BEFORE THE
OIL CONSERVATION COMMISSION
Farmington, New Mexico
October 13, 1960.
Regular Hearing

IN THE MATTER OF

CASE NO. 2095

TRANSCRIPT OF PROCEEDINGS

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IN THE MATTER OF:	
APPLICATION OF THE OIL CONSERVATION COMMISSION on its own motion to consider prorating the gas production from the Dakota Producing Interval, San Juan and Rio Arriba Counties, New Mexico.	CASE NO. 2095

BEFORE:

John Burroughs, Governor, State of New Mexico
Mr. A. L. Porter, Jr., Secretary-Director
Mr. Murray Morgan, Land Commissioner

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: We will take up Case 2095, and at the outset, I would like to call for appearances in the case.

MR. PAYNE: Case 2095. Application of the Oil Conservation Commission on its own motion to consider prorating the gas production from the Dakota Producing Interval, San Juan and Rio Arriba Counties, New Mexico.

MR. HOWELL: Ben R. Howell and Garrett Whitworth, and associates Mr. Sutin, Montgomery and Federici who have filed a written appearance in the case, representing El Paso Natural Gas Company.

MR. BRATTON: Howard Bratton, appearing on behalf of Humble Refining Company, and also appearingin association with Mr. Miller Carr, attorney from Texas, appearing on behalf of Delhi

Oil Corporation; also appearing in association with Mr. E. E. Fogelson, member of the Bar of the State of Texas on behalf of International Oil Corporation.

MR. VERITY: George Verity, appearing for Southern Union, and also in conjunction with Mr. Quillman Davis of the Texas Bar for Aztec Oil.

MR. CONDRA: For Pan American Petroleum Corporation, C. G. Condra, and Guy Buell.

MR. GAETJENS: Paul Gaetjens, we will appear for Texaco. We will have only a closing statement, and will not present any direct testimony.

MR. PORTER: Anyone else desire to make an appearance in Case 2095?

MR. TRUEBLOOD: Harry E. Trueblood, representing Consolidated Oil and Gas Company. I am not a member of any Bar; I know quite a bit about the Dakota formation. I would like to make an appearance.

MR. PORTER: Mr. Bushwell.

MR. BUSHWELL: H. J. Bushwell, appearing on behalf of Amerada. We will just make a statement; no testimony.

MR. HALEY: H. D. Haley, Continental Oil, District Superintendent from Durango. We wish to make a statement in the latter part.

MR. BERNARD: Frank Bernard, appearing for British American Oil Company. I have a statement; no testimony.

MR. HOLLAND: A. G. Holland, representing Caulkins Oil Company. We have no testimony to present; we would like to make a statement.

MR. POPP: Tom Popp, representing Sunset International Petroleum. I am here to make a statement.

MR. PORTER: Any other appearances?

MR. PAYNE: Oliver Payne, representing the Oil Conservation Commission. We propose to call two witnesses. I would like to have a 5-minute recess so we can post the exhibits.

MR. PORTER: We will take a short recess.

(Recess.)

MR. PORTER: The Hearing will come to order, please, and the Commission will be represented by Mr. Payne.

MR. PAYNE: I have two witnesses, Mr. Utz, and Mr. Arnold.

MR. VERITY: Prior to the presentation of evidence in this case, in behalf of Southern Union we believe there may be some technical and legal problems with regard to it, and Southern Union wants to be certain of two things: That they have proper opportunity to present evidence in support of their progress, and also that the notice and scope of the Hearing is broad enough to permit it. As late as Friday of last week, Southern Union has obtained information from shut-in wells which indicates that there is positive evidence of drainage in the Dakota Interval in excess of 640 acres. The same evidence causes them to have great question

as to whether or not the reservoir justifies their drilling more than one well to 640 acres. We are of the opinion that we need a little more time to study the information that has so recently become available to us.

We are also aware of the fact that other individuals are making studies on the reservoir characteristics in the Dakota, and this information needs to be presented after it has a proper analysis of the study.

Now, we think that it is necessary we have a time of 60 days in order to further analyze information, so that we can make a proper request, and make the Commission aware of the information we have, which indicates that there is drainage, and that the Commission should permit a period of twelve months within which further studies and interference tests could be made. The idea in mind, by coming out with the order, that would permit those individuals who wanted to drill on 320 acres to do so; and also permit those individuals who felt that one well to each 320 was not justified, to drill one well to 640 acres, and have a double allowable thereon.

Now, Southern Union does not insist this matter be heard in this cause, so long as it is definitely understood that the matter could be taken up under another Cause and another Hearing. We are of the opinion that it is a proration question, and not a spacing question; but as I said before, we do not insist that it is heard at this Hearing, so long as the Commission, and anyone who might

object, would not object to it being set down and heard under another docket and possibly a broader notice.

MR. PAYNE: Mr. Verity, if the Commission decides to prorate gas production from the Dakota Producing Interval, the initial proration period would not start till February the first of next year. Thereafter, if you so wish, we will advertise the case in December for the proper size of proration units in the Dakota.

MR. VERITY: I believe that would be satisfactory, and then we would be given opportunity at that time to present evidence, after further study, at which time we would request a temporary order for a period of twelve months, which would give permission for transfer of allowables, and conducting proper investigation and further reservoir study. If it were docketed under Proration Notice, it seems to me it would be proper, but certainly if there is any objection to it, we think it should be made at this time, and we should be given opportunity, either in this case, or in another case, without objection to present our point.

MR. PAYNE: We will docket a separate case for December regular hearing.

MR. PORTER: As I understand it, Mr. Payne, this case will be set down upon application by Southern Union, and not upon the Commission's own motion.

MR. PAYNE: That is correct.

MR. VERITY: We don't have any objection to filing an

application to it. The point I feel I must insist on, I feel it should be absolutely clear and understood on the part of the Commission and anybody that might object to it, is that it can't be said at that time that we should have presented our evidence at this Hearing and we have lost our day and our opportunity because we did not do so.

MR. PORTER: As I understand the situation, this case today concerns proration. The matter which you raise concerns spacing.

MR. VERITY: We do not so agree, Your Honor. It is our position that when you start prorating the Dakota gas interval, that the question of whether or not you are going to allow two allowables to one well that is dedicated on 640 acres, is a proration question, and this was exactly the reason I wanted it clear. If you insist that we must present it at this Hearing, then we think we must have a continuance in order to do so. We don't care whether we present it here, or at another docketed case, we want it understood that we -- our position is that we are presently considering a proration question and prorationing theory, and a prorationing request for relief and for an order; and so we don't want it said sixty days from now, we should have presented our position here, because that was the proration here, and therefore we couldn't present it.

MR. PAYNE: It wouldn't be so said, Mr. Verity.

MR. PORTER: Do you intend to request a proration formula?

MR. VERITY: We intend to request that the Commission grant, as a part of the prorationing order, that on a temporary basis of twelve months, the Commission permit any operator or operators in the pool, who desire to drill one well to 640-acre section, to take a double allowable thereof, twice the allowable you give for 320-acre proration units; and further, we think in order that this can be demonstrated more clearly and more certainly throughout the entire pool, we should have twelve months in which to run interference tests, and transfer the allowable so the point can be made as definite throughout the pool. We think it is now in the area where we have our interference information.

We do want the Commission to understand that we think we have a prorationing question, not a spacing question.

MR. PAYNE: Again, I would point out, if the Commission decides to prorate gas from the Dakota Producing Interval, the initial proration period would not start until February 1st, 1961. We will docket a case upon your request for spacing and prorationing units in the Dakota, prior to that time.

MR. VERITY: This is entirely all right; if the Commission so desire, we will file an application.

MR. PAYNE: All right, sir.

MR. PORTER: Mr. Payne, will you have your witnesses stand, please?

(Witnesses sworn.)

MR. PAYNE: Mr. Utz, will you stay and take the stand,

please?

*****

E L V I S U T Z, a witness, called by the Applicant, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PAYNE:

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

A Elvis Utz, engineer with the Oil Conservation Commission.

Q Mr. Utz, how long have you been employed by the Oil Conservation Commission?

A About eleven and a half years.

Q What has been your title during that period of time?

A Gas engineer.

Q You are familiar with gas prorationing as it is worked in the San Juan Basin, Mr. Utz?

A Yes, sir.

Q You are also familiar with the case that has been called here today to consider proration from the Dakota Producing Interval?

A Yes, I am.

Q Have you made any studies in connection therewith?

A I have made some comprehensive studies in regard to this.

Q Why do you feel, Mr. Utz, it desirable to prorate gas production from the Dakota Producing Interval?

MR. PORTER: May I interrupt? I meant to announce the

allowables. The Commission has arrived at a decision in the allowable cases, and the normal unit allowable for the Southeast for November will be 34 barrels; for the Northwest,it will remain at 70.

Q (By Mr. Payne) Mr. Utz, would you please give us any comments you might have on the need for prorating gas production from the Dakota Producing Interval?

A I have a short statement, which will probably cover the whole situation, as far as my opinion is concerned:

One of my duties as Gas Engineer for the Commission is to make periodic studies of non-prorated gas pools as well as prorated gas pools in order to observe the effect of gas proration. As a result of these studies I have observed that gas pools that are not prorated invariably show a far greater degree of unratable takes between wells than do prorated pools. Probably the main reason for this occurrence is that with proration the operators and purchasers have allowables to produce against.

I have made a comprehensive study of gas takes in the Dakota area of San Juan and Rio Arriba Counties, New Mexico. This study indicates that gas proration is needed for the Dakota wells in San Juan Basin. I therefore recommend that the Commission order gas proration for all Dakota wells in the area designated for 320-acre Drilling Units and proration units by Commission Order R-1287 and 1287-A in order to protect correlative rights and prevent waste.

I further recommend that proration begin February 1, 1961, and that Purchasers submit Preliminary Nominations for the Dakota, not

later than December 9th, 1960.

That concludes my prepared statement.

Q Do I understand correctly, Mr. Utz, you feel that it is desirable to prorate the Dakota in order to prevent waste and protect correlative rights?

A That is right, yes, sir.

MR. PAYNE: Thank you. That concludes the direct testimony of this witness.

MR. PORTER: Anyone have any questions of Mr. Utz? Mr. Verity.

CROSS-EXAMINATION

BY MR. VERITY:

Q Mr. Utz, If I understand your testimony, there is more gas than there is, that can be produced and is deliverable, than there is market to deliver to the market?

A Yes, sir.

Q Do you have any opinion, or do you know how much more gas there is than market?

A Mr. Verity, I do not have that information available at this time, but according to the deliverability of the wells, there is at least twice as much gas available from the 175 wells which we have made a study of; we have limited it to 175 wells, and all these wells we have deliverability tests as of July 1st.

Q Then if there is double the amount of gas to market on those 175 wells, this factor would be increasing as other wells are

completed and you make deliverability tests?

A It would, assuming that the market demand does not go up in proportion.

MR. VERITY: That's all.

MR. PORTER: Any further questions of this witness?

(No response.)

MR. PORTER: The witness may be excused.

MR. PAYNE: We will call Mr. Arnold.

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E. C. A R N O L D, a witness, called by the Applicant, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. PAYNE:

Q Would the witness please state his full name, his position, and with whom you are employed?

A E. C. Arnold, Supervisor of District 3, of the New Mexico Oil Conservation Commission.

Q Mr. Arnold, how long have you been employed by the Oil Conservation Commission?

A Approximately ten years.

Q Are you generally familiar with gas production from the San Juan Basin?

A Yes, I am.

Q Are you also familiar with how prorationing has worked in the San Juan Basin?

A Yes.

Q Have you made a study concerning the Dakota Producing Interval --

A Yes, I have.

Q -- in connection with this case?

A Right.

Q Now, Mr. Arnold, are you familiar with the application that has been filed here to consider prorating gas production from the Dakota Producing Interval?

A Yes.

Q Mr. Arnold, how many Dakota gas wells are there in the San Juan Basin, as of September 1st, 1960?

A 301 wells as of September 1st.

Q And how many of these wells are connected with gas transportation facility?

A 228 wells were connected as of September 1st also.

Q How many of these wells do you have a deliverability test on file?

A 176 wells.

Q What is the average deliverability of these 176 wells?

A 1193 MCF a day.

Q 1193?

A 1193, right.

Q What is the average deliverability of the wells whose deliverability is in the range of 200 MCF per day to 3,000

MCF per day?

A 975 MCF PER DAY.

Q What is the average deliverability tests of the wells whose deliverabilities are in the range of 200 MCF per day to 2,000 per day?

A 788 MCF per day.

Q Mr. Arnold, have you made a general comparison of the Dakota Producing Interval, as to the Mesa Verde formation?

A Yes, testimony in 1508 and 1523 pointed out several similarities between the Mesa Verde formation and the Dakota formation, which I will repeat here. The average porosity, as testified to in those cases, is 7.2 percent for the Dakota formation, 9.1 percent for the Mesa Verde formation; average interstitial weight 30.6 percent for the Dakota formation, 28.6 percent for the Mesa Verde formation; average net pay feet, Dakota formation 40 feet, Mesa Verde formation 51 feet. These are very similar reservoirs insofar as rock characteristics range in deliverability producing capacity, and ratio of reserves between individual tracts.

Q Mr. Arnold, in this case at this time, you are not recommending the proration and/or spacing units be changed from those established in Order R-1287, are you?

A No.

Q Now, Mr. Arnold, have you prepared exhibits which show the areal extent and general characteristics of the Dakota formation in San Juan and Rio Arriba Counties?

A Yes, I have.

Q Would you please refer to Exhibit 1, and explain to the Commission what that shows?

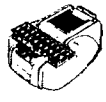
A Exhibit Number 1 is a map of a portion of the San Juan Basin. Shown on this map are all wells which have penetrated the Gallup and Dakota formations. The Dakota producing wells are shown in small squares --The wells which have penetrated the Dakota are shown with small squares; whether or not they are producing is shown with the appropriate symbol inside the square. I have also outlined with a shaded red line the approximate present limits of production from the San Juan and Rio Arriba Counties. Also shown thereon are traces of cross-sections which are Exhibits 2 through 7.

Q Referring to Exhibits 2 through 7, Mr. Arnold, would you explain what they show?

A Exhibits 2 through 7 show generally that the Dakota formation is a blanket type deposit, which is present throughout the major portion of San Juan and Rio Arriba Counties. Marked upon these exhibits are the formation tops, the top of the Gallup formation, the top of the Graneros, the top of the Greenhorn formation, and the top of the Dakota formation.

Q What is the most reasonable marker on those exhibits, Mr. Arnold?

A The most reasonable marker is the Greenhorn, which has very similar electrolog characteristics throughout the Basin.



Q Mr. Arnold, do these exhibits also show the perforated intervals and the pressures?

A Yes, they show the perforated intervals, the pressures, the original open flows, and whether or not the well is a producing well as in every case indicated.

Q Do you have anything further you would like to present, Mr. Arnold, in connection with these exhibits?

A Would you like me at this time to discuss these exhibits individually?

Q Yes, sir.

A The Tubbs Cross-Section D, that is indicated by red tracing on Exhibit 1, this is a North-South section.

Q That is Exhibit 2, Mr. Arnold?

A Yes.

Q Begins in Southwest quarter of Section 18-32 North-6 West, and ends in the Northeast quarter of Section 10-24 North-6 West. All the wells are productive with the exception of the San Juan units 286, Number 98 in the Northeast of Section 3-29 North-6 West, which is this one (indicating). This is a North to South section, it indicates a basinward dip, and shows the producing areas at the Southwest limits of the San Juan Basin.

Exhibit Number 3 is Cross Section B, B-Prime, it is indicated on Exhibit 1,as the original line begins in the NE¼ of Section 36, 32 North, 13 West, on the North end, and ends in the NE¼ of Section 20, 26 North, 12 West on the South end. All wells on this section

are productive with the exceptions of El Paso Number 1 well, which is the most southerly well on this section, it is probably beyond the productive limits of the Southwest.

You will notice on all these sections, there is a generally threefold division in the Dakota formation. There are three generally sandy zones separated by Coleman shale. They are recognizable throughout the Basin, however, it is much more difficult to correlate individual sand bodies within these sand zones on a regional basis. However, I am going to refer to the three zones as the "A", "B", and "C" zones; the "A" zone being the upper Dakota, the "B" zone immediately below it, and the "C" zone is a lower zone.

Q So you are not saying there are only three Dakota zones, there are some sands present in between these "A", "B", and "C" zones, are there not?

A There are producing zones, there are individual sand units within these zones, several of them, yes.

Q Thank you.

A And it is the individual units which are very difficult to correlate on the regional basis, because they merge with each other. This section also shows basinward dip from North to South. One other thing I did want to say, the "A" zone is predominantly the productive zone in the section. This is toward the West side of the Basin where the "A" zone is the predominantly productive zone.

Section C-C Prime, Exhibit Number 4, is the Southwest -- the Northeast section, which is shown on Exhibit Number 1 with the blue line. It begins in the NE¼ of Section 27, 29 North, 14 West, and ends in the NE¼ of Section 26, 32 North, 6 West. Both the "A" and "B" zones are productive toward the Southwest end of this section, with the "A" zone being predominantly productive zone. The "B" zone is the main producing zone toward the Northeast end of the area covered by this cross section.

You will also notice the section on these sections marked as the Graneros and Dakota Interval. Well, this is included within the vertical limits of the Dakota producing interval, as set out in Order R-1287. It is a little bit different type deposit than most Dakota, being an off-shore bar deposit, it has a rather spotty appearance, it is not present in such a widespread range. You will notice that on the Southwest end of Section C-C Prime, sandstone is developed in the Graneros section; whereas, on the Northeast end of this section, we have a shale section with no sand developed.

Section D-D Prime is a West to East section, beginning in the SW¼ of 13, 27 North, 13 West, and ending in the SW¼ of 14, 27 North, 4 West. All wells on this section are productive with the exception of the San Juan unit, El Paso San Juan Unit 27-4, Number 22, which is the easternmost well on this section. This well did gauge 150 MCF of gas from the Dakota, but was not thought commercially productive. The "A" zone on this section again shows

to be continuous from the West end of the section at least as far East as Township 27 North, 8 West. From that point on, it may be traced, however, to the very tight and probably not very productive. The "B" zone again is the predominant producing sand on the East end of this section.

E-E Prime is another North to South section, beginning in the NE¼ of Section 10, 31 North, 11 West, and ending in the NE¼ of Section 28, 25 North, 9 West. The "A" sand is continuous, or the "A" zone is continuous across this cross section, and is the main producing sand. The "B" zone is productive in spots. You will note again the Graneros sandstone is again developed in the Graneros shale interval, particularly on the South end.

Section F-F Prime is a Northwest-Southeast section, beginning in the SW¼ of Section 20, 31 North, 12 West, and ending in the NE¼ of Section 9, 24 North, 4 West. This section is generally on the structure-like strike of the Basin. All wells are productive of gas from the Dakota interval, with the exception of Henson-Sheer Number 3 on the Jicarilla, which is the most southeasterly well on this section. This well "D" was originally completed as a producing well in the Dakota, but it was not plugged back to the Gallup, and is a producing oil well. Again you will notice the "A" zone is predominantly producing. The well to the Northwest that is in the central section, both the "A" and"B" zones are productive, and toward the eastern part, the "B" zone is the main productive interval. The Graneros sandstone is also well developed toward

the East end of this section.

Q Mr. Arnold, would you summarize briefly for the Commission, what Exhibits 2 through 7 show for the purpose of this Hearing?

A They show that the Dakota formation is present as a blanket deposit throughout a major portion of the San Juan-Rio Arriba Counties. It also shows it is productive of gas in the common stratographic reservoir also in the major portion of this area.

Q Mr. Arnold, in general terms would you describe the characteristics of the Dakota Producing Interval, explaining what controls the accumulation of gas, and also explain why there is such a wide diversification of the producing characteristics of the wells in the Dakota?

A As I testified previously, the Dakota may be described as a series of sands, separated by intervening shales and coals. A threefold division can generally be made on original bases. On the regional, however, individual sand units within these sands, are very difficult to correlate the regional bases. The thickness of the Dakota formation production ranges from 200 to 325 feet; however, for purposes of this Hearing, the Dakota formation, or Dakota Producing Interval, when referred to, shall mean the vertical limits as set out in Order R-1287 and 1287-A, which is a 400-foot section, which is based on the Greenhorn limestone and extending downward 400 feet.

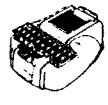
There is an extreme porosity and permeability variation in

the Dakota sandstone throughout the Basin. This was a controlling factor in the accumulation of oil and gas, and it also affects reserves under individual tracts and producing capacity. These variations are due to primary and secondary factors. The primary factors have to do with the depositional environment at the time the Dakota formation was deposited. The Dakota was deposited on the unstable shelf which was fluctuating from moderate marine to swampy conditions.

There is almost every conceivable variation in grain size, angularity of grain sand, sorting of sands, all of which affect porosity and permeability. There were also secondary factors which affected porosity and permeability in the Dakota sandstone. Petrographic analysis made of the Dakota sand has shown that regeneration has occurred in various areas of the San Juan Basin. Regeneration is a crystallization of silica, around individual sand grains. When this happens, it fills the porosity and depletes permeability, and that may explain why we sometimes get dry holes in areas where you would not expect it, from the general stratographic position, that it would produce. Also, it may be explained the individual variation between production rates of offsetting wells.

Q Mr. Arnold, as I understand it, you are proposing to the Commission that they prorate gas production from the Dakota Producing Interval, wherever it might appear in the San Juan and Rio Arriba Counties?

A That's correct.



Q Why do you recommend that in view of the fact there are large areas in both Counties that have presently not been proven productive or unproductive?

A I would recommend that because the boundaries of the various sand units within the Dakota formation are extremely vague; they merge and inter-finger with each other, and this makes pool definition unpractical if not impossible. There is also widespread evidence of vertical fracturing, which would have the effect of inter-connecting various sand units in the Dakota formation. There has also been no evidence of the elongated permeable and impermeable trends that we have in the Pictured Cliffs formation in the San Juan Basin; there doesn't seem to be any particular pattern to the discontinuities. Therefore, it makes it very difficult to say where one particular pool would end, and another would begin; they actually overlap and inter-finger with each other.

Q From an administrative standpoint, are there any advantages to prorating the Dakota Producing Interval as one common source of supply?

A Yes, from an administrative standpoint the first advantage I can find, it would be the wildcat well producing oil. Commission rules say that any well which is drilled more than one mile away is a wildcat well. We are continually having wells in the Dakota formation which are several miles from pool boundaries, which are still obviously wells in a common reservoir with established pools. The only way we can prorate those pools is either

to establish a new pool, or to extend an existing pool; and many times if you have to make a classification of one of those wells, it is difficult to know which pool you should extend to pick up the new well.

Q Now, in connection with this, Mr. Arnold, what do you recommend as horizontal limits of the Dakota Producing Interval?

A I would recommend the horizontal limits be defined the same as in our R-1287-A, which is San Juan and Rio Arriba Counties, with certain exceptions, those being Ute Dome and Barker Dome.

Q Barker Creek?

A Barker Creek Dome; also any oil wells are excepted by the terms of that order.

Q Why would you recommend the Barker and Ute Dome pools be excepted from this order?

A I believe that Barker Creek Dome and Ute Creek are structural traps, and are part of this stratographic reservoir. They have also produced for a number of years; in fact, I think both areas have been used as storage areas.

Q Now, if evidence was presented at a later date that there was a separate and isolated Dakota pool, would you propose then to accept that particular pool from the general Dakota Producing Interval?

A That is right. Any time an operator feels that in a particular area he can prove separation, and he feels the need to do so, the matter could be brought to hearing. However, in the

interim period, if he was improperly classified, so long as we prorate the reservoir, with one reservoir, with one formula, there is no one going to be hurt from improper classification in the meantime.

Q Mr. Arnold, what would you recommend as vertical limits of the Dakota Producing Interval?

A Also the same vertical limits in Order 1287, which is 400-foot section extending downward from the base of the Greenhorn formation.

Q Do you have a name that you would like to propose for this pool, other than Cha-Cha Dakota?

A I don't like to appear dull. I believe I would recommend the Basin Dakota.

Q Basin Dakota?

A Yes.

Q Now, Mr. Arnold, for the present at least, would you propose to incorporate the spacing provisions as contained in our R-1287?

A Yes, sir, I would.

Q Now, is there any problem in the Dakota Producing Interval of oil well-gas well definition?

A There hasn't been up to the present time. There are, however, approximately nine or ten wells which are classified as oil wells and prorated as oil wells, completed in the Dakota Producing Interval. Seven of these are located on the extreme Southeast

end of the area. And there are three wells located in Township 25 North, Range 9 West, that are equally completed in the Graneros sandstone section.

Q How far are these from gas producing wells from the Dakota?

MR. BRATTON: It is a little hard to hear with the air conditioning on; if the witness would speak a little louder, we would appreciate it.

A These oil wells, at the present time, are located several miles from the nearest gas production; and in relationship between the oil and the gas, as of the present time, is a little bit vague. However, we are not going to affect these oil wells in any way at the present time by prorating gas production.

Q (By Mr. Payne) Inasmuch as the gas wells are presently producing at their capacity, and can produce at their capacity?

A That is right, and the oil wells are, as oil wells, under the statewide rules with the oil allowable.

Q Now, assuming this did eventually become a problem, Mr. Arnold, what would you propose?

A Well, if it developed that these areas were completely separate from the gas area, then it might be preferable to establish pools; if it developed this oil is actually in the same reservoir as the gas, then we would have to develop a gas-oil well definition, as we have in some Dakota reservoirs.

Q Would you propose that a committee be appointed to study

this problem, if it should turn into a serious problem?

A I think that would be a good idea.

Q What do you propose as gas allocation formula for your proposed Basin Dakota Pool?

A I propose we use a 75 percent acreage times deliverability, 25 percent acreage formula, the same as has been used in all other prorata dry gas reservoirs in Northwestern New Mexico. I would recommend some modification, which I will elaborate on.

Q All right, sir, is their formula approved, generally acceptable in the Pictured Cliffs and Mesa Verde?

A That's right; it has operated well in those pools, and there is a similarity certainly between the Dakota reservoir and both Pictured Cliffs and Mesa Verde, so far as rock characteristics, producing characteristics, deliverability range, and so forth.

Q Mr. Arnold, what modifications would you suggest?

A Well, as I pointed out, the 75-25 formula has worked very well on 90 percent of the wells in our other reservoirs; there are exceptions, which are the extremely large deliverability wells which vary many times from average conditions. Those particular wells I do not believe in some of our other pools have produced in accordance with their reserves, and to prevent this happening in the Dakota formation, I think we should consider establishing a maximum allowable to prevent that.

Q Do you feel then, in the case of these extremely high deliverability wells, that the general correlation between deliver-

ability and recoverable reserves breaks down?

A Yes, the reserve-deliverability relationship is based mainly upon the fact that net pay thickness and deliverability increased together; also upon the fact permeability-deliverability increased together, and there is a relationship between permeability and porosity. This relationship between permeability and porosity is not a direct relationship; I believe that in some instances it becomes even less direct. I am thinking particularly of local fracked areas, where a well is completed and the frack increases the permeability many times without changing the porosity appreciably. I think that to handle wells which may be completed in that type zone, we do need a maximum allowable.

Q Mr. Arnold, inasmuch as we have no production history under proration from the Dakota, how would you propose to apply any minimum or maximum?

A I would propose that we write an order to prorate gas, and prorate for a 3-month period; under the 75-25 formula, without use of the maximums or minimums, in order to secure production information. That production information will then be available by the end of the fourth month; and during the fifth month I would recommend another hearing be called, at which time the Commission could take testimony relative to establishment of maximum allowables, and also possibly minimum allowables, after we have found how the formula will operate in the pool at that time.

Q In other words, you would propose that a hearing be held

again, at which time operators could present their views as to what the maximum allowables should be, and the minimum if either is necessary?

A That's right.

Q Now, Mr. Arnold, in regard to pool rules for the proposed Basin Dakota Pool, how do you suggest that be handled?

A I do not believe that there would be any changes to Order R-1670, which is the general gas well order for Northwest New Mexico, with one exception. That is in Paragraph 16-A, and that has to do with the matter of classifying marginal wells. At the present time a well is classified as a marginal well if it fails during a 6-months proration period to make its allowable.

Q In any one month?

A I would have to get the rule; I will have to read it. Just a moment. Rule at the present time reads: "After the production data is available for the last month of each proration period, any well which had an under-produced status at the beginning of the preceding gas proration period, and which did not produce its allowable during at least one month of such preceding gas proration period, may be classified as a marginal well". I would change that to read: "Its average allowable during at least one month of the preceding gas proration period".

Q Leaving some flexibility?

A That's right. It would, if you do it on an average basis, it prevents so much fluctuation back and forth in classification

for one thing.

Q Mr. Arnold, in your opinion is it desirable to prorate gas production from the Dakota Producing Interval in order to prevent waste and protect correlative rights?

A Yes.

Q Your studies so indicate?

A Yes, they do.

Q Do you have anything further you would like to present, Mr. Arnold?

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

MR. PAYNE: That concludes the direct testimony. I would move for introduction of Exhibits 1 through 7.

MR. PORTER: Any objection to those exhibits?

(No response.)

MR. PORTER: The exhibits will be admitted. Anyone else have any questions of Mr. Arnold?

CROSS-EXAMINATION

BY MR. TRUEBLOOD:

Q Have you given any thought in your proration formula, as you are prorationing here, to a relationship between formations, as well as a relationship between wells with any formation?

A Well, I believe that I have, and I have recommended the same formula be used in this formation as in other formations.

Q Is it your opinion -- I hate to bring up the ugly word of "economics", it's one thing we are all in the business of --

Is it your opinion that that formula of 25-75 fairly represents a distribution, or the proper assignment of economics, as between reservoirs? I will restate my question: Do you believe it properly attends to questions of pay-out within individual reservoirs?

A Well, I think that it generally does. It is a little bit hard to know at this point exactly how this reservoir, how this formula will operate in this reservoir, because we don't really know what the total market and total deliverability ratio is going to be over the first proration period. If the market is high enough with respect to the total deliverability,then the acreage allowable would tend to provide a fairly high minimum allowable.

Q That is my only question.

A I do think, in cases where the market becomes so low with respect to total deliverability, that we have too low a breaking point and too small an acreage on the allowable. We do need a minimum allowable to prevent premature abandonment.

Q The allowables are set by the two major purchasers of gas in the San Juan Basin, and they are rather unflexible as to their problems of minimum take or pay, and my question was, do you believe this formula equitably distributes available nominations as between reservoirs? In other words, I will put it another way: The Pictured Cliffs well cost $30,000.00, and Mesa Verde cost $60,000.00; is the 25-75 really equitable, if the Dakota costs $100,000.00, could this 25-75 possibly be equitable between reservoirs?

A It's a little bit hard to relate one reservoir to another, this is a matter of nomination, which is made by the purchaser.

Q But the formula, you could make the formula fit as between reservoirs?

A Even if you changed the formula, the market would be, still be determined by the amount of gas that the purchaser wishes to take.

Q Then it would be distributed equitably, if the individual formulas were equitable, is that not correct, whatever was available, in other words?

A I don't believe I quite follow you, as between reservoirs, if you use --

Q I will rephrase my question: If a billion cubic feet were available to be taken or nominated, if there were a formula derived that would relate as between formations so this billion cubic feet were equitably distributed among these formations, would that not be more practicable instead of disregarding the fact, in the case of Dakota, the Mesa Verde exists, and so on?

A I believe that the Commission has the right, under the Statutes, to prevent discrimination in nominations between pools. However --

MR. TRUEBLOOD: That concludes my questions

MR. HALEY: Haley, Continental Oil. I have a few questions.

QUESTIONS BY MR. HALEY:

Q Mr. Arnold, if I understood you correctly awhile ago, there is no proposal to reclassify any existing Dakota oil wells as gas wells, or any definite limit as to what might be the difference between an oil well and a gas well?

A I wouldn't propose to reclassify any wells to gas wells at the present time.

Q In other words, at this time you don't have under consideration say, a gas-oil ratio limit of some figure that might call an oil well or gas well?

A No, sir, I don't have any figure for that; I think it might be a good idea to study that problem, in case it arises.

Q The reason we ask the question, we are currently developing a series of oil wells that possibly will have a high gas-oil ratio and we are basing our economics, as I think someone has mentioned the new proposal for this order will in no way limit those, that is what I wanted to be sure.

A No, they won't.

MR. PORTER: Any other questions of this witness?

REDIRECT EXAMINATION

BY MR. PAYNE:

Q Is it your opinion there is a general correlation between the deliverability of the gas wells in the Dakota Producing Interval, and recoverable reserves under the tracts dedicated to the wells?

A That is my opinion.

Q You mentioned a minimum and maximum, what do you propose tentatively for that minimum and maximum, by recognizing the fact you are not proposing that any such minimum and maximum be placed in any order that issues out of this Hearing?

A Tentatively, I have determined that I think the minimum should be about 200 MCF per day, or six million a month; I also believe the maximum should be established at about 2,000 MCF per day, or sixty million MCF per month.

Q How did you arrive at those figures, Mr. Arnold?

A I believe as much as anything else for arrival at the maximum, I looked at the overall possible production in the Blanco-Mesa Verde pool, I found that there are approximately thirty wells in the Blanco-Mesa Verde pool, which had an average daily production during 1959 in excess of one million -- maybe I better keep this on an MCF basis -- had an original daily production in excess of 1500 MCF per day, and there were not over 15 wells out of 1790 wells which had an average daily production of over 2,000 MCF per day. And actually it would be those few wells which I would intend to control with the maximum allowable. I made the presumption that the range of deliverability and the range of reserves was about the same in the Dakota formation as in the Mesa Verde formation.

Q If such a maximum were sustained at a later date, do you feel it would actually be tied to the recoverable reserves?

A Yes, sir, I feel that could be justified.

Q What is the basis of your minimum figure, is that economics?

A Yes, sir, that's right, just to prevent premature abandonment of wells.

MR. PAYNE: Thank you.

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

(No response.)

MR. PORTER: You may be excused.

(Witness excused.)

MR. PORTER: Mr. Payne, does that conclude your testimony?

MR. PAYNE: Yes, sir, that concludes my testimony.

MR. PORTER: Does anyone else desire to present testimony?

MR. HOWELL: Ben R. Howell of El Paso Natural Gas Company; we would desire to present one witness.

MR. PORTER: Have your witness come forward and be sworn.

(Witness sworn.)

*****

D A V I D H. R A I N E Y, a witness, called by El Paso Natural Gas Company, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. HOWELL:

Q Will you state your name for the record?

A David H. Rainey.

Q By whom are you employed, and in what capacity?

A El Paso Natural Gas Company as Administrative Assistant in the Proration Department.

Q Have you testified before this Commission as an expert witness, and have your qualifications been made a matter of record?

A Yes, sir.

Q I assume the witness is acceptable as an expert witness?

MR. PORTER: Yes, sir, he is.

Q (By Mr. Howell) Mr. Rainey, did you make a study to determine the relationship of the recoverable net reserves in the Dakota Producing Interval, as compared with the initial deliverability of wells completed in that Interval?

A Yes, sir, I have.

Q Will you please state to the Commission, generally, what you did, and the basis that you used in determining the recoverable net reserves?

A Yes, sir. We -- Our Reservoir Department analyzed between approximately 50 and 60 cores on producing wells in the Dakota, and obtained averages of various reservoir factors on a Township and Range basis. If we didn't have a core in the particular Township and Range, we used the averages for the surrounding Townships and Ranges.

Q Let's tie that determination down a minute. Township and Range, by Township do you mean a block containing 36 sections?

A Yes, sir.

Q So let's, in referring to it, call it a Township.

A All right, sir. And in analyzing these cores on the various Townships, they determined weighted average porosity, connote water permeability, and also on the basis of initial completion, dated to the average shut-in pressure for each Township and Range. As I stated, if we didn't actually have core information in the particular Township, we used the average for surrounding Townships to apply to that particular Township. On the basis of that, we took the wells on which we had logs of one kind or another, and determined the net pay thickness on each well on the basis of the effective pay; that is, the pay that was actually open to the well bore. If there were some sections in the Dakota that had not been perforated or opened to production, that section was excluded, so this in effect was a determination of net effective pay. And on the basis of the averages obtained from the pressures, porosity, connote water, and so forth, there was a reserve figure of a reserve per acre foot determined in each Township and Range.

Q Each township?

A Each township. We then, on the basis of the net pay, net effective pay figured in each individual well, calculated a reserve on the 320-acre tract for each well on which we had information. Now, there may be some slight error on some specific wells there, an odd shaped section, an odd sized section; we made an assumption that every well had 320 acres attributed to it. Other than that, on the core volume basis, we believe these reserves are

about as accurate as we can determine, without having pressure histories to determine the actual exact reserves.

We then plotted -- excuse me -- We then tabulated the deliverabilities and reserves by reserve groups, and determined the averages in each reserve group. In other words, from zero to one billion cubic feet of reserves, and one billion to two billion, etc., and tabulated the averages of take in each of those reserve groups; that is what we plotted, and what we call El Paso's Exhibit Number One here. I might point out that the circles represent the averages of wells within those reserve groups, and are not necessarily the same number of wells. For instance, in the range from zero to one billion cubic feet of reserves, only three wells on that behind that dot. In the one to two billion group, there are twenty-two wells. In the two to three billion group, there are thirty-six wells. In the three to four billion group, forty-four wells. In the four to five billion group, there are thirty-four wells. In the five to six billion group, there are eleven wells. In the six to seven billion group, there are five wells. In the seven to eight billion group, there are four wells; and in the last group, which you can see is an out-of-line, is only one well involved.

Q Now, how many wells total are reflected in the tabulation and graph which you have prepared to illustrate your study?

A There are 160 wells total represented here. We had deliverabilities, as such, I believe, on 173 wells.

Q What deliverability was that, was that initial deliver-

ability?

A Yes, sir, that is the initial deliverabilities in each case, so we thought it was a comparable figure between wells.

Q Your purpose in using the initial deliverabilities is to have a figure that was constant all the way through?

A Yes, sir, that was our intent. As I said, we have 160 wells on this graph; however, we had deliverabilities on 173. We threw out 13 of those wells for various reasons. Two of them we had deliverabilities on, and for some reason we did not have copies of the logs in our files; I don't know whether we did not get logs, I did not get copies, and there was no way to determine reserves. The others were thrown out for one of three reasons: First, the well showed, because of its pay section thickness, very high estimated recoverable reserves, and the deliverabilities were not anywhere near in line; for instance, we had one that showed about seven and a half billion cubic feet of recoverable reserves, and deliverability about 200 MCF, we did not feel that was in any way representative of what the deliverability on that well should truly have been. Also, we had about four wells in which the deliverability test that was in our files, was something in excess of what the absolute open flow of the well had been calculated to be, although we did not know whether the open flow or deliverability was more accurate, and did not know which one to attempt to relate to the reserve figures. There are also 23 wells in the group that had initial absolute open flows in the neighborhood of ten to nineteen

million cubic feet, with deliverabilities on the order of 200 to 250 MCF, so we threw those out completely as non-representative, and again not knowing whether the deliverabilities or the open flow was the more accurate figure to use. Of the 173 deliverabilities, we used 160 on this graph.

Q Now, from that study, what do you conclude with reference to the relationship between the net recoverable reserves of gas, and the initial deliverability of the wells completed in the Dakota Producing Interval?

A As can be seen from this graph, there is a very reasonable straight line relationship between deliverability and net recoverable gas. On the basis of that, it is my opinion that deliverability is a very apropos formula to use in this reservoir. It should also be pointed out that the slope of this curve is considerably less than one which would be the case with more than 45 degrees. In other words, the deliverability of the well is more nearly representative of the reserves, the recoverable reserves, than if the curve had been greater than 45 degrees. In other words, there is not as much -- Let me put it another way. The deliverability factor in this reservoir does not give as much weight with respect to reserves, as is being given in many other reservoirs in which deliverability is used as a formula. In other words, to state it again, the deliverability formula here comes more nearly approaching a pool in which we should probably use 100 percent deliverability, than some factor, that might be indicated by an

acreage factor.

Q To put it in another way, would you say this indicates that in this Dakota Producing Interval, the deliverability of the wells does not increase as rapidly as the reserves?

A That's correct.

Q And your graph does show that clearly here by the fact it is a line that doesn't come as high as a 45-degree angle, which would be the result if there was an exact 1 to 1 relationship?

A That's correct.

Q Now, as a result of this study, what would be your recommendation to the Commission as to the allocation formula which would be best for us in the Dakota Producing Interval?

A Well, as I stated, probably this is a good pool to indicate almost 100 percent deliverability; however, in the interest of providing a minimum allowable which seems to be of some concern, it is our recommendation that the stated 75 percent acreages times deliverability, plus 25 percent acreage formula, be used in this pool. In that fashion, the acreage factor in the formula would provide a fairly substantial minimum allowable, in case the well had a very low deliverability.

Q The way that operates is, whatever the market may be, that is going to be taken out of the pool, 25 percent of it is going to go on acreage?

A Yes, sir.

Q And the other 75 percent then would be apportioned between

the wells in this pool on deliverability times acreage?

A Yes, sir.

Q In your opinion, would that formula be effective in preventing waste and protecting correlative rights?

A Yes, sir, I think so.

Q Do you have any other statement you wish to make with reference to the proposed rules?

A No, sir, I believe not. I think we generally concur with the Commission's recommendation that the rules be in accordance with the standard proration order for the Northwest portion of New Mexico, which is Order R-1670, and I think in the interest of ease of administration and a little more, little fairer method of determining marginal wells, we would go along with the Commission's recommendations to make the determination of marginal wells based on the average allowable, rather than any particular month.

Q By so doing, would that eliminate any extreme fluctuation that might exist by reason of market demand or change in the market?

A There are months when it is conceivable that the allowable would be so low, the demand, the result of the allowable would be low enough any well could make it in one month of a proration period, whereas, in fact it would really be a marginal well and should be so classified.

Q Was this exhibit, El Paso's Exhibit Number 1, prepared under your supervision and direction?

A Yes, sir, it was prepared under my supervision, on the

basis that I mentioned of the information which I obtained from our Reservoir Department on the reserves.

Q Does that correctly reflect the facts that you found in your study?

A Yes, sir.

MR. HOWELL: We offer El Paso's Exhibit Number 1 in evidence.

MR. PORTER: Without objection, the exhibit will be admitted into the record. Does anyone have any questions of Mr. Rainey? Mr. Trueblood.

CROSS-EXAMINATION

BY MR. TRUEBLOOD:

Q When you were making your study, as I understood you to say, you eliminated from your reserve calculations, anything that was not perforated?

A Yes, sir.

Q What did you do in the case of brazojet single point entry factor treatments?

A Let me clear that up. What we did in the portion of the formation that was not effectively opened to the well bore, was eliminate. In other words, as Mr. Arnold testified, there may be in some areas, two to three producing zones within the Dakota Producing Interval. If only one Interval of the three were open to the well bore as effective reserves contributing to the deliverability of that well, that was the only portion that was included.

We did not exclude anything that was open to the well bore, any portion open to the well bore.

Q You do concur with their vertical tracking in the Dakota?

A Very definitely.

Q In this approach, don't you disregard vertical fracking?

A No, sir; for the reason the sections there were excluded. with sections that were completed, separate zones that were completely zoned from other zones by shale barriers, or something like that. In other words, if -- To clarify that a little more, say there is sand present, say from 7500 feet to 7550 feet there it is sand; the sand is only actually perforated from 7500 to 7525, base of the vertical frack. We include the entire 50 feet that sand was open to the well bore; where sands are completely separated from what was open into the well bore only applies.

Q There is not such a thing as vertical fracking in the shale?

A Quite possibly; we excluded that as not too probable.

MR. TRUEBLOOD: Very unusual reservoir. That's all.

MR. PORTER: Any further questions of this witness?

(No response.)

MR. PORTER: The witness may be excused.

(Witness excused.)

MR. PORTER: Anyone else desire to present testimony in the case?

(No response.)

MR. PORTER: At this time we will have the statements. Mr. Buell.

MR. BUELL: Guy Buell, for Pan American Petroleum Corporation. It is our recommendation to the Commission that the Basin Dakota Gas Pool be prorated as proposed by the Commission staff.

MR. PORTER: I see you concur with Mr. Arnold in the pool name?

MR. BUELL: Yes, sir.

MR. PORTER: You better do that before Mr. Payne gets through with you. Anyone else have a statement? Mr. Davis.

MR. DAVIS: Quilman Davis, representing Aztec Oil and Gas Company. To protect correlative rights and prevent waste, we recommend that the Commission prorate Dakota gas, commencing February 1, 1961.

MR. PORTER: Mr. Verity, were you about to make a statement?

MR. VERITY: No, I was not. We have no objection to the recommended proration.

MR. GAETJENS: Paul Gaetjens, representing Texaco, Incorporated. I will have our District Engineer, Mr. Johnson, give a prepared statement.

MR. JOHNSON: Texaco, Incorporated, as operator of Dakota wells in Northwest New Mexico, is not in support of the recommendation to include deliverability as a prorationing factor

for the Dakota reservoir. It is Texaco's opinion that the deliverability does not have a correlation to the recoverable gas in place under a particular tract, and therefore should not be considered a factor in gas prorating. To include deliverability as a factor will start a race to perforate larger intervals, and frack with larger treatments, which will not increase reserves, but will merely increase the wells' deliverability. We can foresee that such practices to increase deliverability can cause both physical and economical waste. To protect the correlative rights of all parties concerned, Texaco believes that the ideal prorating method should be to consider reserves in place. We also believe this type of prorating would be more difficult to administer. With the great strides made within the industry in the past, and with those which will be made in the future, we believe that one day such prorating will be possible; until that time arrives, we recommend the retention of the 100 percent acreage formula.

MR. TRUEBLOOD: Harry E. Trueblood, Consolidated Oil and Gas. I will deliver a short, unprepared statement. I concur whole-heartedly with Texaco's appraisal of the use of deliverability to a point. For the Oil and Gas Conservation Commission in any State, New Mexico or otherwise, to place an ultimate premium on an operator's ability to originally frack treat hard type fracked reservoirs of the type that were under discussion today, is a complete injustice, since there are many, many small operators who can't sit back and wait to take their pay-outs. There are many

operators who cannot afford to frack at the wells, from five to ten different times there on a specific completion job. I think that El Paso Natural in their presentation, and I think Mr. Arnold for the Commission, has completely disregarded the fact there is a premium being placed on the person's ability to expend funds in the original completion of a well, at a time when we have a very difficult outlet, sales outlet situation in the San Juan Basin. I think for the Commission to place 100 percent, or 75 percent even, of a well's allowable on nothing more than deliverability, is completely impractical. I think there should be a depth factor added to this particular formula, and the formula will be so devised as to correlate between individual formations within the San Juan Basin.

MR. PORTER: Anyone else have a statement to make? The Commission will take the case under advisement. Excuse me. Mr. Holland.

MR. HOLLAND: A. F. Holland, as operator of producing gas wells in the San Juan Basin area, concurs in the principle of proration of gas from the Dakota Producing Interval. We would urge the Conservation Commission, and the gas purchasing companies, to recognize the different producing depths for the Pictured Cliffs formation, the Mesa Verde formation, and the Dakota formation, in preparing nominations and allocations for the various gas pools of the San Juan Basin area. To amplify this principle, it is our opinion that the best interests of conservation are not served by,

for example, the shallower Pictured Cliffs being assigned an allowable equal or comparable to locations which might be assigned to the deeper producing Dakota wells.

It is our opinion that the Conservation Commission and the gas purchasing companies should devise some plan to afford equitable distribution of gas demand to the various producing horizons of the San Juan Basin area.

MR. PORTER: Did I overlook anyone?

MR. BERNARD: Frank Bernard, British American Oil Company. British American Oil Company has acreage in the State of New Mexico, in the area under consideration, and submits the following comments: If the Commission finds the present method of nominations among the various pools is inadequate and proration between the various pools is essential, then British American feels the only equitable thing is to prorate between pools on the reserve basis. Recognizing that the method of proration must be workable, we suggest the reserve must be established using a fact base on bottom hole pressure, times acreage, times pay thickness. To allocate production between pools within a pool rim, and feels that the allocation formula should include both deliverability and acreage. However, no more than 50 percent, or less than 25 percent should be given to the deliverability, the remaining factor being based on straight acreage. We believe that such a formula will protect correlative rights by giving each well its just share of the market; prevent the unnecessary wells by encouraging wider spacing; through acreage promote more

efficient well maintenance through deliverability credit.

MR. PORTER: Anyone else have a statement?

(No response.)

MR. PORTER: The Commission will take the case under advisement.

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

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

WITNESS my Hand and Seal, this, the 19th day of October, 1960, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

NOTARY PUBLIC.

My Commission Expires:

June 14, 1964.

I N D E X