q Just what amount of porosity did you consider in calculating net pay? What would it be comparable to on Exhibit No. 4, the core analysis?

A In most cases it's about two or three percent.

Q What was the original bottom hole pressure, the first pressure that was ever taken in the pool, Mr. Young?

A The first pressure that was ever measured in the pool

was in the No. 1 well, and it was 6,046 psi.

Q Would that be this red point, the first red point for No. 1 on Exhibit 3?

A Yes, sir.

Q That is the pool original bottom hole pressure?

A It's the initial pressure that was measured, Mr. Nutter.

Q Is that in the bottom of the well or is that taken to some datum that could be comparable to the other bottom hole pressure that was recorded then?

A These were all at the subsea datum.

Q What is that datum, please?

A It's minus 10,744.

Q And all bottom hole pressures on all of these exhibits are all corrected to that same datum?

A Every pressure which we have presented today, and every one that has been measured, except one, was actually measured at that subsea depth. The No. 6 well was corrected several hundred feet. That's the only one that has been corrected.

Q So, they were all taken at the same depth?

A They were all measured at the same subsea depth.

Q And no correction?

A No correction except on the No. 6 well.

Q To what do you attribute the fact that the No. 2 and 4

wells, on their original completion, had considerably higher than the initial bottom hole pressure for the pool?

A The only explanation I could give there, Mr. Nutter, is that from the production of the No. 1 well we had established pressure gradients within the reservoir. This being a water drive reservoir, and No. 2 and No. 4, from our structure map appears to be closer to the edge water contact, may have, pressure gradients may have been established by that time giving those two wells higher pressures. You notice the most recent pressures have the same relationship.

Q Yes, sir. If we assumed that these more recent pressures are the result of this gradient, to what would you attribute the lower pressure in the discovery well when it was first completed, then?

A I have no explanation of that, Mr. Nutter.

Q And No. 5, you feel, has the lower pressure because it's over near the fault?

A That seems to be--

Q And hasn't been receiving the full benefit of the water drive from the West and the North?

A That seems to be the reasonable explanation for that.

Q Even prior to the time that the well had been produced and when its initial pressure was taken in August of '61?

A Yes, sir.

Q On Exhibit No. 5, Mr. Young, you shut the No. 2 well back in and had an immediate rise to 6,066. Did you have a bomb in No. 1 at the same time to find out what happened to the pressure there?

A No, sir, we did not.

Q So there's no companion curve on the No. 1 available to show what reaction it had to the shutting in of the No. 2?

A No, sir.

Q I presume, Mr. Young, on Exhibit No. 6, that from 307 hours to 335 hours the slight increase in pressure in the No. 4 well, you would attribute to the fact that the producing rates of the No. 2 had been reduced, and then raised back up, but not to the original level of the No. 2 production, right?

A Not necessarily, Mr. Nutter. This data, this test is presented for the Commission's information, it's the actual recorded data, the pressure and the actual flow rate. Now, whether there is this quick communication between these wells I say is inconclusive. Certainly, in my opinion, during this time there is some pressure interference between Wells 2 and 4, but certainly these tests are inconclusive as to proving it.

Q You are not necessarily saying that the increase from 307 hours to 335 hours is due to the reduction in the production

rate from the No. 2?

A No, sir.

Q I suppose, then, it would follow that on Exhibit No. 7 the increase in the bottom hole pressure of No. 4 wouldn't be due to maintaining the flow rate of No. 2 at a constant rate?

A No, sir. I think we've pointed out in the direct that this data was certainly, didn't help us in the case.

Q Now, on Exhibit No. 8, Mr. Young, up here on Well No. 4, from our No. 42 to our No. 48 we don't have any pressure recorded. But the last pressure prior to changing the charts in the well was 6,070 and the next pressure was 6081. To what do you attribute the 11 pound difference?

A This is a characteristic in using the Amerada bomb to record these bottom hole pressures continuously. Any time that you have to pull the Amerada bomb, when you get back on bottom your absolute pressure is not always the same.

Q Well, this is an 11 pound differential here?

A Yes. Here again, these are what we measured with the bomb. They're presented as a complete record of all the interference testing we did. Now, it's my opinion that there was not that much change in that pressure, it's only a characteristic of having to change the Amerada chart, the chart in the Amerada bomb.

Q This characteristic here indicates an 11 pound differ-

ential pressure measured in the course of just two or three hours according to the bomb?

A Yes, sir.

Q Which is an inherent error of so many percent, the 11 pounds. In some of these comparisons that you have made, you have noted differences in pressures of 1 pound from beginning to ending of interference tests and so forth?

A Yes, sir.

Q Is this a reliable comparison when just taking the bomb out of the hole and putting it back in would result in an 11 pound differential?

A I didn't get the question.

Q Do you think it's proper to cite a 1 pound differential in pressure on an interference test when the bomb has such characteristics as to result in an 11 pound pressure differential merely from removing it from the well and putting it back in?

A I wasn't saying that these 1 or 2 pounds are actual measurements of interference. Again, they are the data we obtained and I presented them to the Commission. These few pounds that you are referring to, yes, they are probably inherent characteristics in the bomb.

Q Just for the sake of the record, Mr. Young, would you describe the chart that's used in an Amerada bomb and depict how

many inches it takes to measure 100 pounds differential on that chart?

A The maximum chart scale is two inches.

Q And two inches is showing how much pressure here?

A In these tests, a 10,000 pound element was used.

Q So the two inch travel of the needle there, or the pencil, represents a 10,000 pound differential from zero to 10,000?

A That's correct.

Q And it would be difficult to measure a one pound when you're measuring 10,000 pounds in two inches?

A I certainly agree with you.

Q What specific criterion did you use to arrive at your recommended allowable factor of 15.50 for these Devonian wells? I realize you said 150% of an 80-acre allowable, but is that based on any particular thing?

A No, sir, we have proven in the interference tests that these wells are capable of producing two and three times an 80-acre allowable. The one and a half times an 80-acre allowable is something considerably under what we have proven they are capable of producing. I recommended the one and a half times the 80-acre allowable.

Q But the specific number, one and a half times the 80-

acre allowable is not based on any calculated payout, or anything like that?

A No, sir.

Q Just an arbitrary 150% of the existing allowable?

A It is an efficient rate for those reservoirs. I think these wells are capable of efficiently producing that rate.

Q I want to know what the basis of the 150% was, if any.

A No basis.

Q In calculating the allowables on Exhibit 13 at 40 acres, 80 acres and 160 acres, you note that the 40-acre allowable, if the field were developed with 57 wells, would total 18,000 barrels; with 29-80-acre, 10,200 barrels; and 7900 barrels with 15 on the 160-acre wells. I didn't quite follow exactly what you meant when you believed that possibly these lower allowables on the 160 acres would result in a more efficient drainage of the pool with less likelihood of water encroachment prematurely. Would you elaborate on that a little bit, please?

A Since water drive reservoirs are rate sensitive, Mr. Nutter, the lower production rate, as determined by using the 15.50 and 160-acre spacing might possibly, the slower rate might possibly give you a more efficient depletion of your reservoir by the water drive. That doesn't necessarily mean that the other two rates would be inefficient.

Q You state that the water drive reservoir is rate sensitive. As far as the individual well is concerned, if you had a bottom water drive, or water below the lowermost perforation, the increased withdrawals, say, of 527 barrels per day as compared to 318 barrels per day, may enhance the opportunity of the water to coming on an individual well, wouldn't it?

A To have water coning, Mr. Nutter, you must have good vertical permeability. In most of these limestones, according to the core analysis, we do have tight streaks here and there which, in my opinion, would prevent water from actually coning into these wells.

Q If these tight streaks would keep water from coning in on the wells, would they not also keep the perforations on the four wells that haven't gone into the lowermost section of the Devonian from producing the reserves in the lowermost section?

A Well, it could.

Q And notwithstanding that fact, Ohio hasn't drilled into the lowermost pay in the last four wells?

A No, sir.

Q On your Exhibit No. 11, where you are computing the pressure decline actual versus the computed pressure decline for the drainage area of 251 acres, you were using Well No. 1, is that correct?

A Yes, sir, for example, I was using Well No. 1, I was using its cumulative production, its actual net pay, and then 251 acres surrounding.

Q As far as we know at this time, this well has the most net pay of any well in the reservoir, is that correct?

A Yes, sir.

Q So this computation would not be typical of the reservoir either using the 55 feet of pay average on cross section No. 2 or on the reserves as computed on Exhibit No. 9?

A The absolute magnitude of the calculated pressure decline would not, but the significance of it is applicable to any well in the field.

Q Although this well, as far as we know, is the best well insofar as net pay is concerned and not a typical well?

A That's right.

Q Referring back to Exhibit No. 1 again, Mr. Young, it appears that the five wells which Ohio has drilled to date have been drilled in either the Northwest Quarter Quarter section or the Southeast Quarter Quarter section of each of the respective Quarter sections, would that be correct?

A Yes.

Q So, in effect, you have actually drilled the well to date, including the No. 7, which is now drilling below 12,000

feet on a uniform 80-acre spacing pattern?

A Of the completed wells in the Devonian, there is still the one per Quarter section.

Q Yes. Well, how about the No. 7, there's two wells counting the No. 7?

A The No. 7 is not scheduled as a Devonian completion. It's target is the Lea-Pennsylvanian gas sand.

Q It will not go to the Devonian?

A Our current plans are not to carry it to the Devonian at this time.

Q I was wondering how you would dedicate 160 acres to those two wells, what depth is the Pennsylvanian encountered here?

A It's about 12,300.

Q What about the Bone Springs, is it present in this area also?

A Yes, sir.

Q What depth is it?

A The Bone Springs pay is about 9500 feet.

Q Of the five wells which have been, well, actually you have four wells completed now as Bone Springs and Devonian duals, is that correct?

A That's correct.

Q And you have the No. 6 well, which is to be completed

as a Pennsylvanian and Devonian dual. Your No. 7 will be a dual in the Pennsylvanian and Bone Springs?

A Yes, sir.

Q Or will it be a single --

A That's our current plan.

Q A dual in the Pennsylvanian-Bone Springs?

A Yes, sir.

Q In going into the cost on these wells, you haven't considered any other pay in arriving at your net payouts and return per dollar invested and so forth, have you?

A No, sir, I have not.

Q Now, this $510,000 which is your estimated cost of a well, is that for a single completion to the Devonian?

A Yes, sir.

Q So, so far you don't have a single completion to the Devonian, do you?

A No, sir.

Q So these costs, as related on Exhibit No. 10, are for a hypothetical well which has not as yet been drilled then?

MR. COUCH: I think this is getting toward a legal question involved here. Hypothetical in the sense that it hasn't been drilled, but very practical and very necessary in this hearing, because in looking at the cost for development of this

pool under the statutes of our State, we must consider it as a pool by itself. The statutes say it is not permissible to consider the other developments, the other possibilities that may or may not exist in arriving at the proration unit for this Devonian Pool. As a legal matter, that would be my objection to implying here that we've tried to present something hypothetical. We tried to present it as we conceive the law to be.

MR. NUTTER: I will withdraw that question and ask another one.

MR. COUCH: All right.

Q Has a $510,000 well been drilled as yet as a single completion in the Devonian?

A No, sir.

MR. NUTTER: I believe that's all, thank you.

MR. PORTER: Mr. Morris.

CROSS EXAMINATION

BY MR. MORRIS:

Q Along the same line, Mr. Young, as to the wells that have been drilled and are dually completed, has the cost of any well been allocated so much to the Devonian, so much to the Bone Springs? Do you feel that such an allocation could be made with any reasonableness?

A So far as I know there has been no allocation of that nature done, Mr. Morris.

Q For purposes of recovery from any given well that's been dually completed, it will be hard under your system of bookkeeping to figure when the Devonian completion has paid for itself or when the Bone Springs completion has paid for itself?

MR. COUCH: Mr. Morris, I don't wish to be arbitrary in interrupting, but this witness, I believe, does not know the methods that our Accounting Department uses to keep records and to keep books on allocations of costs in this manner. I just don't believe he has the information, and I don't believe he's able to give you the way we would allocate it for the purpose of determining payout. These figures were prepared intending to reflect what we thought were the legal requirements determining the cost figures.

MR. MORRIS: Mr. Couch, do you not believe that inasmuch as the wells in this area are actually dually completed and probably others will be dually completed, that it would be unreasonable to ignore the fact that the cost of the well should be allocated between zones, and in figuring the cost of what a well to the Devonian is going to be you need to make such an allocation to determine what the costs have been to date for this particular zone?

MR. COUCH: Mr. Morris, if I followed that, again, from the legal standpoint, I understand that the reasonable opportunity to recover reserves from each pool is to be determined with

relationship to the costs for production from that pool. We have, in the past, testified as to the cost necessary to be added to this $510,000 in order to dually complete the wells in the Bone Springs, for example. In other words, the actual dollar costs have been made a matter of record, the average cost in the first hearing of this case, I believe we had some testimony on that score. Does this approach an answer to the point?

MR. MORRIS: I believe the point has been made. I'm not going to pursue that line any further.

Q (By Mr. Morris) Mr. Young, in response to Mr. Nutter's first question you answered that you believed the seismic information you had in this area still to be good. Do you believe that the Lea Unit covers the geologic structure in this area that is productive from the Devonian formation?

A Since the productive limits have not been defined, Mr. Morris, I don't believe that question could be answered.

Q The Lea Unit was established insofar as possible to contain the production of acreage in the Devonian?

A It would be my opinion that the unit was put together based upon that seismic picture.

Q And that picture has not changed to date?

A No, sir.

Q Do you believe that other Devonian wells will be drilled

in this area but outside the present boundaries of the Lea Unit?

A I am sure there will be wells drilled. As a matter of fact, there is one drilling North of the unit now which is the Texaco Quail Federal No. 1 in the Northwest of the Southwest of Section 1, Township 20 South, Range 34 East.

Q Is that projected to the Devonian?

A It's my understanding that it is.

Q Do you feel that other wells that might be drilled would be productive in the Devonian that would be located outside the Lea Unit?

A Until drilling operations establish that fact, I don't think anyone could answer that, Mr. Morris.

Q Mr. Young, if the participating area is established as proposed onyour Exhibit No. 1, is there any reason why the operator of the unit could not voluntarily space his wells on a 160-acre program without any compulsion from the Commission as to whether it would have to be 40, 80 or 160, he could still drill his wells on a 160-acre unit if he so desired?

A That is possible.

Q The only consideration, then, would be the allowable that that well would receive to make it justifiable?

A What do you mean "justifiable", Mr. Morris?

Q In other words, if an operator should, in his own mind,

decide that 160-acre spacing was desirable within the unit and that 80 was not, he could, without any Commission compulsion whatsoever, space his wells one well to a 160-acre unit?

MR. COUCH: Mr. Morris, if I may intervene again, whether the operator could do that or not I think would depend certainly on law questions with regard to the plans of development which we're required to file and obtain approval of by the Land Commissioner and by the United States Geological Survey with regard to the development of a unit. There would be questions, insofar as royalty owners are concerned, as to our obligations to develop on some pattern different from that which the Commission has designated as the proper proration unit, we feel, and there would be the question of our obligation to drill any offset wells that were drilled on a pattern different from that which would be in effect under the proration unit fixed by the Commission.

I think all of these things involve legal matters as to the obligations that could arise and the pressure that could be put on the operator to develop the field on a pattern that he himself had chosen, and that had not received the sanction of this Commission; as far as the planning of the operator is concerned, Mr. Young could certainly answer that question as to whether the operator could successfully maintain a pattern. Under these other

legal obligations, I think there are some serious questions about it.

MR. MORRIS: Thank you, Mr. Couch.

Q (By Mr. Morris) As you are aware, the Commission, in 80-acre pools, has followed the pattern of giving one depth factor to a 40-acre tract and then allowing just a single normal unit allowable to be added on to that to arrive at the 80-acre allowable. If the Commission should follow the same pattern in arriving at the allowable for a 160-acre proration unit such as you have proposed, you'd come up with something considerably less than the one and a half times the 80-acre allowable that you have proposed, would you not?

A Yes, sir.

Q As a matter of fact, you'd come up with a factor of 12.33 for your 160-acre tract rather than 10.333 that you have for an 80-acre tract?

A Yes, sir.

Q Following the Commission pattern?

A Yes, sir.

Q Do you feel that the allowable that a well on 160 acres would receive with a factor of 12.33 would be too low to justify the drilling of wells in this area?

A What do you mean too low, Mr. Morris? I didn't follow

your question.

Q Could you realize an economic payout based upon a factor of 12.33 for a well located on a 160-acre proration unit?

A Yes, sir, you could.

Q You don't feel that you would have to have 150% of an 80-acre allowable in order for it to be economical?

A No, sir.

Q Mr. Young, has any thought been given to the institution of a pressure maintenance project sometime during the life of this pool?

A From all the available data at this time, Mr. Morris, I think the pressure is going to be maintained naturally with the extremely effective water drive that appears to be operating on the Lea-Devonian.

Q You think that that pressure will be maintained to the economic limit of the pool?

A Yes, sir.

Q Mr. Young, do you believe that one well on a 160-proration unit would recover substantially the same amount of oil as two wells in that 160-acre unit spaced and developed as though they were on 80-acre proration units?

A In my opinion there would be no measureable difference.

Q No measureable difference?

A Yes, sir. I recognize the fact that there's others that believe otherwise, but my opinion is there won't be any measureable. Certainly there wouldn't be enough additional oil recovered to justify drilling the second well.

MR. MORRIS: I believe that's all, thank you.

MR. PORTER: Anyone else have a question of the witness?

MR. COUCH: I would like to ask a few questions, if I may, to clarify on redirect, Mr. Porter.

MR. PORTER: Yes, sir.

REDIRECT EXAMINATION

BY MR. COUCH:

Q Mr. Young, for purposes of clarification, principally with relation to the contouring shown on Exhibit 1, in addition to the correction you made of the 265 feet, did you also make some slight changes in the minus 10,700 foot contour as a result of information from Well No. 6?

A Yes, sir, and also a slight adjustment from information obtained on Well No. 5.

Q That simply had the effect of broadening out that minus 10,700 contour, did it not?

A Yes, sir. There was also a slight revision in the minus 10,800 foot line in the vicinity of United States Smelting No. 1. It had a tendency to pull it in slightly.

Q Those slight differences would be readily apparent from comparing this Exhibit No. 1 with the Exhibit 1 in the original case?

A Yes.

Q That actually had the original geophysical contouring on it?

A Yes, sir.

Q And the difference being, then, in the numbers that were shown as to the subsea?

A Yes, sir.

Q With regard, now, to pressure differentials recorded on these tests, I would like for us to try to clarify just a bit the pressure differentials that occur during the time that a single chart is in the hole in one of these Amerada bombs. The difference between the pressure differential shown there and the pressure differential that's recorded at the end of one clock and then when you change the bomb and run another chart in the hole, you get a different pressure reading at that time. What's the difference in the last case where you change charts and pull the bomb out and run it back in the hole with a new chart?

A The bomb is giving you a different absolute magnitude in your pressure.

Q In other words, it's starting at different numerical points?

A Yes, sir.

Q The bomb is subject to some error there in the recording of this initial absolute pressure when it's put in the hole, is that right?

A Yes, sir.

Q When that clock is in the hole and the bomb is then recording pressures, what about the relative pressure changes shown on that chart during one test? Is that subject to this same possible error? Is this absolute pressures now or is this intended to show relative pressure change?

A It tends to show the relative pressure change.

Q Not subject to this initial recording error of absolute pressure?

A Well, certainly not to the magnitude of the absolute pressure change from one chart to the other.

Q Was it then because of the recognition of this difference between those two situations that you did attach more importance to smaller pressure changes recorded during a continuing test on one chart than you did to those pressure changes which occur as a result of changing charts?

A Yes, sir.

Q With regard to the basis for the recommendation of one and a half times the normal 80-acre allowable, are you aware whether in the past in 80-acre pools in this State the Commission has on one or more occasions fixed an allowable at one and a half times a 40-acre allowable for those 80-acre pools?

A No, sir, I'm not.

Q Mr. Young, it has been pointed out by cross examination that the Ohio did not drill, after the test wells did not drill its subsequent Devonian wells all the way through the Devonian pay section. Do you know the reason that we did not?

A In my opinion that is a conservation measure in these water drive reservoirs, by not penetrating to the water-oil contact, if there is fractures, you would have less likelihood to produce water prematurely.

Q And you would be, try to be doubly safe and prevent that possibility from occurring?

A Yes, sir.

Q It certainly wasn't any sort of effort to fail to produce any oil out of that Devonian?

A That's correct.

Q And with further production history and further development, these wells could then be deepened, couldn't they?

A Yes, sir.

Q If we were satisfied that the lower portion of the pay was not being produced by the existing well?

A That's correct.

Q Mr. Young, will you refer to your Exhibit 10, I believe it is, with the schematic drawing of the cylinder.

MR. NUTTER: Exhibit 11.

MR. COUCH: Exhibit 11. Thank you, Mr. Nutter.

Q If, in that schematic drawing, instead of using 98 feet of net pay you had used 55 feet or some smaller amount of net pay and had then computed the recoverable reserves within the cylinder area covering the 251 acres, could you tell us by estimate at this time whether the calculated pressure drawdown would havebeen greater or less than the drawdown of 1150 psi which you calculate under this particular example?

A With less net pay in this calculation, the pressure decline would be greater than is shown in Exhibit 11.

Q That is with the same cumulative withdrawal from it?

A Yes, sir.

Q So that this is an example that could be applied, this same formula used, using the cumulative withdrawals of any well?

A Yes, sir.

Q And the net pay of that well?

A Yes, sir.

Q In selecting No. 1, it had the most cumulative withdrawal of any of the wells in the field, didn't it?

A Yes, sir.

Q By taking the well with the greatest cumulative production, would that be the well that you would expect if it had a limited draining area that it would have a greater pressure decline?

A Yes, sir.

Q Is that one reason you chose Well No. 1 for the example?

A Yes, sir.

Q Mr. Young, do you have any actual cost figures, or what it cost Ohio and the non-operators in the unit to drill to the Devonian and make the Devonian completion in some of these wells, exclusive now of any cost that was incurred only for purposes of dualing?

A I don't believe I follow the question, Mr. Couch.

Q Do you have any actual cost figures of what it cost to drill any of these Devonian wells, any one of those wells, the actual cost to drill it to and complete it in the Devonian formation?

A No, sir.

Q Do you have any cost estimates on what additional cost was required to dually complete these wells?

A The average cost of dually completing these wells in the Bone Springs is $25,000.00.

Q Do you have any actual total cost figure for any one of these wells for the total cost of it, including the Bone Springs dual?

A Yes, sir.

Q Will you give us that actual cost figure and which well it was?

A The No. 1 well dualled into both zones cost $657,000.00.

Q All right. Do you have any actual cost figures on any other well?

A The No. 2 well cost $541,000.00.

Q Any other cost figures?

A No. 4, $515,000.00.

Q Keep going, you have got them.

A No. 5, $559,000.00. Those are all actual cost figures that it cost to dually complete those three wells. I have an FEA cost on the No. 6.

Q That's the one that's recently completed?

A Yes, sir.

Q What is the FEA cost? A $572,000.00.

Q That's dualled into the Pennsylvanian?

A This's the estimated FEA cost for the Devonian-Bone Springs.

Q That's right, the well was originally planned that way?

A Yes, sir.

Q In arriving at the average cost of $510,000.00 that you talk about, did you use those actual cost figures you have just given?

A I used the average cost figure exclusive of Well No. 1.

Q You said you used the average?

A I used the actual cost figures exclusive of Well No. 1.

Q Why did you throw that out?

A Because it was so much higher than the others by a hundred thousand dollars.

Q You wanted to get a realistic figure?

A Yes, sir.

Q What else did you deduct from there?

A The average cost without No. 1 of the five wells is $537,000.00.

Q How did you get down to the $510,000.00?

A The cost to dual an existing Devonian well into another zone is $25,000.00.

Q At least that's the Bone Springs?

A The Bone Springs. Therefore, the estimated cost for Devonian completion would be $510,000.00.

Q That assumes that you have no problems in making this

dual completion?

A Yes, sir.

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

MR. PORTER: Mr. Utz.

RECROSS EXAMINATION

BY MR. UTZ:

Q What is the depth of the Bone Springs in this area?

A Approximately 9500 feet.

Q The Pennsylvanian? A 12,300.

MR. UTZ: Thank you, that's all.

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

(Witness excused.)

MR. PORTER: Call your next witness, Mr. Couch.

MR. COUCH: Mr. J. D. Wheeler is to be our next witness.

J. D. WHEELER

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

DIRECT EXAMINATION

BY MR. COUCH:

Q Will you please state your name, sir, and your position with the Ohio Oil Company?

A My name is J. D. Wheeler. I'm the Division Manager of

the Houston Production Division of the Ohio Oil Company. The Houston Division includes all of New Mexico, with the exception of the Northwest Quarter.

Q Mr. Wheeler, you have considered, I'm sure, the Lea Unit very carefully, haven't you?

A Yes, sir.

Q And from management's standpoint, do you have some comments that you would like to add to this record today?

A Yes, sir, I do have.

Q Would you please proceed?

A Some thirteen months ago at the hearing for temporary 80-acre spacing I outlined our development plan for the Lea Unit. I stated that while we were asking for 80-acre spacing, it was our intention to step out 160 acres at a time in order to evaluate the various reservoirs as quickly as possible. This has been done insofar as the North end of the field is concerned.

The title question in the South end of the field has prevented similar development in that area. While engineers have been gathering the data which has been presented here today, management has been concerned with other problems, and it is about those matters that I wish to speak briefly today. The problems like money, how much money is going to be allocated to the Houston Division. How much of that money are we going to have to spend

for development wells. How much are we going to have to have left to drill wildcat wells, and similar problems.

Slightly over two years ago I also appeared before this Commission in connection with our request for 80-acre spacing in the Bluitt-Pennsylvanian field, since merged with the Allison-Pennsylvanian field. The Commission granted that request, and I'm happy to say that uniform development has resulted, the field is essentially completely developed and is performing in the manner that indicates the field will be properly depleted and the operators are making money.

The Ohio Oil Company has drilled a total of 122 wells in this field and a number of them part interest, with Ohio as an operator. This development cost approached four million dollars. Had we drilled one well to 40 acres we would have approximately doubled our development costs.

With the economics of that field in mind, I'm sure we would not have drilled on each 40 acres, but without the protection of the 80-acre order, I feel sure that unnecessary wells would have been drilled. Recently we completed a 15,000 foot plus Devonian wildcat in the Wilson Pool of Western Lea County a few miles South of the Lea Unit, at a cost of over six hundred thousand. The cost of drilling this expensive dry hole, of course, came out of the company till, but actually the money was in the till because we,

in this division, with the help of this Commission, refrained from drilling unnecessary wells in the Allison-Pennsylvanian field. Last month at the API meeting in Chicago Lyon V. Terry of Laymon Brothers, New York, gave a paper before the production group entitled "The Producer's Problem of Diminishing Returns". The paper was primarily presented to point out some of the reasons that oil stocks have lagged behind on the securities market.

Some items from his paper seem to agree with my analysis of our problem here today, and while these are not exact quotes, any figures that I use are quotes from the paper. Mr. Terry stated that the squeeze is on between the constant price of produced crude and the increasing cost of finding, developing and producing it. Figures presented indicated the spread between these two figures has decreased from $1.70 per barrel in 1948 to $.35 in 1957.

While those are the last figures, there isn't any reason to think that the situation has improved any since 1957. Three solutions were mentioned for overcoming this dilemma. One was an increase in price. Second was cut the cost, third was to go out of business. A number of smaller companies in recent years have found the situation so tough that they have sold out. Of course, there isn't too much chance for increasing price with the great amount of foreign crude that's available at a lower price than

we're able to produce our oil. Therefore, it's cut costs or else.

Many companies, most companies, in fact, have already taken many steps to cut costs, streamlining corporate organization, reducing personnel, installation of automatic computers, and so forth. The remaining major opportunity is to reduce the number of development wells drilled to deplete a reservoir. Frequently wells unnecessary for reservoir drainage are drilled for the sole purpose of increasing the operator's daily allowable. Now, Terry, in his paper, recommended an allowable that would be based 100% on acreage. In other words, he recommended that if you drill on 160 acres instead of 80 acres in this field, you should get double the allowable. Of course, that would be a real fine arrangement financially, but we didn't see fit to make that recommendation.

Mr. Young did recommend one and a half times the 80-acre rather than the double that Mr. Terry had suggested. We believe that double allowable under the present supply and demand situation would give this field too great an advantage in the competition for allowables and markets.

On the other hand, there must be some additional allowable or present worth figures would make it advisable to over develop the property. Our request for 160-acre spacing is definitely not a hardship case, as indicated by Mr. Young's Exhibit No. 10, which shows a $568,000.00 profit per well, or a 1.11 to 1 profit to

investment ratio on 80-acre spacing. However, it is my firm conviction that the oil industry is shirking its duty to its country and even to the state in which it operates if we fail to eliminate the drilling of unnecessary wells when the physical facts in the case indicate that such elimination will not result in the reducing of ultimate recovery from the field. Failure to eliminate the drilling of unnecessary development wells results in increasing the cost disadvantage between the domestic and foreign oil.

It causes budget money that should be spent in drilling wildcat wells to be spent on development wells. This, in turn, cuts down on the available reserves of the country by reducing the discovery rate. The additional development wells will, in turn, deplete the already discovered reserves at a faster rate, so once again I'm back here with the same plea I made a couple of years ago, which was, when justified, wider spacing for development wells and closer spacing for wildcats.

I think that completes what I had in mind saying.

MR. COUCH: Thank you. Your witness.

MR. PORTER: Anyone have a question of Mr. Wheeler?

MR. MORRIS: One question.

MR. PORTER: Mr. Morris.

CROSS EXAMINATION

BY MR. MORRIS:

Q Mr. Wheeler, some discussion was given when Mr. Young was on the stand to the problem of allocating cost between wells that have been dually completed. I was wondering if you could comment on what the Ohio's practices are and what you feel should be done in that regard?

A Mr. Morris, that could be done in a number of ways. My own opinion is that since we have to drill a well to the Devonian in order to produce the Devonian, and since this is the reservoir that has the real reserves, that we would probably allocate the cost of drilling and completing the well to the Devonian and then charge to any other reservoir the cost of the dual completion. It can be done in any number of ways. It's strictly up to the Accounting Department how they want to carry it.

Q You wouldn't allocate the cost to each pool based upon reasonable equal return on your investment from each of the two pools?

A Oh, I don't believe we'd be that precise about it, no. I would think we would probably charge the cost to the Devonian of drilling the well to the Devonian and completing it.

Q You charge about $500,000.00 to the Devonian and about $25,000.00 to the Bone Springs?

A I think that will make the best picture for both

reservoirs.

MR. MORRIS: Thank you.

MR. PORTER: Any further questions? You may be excused.

(Witness excused.)

MR. PORTER: Anyone else desire to present any testimony in the case? The Commission will hear anybody who would like to make a statement at this time.

MR. BLACK: C. R. Black with Texaco, Inc. out of Midland, Texas. As brought out in testimony in this case, Texaco is presently drilling the Texaco Quail Federal No. 1 immediately North of the Lea Unit. It is anticipated that the well will be dually completed in the Lea-Devonian and Lea-Bone Springs. Texaco believes that the evidence presented by the Ohio is certainly indicative of the fact that a well completed in the Devonian reservoir is capable of effectively and efficiently draining in excess of 160 acres.

Texaco will always urge that the widest and most feasible spacing pattern for the initial development of any reservoir be established. Texaco believes that if the engineering data that is gathered as the pool is developed will not support the wide spacing pattern, it is never too late to come in and infill drill in order to prevent physical waste.

On the other side, if the reservoir is developed on a closer

spacing pattern and a wider spacing pattern would have efficiently and effectively drained the reservoir, it is too late then to recover the investment cost of drilling these unnecessary wells.

In this particular case the drilling of one unnecessary well results in an investment loss or economic waste of approximately $500,000.00. Texaco believes that this investment could be used by the industry for the exploration and development of other reservoirs in this State, and would certainly be an economic benefit to the industry and to the State of New Mexico.

Therefore, Texaco, as a prospective operator in the Lea-Devonian field, wishes to concur with Ohio's application for 160-acre spacing and respectfully urges that the Commission approve the application as submitted by the Ohio Oil Company.

MR. KASTLER: Bill Kastler from Roswell, New Mexico, appearing on behalf of Gulf Oil Corporation. Gulf is a non-operator and participating party in the Lea Unit. As such, we have a direct interest in this case. We believe that the Ohio Oil Company has presented a reasonable interpretation of the facts as they appear to exist at this time. That the drainage pattern of Well No. 1 as an example appears to be greater than 80 acres, indeed it appears to be justified that it is on the 251 acres claimed, or perhaps even greater.

We, therefore, concur in the request for 160-acre spacing

in this pool, and we also concur in the request for one and a half times allowable. Thank you.

MR. PORTER: Mr. Anderson.

MR. ANDERSON: As it has been pointed out, in the course of this hearing today, all, or at least the greater portion of the acreage that is involved in this application is in the Lea Unit area which consists mostly of Federal lands with one or two tracts of State of New Mexico land. Now, the wide spacing, or maybe we shouldn't call it wide, the wider than usual spacing that is sought by Ohio is not inconsistent with the principle of unitization in which operations we feel that we should get the greatest recovery of oil or gas without drilling unnecessary wells.

At the present time, as established by them, we've got five Devonian wells drilled in the northern third of what looks like is the Lea-Devonian Pool. From the evidence put on, some pressure surveys indicate that drainage does occur over a larger lateral distance than that which would be necessary for drainage of some sort in a 160-acre spacing if we considered per radial drainage.

Other pressure information appears to be inconclusive. The 160-acre spacing for oil is a departure, to my knowledge anyway, of any of the orders that have been issued by the Commission. Of course, we do have some unusual circumstances. One of them that is foremost in my mind is that the entire area, or at least

probably all of the area that, or possibly, let's make it probably that will be productive in the Ohio, at least based on what information we have now, is unitized.

Another thing is that this Devonian production lies at the greatest depth of any oil production, at least so far as I know, in New Mexico. We, in the Survey, have considered the matter of spacing; as far as 40-acre spacing is concerned, why none of us are thinking about that at all. We feel that we certainly can forget about that in the Lea-Devonian. We feel that the evidence today has put out a good case for 160-acre spacing, certainly as good a case as could be made for it at this time for 80-acre spacing in any of the testimony or any of the knowledge that we have of the field, and I think some of you will recall that when the application for Devonian participating area and the Bone Springs participating area was filed with the Survey, we had discussions at some length of the reservoir characteristics, and all of the geological information that was available at that particular time and later.

So, based on what knowledge we have of it, and the testimony here today, we feel in the Survey that it would be both desirable and appropriate to develop this Lea Pool on 160-acre spacing, at least until such time as we have the entire productive area developed on that basis. Then, if the necessity exists for drilling

infill wells on an 80-acre pattern to take care of probably some of the geologic or reservoir characteristics of which we are unaware today, we can go ahead and do that. We can't undrill them if we go on 80-acre spacing now.

As far as the requested allowable is concerned for 160-acre tract, it seems to me that the allowable requested, one and one half times the normal allowable for that depth, would certainly not be inappropriate. So far as the Geological Survey is concerned, we feel that 160 acres would be appropriate in this case and we recommend that the Commission adopt it.

MR. PORTER: Mr. Morris.

MR. MORRIS: If the Commission please, I have a telegram from Sinclair Oil and Gas Company signed by Mr. Joe Mefford. "Sinclair Oil and Gas Company concurs with Ohio Oil Company in recommending 160-acre oil proration units for the Lea-Devonian Pool with a top allowable of a regular 40-acre depth factor allowable plus three additional unit allowables.

MR. COUCH: I have a closing statement.

MR. PORTER: Mr. Couch.

MR. COUCH: I notice a little consternation there, I don't know what Mr. Mefford means when he says the three allowance. Maybe he means the three 80's. With respect to allowance, and without criticism of Mr. Mefford, I wasn't sure what he had in

mind. I would like to say that the recommendation for one and a half times the allowable has had support in the past in that there are fields in which 80-acres were approved several years ago, I believe there are two of them in which the Commission saw fit to grant one and a half times the 40-acre allowable for the wells as developed in the field on 80's.

MR. PORTER: One was one and a half and one was two.

MR. COUCH: One was double?

MR. PORTER: Yes, sir. I don't believe it's producing under that arrangement at the present time, but that was the original order.

MR. COUCH: I think that's correct. It was, I would say, principally for this reason that we arrived at the one and a half times figure. Actually our approach to the recommended allowable was to attempt to ascertain what these wells could efficiently provide without waste and to consider then the modification Mr. Wheeler has suggested of being certain that this pool was not going to receive more than its fair share of the allowable in the southeastern part of the State, and using that with its past history of the Commission is where the one and a half figure came from.

I'll also say this, that Mr. Wheeler has, I think was waiting for me to ask him a question. I thought he was going to say it

on his own up there. That, in this case, if the Commission should feel that the one and a half times is too much for any reason, the Ohio, at least, for it is not qualified here to speak for the other owners in the field, would not object to a hundred sixty-acre allowable based on two additional normal allowables plus the present 80.

We think that the field will justify the one and a half times allowable, and that was the basis for our recommendation, but we recognize that there is room for difference in consideration here, and I wanted our position to be shown in the record with regard to the allowable situation.

I have here three letters that I would like to put in the record; one from Edwin B. Cox and Edwin L. Cox, one from Drilling and Exploration Company, Inc., and one from Pure Oil Company, all being working interest owners in the Lea Unit, and also to advise the Commission that the other working interest owners, J. Hammond and W. T. Ross and wife have been fully notified of this hearing and are aware of what has been proposed and have indicated their approval of our proposals.

I offer these three letters as Exhibit 14 in our case. Those three letters also approve what we're asking for. I think virtually all has been said that could be said or needs to be said at this time. I'm not going to attempt to summarize the

data or advert to it or further evaluate it. It's there. It speaks for itself. I'll just make this one observation. We have here brought to the Commission all of the available data that we have. The interference test did not show the dramatic pressure decline that perhaps would have made this a very obvious and fat case. What they did show was in the reverse, that the pressures and the permeabilities in this reservoir, the effectiveness of this water drive is such that you just can't get any dramatic drawdown between these wells producing at these rates.

With that we commit to the hands of the Commission our application here. Thank you, gentlemen.

MR. PORTER: I would like to go further with my statement of facts for the record. Concerning the fact that it was established from 80-acre pools, as I recall in the Knolls Pool which was a Devonian Pool, and the Bagley-Siluro-Devonian Pool, the factor of one and a half both came about prior to the establishment of 80-acre factors. We had no 80-acre factors in existence at that time.

Does anyone else have anything? The Commission will take the case under advisement and we will take a short recess.

I N D E X

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 22nd day of December, 1961.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1963.