BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO. 1599

TRANSCRIPT OF HEARING

FEBRUARY 20, 1959

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I N D E X

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE 1599 Application of El Paso Natural Gas Company for 320-acre spacing, promulgation of special rules and regulations and for a redetermination of the vertical limits of the Angels Peak-Dakota Gas Pool, San Juan County, New Mexico. Applicant, in the above-styled cause, seeks an order establishing 320-acre spacing in the Angels Peak-Dakota Gas Pool in San Juan County, New Mexico, and for the promulgation of special rules and regulations for said pool. Applicant further seeks to change the vertical limits of the Angels Peak-Dakota Gas Pool to include the interval lying between the base of the Greenhorn limestone and the base of the upper productive portion of the Morrison formation.

Auditorium
State Highway Department Building
Santa Fe, New Mexico
February 20, 1959

BEFORE:

A. L. Porter
Governor John Burroughs

TRANSCRIPT OF HEARING

MR. PORTER: We will take up next Case 1599.

MR. PAYNE: Case 1599, "Application of El Paso Natural Gas Company for 320-acre spacing, promulgation of special rules and regulations and for a redetermination of the vertical limits of the Angels Peak-Dakota Gas Pool, San Juan County, New Mexico."

MR. SETH: Mr. Garrett Whitworth and Oliver Seth appearing for El Paso Natural Gas Company.

MR. PORTER: Are there any other appearances in this case?

MR. NEWMAN: Kirk Newman, Atwood and Malone, Roswell, New Mexico, and Guy Buell --

MR. PORTER: Just one minute. Mr. Newman, would you repeat your statement, please?

MR. NEWMAN: Kirk Newman, Roswell, New Mexico, and Guy Buell of the Texas bar representing Pan American Petroleum Corporation.

MR. WHITWORTH: We have three witnesses to be sworn.

MR. PORTER: Would you have them stand and be sworn all at the same time, Mr. Whitworth?

MR. WHITWORTH: Mr. Allan Loliet, Mr. Darrell Canfield and Mr. Norman Woodruff.

(Witnesses sworn in.)

MR. WHITWORTH: Our first witness will be Mr. Allan Loliet.

MR. PORTER: Will those exhibits be marked?

MR. LOLIET: No, sir.

ALLAN LOLIET

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

DIRECT EXAMINATION

BY MR. WHITWORTH:

Q Please state your name, by whom you are employed and in what capacity you are employed?

A My name is Allan Loliet, I am employed by the El Paso

Natural Gas Company in Farmington, New Mexico as a geologist.

Q And you have previously testified before this Commission as an expert geologist?

A Yes, sir.

MR. WHITWORTH: We ask that the witness' qualifications be accepted.

MR. PORTER: They are acceptable.

Q (By Mr. Whitworth) In your occupation as a geologist with the El Paso Natural Gas Company, have you had occasion to study geologically the Dakota formation and the Angels Peak area?

A Yes, sir.

Q How long have you been engaged in that study, Mr. Loliet?

A In the Dakota formation out in the San Juan Basin, approximately a year; in the Angels Peak area, about two or three weeks.

Q In making this study, what geological data have you used?

A Electric logs, gammaray neutron induction.

Q Do you have information on the wells that have been drilled through the Dakota formation and the Angels Peak area?

A Yes, sir.

Q Do you have an exhibit depicting the well data, information?

A Yes, sir.

Q What is the exhibit that you have on the board now?

A The first exhibit we have here, Exhibit Number One, is a map of the Angels Peak area. The map--the Angels Peak-Dakota field is outlined in this manner here and it also shows the wells drilled to the Dakota surrounding the Angels Peak area. These symbols here just show the status of the wells in the Dakota. Red indicates producing gas from the Dakota, blue, no production from the Dakota, and black and red producing oil and gas from the Dakota. Also on this map is shown the line of cross section through the Angels Peak area and surrounding territory.

Q Now, the cross section that is shown on this exhibit will later be shown individually, is that correct, by different exhibits?

A Yes, sir.

Q What wells, particularly, have you studied in making this information available?

A All the wells that are shown on the cross section, and the wells that are in the Angels Peak area of which we have data.

Q Now, you have a sheet showing well data information?

A Yes, sir.

Q What is that exhibit?

A That's Exhibit 1-A.

Q In making this inquiry, have you determined the extent of the Dakota formation in the Angels Peak area?

A Yes, I have.

Q What have you determined to be the extent of the

Dakota Formation in this area?

A The Dakota Formation is widespread throughout the Angels Peak-Dakota field.

Q Now, you mentioned a cross section that you were going to show individually to the Commission. What is your next cross section, Exhibit Two?

A Exhibit Two is cross section Number One, which is north-south through the Angels Peak-Dakota field.

Q Do you have Exhibit 1-A, which is your well data information, before the Commission?

A Yes, I believe it is.

Q All right. Now, will you put up Exhibit Two on the board?

A All right.

Q Will you explain this exhibit to the Commission?

A Exhibit Number Two is a cross section, north-south, through the Angels Peak-Dakota field. On the left is the northernmost well, and the right is the southernmost well in the cross section. In this cross section, I have taken three units in the Dakota and correlated them throughout the area. In the depth tract, they are colored. Red indicates gas production from the Dakota, and these three units, green, yellow and orange, are more or less units that have widespread production in the Dakota throughout the area.

Q Would you point out where this particular cross section

is on your Exhibit Number One?

A The first well starts north of the Angels Peak-Dakota field, which is the Sunset Citro-Kutz Federal 1-E, the Kingwood Number 1 Kutz, McRae Number 1 Kutz, the Sunset Number 2 Kutz Federal, Sunset and Citro-Kutz Federal, Pan American E. E. Martin 1-D, the Pan American Gordon 1-D, the Weaver and Brown McAdams Number 4 and El Paso Natural Gas Company's Huerfano 103.

Q What data did you use in the preparation of this cross section?

A Mechanical logs.

Q Now, what does this exhibit indicate to you with respect to the existence and extent of the Dakota formation in the Angels Peak area?

A To me, it shows that the Dakota formation is present throughout the Angels Peak area.

Q All right. Now, do you have your cross section, your Exhibit Number Three, which is the next cross section?

A Yes, sir.

Q This is El Paso's Exhibit Number Three?

A Yes, sir.

Q Would you explain that to the Commission?

A That is an east-west cross section through the southern part of the Angels Peak-Dakota field. The legend in color is similar to Exhibit Number Two. The same sands, the same units that are depicted on there are the same ones that are present in the

north-south cross section.

Q Would you indicate where this particular cross section is on Exhibit One?

A This cross section is in the southern part of the Angels Peak-Dakota field, which is the Pan American McAdams 1-B, Weaver and Brown McAdams Number 3, El Paso Natural Gas Number 107 Huerfano, Huerfano 107, and El Paso Natural Gas Huerfano 99.

Q Does this exhibit indicate to you the existence of the Dakota formation throughout the whole Angels Peak area?

A Yes, sir.

Q What data did you use to prepare that exhibit?

A Mechanical logs.

Q Do you have Exhibit Number Four?

A Yes, sir.

Q That is El Paso's Exhibit Number Four?

A Yes, sir.

Q Would you explain that to the Commission, please?

A Exhibit Number Four is also an east-west cross section througout the southern part of the Angels Peak-Dakota field, and it extends east and west beyond the field, the wells in here do. The wells include the Hancock Doughnut Number 1, the El Paso Huerfano 105, El Paso Huerfano 106, Weaver and Brown's McAdams Number 4 and 2, El Paso's Huerfano 99 and 92 and Magnolia's Number 1 Crandell.

Q Now, you have pointed out on Exhibit Number One where

this cross section runs. For the record, in what direction does it run in the Angels Peak area?

A This one runs east-west.

Q And did you use the same geological data to prepare this exhibit that you have on the others?

A Yes, sir.

Q Do you have another exhibit showing another cross section?

A Yes, sir.

Q This is El Paso's Exhibit Number Five?

A Yes, sir.

Q Would you explain that, please?

A This Exhibit Five is from the previous cases, 1508 and 1523, and this exhibit is used at this time to show the tie-in of the Dakota throughout the San Juan Basin with the Angels Peak area and these units which I have depicted in the Dakota are present throughout the whole area as they are in the Angels Peak area. This exhibit is an east-west cross section and just due north of the outline of the Angels Peak-Dakota field, and the common well we had in this case for Exhibit Number Two is the McRae Kutz Federal Number 1, which is also present in this cross section, the cross section from the previous cases.

Q What does this exhibit indicate to you with respect to the continuation of the Dakota formation throughout the San Juan Basin?

A This exhibit shows that the Dakota is present throughout the San Juan Basin and also within the Angels Peak area.

Q How would you determine the top of the Dakota formation in the Angels Peak area?

A Perhaps you could state that as the Dakota producing interval.

Q All right, how would you determine the Dakota producing interval?

A The interval from the base of the Greenhorn, and four hundred feet below that.

Q And you would determine the top of the producing interval as the base of the Greenhorn, is that right?

A Yes, sir.

Q And how would you determine the base of this producing interval?

A Four hundred feet below the base of the Greenhorn.

Q I see. So that should be the vertical lines that you have just described there in the Dakota reservoir, that should be the producing interval in the Angels Peak area?

A Yes, it should.

Q How does the depth of the Dakota formation compare with that of the Mesa Verde?

A The Dakota formation is about 2,000 feet deeper than the Mesa Verde.

Q What would you say were the characteristics of the

Dakota formation with respect to the deposits and how they were deposited there?

A You mean the environment in which the Dakota was laid out?

Q Yes.

A Probably offshore bars, some lagunal or near shore deposits and some deep sea deposits.

Q Is that characteristic or common to the whole Dakota formation throughout the Angels Peak area?

A Yes, sir.

Q And did you find the similar characteristics throughout the San Juan Basin with respect to the Dakota formation?

A Yes, sir.

Q Is it your opinion that the Dakota formation would, the vertical limits that you have just suggested, constitite a common source of supply of gas in the Angels Peak area in the San Juan Basin?

A Yes, sir.

Q All of the exhibits that you have shown to the Commission were prepared by you or under your direct supervision?

A Yes, sir.

MR. WHITWORTH: We ask that these exhibits be admitted into evidence.

MR. PORTER: Exhibits, El Paso Exhibits One through Five?

MR. WHITWORTH: Yes sir, One, One-A, Two, Three, Four and

Five.

MR. PORTER: Without objection, the exhibits will be admitted.

Does anyone have a question of the witness?

MR. ARNOLD: Yes, sir.

MR. PORTER: Mr. Arnold?

MR. ARNOLD: Mr. Loliet, there's an operator in the general area who recently called about some gas which was found in the Greenhorn formation. Would you have any recommendations as to where that gas production should be placed with regard to your vertical limits? He was interested in completing the well in the Dakota formation.

A That I don't know. I think there's very little, if any, production or shows in the Greenhorn that I know of, except perhaps this instance that you are referring to. I wouldn't know what to say about that. There is one well that has produced in the Greenhorn, so it is said, and it's in the extreme western part of the Basin just south of El Vado Lake. They had a well drilled and it was said it was producing from the Greenhorn. It might not necessarily have been, though.

MR. PORTER: Mr. Arnold, is this well in the Angels Peak?

MR. ARNOLD: It was in the South Blanco-Dakota Pool, which is east of the Angels Peak about fifteen miles. It was a very small amount of gas, therefore it probably wouldn't warrant a separate application. It would be a problem which we will start

having on several Dakota wells.

A Well, was that definitely producing or had a little gas from the Greenhorn?

MR. ARNOLD: Yes.

A It was.

MR. ARNOLD: Would you have any objection to marking the top of the upper limits at the top of the Greenhorn--rather, the base? Do you think it would be a good idea to cover that situation?

A Well, in my opinion, I wouldn't have any objection. The reason we chose the base of the Greenhorn previously is because it is a very good marker, and up to this time, there has been no main production or shows in the Greenhorn, to my knowledge.

MR. ARNOLD: Thank you.

MR. PORTER: But you personally would have no objection to including the Greenhorn?

A No, sir.

MR. PORTER: Mr. Utz?

MR. UTZ: Mr. Loliet, the base of the Greenhorn is a much better marker, you say, than the top of the Greenhorn?

A I wouldn't say much better. I think it's a rather more definite sign than the top of the Greenhorn. You might have a little difficulty, say in picking it within fifteen, twenty or thirty feet in distance. I think the base of the Greenhorn is much more pronounced, a much more pronounced marker.

MR. UTZ: What is the maximum depth of your Greenhorn

thickness?

A The thickness would be about fifty feet.

MR. UTZ: You think fifty feet would cover the whole area of the basin?

A I believe so.

MR. UTZ: And it might be well to use a vertical limit of fifty feet above the base of the Greenhorn and four hundred feet below, would it not?

A Yes, sir.

MR. UTZ: That's all I have.

MR. PORTER: Any further questions of the witness?

You may be excused.

(Witness excused.)

MR. WHITWORTH: Darrell Canfield.

DARRELL CANFIELD

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

DIRECT EXAMINATION

BY MR. WHITWORTH:

Q Please state your name, by whom you are employed and in what capacity you are employed?

A Darrell Canfield, employed by El Paso Natural Gas Products Company as Division Landman in Farmington, New Mexico.

Q You previously testified before the Commission with respect to El Paso's application for 320-acre spacing in the

Dakota formation for the San Juan Basin with the exception of the Angels Peak area, the Barker Creek and the Ute zones, is that right?

A That's right.

Q Have you prepared any exhibits showing the ownership in the area in question?

A I have.

Q And that is El Paso's Exhibit Six?

A Yes, sir.

Q Would you please explain that exhibit to the Commission?

A This exhibit reflects the ownership of the working interests within the area by the operators, with one exception in this area where Sunset International, Pan American, Three-States and El Paso have agreed to exchange 160 acres throughout this area in here to establish a full 320-acre block. That has been agreed to by the various companies. The red outline on the map reflects the present Angels Peak-Dakota Pool and the dotted line reflects the present boundaries of the Huerfano, the north boundary of the Huerfano unit.

Q This map directly reflects the information which has been accumulated by El Paso's Farmington office in the Land Department regarding ownership of land in the Angels Peak-Dakota area?

A Yes, sir.

Q Did you prepare this ownership map?

A Yes, sir.

Q In your opinion, should El Paso's application in this case be granted, would there be any complications with respect to ownership insofar as 320-acre blocks are concerned?

A There will not be.

MR. WHITWORTH: We ask that El Paso's Exhibit Six be admitted into evidence.

MR. PORTER: Without objection, the exhibit will be admitted.

Any questions of the witness?

You may be excused.

MR. WHITWORTH: Norman Woodruff.

NORMAN WOODRUFF

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

DIRECT EXAMINATION

BY: MR. WHITWORTH:

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

A My name is F. Norman Woodruff, I am employed by El Paso Natural Gas Company as their manager of proration operations.

Q You've previously testified before this Commission?

A Yes, I previously testified before this Commission as a reservoir engineer, particularly in the San Juan Basin and on the Dakota formation.

MR. WHITWORTH: We ask that the witness' qualifications be accepted.

MR. PORTER: They are.

Q (By Mr. Whitworth) Mr. Woodruff, you made a study with respect to the Angels Peak-Dakota area concerning certain wells that are involved in the Angels Peak-Dakota Gas Pool, is that true?

A Yes, sir, that's true.

Q And have you also made a study of the core analyses in this area?

A Yes, sir. My entire study has covered or has used core anaylses, electric logs, and the history of drilling, completion, testing, and production of the wells in the Angels Peak area.

Q How many wells have you studied?

A I have studied, within the Angels Peak area, the entire nine wells either completed or under completion, and have studied the area surrounding the Angels Peak,, the presently designated pool boundaries. I have concentrated my studies to an additional nine wells that exist within a mile to a mile and half off the existing pool boundaries.

Q How many core analyses have you studied?

A I have studied three core analyses. One core analysis exists within the Angels Peak-Dakota Pool, that being the Sunset Citro-Kutz No. 1 Well. Now, in order to verify the findings of

this one well within the limits, I've studied the core analysis on El Paso Natural Gas Company's Huerfano 106, which exists adjacent to the pool at the south, and the McRae's Sunset Kutz-Federal No. 1 Well which exists at the north extremity of the pool.

Q Now, would you explain why you studied the surrounding area to the Angels Peak-Dakota Pool?

A I studied the area surrounding the Angels Peak Gas Pool to verify my findings for the Angels Peak Gas Pool. As explained, there is only one core analysis inside, and to verify the facts exhibited by that core analysis, I compared that analysis with the other two analyses in the area.

Q That is, this comparison has shown that the data available within the area of the Angels Peak Pool compares favorably with the area outside?

A Yes, sir, it has.

Q What characteristics in the Dakota Gas Pool have you found from your analysis?

A I think, to make it easy to understand what I am going to testify to, I will hand you a tabulation which sets out the data that I have found for the Sunset 1 "F" Well, the one well within the Angels Peak-Dakota Pool. We have determined that the characteristics exhibited for the net effective pay are 7.7 per cent porosity, and 33.3 per cent interstitial water. We have found for the El Paso 106 Well existing at the south extremity of the pool, a 7.3 per cent porosity, and a 35.01 per cent interstitial

water. For the McRae Sunset Kutz-Federal No. 1 Well existing at the north extremity of the pool, I have found an 8.2 per cent porosity, and a 33.4 interstitial water. I have averaged those three core analyses and that is shown in Column 3 on the tabulation that I have furnished to you, which shows that for the three, we have 7.9 per cent porosity, and 33.7 per cent interstitial water. Now, these figures are weighted-average figures. That indicates to me that, from the core analysis data available in the Angels Peak Pool, from the one well, that it is to be relied upon.

As may be noted from my summary, I have compared the characteristics of the Angels Peak-Dakota Pool, as exhibited by that one core analysis with the data available from the Dakota formation as a whole, which may be found in Column 4. The Angels Peak porosity was 7.7 as compared to 7.2 for the Dakota reservoir as a whole. Average interstitial water content for the Angels Peak Pool was 33.3 as compared to 30.6 for the entire Dakota reservoir. These characteristics have also been compared with the Mesaverde reservoir shown in Column 5, where the Mesaverde exhibited a 9.1 per cent porosity, and a 28.6 per cent average interstitial water content. We had available within the Angels Peak-Dakota Pool limits eight electric logs, and from those eight electric logs, and utilizing the core analyses data available, we have determined an average thickness of the net effective pay of 49 feet. We had six wells within a mile to a mile and a half of the boundaries of the Angels Peak-Dakota Pool which also had

electric logs, and we have determined from the electric logs and core analyses data, that the average thickness of those six wells was 41 feet and the average for all 14 wells was 45 feet. We may compare those averages with the thickness found for the average well in the Dakota reservoir as a whole, which showed 40 feet, and with the Mesaverde reservoir as a whole, which showed for an average well a net effective pay thickness of 51 feet. Now, I should say that all thicknesses that I have referred to here have been net effective pay thicknesses.

In reviewing the data on average thicknesses, it may be seen that the Angels Peak-Dakota Pool, or the eight wells within the pool that we had data on, exhibited an average thickness of approximately 9 feet greater net for the Dakota reservoir as a whole. That may be attributed to one of two facts; the existence of some development in the Dakota within the Angels Peak area that was not found on the average outside, and the fact that many of the earlier wells drilled outside of the Angels Peak-Dakota area were drilled only into a portion of the Dakota reservoir and consequently did not find all of the sand development which may have been available.

Q I notice that the average initial bottom hole pressure for the Angels Peak area is less than the Dakota reservoir as a whole. Would you care to comment on that?

A Yes. The Angels Peak area bottom hole pressure has been determined to be 2,334 PSIA. This is a figure determined

by our reservoir engineering section and one which has been utilized in our submittal to the Federal Power Commission. In the Dakota reservoir it is 2,877. I think that the variation in the reservoir pressure can be readily understood when it is realized that in the basin as a whole, which is not covered in this map, which is much more extensive than the pressure found in the Dakota Pool, ranges from a high of approximately 3,300 pounds along the north boundary of the State of New Mexico, the northeast portion of the Dakota formation, to a low of approximately 2,300 pounds in the extreme southwest portion of the basin, so that we have a general gradation of pressures from the northeast to the southwest. The pressures exhibited in the Angels Peak-Dakota Pool are general characteristics of the pressures found in other wells within the general area on the southwest edge of the Dakota reservoir. Actually, I had made available to me at the time of my departure from El Paso, results of some tests taken by Sunset on several of their wells, which have not yet been shown to be completed on our records, and they exhibited a pressure which was slightly higher than the average that I have given you here. Those particular wells exhibited pressure of about a hundred pounds more. It is my reasoning that we probably will have to adjust our bottom hole pressure estimate for the Angels Peak-Dakota area based on this new evidence that we have available to us.

Now, I've utilized this reservoir data testified to here to

determine what the average recoverable reserves for 320 acres would be for the Angels Peak-Dakota area surrounding the area and have compared it with the Dakota formation as a whole and the Mesaverde reservoir.

The recoverable reserves for a 320 acre average well within the Angels Peak-Dakota Pool was found to be 4,100,000 cubic feet. The wells surrounding the Angels Peak Pool exhibited an average reserve of 3,540,000. Taking both those inside and outside the pool, the average was 3,840,000. This average compares with the average Dakota reservoir as a whole of 4,128,000, and compares with the average for the Mesaverde reservoir of 3,872,000.

Q Are you familiar with the spacing program with respect to Mesaverde wells?

A Yes. Within the San Juan Basin, the spacing adopted for the Mesaverde reservoir is 320 acres.

Q Do you consider that a Mesaverde well can efficiently and economically drain a field of 320 acres?

A Yes, I do, based on evidence that has been exhibited to date by wells producing from the Mesaverde reservoir and on communication tests which have been exhibited, the drainage between wells that are producing and wells that are shut in as well as the fact that in areas that have been under development and producing for an extensive period of time, infield wells, or wells drilled in the midst of such wells have shown a lesser bottome hole pressure than the wells, than the pressure initially exhibited

by the wells surrounding it.

Q So that would you say that Mesaverde wells have generally demonstrated their ability to drain at least 320-acres?

A Yes.

Q Now, will you compare the ability of a well completed in the Dakota formation in the Angels Peak with that of a well completed in the Mesaverde formation with respect to the well being able to drain 320 acres?

A Yes, I will, but first I would like to give the Commission some additional data which I have found to exist which I would like to also base that conclusion upon.

Shown on my tabulation is the average initial potential flow or three-quarter inch choke volume for the wells in the Angels Peak area which I've compared with the surrounding area in the entire Dakota reservoir and entire Mesaverde reservoir.

Now, I've used, as you note, the initial potential flow or the three-quarter inch choke volume. There is a reason for doing that in that the two tests, or in that prior to a couple of years ago, the procedure recommended by the Commission varied from the procedure since that time. Prior to the period we determined in the San Juan Basin an initial potential flow; subsequent to that time, we have determined an absolute open flow. In determining the absolute open flow, we produce the well through a three-quarter inch choke. There is a good reason for this. It saves gas, it does not permit as much gas to be produced. The three-

quarter inch choke offers a restriction. You can take that volume then and extrapolate it to an absolute open flow, which is to protect its characteristics had there been zero back pressure exhibited to the well. We find that taking the new test procedure through the three-quarter inch choke, that for the better wells we get an absolute open flow which is greater than the initial potential flow formerly received by the old test, but on the average we have found that the three-quarter inch choke volume, or said differently, the volume produced through the three-quarter inch choke is comparable to the old initial potential flow, so we have compared the old initial potential flow and three-quarter inch choke volume in getting the average that I am going to relate to you. That's true not only in the Angels Peak Pool, but through the Dakota reservoir as a whole. The average wells in the Angels Peak-Dakota, and I had six wells with initial potentials, was 3,910,00 cubic feet. The average for the Angels Peak and the eight wells surrounding the Angels Peak on which I had test data was 4,110,00 cubic feet. This compares with an average for the entire Dakota reservoir of 4,373,000 cubic feet and compares with the average entire Mesaverde of 3,950,000 cubic feet.

Now, in a prior hearing, our combined Case 1508 and 1523, which pertained to the Dakota reservoir as a whole, I compared the deliverability characteristics of the Dakota reservoir and the Mesaverde reservoir. I did that by taking those wells which had both deliverability tests and initial potential tests.

The well had to have both. so that I could establish a relationship between deliverability and initial potential, the percentage relationship. That was done, and the percentage was applied to the average potential for the entire Dakota and Mesaverde reservoir. Now, on my tabulation under the Dakota reservoir and Mesaverde reservoir you may note that I showed an average State D of 825 for the Dakota reservoir and 712 for the Mesaverde reservoir based on that approach. I utilized the same approach for the Angels Peak Pool and for the surrounding area and found that the average State D was 915 MCF, and for the area, 1,440,000 cubic feet. These two figures compare with 825 for the Dakota reservoir.

Utilizing the same theory, I made, and testified to in the prior hearing, an analysis of the average deliverability against 500 pounds line pressure, and found that for the Dakota reservoir as a whole, it exhibited a 1,100,00 cubic feet deliverability and that the Mesaverde, a 750,000 cubic feet deliverability.

Comparable analysis for the Angels Peak Dakota showed a 950 average deliverability against 500 pounds and for the entire area, an average deliverability of 1,615,000 cubic feet. My professional opinion of the dependability of the state deliverabilities against 500 pounds pressure exhibited here for the Angels Peak-Dakota and the Angels Peak area is that they probably will not average as high a percentage as has been shown from this study. The data we had -- we had very little data available,

very few wells had both potential and initial deliverability tests. This development in this area has been comparatively new and tests of both types on wells have not been taken in the majority of instances. However, it very definitely indicates to me that the characteristics of the wells in the Angels Peak Pool will be at least as good, if not better, than the characteristics of the average Dakota reservoir well.

Now, you had asked me --

Q Getting back to the previous question --

A --to compare the ability --

Q Right.

A --of the Angels-Peak Dakota wells to drain 320-acres. as compared to the average well in the Mesaverde reservoir?

Q That's right.

A Based on the data which I have discussed with you here today, I consider that the characteristics of the Angels Peak-Dakota Reservoir are such as to indicate a better ability to drain a 320-acre tract than was true of a Mesaverde well. The average State D, percentagewise, indicates at least as good or better ability for the reservoir to give up its reserves and the ability to deliver gas at the wellhead. Against comparable wellhead pressures, indications are that the Dakota reservoir within the Angels Peak area should be able to produce its reserve with more ease than is true of the average well in the Mesaverde reservoir.

Q Now, in your opinion, can wells be drilled economically

on 160 acres in the Angels Peak-Dakota Pool?

A Based on the reserves calculated utilizing the data that is available and that I have been testying to here, I consider that they very definitely could not.

Q How about 320?

A I believe that they could be economically drilled on a 320-acre tract, but the pay out is still going to be a long term pay out feature on the average well.

Q What is the present spacing rule for the Angels Peak-Dakota Gas Pool?

A The Angels Peak-Dakota Gas Pool is drilled on statewide spacing of 160 acres.

Q If the Commission does not grant El Paso this, how many additional wells will have to be developed?

A Within the present designated limits of the Angels Peak-Dakota Pool, there is room for approximately 22 wells on 320-acre, so if we were to develop on 160-acre, it would take approximately 22 additional wells to develop.

Q What could the effect of this be on the ultimate density of the development in this area?

A If you develop the Angels Peak-Dakota area on 160-acre, then it will be necessary for the operators in areas adjoining the Angels Peak-Dakota Pool to meet offsets and develop on a 160 acre basis too. That could have a sort of snowballing effect in that it could conceivably ultimately result in 160-acre spacing over a

goodly portion of the entire Dakota reservoir.

Q How would you classify the present stage of development in the portion that we are speaking of, the portion of the Angels Peak-Dakota?

A On 320 acres, we have about 40 per cent development of the Angels Peak-Dakota Pool area. Depletionwise, it is in the initial stages of depletion.

Q You talked a while ago about recoverable reserves in the Angels Peak-Dakota Gas Pool. Why is it important, in your opinion, to prove recoverable reserve as rapidly as possible?

A From the standpoint of developing a market outlet for the gas that is found in the Dakota, it is important to prove the reserves as quickly as possible because you must first know that you have the reserves before you can go to the Federal Power Commission and request the additional compression and plant facilities and pipeline facilities to transport that gas out of the basin and furnish a market also, so it is extremely important to prove your reserves as quickly as possible.

Q And in your opinion, the 320-acre spacing pattern would be most likely to result in reasonable development in proving of these additional reserves, is that right?

A That is correct, I consider that we must have at least a 320-acre spacing program to drill an economic well. I consider that, to encourage drilling and proving of the Dakota reservoir both in and out of the Angels Peak-Dakota Pool, that

we must give that incentive to those people who will be drilling the wells, and of course, drilling on 320-acre spacing, we will prove up the reserves much faster than would be true if drilled on 160-acre spacing because normally a company provides for the drilling of just so many wells each year, and with 320-acre spacing you can prove up at least twice as much in the same period of time as you would 160-acre spacing.

Q Now, should the Commission see fit to grant El Paso's application in this case, how would you suggest that rules and regulations be promulgated to effect this 320-acre spacing.

A Based on the data which I have been able to find on the Angels Peak-Dakota area and which I have testified to before the Commission today, I consider that the rules identical to that for the balance of the Dakota formation in the San Juan Basin can be applied to the Angels Peak-Dakota reservoir, and it would be my recommendation that the Commission amend the rules adopted for the Angels Peak-Dakota reservoir which is Order No. R-1287 in such manner as to include the Angels Peak-Dakota Pool.

Q In the absence of this you would have no objection to the publication of a new order with respect to the Angels Peak-Dakota Gas Pool?

A No, I would not.

Q There has been some talk about proposed vertical limits for the Angels Peak-Dakota Gas Pool. What is your

recommendation in that respect?

A We have an Order R-1287 for the entire Dakota reservoir with the exception, I believe, of three areas, a designation of that includes an interval from the base of the Greenhorn to a point four hundred feet below the base of the Greenhorn. Now, that was based on the evidence available at that time as was testified to by Mr. Loliet. That was a good marker, and there was no indication of production above that marker. I believe that marker still is reasonable. There has been mentioned here that in a particular area, production has been found above the base of the Greenhorn. Certainly we don't want to exclude gas which would have no other means of being recovered, that would be wasteful. It would be my recommendation that the Commission consider exceptions should those conditions exist, exceptions to the existing rules so as to permit an operator who finds some presence of gas in that area to include that gas within the designated limits of the Dakota producing horizon. I agree, as did Mr. Loliet, that there appears to be no injury that would be encountered were we to expand the Dakota interval limits to include the interval 50 feet above the base of the Greenhorn, and I think that the question could be resolved either by amending the interval designation or by granting an exception should that appear appropriate.

Q Can you think of anything else you would like to add to your testimony in this case?

A Yes, there is one other thing. In my testimony in Case 1508 and 1523, I testified as to my attempt to correlate the permeabilities within the Dakota reservoir and the Mesaverde reservoir. We found that there was great varity of permeability but based on the average, we found that in each reservoir it was between four and five millidarcies. I attempted to make a similar comparison for the wells within and surrounding, immediately surrounding the Angels Peak-Dakota Pool and found out that I was unable to do so. To determine why I investigated and found that the core analysis within the Angels Peak-Dakota Pool and in the area immediately surrounding are plug core analyses. By plug I mean that from the cores were taken plugs of approximately an inch diameter and those plugs were analyzed to determine the porosity, interstitial water content, and permeability. Those appear to very satisfactorily provide data on porosity and interstitial water, but do not provide data on permeability. I checked to the best of my ability on the older cores for areas outside the Angels Peak-Dakota area and apparently the core analyses were made on the entire area. Now, there is a variation in what you will find under those conditions when testing the Dakota reservoir because we find that the Dakota reservoir exhibits considerable fracturing, and permeability taken on an entire core will normally show greater permeability as caused by the fracture system than would a plug which would be taken from the matrix proper. To show that that condition of fracturing

exists within the Angels Peak-Dakota Pool, I would like to read to you some notes on the core analyses for the Sunset International Petroleum Corporation's Citro-Kutz No. 1 "F", the one well within the Angels Peak-Dakota Pool limits, located in Section 16, 27 North, 10 West, San Juan County. They have reported one foot intervals between 6403 and 6410 feet, and they report for each interval consecutively. No fractures for the first interval, vertical fractures, vertical fractures, vertical fractures, vertical fractures, vertical fractures, no fractures, and vertical fractures. They also cored and reported the interval 6410 feet to 6413 feet, and consecutively here are the notes that they made: Vertical fractures, vertical fractures, no fractures, no fractures, no fractures, no fractures, no fractures, no fractures, horizontal fractures, no fractures, no fractures, vertical fractures, vertical fractures, vertical fractures, vertical fractures, vertical fractures, vertical fractures, vertical fractures, no fractures, and no fractures.

My conclusion is that throughout the major portion of the interval cored, that vertical or horizontal fractures were exhibited in the cores recovered, so I think that we must not place too much regard to the permeability indicated for the core analysis within the Angels Peak-Dakota Pool. I think as an example -- Well, we've all heard that the proof of the pudding is in the eating. Well, I believe within the Angels Peak-Dakota Pool, the proof of the permeability is in the production,

and I have indicated to you through my testimony the producing ability of the wells within the Angels Peak, which indicates to me at least as good producing characteristics as the wells outside the Dakota reservoir.

I believe that's all.

Q Now, you stated that there has been no opportunity to conduct actual interference tests?

A No, I did not state so, but that is true. To my knowledge, there has been no attempt nor has there been time for adequate production to conduct interference tests within the Angels Peak-Dakota Pool area.

MR. WHITWORTH: That's all.

MR. PORTER: Any questions of Mr. Woodruff? Mr. Utz.

CROSS EXAMINATION

BY: MR. UTZ:

Q Mr. Woodruff, your reservoir data sheet here, what exhibit is that?

A I didn't offer it as an exhibit, I just offered it for information purposes. We will make it an exhibit if you desire it be done.

Q As long as it is a matter of record I don't care myself. Opposite your column of average initial potential, three-quarter inch choke volume, was that a three-quarter inch absolute open flow, or was that actual open flow volume?

A No, sir, it is the actual volume produced through

the three-quarter inch choke.

Q So it is not corrected to any standard pressure?

A That is correct.

MR. UTZ: That's all I have.

QUESTIONS BY MR. BURROUGHS:

Q What is the approximate cost of a well completion?

A A well drilled to and completed in the Dakota reservoir will average about $135,000 if there is no difficulty encountered.

Q Would you estimate the pay out time on that.

A I can make some calculations if you would like for me to do so.

Q No, that is not necessary, just an approximation.

A I would say that, based on a continuation of the average deliverability characteristics exhibited by these wells initially, that an average well will probably take ten years or better to pay out assuming that it has a 320-acre reserve. I don't think the average well on 160 acres would ever pay out.

MR. BURROUGHS: Thank you.

MR. PORTER: Mr. Woodruff, what would you recommend for the wells which are already drilled off pattern?

A Well, it is my recommendation that this area be included within the coverage of your previous Dakota rules or your existing Dakota Rules, which give exceptions to all wells which were drilled prior to the existence of the order. Now, all except two of the

nine wells within the designated limits of the Angels Peak Pool were drilled on 320. There are two wells drilled on 160, which would need such an exception.

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

(Witness excused.)

MR. PORTER: Anyone else desire to present testimony in this case? Any statements?

MR. NEWMAN: If the Commission please, on behalf of Pan American Corporation, Pan American urges the approval of the application of El Paso. Pan American's engineers are of the opinion that when additional data is available after development is made and proved, that the optimum unit area should be 640 rather than 320. We certainly think it should be at least 320. If the data shows that it should be 640, we presume the Commission docket will be open. We urgently request approval of this application to prevent the drilling of any unncessary wells.

If the Commission please, I am also authorized on behalf of Weaver and Brown, who have the two wells drilled in this pool on 160-acres, they have three wells in the one section, authorized to state for them that they approve the adoption of the application, approval of the application for El Paso so long as the stated exception for the previously drilled wells is included in there.

MR. GORDON: With the permission of the Commission, I would like to make a statement.

MR. PORTER: You may go ahead.

MR. GORDON: Joseph C. Gordon with Three States Natural Gas Company. Three States is not represented by an attorney.

MR. PORTER: That's all right, you can state your company's position.

MR. GORDON: All right, sir. Three States is the operator of the discovery well in the Angels Peak Field and also has substantial interest in other wells that are operated and are now being completed in the field, and we concur with El Paso Natural Gas Company and urge that the 320-acre spacing be put in effect in the Angels Peak-Dakota field.

MR. PORTER: Anyone else have anything to say in this case? Take the case under advisement.

MR. PAYNE: Mr. Commissioner, pardon me, but we have received communications from three companies which concur in El Paso's application. Sunset International Petroleum Corporation, Southern Union Gas Company, and Kingwood Oil Company. These statements will be included in their entirety in the record.

MR. PORTER: If nothing further in this case, take the case under advisement and take up next Case 1526.

John B Nunn, representing Sunset International Petorleum Corporation.

The Commission may have noted that El Paso Natural Gas Exhibit, the ownership map, reflects a substantial change from the ownership mappresented at the October 15, 1959 hearing. This is the result of an acreage exchange which has been agreed upon to eliminate the checkerboard of 160-acre tracts that previously existed and to clear the way for 320-acre operations.

With the ownership problem solved, Sunset International Petroleum Corporation is in a position to support 320-acre spacing.

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George Verity for Southern Union Gas Company.

We concur and adopt the position of El Paso Natural Gas Company in this case and urge the Commission to grant the application.

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Gentlemen:

RE: Case No. 1599, Application of El Paso Natural Gas Company for 320-acre spacing, Angels Peak-Dakota Gas Pool, San Juan County, New Mexico.

The caption application is set for hearing on February 18, 1959. Kingwood Oil Company has completed a producing gas well in Section 22, Township 28 North, Range 10 West; has interests in other lands in the area; and contemplates additional drilling therein.

Since Kingwood will be unable to have a representative present at the hearing, the pupose of this letter is to urge and recommend strongly to the Commission adoption of 320-acre spacing for the Angels Peak-Dakota Gas Pool, as requested by El Paso Natural Gas Company. We believe that any spacing on a pattern less than 320-acres would result only in physical and economic waste and would have an adverse effect upon the correlative rights of royalty and working interest owners in the area, as well as the State of New Mexico.

In view of the fine conservation record you have established in New Mexico, we sincerely hope that your findings in this case will be consistent with such record; however, should you order spacing upon a basis less than 320-acres, then we request and would recommend that such order restrict the horizontal limits of the Angels Peak-Dakota Gas Pool to its presently defined boundaries and that you eliminate entirely application of the state-wide one mile rule to this particular pool.

Very truly yours,

Kingwood Oil Company

(s) C. A. McKenzie, Attorney.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

We, Jerry Martinez, and Joseph A. Trujillo, Notaries Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by us in Stenotype and reduced to typewritten transcript, and that the same is a true and correct record to the best of our knowledge, skill and ability.

WITNESS our Hands and Seals this 24th day of February, 1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Jerry Martinez
NOTARY PUBLIC

My Commission Expires:

Jan 24, 1960

Joseph A. Trujillo
NOTARY PUBLIC

My Commission Expires:

Oct. 5, 1960