CASE 2049 - TRANSCRIPTS

Case No.

2049

Application, Transcript, Small Exhibits, Etc.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 16, 1963.

IN THE MATTER OF:

Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico. Upon application of J. Gregory Merrion, rehearing has been granted under the provisions of Rule 1222. The scope of the rehearing shall be limited to evidence concerning wells completed in the Devils Fork-Gallup Pool since September 13, 1962.

CASE NO. 2049

BEFORE:

HONORABLE JACK M. CAMPBELL, Chairman
MR. A. L. (PETE) PORTER, Secretary-Director
MR. E. S. (JOHNNY) WALKER, Land Commissioner

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: We'll take up Case 2049.

MR. DURETTE: Case 2049. Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico. Upon application of J. Gregory Merrion, rehearing has been granted under the provisions of Rule 1222.

If the Commission, please, the Commission has received a letter from Mr. William J. Cooley, attorney for the Applicant, requesting this case be dismissed; and I would like to read this letter in the record at this time. The letter was received on January 14th, reads as follows:

"Gentlemen: You are hereby requested to dismiss the application of J. Gregory Merrion for rehearing in Case Number 2049, which has been set down on your docket on January 16,1963."

And we also have received no objections to this dismissal.

MR. PORTER: Mr. Bratton.

MR. BRATTON: Mr. Chairman, we have no objection to the dismissal of the case, but Mr. Dave Rainey and I would like our appearances entered, so we will earn another hash mark as sole survivors of Devils Fork.

MR. PORTER: The record will please make note of the appearance of Mr. Howard Bratton and Mr. Dave Rainey.

The case will be dismissed.

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

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

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 30th day of January, 1963.

Marianna Meier
Notary Public-Court Reporter.

My Commission Expires:

April 8, 1964.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
September 13, 1962

IN THE MATTER OF: (Reopened and Continued)

Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico. Case 2049 will be reopened pursuant to Order No. R-1670-B to permit interested parties to appear and present testimony relative to the effectiveness of the special rules and regulations for the Devils Fork-Gallup Pool.

Case 2049

BEFORE: Honorable Edwin L. Mechem
Mr. A. L. "Pete" Porter
Mr. E. S. "Johnny" Walker

TRANSCRIPT OF HEARING

MR. PORTER: We will take up next Case 2049.

MR. DURRETT: Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico.

MR. PORTER: I would like to call for appearances in Case 2049 at this time.

MR. BUELL: For Pan American Petroleum Corporation, Guy Buell.

MR. FEDERICI: For El Paso Natural Gas Company, Seth, Montgomery, Federici and Andrews, associated with Mr. Ben Howell of El Paso.

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox, Santa Fe, New Mexico appearing on behalf of Val Reese and Associates, Inc. and Bco, Inc.

MR. COOLEY: William J. Cooley, Verity, Burr & Cooley, Farmington, New Mexico appearing on behalf of Greg Merrion Associates.

MR. SELINGER: George W. Selinger for Skelly Oil Company.

MR. PORTER: Does anyone else desire to make an appearance in Case 2049? Now I would like to ask who intends to present testimony. Mr. Cooley.

MR. COOLEY: Mr. Greg Merrion will expect to present testimony at a later time.

MR. PORTER: All right.

MR. KELLAHIN: Val Reese and Associates and Bco also expect to present testimony later.

MR. BUELL: Pan American Petroleum Corporation will also have some brief testimony.

MR. PORTER: Is that later or earlier?

MR. BUELL: We would prefer to be the latest.

MR. HOWELL: If the Commission please, El Paso doesn't know whether to present testimony or not. It depends on what happens here. We may have some testimony.

MR. PORTER: You are just trying to insure that you'll be later. Mr. Selinger.

MR. SELINGER: We won't present any testimony. We make our testimony in the form of unsworn statements throughout the whole hearing.

MR. PORTER: I will ask you one more question. Mr. Buell, we would ask you for Pan American to state the position of your company. That is, do you favor continuing the present rules or do you advocate a change?

MR. BUELL: It will be Pan American's representation to the Commission that the present rule be continued.

MR. PORTER: Mr. Howell.

MR. HOWELL: El Paso has the same position and would recommend a continuation of the present rule.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: Val Reese and Associates and Bco, Inc. will recommend a change in the present formula.

MR. PORTER: Mr. Cooley.

MR. COOLEY: Greg Merrion and Associates will recommend considerable changes in the formula.

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MR. PORTER: Mr. Kellahin and Mr. Cooley, since you are advocating a change in the present rules, we are going to ask you to put on your testimony first. As to which one of you goes first, you can decide that yourself.

MR. KELLAHIN: We will be glad to go ahead.

(Witness sworn.)

LEWIS C. JAMESON

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A Lewis C. Jameson.

Q By whom are you employed and in what position, Mr. Jameson?

A I'm employed by Val Reese and Associates, Inc. in Albuquerque, and I'm geologist and Vice President of the company.

Q Have you previously testified before the New Mexico Oil Conservation Commission as a geologist and had your qualifications made a matter of record?

A Yes, they have been and I have testified in previous hearings on Devils Fork.

MR. KELLAHIN: Are the witness's qualifications acceptable to the Commission?

MR. PORTER: Yes, sir.

Q (By Mr. Kellahin) Now, Mr. Jameson, what interest are you representing in this hearing?

A I am representing Val Reese and Associates 1-19 Lybrook Well and I'm also authorized to represent Bco, Inc. in the three wells which they operate in the Devils Fork Pool.

Q Which wells are those?

A The 1-23 Byrd, the 5-23 Byrd, the 1-29 Zamora. These wells were drilled by Val Reese and Associates and Val Reese and Associates owns a working interest in them.

Q As I understand, then, you are representing both Val Reese and Associates and the interest of Bco in this case?

A That is correct.

Q Would you summarize Val Reese and Associates, Inc. and Bco's position in this hearing?

A Well, our position in brief is that we believe communication exists between the Devils Fork Gas Pool and the Escrito Oil Pool, and because of this communication we believe that the formula is not accomplishing its purpose of maintaining a constant gas-oil contact, and therefore protecting correlative rights and preventing waste.

Q Have you prepared an exhibit which shows the relation of the two fields?

A Yes, I have.

Q Will you pass that out, please.

(Whereupon, Val Reese & Associates' Exhibit No. 1 was marked for identification.)

MR. BUELL: May it please the Commission, with respect to any testimony concerning communication between Devils Fork and Escrito, I would like to remind the Commission that that matter has already been looked at by the Commission and resolved that there was no communication. With respect to any additional testimony at this hearing, I would like to point out to the Commission that in my opinion it is not within the scope of the hearing and we would object to it.

MR. KELLAHIN: If the Commission please, there has been considerable change in development in the pools involved here since the Commission made its determination that there was no communication. We expect to touch on some of the evidence that was evidence at the time upon which the Commission based that finding, and it's our recommendation that the two pools be combined. That, in effect, does change the pool rules in the Escrito and the Devils Fork Pool, and we are recommending that the same rules in the Escrito be applied to the Devils Fork. For that reason it does fall within the scope of this hearing and we submit that we have a right to present the testimony showing the communication between the two pools.

MR. HOWELL: If it please the Commission, El Paso objects to any testimony relating to the Escrito Oil Pool as not being within the call of the hearing and not within the scope of this hearing and of this proceeding, and without notice to other interested parties.

MR. PORTER: Does anyone else care to comment on the counsel's objection?

MR. SELINGER: I might say this as an unbiased party.

MR. WALKER: A friend of the Commission?

MR. SELINGER: A friend of the Commission. This case has been postponed a number of times. Actually, in effect, the rules were put in, set up and established on a temporary basis and was continued from time to time periodically to see how these rules would affect and how they would apply to the production and development and more or less have an effect. Actually, we believe that the parties who advocate the continuation of existing rules had the burden to go forward, because it was originally established as temporary, and this is in the nature of a report to the Commission because it was continued from time to time to see the effect of those rules.

The whole purpose of this whole hearing is to determine the

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volumetric equivalent between your oil wells and your gas wells. If there's some other oil reservoir or gas reservoir that might affect the balance, we think the Commission should be advised of it now. If, as these people say, there is a connection between some portion of the Devils Fcrk-Gallup reservoir with any other reservoir, I think the Commission should be advised, because obviously it offends and effects the volumetric equivalency between the wells in this common source of supply, the Devils Fork-Gallup.

Whether it's in the notice or out of the notice, you are here to determine if there is a volumetric equivalent between oil and gas wells. That's the purpose of this whole hearing. If there's anything that would unbalance, I think the Commission should be permitted to hear that.

MR. PORTER: The Commission will overrule the objection. The purpose of the case, of course, is to determine whether or not the present formula is effective, and the Commission would like to hear anything that might affect that formula, whether the wells be within the pool as it is presently defined or whether they be outside of the pool. We feel that we should hear the testimony.

MR. BUELL: May it please the Commission, I would certainly agree with the Commission that if in truth and in fact

Escrito and Devils Fork wells are producing from a common reservoir, that would be valid testimony relating to the volumetric formula, but from the standpoint of Pan American's position, we feel this way, we feel that the two fields are separate.

We must, however, plead complete surprise to the Commission in that we are not here today to defend that position, and in view of the Commission's ruling on my objection, I would like to advise the Commission at this time that it will be Pan American's position to move for a continuation in order for us to prepare ourselves to defend our position that Escrito and Devils Fork are two complete and separate and distinct accumulations of hydrocarbon.

MR. KELLAHIN: If the Commission please, it's rather startling to hear a claim of surprise when this very question came up in the discussion of Bco's 5-23 Byrd Well, the 3-23 Kenney Well at the June hearing. This very point was discussed at that time.

MR. PORTER: Where are those wells located, Mr. Kellahin?

MR. KELLAHIN: They are in the Devils Fork Pool in Sections 23 and 24.

A Mr. Commissioner, may I clarify something possibly?

MR. PORTER: Surely.

A In the last hearing that was June the 14th, there was some discussion about whether the Bco 5-23 Byrd Well in Section 23 should be included in the Devils Fork Pool or in the Escrito Pool. We, through cross examination of the Pan American witness, established at that time that the Bco 1-23 Byrd in the same section to the north was producing from the correlative equivalents of both the Devils Fork sand development and the Escrito sand development, both sand developments being a slightly cleaner portion of the Marye's zone of the Gallup.

MR. PORTER: Thank you. Does anyone else have any comments on Mr. Buell's motion for continuation of the case?

MR. COOLEY: It's the position of J. Greg Merrion and Associates that these numerous continuations and delays are continually working to the disadvantage of J. Greg Merrion and Associates and that any further continuances in this case we will strenuously oppose.

MR. PORTER: Mr. Buell, did you actually make a motion?

MR. BUELL: There was a little doubt in my mind when you said you would act on it. I was just getting up to formally move on behalf of Pan American that due to our surprise, that we're unable to defend our position that the two fields are separate. It would be grossly unfair for the Commission to continue with this hearing and not allow us the opportunity to defend our position. For that reason Pan American formally moves that this case be continued.

MR. PORTER: The Commission will overrule your motion for continuation, Mr. Buell. Mr. Kellahin, we'll ask you to proceed with your witness.

MR. KELLAHIN: Thank you.

Q (By Mr. Kellahin) Mr. Jameson, referring to what has been marked as Exhibit No. 1, will you identify that exhibit and discuss the information shown thereon?

A Exhibit No. 1 is an area map showing the relationship between the Devils Fork limits as outlined by the Commission's orders and the Escrito Oil Pool limits. The Devils Fork limits are shown by the dotted line and the Escrito limits are shown by the solid, heavy line. I will be using this exhibit to show that in effect the gas cap has moved and is moving and that the fields are in communication.

Q Do you also show a cross section on that exhibit?

A Yes. My line of cross section A-A^{1}, which will be my Exhibit No. 2, is shown on the area map as extending from the Bco 5-23 Well, which I believe everyone will agree should be in the Escrito Pool, and the 1-23 Byrd Well which has been established as producing from both of these little previously discussed sand lenses on up to the Redfern and Herd No. 1-A to the Redfern and Herd No. 2 Largo and the Redfern No. 1 Largo on the east.

Q What is the significance of the wells that are shown in the triangle, Mr. Jameson?

A The triangle symbols denote wells which were cored. These cored wells have been used at various times to establish that the reservoir characteristics throughout the entire area are the same.

Q Have you prepared a cross section?

A Yes, my Exhibit No. 2 is the cross section, the trace of which is shown on Exhibit No. 1.

(Whereupon, Val Reese & Associates Exhibit No. 2 was marked for identification.)

Q Referring to Exhibit No. 2, will you discuss the information shown on that exhibit?

A Exhibit No. 2 is a cross section on a datum that is a marker bed within the Gallup formation and the cross section, therefore, does not show structural position or relative structural position of the wells. It is merely a correlation of the sand which is producing on Well No. 5, that is the Redfern and Herd No. 1 Largo Spur across the area into the Bco No. 5-23 Byrd Well.

As was mentioned in my clarification statement, both the sand which is shown on the cross section by the sandstone symbol, the stipling, which is the Devils Fork sand, and the Escrito sand, are present in several of the wells. Both of these little sand lenses are within the main development of Marye's sand as it's commonly known in I believe each of the Gallup fields in northwestern New Mexico.

Q You've expressed an opinion that there is communication between these two pools, on what do you base that belief?

A In the center column of the logs are shown the perforations. The symbol used to denote this is shown in the left hand and both the Escrito and Devils Fork sands, that's using the term a little loosely because actually the distinction between them is very small, but they are actually open to the well bore in both the Bco 1-23 Byrd and 5-23 Byrd.

Q I think you previously pointed out that this fact was brought out in the June hearing, was it not?

A Yes, it was.

Q Now, Mr. Jameson, have you participated in the hearings in the Devils Fork Pool case since their inception?

A Yes, I have. I have either presented testimony or been present for every hearing.

Q Are you familiar with the testimony in the original hearings in regard to a non-permeable barrier between the two pools?

A Yes, sir, I am. That barrier was advocated by Redfern

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and Herd witness and Pan American witness.

Q Where is that barrier with relation to wells shown, for example, on Exhibit No. 1?

A My understanding of the barrier would place it somewhere very close to the location of the third well shown on this cross section. That is the Redfern No. 1-A Largo Spur. Since the advocation of this non-permeability barrier, which incidentally our company could never find in its studies, there have been some eight to ten wells drilled within the barrier as defined by these witnesses.

Q Are those producing wells?

A Yes, they are.

Q Then do you find any evidence of any effective separation between the Devils Fork and the Escrito?

A No, I find none and in addition to the communication within the well bore we have cored wells in this area and found that the Gallup is fractured, and to go on the theory that these fractures will not put these two sands in communication if they are not already in communication through deposition is rather far flung.

Q Then, in your opinion, is there effective communication between the two sands?

A Yes, there is.

Q You referred to the sands being present in the two Byrd wells. Do you have any evidence that the Devils Fork sand is producing in these two wells?

A Yes. Several things lead us to this conclusion. The gas-oil ratios in the 1-23 Byrd and the 5-23 Byrd, as well as the Reese No. 3-23 Kenney well, which is the offset to the 5-23 Byrd well to the west, have shown an unusual increase. This data is presented for convenience in my Exhibit No. 3, and it is taken from the C-116's which our company and Bco, Inc. have filed with the Commission. I am sorry, I have only three copies of this. I will be glad to make my copy available to the other interested parties.

(Whereupon, Val Reese & Associates Exhibit No. 3 was marked for identification.)

Q What is the significance of this gas-oil ratio?

A Let's look at the 5-23 Byrd well first, those of you who have the exhibit will see that 9-17-61 gas-oil ratio test showed 1,353 to 1. Less than a month later, on 10-5-61, this had increased to 6,600. On 1-12-62 this was 12,737. On 4-25-62 this was 21,823, on the last gas-oil ratio taken, which was 7-23-62 the gas-oil ratio had increased to 24,615. Now, this alone doesn't mean much. However, a comparison to other wells adjacent will show that they have not yet been affected by a change in our gas-oil contact in the Devils Fork. The next well on the gas-oil ratio information is the Love 2-23.

By referring to area map, Exhibit No. 1, the relationship of these wells may be determined. The 5-23 Byrd well being the easternmost well, and then as we proceeded to the west, the Reese 3-23 Kenney well and the next offset in the next 80 is the Reese 2-23 Love well.

Looking back at Exhibit No. 3, the gas-oil ratios and the dates are so similar that I won't repeat them. However, the first one was taken in April of 1961, which was 439 to 1. Next was 1,025; next, 3,720; next, 3,207; next, 3,376; next 4,321. From this information it is evidenced that they haven't received a very rapid increase in gas-oil ratio that has been experienced in the Byrd 5-23. The increase has, however, been observed at a more recent date in the well which is halfway between the Love and the Byrd wells. That is the Kenney 2-23, It's gas-oil ratio has increased from 7-20-61 of 368 to 1 to a present gas-oil ratio of 15,149 to 1.

Only wells shown on Exhibit No. 3, the Blakely 6-23 well in Section 23 is a relatively new completion and it is still producing at a ratio of 3,691 to 1. Likewise, the Lybrook 2-22 well has increased from an initial gas-oil ratio on 12-24-60 of 1,486 to 1 to a present gas-oil ratio of only 3,207 to 1.

The well to the northwest of the Lybrook 2-22 well, that is the Lybrook 6-22 well, has shown an increase, and by a study of the log shows a better section of Devils Fork sand.

I believe that's all that I had about our Exhibit No. 3. However, additional evidence of Mr. Kellahin's question as to on what we base our belief that the Devils Fork sand is producing in these wells is evidenced in the production information. The Bco 1-23 Byrd well, and I'm afraid I used Bco and Reese interchangeably on these wells in which we have a working interest, anyhow, the Byrd 3-23 well production has increased rather significantly, which I believe everyone will agree is rather unusual, to say the least, for a Gallup well.

The production in, well, we'll go clear back to February. In February the production was 5,172 MCF for the month. The well produced 28 days. In March the production was 3,396 MCF, and I believe that was a short month which would have three chart periods or twenty-four days. The April production was 4,213 MCF, and then we start our increase. In May, in twenty-five days, excuse me, in thirty days the well produced 5,027 MCF. In June in twenty-five days it produced 7,133 MCF. In July it produced 8,669 MCF in twenty-seven days. I don't have the exact production for August, however, I saw the El Paso run statement yesterday and it was 8,300 and some odd MCF for the month. This same type increase is shown on the 5-23 Byrd well.

Again, this information is taken from the C-115's which have been filed with the Commission. The production in March was 3,316 MCF and had increased to a production for July of 8,608 MCF. On both of these wells the oil production has not increased in the same ratio by any means that the gas production has increased. Going back to the 1-23 Byrd well, I should have discussed this previously, the gas production for February was 375 barrels, and then in March 435; April, 544; May, 599; June, 496 and July, 599, so there has been no significant increase at all.

While I'm looking at the production there is another area that increases such as these are apparent. That is in the Rutledge oil wells. The first one that I would like to discuss is the Rutledge 4-B Miller in Section 12 of 24, 7. Mr. Rutledge's production is rather erratic, beginning in December of 1,726 MCF, goes to, and I won't say the month's date, I'll just give the volumes, 1,656, 1,183 and then in March he had a very good month, 5,261, 1,859 and then May comes along, 9,454 MCF. Then June, 7,156 MCF. Well, this to me is pretty significant. The same type thing is shown on Mr. Rutledge's 2-B Miller. The production is increased from a January rate, which I believe is the same as on the other well of 1,799, I might stand corrected on that, up to a June rate of 9,060 MCF.

Q Does that complete your testimony in regard to the gas-oil ratios and gas production?

A Yes, I believe it does.

Q You have referred to the presence of the Devils Fork sand in the Escrito Pool in some wells. Have your studies disclosed the presence of that sand in other wells than those you have mentioned?

A Yes, they have. We expect a portion of the Devils Fork sand to be present in the 1-25 Mesa well which we drilled in Section 25 of 24, 7. This sand is present, it is not of the same porosities, permeabilities and cleanliness that it is present up in Mr. Redfern's No. 2 Largo Spur, which open flow potentialed 2,370, but it is present.

Also we have correlated the sand to the west in much the same method as Mr. Emory Arnold did, in testifying for the Commission at one of the earlier hearings, and find that this sand is present in the Pan American No. 1-30 in Section 15 of 24, 7.

Q You've referred to the Devils Fork sand and the Escrito sand for the benefit of the Commission. Would you clarify just what you are talking about there, please?

A I'm simply talking about them as separate sands as a matter of convenience. They are simply cleaner sand lenses within the same sand, that is the Marye sand of the Gallup formation.

Q Are the vertical limits of the two pools the same?

A Yes, they're identical. That is the limits of the Gallup formation.

Q If these sands are present as you have testified, they would be properly included within the pool under which they are found?

A Yes, they would be.

Q Now, if the Devils Fork formula is to be continued in use, do you have any recommendations to make?

A Well, we have nothing against the formula as such. We do believe that in order for any volumetric formula to be effective you must be talking about a closed reservoir. We do not believe this is the case in this area. If a Devils Fork type formula is put into effect it would be my recommendation that bottom hole pressures be required on both oil and gas wells as was recently done by the Commission on their tests in, I believe it was August. I may stand corrected on that. However, that type information is of absolute necessity.

Also it would be my recommendation that in order to protect gas operators on any future volumetric formula it should be required from the first that all gas, whether it's vented or sold be metered.

Looking back at my production on some of the oil wells in the Devils Fork Pool, there was not even any gas reported on the Commission's C-115's until December of 1961. Any gas that is produced, whether it's vented or sold in the oil portion of a pool such as this, restricts unduly the gas production.

Q Do you have a recommendation as to the pool rules which should be applied to the Devils Fork?

A I believe that the evidence that we have been waiting for for this several years is at hand at this time. That is that the gas-oil contact which we were guarding so carefully is moving and that therefore the Devils Fork rules are not accomplishing their purpose, and it is my recommendation that the Escrito rules be adopted for the entire area. The Escrito rules, as I'm sure the Commission already knows, were patterned after the Angel's Peak rules and designed to take care of the situation where oil and gas is produced from the same reservoir.

Q Were Exhibits 1, 2 and 3 prepared by you or under your supervision?

A Yes, they were.

MR. KELLAHIN: I would like at this time to offer in evidence Exhibits 1, 2 and 3.

MR. PORTER: Any objection to the admission of these exhibits? They will be admitted.

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(Whereupon, Exhibits 1, 2 and 3 were admitted into evidence.)

MR. PORTER: Does anyone have a question of the witness? Mr. Buell.

CROSS EXAMINATION

BY MR. BUELL:

Q Mr. Jameson, with respect to the gas wells that are now classified as being in the Devils Fork Pool, what would be the effect of your recommendation, assuming the Commission adopts it on the allowables of those wells?

A They would be allowed to produce at a higher rate, which would keep the gas-oil contact from moving.

Q Actually, as a matter of fact, their allowables would be increased about 400%, would they not, Mr. Jameson?

A The allowables would be 1,300 some odd MCF per day, which I believe would be less than three times what their present allowables are.

Q A little less than 300% increase?

A Yes.

Q With respect to your clients, the people you are representing here today, how many oil wells do they operate in Devils Fork?

A There are two oil wells which are within the presently defined limits of the Devils Fork Pool.

Q And other than those two, and if I may refresh my memory, those are the two that there was some evidence relating to at the June portion of this hearing, but particularly one of them was in Escrito, are those the two wells you are mentioning?

A Yes, that's correct.

Q And other than those two wells, your clients operate only gas wells?

A That is correct, and we benefited from the movement of this gas-oil contact as much as anybody to date in that we have received as much increase as anyone. However, I hate to see it go north, that's where Pan American's oil wells are.

Q I understand your sentiments completely, Mr. Jameson. I want you to assume something for me for the purpose of this question. Let's assume that you are wrong and that actually Devils Fork and Escrito are two separate and distinct reservoirs. With that assumption, if the Commission should adopt your recommendation and increase the allowables of the Devils Fork gas wells 300%, in your opinion, Mr. Jameson, wouldn't that result in waste?

A No. I don't believe that waste has occurred under the Escrito formulas, and we're asking for the same type formula. Nor do I believe that waste has occurred under the Angel's Peak formula.

Q As I understand your testimony, it's your testimony that in your opinion the Devils Fork reservoir and the Escrito reservoir are one and the same and that communication exists throughout?

A That's right.

Q And that we are not looking at two separate and distinct reservoirs but we are looking at one only happy, communicable reservoir?

A That's correct.

Q Let's look at this happy, communicable reservoir for a minute, Mr. Jameson, and let's start at the north at Devils Fork, there we have oil wells?

A That's correct.

Q Let's move a little south on Devils Fork up structure, then we come to gas wells, do we not?

A Yes.

Q Then we go further south up structure Escrito, what do we come to, oil wells?

A That depends on just exactly where you go into Escrito.

Q Go up structure, don't we find oil wells up structure of Escrito and Devils Fork?

A I would say that the 1-25 Mesa well which we fought rather hard and were bitterly opposed by both Pan American and El Paso to get in the Devils Fork Pool, I would say that it's updip from the Killarney 1-24 well, and it is definitely a gas well. I do believe that the wells are in the same pool, and I believe that the wells to the west in the same sand, that is the Standard 2-26 and Standard 4-26, which have the same type productive characteristics as our Mesa 1-25 well in Section 25, those are also updip. However, they are down dip from the Bco 7-27 Lybrook well which is in the same sand.

Q Mr. Jameson, I don't want to seem impertinent, but let me ask you, did you answer my question yes or no?

A I said that you can go updip from the Devils Fork Pool and get into both oil or gas depending --

Q So your answer was yes or no?

A Correct.

Q Let's recapitulate here a little, we started on the north oil Devils Fork, come up structure to gas, and your testimony just now that you can go up structure to Devils Fork gas and find Escrito oil?

A Yes.

Q Then can we not go further up structure in the happy, communicable reservoir and find gas wells in the Escrito?

A No, I think that the high structure well in the

Escrito Pool is the No. 1 Pan American Zanotti and has a low gas-oil ratio.

Q Is it your testimony that in Escrito all the gas wells are lower structurally than the Escrito oil wells?

A All of the gas wells are not lower than all of the oil wells. However, there are some oil wells, which is my testimony on the Escrito Pool limit, pool rule hearing, there are oil wells updip from gas wells in the same reservoir.

Q All right, in this one communicable reservoir that you say we have here, it's your testimony that we have oil, up structure we have gas and farther up structure we have oil?

A Yes, that's correct.

Q And we have communication in this reservoir?

A Yes, that is correct. And I'm well aware of all the engineering theories that this can't happen. However, I believe that it has in the Escrito and in Angel's Peak.

MR. BUELL: Thank you, Mr. Jameson, you have just made engineering history.

MR. PORTER: We will take a ten-minute break.

(Whereupon, a recess was held.)

MR. PORTER: The hearing will come to order, please. Does anyone else have a question of the witness?

MR. COOLEY: Yes, Mr. Commissioner.

MR. PORTER: Mr. Cooley.

BY MR. COOLEY:

Q Mr. Jameson, are these wells to which you have testified, would you tell us which wells are perforated in both the Devils Fork and the Escrito sand?

A All of the Reese or Bco wells are perforated from one end of the Gallup to the other.

Q Of the wells that you show on your cross section, which wells are perforated in both sands?

A The first and second logs on the cross section, that is the 5-23 Byrd and the 1-23 Byrd.

Q I see the Redfern and Herd 1 was perforated in Escrito?

A No, Mr. Redfern limited his perforations to the best sand development that he had, which is equivalent to the same sand he had in the No. 2 Largo Spur.

Q That would be the Devils Fork then?

A Yes.

Q How does the Escrito sand compare with the Byrd 1-23 with the Redfern Byrd 1-A as you have observed them on the log?

A The Escrito sand is less developed in the 1-A, however we have core analyses in the area which showed sand of this quality to be of the quality necessary to contribute production. That is with sufficient porosity to be a reservoir and with the same permeability as we're producing out of the other wells in the Escrito.

Q What permeability is that?

A Very low. The same permeability that any edge well in the Escrito is producing from.

Q Specifically can you tell us what that very low permeability is?

A Well, of course, it varies. I have all of the core analyses, if you would like for me to go into them.

Q Is there a minimum at which you consider it non-productive?

A We have got wells with very low permeabilities that are producing and therefore it's difficult to determine just where your breaking point between productive and non-productive sand is if based strictly on permeability alone.

Q Are these areas of permeability in a dry core?

A Yes.

Q They do not take any consideration permeability to oil?

A No.

Q Are permeability to oil and permeability to gas the same?

A No. That is true, however we have one, you know the well is produced.

Q But from one sand?

A The best sand that we have will be poor in some wells but they still produce.

Q Let's go into which is the better sand, these are two distinct sands, sand stringers.

A As I said previously, they are simply a cleaner sand development within the Marye's sand, and I would not say that they're distinct sands in that they are very possibly in communication in the natural state as well as in the well bore, as well as natural fracking, as well as man instigated fractures due to completion of the wells by sand frack methods.

Q Is it as strong as you can go there was possible communication between the two reservoirs naturally?

A Well, as I'm sure Pan American's cross examination was leading up to, the sands have been there a long time. Normally you would expect gas to be on top through the geologic age, however, this is not the case in this field possibly due to little various sand stringers. Now, these sand stringers are not, I don't want to leave the impression that this is strange just where it is in between Devils Fork and Escrito. There is a small depositional change, and I believe the evidence indicates they're in communication. However, that is not the only sand change in the Escrito field. There are other sand lenses in the

Escrito field and if we start chasing these little old sand lenses, we have three or four more of them through the Escrito, maybe we had better make more fields, yes.

Q What is the predominance of the additional sand stringers you find in the area here?

A I believe the most predominant, at least the sand which is of the greatest areal extent, is the Devils Fork, I mean is the Escrito sand which is the section immediately below the stippled portion on the 5-23 Byrd well tracing, log tracing.

Q As to the oil wells concerning which you've testified in the Southwest Quarter of 23, Kenney, Love wells and Blakely wells and additional oil wells to which you testified, they are also open in both sands, both stringers?

A Yes, they are, as well as some above and below.

Q As you said, as much of the Gallup as you could perforate?

A Right.

Q And as a practical matter it's difficult to tell on any given well from which particular sand stringer you are getting the majority of your production, is that right?

A That's true. We have limited our perforations to zones which we have evidence or are capable of contributing.

Q Now producing from the Redfern-Herd 1-A and moving down your cross section, would you tell us in the Redfern-Herd 1-A well which is the better sand stringer, the Devils Fork or the Escrito?

A The Devils Fork is better. However, the Escrito is thicker.

Q Proceeding then to the Byrd -- excuse me, what specific interval is the Escrito sand there?

A I probably should have marked that off. However, as the argument at the first of the hearing was, we're not talking about Escrito but, so I didn't correlate its sand into it. I just correlated the sand in question out of it. In the Redfern and Herd No. 1-A Largo Spur, the Escrito sand would extend from the stippled area downward to the base of the Marye zone which is approximately, oh, 5808.

Q Moving on to the Byrd 1-23, which is the better sand of the two, the better stringer of the two in that well?

A In this well the better is probably the Devils Fork, and this is borne out by the productive characteristics of the well. We potentialed this as a gas well and it's reflected on Exhibit No. 3 as being the first month it had a very high gas-oil ratio. It would be like a typical gas well in the Devils Fork. However, the characteristics of a gas well were rather short lived and we were immediately setting additional

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tank facilities.

Q Moving on to the oil wells in the Southwest Quarter of 23, what is your better sand stringer there?

A Well, I have core analyses in the Escrito Pool as well as in the Devils Fork Pool, in fact, I believe I have core analyses on every well that has been cored, and we know that sands such as the upper portion of the Mayre's sand, that is the portion that would be stippled on this Bco No. 5-23 Byrd well, are of reservoir quality.

The next little sand load, and there are three shown on the tracing of the well log, is possibly a little bit cleaner sand.

Q Then it's your testimony that the Escrito is the better sand in these wells?

A Yes, possibly. It's a little cleaner.

Q If you move on to the west this becomes more and more true, does it not?

A That's true.

Q Moving to the far northeast portion even beyond your Exhibit No. 1, is there a third sand stringer that occurs in that area, namely the Otero?

A This would be on to the northeast of the Merrion wells, say?

Q Yes. A Yes, there is.

Q Is it also true that throughout the San Juan Basin that it's the characteristics of the Gallup formation to be strung throughout with various sand developments at various depths isolated by shale development?

A Yes, it is, and as I mentioned a few minutes ago, there are some three or four other little sand changes within the Escrito field itself.

Q Isn't it also true that as these sands lie in the reservoir partially overlapping each other and each having a high and a low, that with respect to a given sand you drill in the low on that sand and as you move up that sand you find more gas development?

A Yes, that is true. Until man comes along and disturbs the thing.

Q Correct. But in the natural state, now, at the same time that one well bore could intersect, and in very many cases does intersect two or more of such stringers?

A That's right. And along this same line we have to remember that this dip that we have got here today isn't the same as it's always been. In other words, the dip has changed and that changing dip may have trapped gas down dip from oil in the same sand.

Q How has this occurred?

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A And they'll be in pressure communication.

Q How does this change?

A Due to the change in the dip.

Q What caused the change in the dip?

A That's the history of the San Juan Basin. The San Juan Basin didn't always look like it does today.

Q Isn't it true that most of the communication is man made and the greater portion of it in the area in the Southwest Quarter on your Exhibit No. 1 is the cause of communication in itself?

A I would say the easiest to prove communication is man made. However, that does not eliminate the possibility of natural communication, and there is no reason to believe that gas can not be below oil in the same reservoir and be in communication due to sand wedges and change in dip.

Q Now we are talking in terms of possibility. Isn't it a fair statement to say that by far the greatest degree of communication to which you have testified this morning is man made communication either through man made fractures or communication in the well bore itself, by far the greatest degree of communication?

A Yes. However, are we interested in degree?

Q Well, you are talking in terms of communication in the reservoirs. The point I'm trying to make, if the communication to which you've testified this morning is not actual communication that the Commission has ordinarily taken cognizance of, that is communication in its natural state.

A My testimony this morning was that there was communication. I care not how it came nor do I spend my time changing sand lenses.

Q One way to stop the communication very quickly would be to put a bridge plug in between these two zones, would it not?

A While we are at it, shall we plug various zones in both the Pictured Cliffs-Mesaverde and other Gallup wells?

MR. KELLAHIN: I think the line of testimony is becoming argumentative. The witness has testified that there is communication, whether it is man made or natural at this stage of the development of the pool is not particularly material.

MR. COOLEY: Communication, as it has been understood by the Oil Conservation Commission of New Mexico, has been natural communication between the reservoirs in its virgin state, and the fact that communication has been caused by virtue of open holing these wells from top to bottom in the Gallup is very little if any reason to base a conclusion that there is communication between the reservoirs. If this communication is a detriment to conservation, then the way to stop it is to separate the zone.

If it's not a detriment to conservation, then let it commune, but this's not communication in the sense they are one common pool with common characteristics.

MR. PORTER: I believe you answered Mr. Cooley's question that if there is communication, you say there is communication?

A Yes, sir.

MR. PORTER: You stated that outright, that the easiest to prove was the man made communication, but you think there may be natural communication?

A Yes, sir. We have always thought there was natural communication between the two as defined in different pools.

MR. PORTER: He has answered that. What else are you trying to determine, Mr. Cooley?

MR. COOLEY: May I proceed further.

MR. PORTER: Yes.

Q (By Mr. Cooley) If there is the happy communication that Mr. Buell referred to between these two pools, would you expect that the oils would have substantially the same characteristic?

A Well, there are not, there's really not a great deal of difference in the characteristic of Gallup oil --

Q Would you answer the question?

A -- from one area to another.

Q Would you expect the oils to have substantially the same characteristics?

A Oh, I believe they would because they are both Gallup.

Q Would you tell us whether the oil produced from the Devils Fork Pool is a completely saturated oil with respect to gas? Is it completely saturated with gas?

A No.

Q The Devils Fork oil is not completely saturated?

A Oh, excuse me. I'm thinking of the wrong field.

Q Is the Devils Fork oil completely saturated with gas?

A I suppose that it would be.

Q Is the Escrito oil completely saturated oil?

A Not at this time, because the Escrito field is the older pool and the pressures have decreased.

Q Was it ever under virgin conditions a completely saturated oil?

A Well, since I believe that reservoir is the same and that gas and oil are occurring in the same reservoir, I see no reason why it should be different than Devils Fork.

Q Well, if you please, just answer my question. Are you aware of the characteristics of the Escrito oil in its virgin state? If you are not, just say so.

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A Well, I thought I was, but I evidently didn't answer your question to your satisfaction.

Q How aware are you of what the characteristics of the oil was in its virgin state?

A Unless I answered your question, no.

Q Are you aware that the Escrito oil was a completely saturated oil in its virgin state?

A No.

Q Isn't it true that this is now and has always been an under saturated oil?

A Yes, it's possibly right, I don't really know conclusively.

Q You testified on direct that the gas-oil contact, in your opinion, in the Devils Fork Pool was moving. Do you have any testimony as to what direction it's moving and what area it's moving?

A Well, I know that our production in the No. 1-23 Byrd, that is of gas, has nearly tripled, and I don't think our management is any better. I just wish we could depend on all of our casinghead gas production to triple.

Q That's classified as a Devils Fork oil well, is it not?

A That's right.

Q And hasn't it also been testified to that that's a particularly anomalous well and is lower structurally or higher structurally, rather, than a number of the gas wells in the area?

A Yes, that's right.

Q Isn't it also your opinion that this is what can be referred to as pinched oil or transported there by a nose?

A Again, I don't spend all my time chasing these little tiny sand lenses, I look at the Gallup and it's possible that's the reason for the occurrence of the oil in this well. However, that's not a conclusion that you could say for sure.

Q Do you have any evidence of what has happened to the gas-oil contact in the northeastern portion of your Exhibit No. 1?

A It has not yet reached the Merrion wells, and I hope that measures will be taken to prevent it from reaching them. It has reached, by observation of the gas production, the Rutledge 5-B and 4-B as was covered in my testimony.

Q You also testified concerning the gas production from certain of the oil wells in the oil column. From whence do you believe this gas to be coming? Where is the gas production coming from out of these oil wells?

A Which wells are we talking about?

Q The Merrion wells and the wells in the northeast portion of your Exhibit 1.

A Well, undoubtedly he has some solution gas.

Q Do you know how much? A No.

Q If I were to tell you that there is nearly as much gas reserves in addition to the oil per reservoir cubic area in the oil column as there is in the gas column, would this sound correct to you?

A I'm familiar with the various core analyses in this area and I wouldn't doubt that at all.

Q That there is as much gas in addition to the oil in the oil column as there is per cubic area as there is in the gas column?

A That's right. The cores on the Skelly 1-G and the El Paso No. 89 well show the oil saturation to be of a magnitude that would normally mean that the well would produce not gas but oil. In other words, they're in excess of, oh, 28 or 30% residual oil saturation, which is indicative of an oil reservoir instead of a gas reservoir.

MR. COOLEY: No further questions.

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

MR. HOWELL: Yes.

MR. PORTER: Mr. Howell.

BY MR. HOWELL:

Q Mr. Jameson, am I correct in understanding your conclusion to be that the gas-oil contact is moving from the direction of the gas wells toward the oil wells?

A Yes, that is correct.

Q Well, now, to solve that you propose to increase the amount of gas produced from the gas wells, am I correct in understanding your recommendation?

A That is correct. I would like to point out that oil wells in both Devils Fork and Escrito are treated equally. The gas wells are restricted under Devils Fork and not as much under Escrito. Therefore, if you have got movement out of Devils Fork into Escrito, it would stand to reason you needed to produce more gas.

Q Well, now, wouldn't you get the same result if the Commission were to impose a limiting gas-oil ratio on the production of those oil wells in which the gas-oil ratio is climbing?

A There is such a limit, 2,000 to 1.

Q And as the gas-oil ratio climbs, the amount that will be produced from these wells will be reduced as the tests come in and show the increased gas-oil ratio, is that correct?

A Yes. They will be put under restricted allowable.

Q And that will have the same effect in retarding if there is a movement from the gas wells to the oil wells as producing more gas, would it not?

A That's right. However, this restriction has been in effect and the ratios in these wells that I have discussed have increased and gas has moved.

Q That is your conclusion?

A Yes.

MR. HOWELL: That's all.

MR. PORTER: Anyone else have a question? Mr. Selinger.

MR. SELINGER:

Q I think Judge Howell put his finger on the entire matter of the inequity of the existing rules. With respect to the oil wells, do they not have a top allowable of 161 barrels of oil if they can make it?

A Yes, there's not a well out there that's restricted to its production.

Q I notice the maximum on the September schedule is 63 barrels of oil, but the oil wells have the right to produce up to 161 barrels of oil a day, and its maximum gas-oil ratio limit is 2,000, isn't that correct?

A I believe it's 164.

Q 164 was a gas-oil ratio limit of 2,000 cubic feet?

A That's right.

Q Or a total volume of what, 164 times 2,000, is that correct?

A 328.

Q Now, the gas wells do not get to produce the top of 161 times 2,000, do they?

A No, they don't.

Q And there's where your inequity is, they get to produce the actual production which is the average of the 11 wells is 26 barrels a day. The gas allowable is based on the actual production, actual capability of the oil wells, isn't that correct?

A That's right. If we had a greater capacity in these oil wells to the north we would have always had a higher gas allowable.

Q So are you recommending then that the gas wells be treated and accorded the same rights that the oil wells in the Devils Fork-Gallup have the maximum limit of 164 times the 2,000 based on a 320-acre unit?

A Yes, I believe if you have one 80-acre tract, whether it be a portion of four 80-acre tracts dedicated to a gas well or one 80-acre tract dedicated to an oil well, they should be allowed to produce the same.

MR. SELINGER: That's all.

MR. PORTER: Will you give that answer again?

A I believe that an 80-acre tract should be allowed to produce the same volume whether it's dedicated to an oil well or a gas well. In actuality, if your top unit allowable of 164 is multiplied by two MCF, you get 328. Well, that's 328 MCF that an oil well can produce in addition to its volume of oil fluid. If you have just a plain old gas well, you don't get this additional volume due to oil. Therefore, you do have, as was pointed out in the Escrito hearing, a differential toward the oil area from your gas area because equal gas volumes, but unequal oil volumes, are withdrawn from each 80.

MR. PORTER: You didn't say that you thought an oil well on 80 acres should have the same amount of gas as a gas well on 320?

A No. The way the Escrito rules are set up, an oil well is allowed up to 328 MCF and then by special permission we can grant up to 320 acres to a gas well, or four 80-acre tracts, which gives it as a gas well a total allowable of four times the 328.

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

(Witness excused.)

MR. PORTER: The hearing will be recessed until 1:00 P.M.

(Whereupon, a recess was taken.)

MR. PORTER: The hearing will come to order. Mr. Kellahin, I believe you just had the one witness?

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MR. KELLAHIN: Yes, we have completed our presentation.

MR. PORTER: That concludes your testimony?

MR. KELLAHIN: Yes.

MR. PORTER: Mr. Cooley?

MR. COOLEY: Yes, we would like to put on Mr. J. Gregory Merrion at this time.

MR. PORTER: Would you have him stand and be sworn?

(Witness sworn.)

J. GREGORY MERRION

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

DIRECT EXAMINATION

BY MR. COOLEY:

Q Would the witness state his full name for the record, please?

A J. Gregory Merrion.

Q Have you previously testified in this case?

A I have.

Q Have your qualifications as an expert in this case been previously accepted?

A I think they have.

MR. PORTER: Yes, sir, they have.

Q (By Mr. Cooley) In your previous testimony, Mr. Merrion,

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at the June hearing, did you at that time present an Iso-Vol map which purported to show your interpretation of the productive gas acreage and the productive oil acreage in the Devils Fork Pool?

A Yes, I did.

Q Would you briefly review what this map shows?

A This map showed that there were roughly something in excess of 8,000 acres of oil-productive sand in the Devils Fork field as compared to about 8700 acres of gas-productive sand, and that the oil was only about half developed and the gas productive was 80% developed.

Q Upon what data were these calculations based?

A I had analyzed logs in the Devils Fork field and arrived at the porosity feet of net effective pay sand in the Gallup Marye zone.

Q Was this also dependent on the contours in the area?

A I had also drawn a structure map and superimposed gas-oil contact which was dependent upon the contours in the area.

Q Has there been any drilling in the Devils Fork Pool oil column since the June hearing?

A There have been three wells drilled and location now being made for a fourth one.

Q What were those three wells?

A The Canyon Largo Unit No. 1-18 of El Paso Natural Gas

Company, the NC State No. 1 of mine, and the Edna No. 4 of mine.

Q Was the results obtained from the drilling of these wells comparable to that predicted by your Iso-Vol map entered in June?

A It was as good as predicted, if not better, in every case.

Q Have you prepared another Iso-Vol map which shows the three recently drilled wells in the oil column?

A Yes, I have.

(Whereupon, Merrion's Exhibit 1-A was marked for identification.)

Q I hand you what has been marked as Exhibit 1-A and ask you if that is the amended Iso-Vol map?

A That is correct.

Q You have referred to three wells that have been drilled since the June hearing. Are those wells in any particular way identified on this exhibit?

A Yes, they're all circled in red.

Q Would you point out each to the Commission, please?

A Starting in your upper left-hand corner, the Edna No. 4 on which I have designated 1.22 is the porosity feet of net effective pay, Marye pay sand. Further, the Canyon Largo Unit 1-18 on which I have designated 2.46 feet of net effective pay sand, 2.46 porosity feet of net effective pay sand. Down in

Section 16 about a mile to the Southeast the NCRA State No. 1 which I drilled and which has a net effective porosity feet of 2.08.

Q How do these wells compare with the oil wells previously drilled in the oil column?

A Well, at least in the case of the 1-18 Canyon Largo Unit and the NCR State No. 1 they appear to be by far the best oil wells in the field and their section of pay sand is better than any of the gas wells in the field. The Edna No. 4 is roughly somewhat better than the average of the previously drilled oil wells.

Q According to your previous exhibit, how many feet of effective porosity did you calculate for these areas?

A Well, I had to extend my contours to the north in the case of the Edna 4 and the Canyon Largo Unit. I had not drawn a 2.0 contour on the previous map and both of the Canyon Largo Unit 1-18 and NCR State No. 1 had sections thick enough to rate over 2.0 on the Iso-Vol. Hence, I had to make it juicer in the center.

Q Then, in short, your amended Iso-Vol map is even more optimistic with regard to oil reserves than was your initial map?

A That's correct.

Q Would you please give the productivity of each of the three wells that has been drilled since the June hearing and the completion data?

A The Canyon Largo Unit 1-18 had an official IP of 174 barrels per day. It appears to be a better well than that from what I can see, and I understood it was producing 14 barrels an hour after recovery of all load oil. I don't know what its actual top productivity is. The NCRA State No. 1 has an IP of 188 barrels of oil per day, and as of yesterday morning, which was almost two weeks after it had been completed, it had been shut in a few of those days, but it was still producing 165 barrels of oil per day.

The Edna No. 4 has not yet been perforated and fracked. We had to shut down field operations to prepare for the hearing.

Q Do you have any opinion as to what the production on the El Paso well and your NCRA State No. 1 well will level off at?

A I'm always being asked to make estimates. The El Paso 1-18 has been producing, I would have estimated to begin with that it would certainly be a top allowable well, a 164 barrel a day well or better. I understood it's only making 130. That is confusing to me. The NCRA State No. 1 appears as though it may level off somewhere between 125 and 150 barrels a day after the great drainage radius is extended after the frack treatment.

Q What was the order in which these wells were drilled chronologically?

A The Canyon Largo Unit 1-18 was drilled first.

Q How far did this well step out from previously known oil production?

A Well, it was one-half mile west of my Edna No. 2.

Q And the next well in the order of time drilled?

A The NCRA State No. 1 was drilled next.

Q How far did it step out from previously known production?

A Somewhere between a mile and a quarter and a mile and a half east of the 1-18 Canyon Largo Unit and the Canyon Largo Unit 89.

Q This bears out the confidence that you had in your own calculations with regard to the oil column, does it not?

A I would think it would.

Q What in your opinion does the drilling of these three additional wells do to verify the accuracy of the present amended Iso-Vol map as now identified as Exhibit No. 1-A?

A Well, I would say it's the most reasonable picture we have and the fact that these three wells came in as good or better than I predicted makes me have great confidence that it's going to work out just about the way it looks here.

Q Based upon this exhibit, how many acres of productive oil column did you calculate that there are in the Devils Fork Pool?

A I haven't changed my estimate from the last time, which would be roughly 8300 acres of oil area and 4700 acres of gas area.

Q How many acres of oil area and gas area does the present allowable system recognize?

A Well, the present allowable system recognizes 80 acres per oil well and prior to the drilling of these three wells we had ten wells in Devils Fork classified as oil wells and one oil well in Escrito classified as Devils Fork oil well, which gave 880 acres in the formula. We know of three new wells, and if the formula is extended, will have an additional 240 or about 1120 acres taken care of in the formula. In the gas cap there are ten gas wells to each of which is allotted 320 acres, for a total of 3200 acres, or about two-thirds of the gas cap is allowed for in the formula.

Q What percentage of the gas cap area is developed, in your opinion?

A I said 80% before. It might not be quite that great. It might be closer to 2/3rds, something like that, but certainly more than half developed.

Q And the percentage with respect to the development in the oil column?

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A Well, if you only consider 80 acres developed for each well, that would make about 12 or 15% of the oil column developed at the present time. However, the development has taken place on 160 acres in part of the oil column and, of course, that's not recognized in the formula either.

Q Under the present operation of the formula, what is the relative situations of the oil column as compared with the gas column that is recognized by the formula?

A Well, assuming that the formula is continued from here and I complete my Edna 4 well, and they take into consideration the 1-18 Canyon Largo and NCRA State No. 1, the formula will recognize that the gas cap is three times as large as the oil column.

Q And, in fact, what is the comparative situations of the two?

A Well, it appears to me that, as I have said before, there are 8300 of oil and 4700 acres of gas area which would make the oil area one and a half to two times as large as the gas area.

Q While, in fact, the oil area is considerably larger than the gas area, the formula proceeds on the basis that the gas area is much larger than the oil area, is that correct?

A That's correct.

Q In your opinion, does this have any detrimental effect on conservation?

A Very definitely. It does not allow for the expansion, well, it permits the expansion of oil into the gas cap, a considerable amount of oil, which will be forever wasted, a good bit of it.

Q Mr. Merrion, you say you did testify at the June hearing. Were you present at the time that that hearing was continued?

A Yes, I was.

Q Do you recall for what purpose that hearing was continued?

A A number of the gas cap operators have requested that a pressure survey be run in order to determine which way the pressure gradients ran.

Q Do you know, in fact, whether such pressure surveys were run?

A They were run from July 30 to August 6 of this year.

Q In your opinion what is the only sure way to determine whether or not the formula that is now operating is operating effectively and efficiently?

A I think the pressure survey certainly gives us some information as to whether it is operating effectively and

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efficiently.

Q Were you present at the August 17 hearing in 1960 when the present pool rules were adopted?

A Yes, I was present.

Q Do you recall the testimony of Mr. Woodruff with regard to the method of determining whether the system or the formula was working or not?

A Yes. I roughly recall his testimony.

Q I hand you the transcript, the official transcript of that hearing, and ask you to read a portion of Mr. Woodruff's testimony beginning at the bottom of page 34.

A Oh, beginning "In your opinion"?

Q Yes.

A All right. "Q In your opinion, will the application of this formula reasonably maintain the gas-oil contact in place without allowing it to move substantially? A I consider that it will, to the best of our ability. May I explain that, to the best of our ability, I say we have all tried to combine in determining this formula, both oil operators and gas operators, with one objective in mind, and that is to maintain a constant location of the gas-oil contact so that we will get the maximum recovery of oil, and so we will get the maximum recovery of gas. We will prevent the migration of one substance, the oil to the gas zone, or the gas to tho oil zone. We will maintain the gas-oil contact constant, and we all think this formula will come the nearest to it of any type of application we can conceive of, and we have further provided in the rules for the taking of pressures twice a year. Now, those pressures would be guideposts to us to determine the effectiveness of this formula. If this formula isn't one hundred percent effective the pressure performance history in the oil zones and the gas zone will tell us it isn't, then we can analyze what, if anything, needs to be done to correct for it, but now, we think it will work perfectly. We do know a formula of this type has worked perfectly elsewhere, and we are asking that we be permitted to utilize it in this pool."

Q Since that time there have been numerous pressure tests taken, have there not?

A Yes, there have.

Q As you previously testified, there were pool-wide pressures taken between the June hearing and this hearing?

A That's correct.

Q Have you been present all during this hearing?

A Yes, all but the first minute or two.

Q Have you heard all the testimony that has been given in the hearing?

A Yes.

Q Has there been any testimony whatsoever from anyone as to what these pressures have revealed that were taken since June?

A I have not heard them mentioned.

Q Has the word pressure been mentioned?

A Not to my recollection.

Q Have you taken the time to calculate and to tabulate the pressures that were taken during this test?

A Yes, I have. I spent a considerable time working on it.

Q Have you tabulated those?

A I have.

(Whereupon, Merrion's Exhibit 2-A was marked for identification.)

Q I hand you what has been marked as your Exhibit 2-A and ask you if this is the tabulation to which you refer?

A Yes, that is right.

Q Would you proceed to explain to the Commission what is shown in this exhibit?

A This exhibit is a summary of the bottom hole pressure buildup calculations in the Devils Fork field. It was requested at the last hearing by the gas cap operators that a pressure survey be run to determine in fact if there was a pressure gradient in favor of the oil column or the gas column. I requested that in order that we could determine how accurate these pressures would be that three pressures be run on each well because of the pressure gradients which are introduced toward a well bore during production and because of the difference in viscosity of the oil and the gas, the difference in the shut in times, I claimed that these three-day shut in pressures which had been previously run in Devils Fork did not reveal true pressures and hence the survey was run that way, and in general three pressures were run on almost every well.

Q Where did you obtain the data upon which you base this exhibit?

A I obtained it from the information put out by the district office in Aztec of the New Mexico Oil Conservation Commission.

Q Were these data also available to all other operators in the Devils Fork Pool?

A I understand they were sent out to everybody.

Q Will you proceed to explain the exhibit?

A On page 1 I have tabulated for each well in Devils Fork on which a pressure was run in the first column the highest measured pressure, the second, the extrapolated pressure, and I might explain extrapolated pressure. In each case an attempt was made to plot the pressure buildup for each well plotting the logarithm of dimension versus time versus pressure, and extrapolating the straight line portion of that line to the edge pressure on the radius of drainage. This was done by the method which was first introduced by Mr. Horner at the Third World Conference at Hague, Netherlands and has been widely accepted in the oil industry. I think everybody is familiar with it.

Q This is the system that you used, the Horner method?

A Yes, I did where applicable. The fourth column I tabulated the pressure by Horner's method as calculated for a closed reservoir. Horner's method was originally derived for one well in an infinite reservoir, and the extrapolated pressure extrapolates to the pressure which the well would build up to in the event it was a water drive reservoir or an infinite reservoir. In this case it was not the case and he has derived a method whereby you can calculate it by a complicated bit of methods which he makes simple.

Q This system is directly applicable to this type of reservoir, is it not?

A Some wells it was applicable to where the data was applicable. Some wells it was not. In the areas where essentially complete development had taken place, the closed reservoir method was applicable provided, of course, you had the points on the straight line portion of the curve and provided the well had been stabilized prior to being shut in.

Q Based upon the data that were available to you and the actual conditions that existed, are the extrapolated pressures and the pressures that you have calculated by this method accurate in your opinion?

A I think they turned out very well. Considerable amount of judgment had to be used in arriving at them, but I went through every one of the charts and arrived at my pressures before I started plotting it and I put the pressures on the map and drew up a pressure contour map and I didn't have to go back and fudge at all.

Q And it did work out?

A It plotted very uniformly.

Q Proceed then to explain further the exhibit.

A The last column, of course, is my estimate of the true average reservoir pressure within the radius of drainage of each well.

Proceeding to the first draft for the Bco, Inc. Byrd No. 1-A, I might explain the dimensionless time which is calculated by taking the cumulative production, dividing it by the stabilized rate and coming up with a psuedo producing time which in the case of the Byrd Bco, Inc. is 489.2 days. The well was shut in on July 30, the first pressure measured on August 1st, the increment of shut in time is two days, and the dimensionless time is calculated by dividing two by 489.2 plus two days, and we come out with .00407.

On the last column they are supposed to have pressure tabulated but my help didn't seem to get that down here on this particular graph. We'd have to refer back to the Commission's chart on that. At any rate, the three points would fall fairly well on a line, possibly the third point is departing somewhat from the straight line portion of the curve. The extrapolated pressure at final shut in time is 1330 pounds per square inch, the slope of the curve is 214 pounds per square inch per single and the Horner calculation of it indicates 1000 pounds per square inch. This is the best estimate of average reservoir pressure within the radius of drainage on this particular well.

The Redfern and Herd No. 3, bottom hole pressure buildup from July 28, '62 through August 6 of 1962, there are only two pressures measured on this well. The second one, the Commission's chart indicated that the gradient in the tubing they were extrapolating 87 feet from the bottom depth to the datum. They changed the gradient in the tubing from .04 psi to .20. This I felt was not very logical for extrapolation purposes. It has been my experience that as a well remains shut in longer, the fluid tends to go into the formation, and even if this were not the case, the measured pressures I felt were probably a better indication of the change in pressure between the two times. So I used a corrected pressure on the August 6 of 1493 rather than that which had been reported.

These two points extrapolated to 1674 pounds, which is what the pressure would have been had it been an infinite reservoir. I calculated by Horner's method that the average pressure within the radius of drainage was 1542 pounds per square inch and this was my best estimate of average pressure for this well.

Q Proceed to the next well.

A Pan American Dashko B-2, if I could come back to that later it will make more sense.

Q All right.

A The El Paso Natural Gas Company Canyon Largo Unit No. 89 well had been shut in on the 18th of July and built up through the August 6. The first pressure measured was 14 days after the well had been shut in. The data was plotted and indicated 1600 pounds extrapolated pressure, the Horner calculation indicated 1470, which was less than the actual measured pressure. It was my conclusion that this well had already departed from and started leveling off prior to the survey and hence the extrapolation in the Horner method calculation was not applicable, and it was my feeling that the 1400, the average reservoir pressure, the best estimate would be an average between the highest measured of

1482 and the extrapolated of 1600, and I used 1541.

The Paul F. Rutledge Miller A-1 bottom pressure buildup from July 16 to August 6, first pressure measured was on August 1st, sixteen days after being shut in. The data was plotted, extrapolated to 1575 pounds, the Horner calculation indicated a pressure of 1362; it was again my conclusion that the buildup had already departed from the straight line portion of the curve. That the best estimate of reservoir pressure was an average between the highest measured pressure and the extrapolated pressure. I used 1473 pounds per square inch as the average pressure between the radius of drainage.

The NCRA State No. 1, this well had produced only 343 barrels of new oil prior to being shut in. The stabilized producing rate was 188 barrels a day prior to being shut in. A pressure bomb was run in 29 hours after it was shut in and kept on bottom until 73.25 hours after it was shut in, and the pressure was continuously measured. The extrapolation indicates an edge pressure of 1941 pounds per square inch. Due to the short producing history of this well, it was my conclusion that the radius of drainage was very small, and since there was no producing wells within a mile and a half of the well, I felt like the best estimate of average pressure within the radius of drainage was the extrapolated pressure of 1941 pounds per square inch. This is

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what I used. The Pan American Dashko B-1 pressure was built up from July 30 to August 6, 1962, the plot of data extrapolated to a pressure of 1486 pounds per square inch at infinity and the Horner method indicated, a pressure of 1356 pounds per square inch. This was, I felt, very reasonable and accurate data for the average pressure within the radius of drainage on the Dashko B-1. 1356 pounds per square inch was used.

Paul F. Rutledge B-4 was built up from July 30 to August 6. We had three points, the third point seems to be departing from the straight line portion of the curve. The extrapolated pressure was 1838 pounds per square inch. The Horner method indicates an average pressure within the radius of drainage of 1609 pounds. This I felt was accurate data. I used 1609.

The Redfern and Herd Largo Spur 1-A was built up from July 28 to August 6, 1962. The extrapolated pressure was 1761 pounds per square inch, the Horner method calculation indicated 1582, 1582 I felt was an accurate figure for the average pressure within the radius of drainage.

The Edna No. 3 was shut in on July 30th and built up to August 6. The pressure data submitted by B and R to the Commission on that I didn't feel was accurate in that sona log dead weight tester method was used, and they used the same gas gradient on each one of the three pressures. Of course, as the pressure built up on the annulus, the weight of the gas column will increase in proportion for your surface pressure. I corrected the data accordingly and this varies from that reported by BR. The sona log is somewhat less accurate than bomb data and I drew my build up through an average of three points. It extrapolated 1843 pounds per square inch. The Horner method indicates an average pressure within the radius of 1622 pounds per square inch. This I felt was reasonably accurate.

The Edna No. 1 pressure was measured by the bottom hole pressure bomb method. The extrapolated pressure was 1930 pounds, the average pressure was indicated by Horner to be 1748 pounds per square inch. I felt this was accurate. I used it.

The Edna No. 2, through a mixup was not, pressure was not measured except on the last day of shut in. They measured an actual pressure of 1709 pounds. I felt that to obtain an average reservoir pressure it would be necessary to plot the 1709 pounds and extrapolate to an average edge pressure in the adjacent wells. I did that extrapolating to 1930 pounds and calculated by Horner's method that the average pressure within the radius of drainage was 1843 pounds.

Bco, Inc. Byrd 5-A pressure was measured from July 30 to August 6. The extrapolated pressure was 955 pounds, the average pressure within the radius of drainage was 765 pounds. It might be mentioned here that this is the well that we think might be in the Escrito field, which Mr. Jameson thinks is, I don't know what he thinks. At any rate, the extrapolated pressure is 955 pounds. The average pressure is 765 pounds. This is about 400 pounds less than any other pressure in the field.

The El Paso Natural Gas Company Canyon Largo 118 was shut in on the 29th of July and pressure was built up to the 6th of August. We had three points here, the extrapolated pressure was 1933 pounds per square inch; as in the case of NCRA State No. 1 it was my opinion that this should be treated more as an infinite reservoir due to the short producing history and due to the lack of stabilization of the small drainage radius which must have been induced during that short time. I used 1933 as my average reservoir pressure.

Going back to the Pan American Dashko B-2, there were three points which extrapolated to about 2700 pounds. The well had stabilized at only 4.9 barrels a day. It was my feeling that this well was not, had not reached the straight line portion of the buildup curve, and the most accurate way of calculating the pressure was to assume it was approaching straight line portion and to extrapolate to the average edge pressure in the adjacent wells. This I did, extrapolating to 1509 pounds, and by Horner's method I calculated an average reservoir pressure of 1286 pounds per square inch. There's a good deal of good data, a good deal that required interpretation, but I think the results I have tabulated here are a fairly honest appraisal, and I think that it's fairly accurate.

Q Can we say this, that this is the most accurate pressure data that is available at this time?

A I think there's no doubt about that since it's the only pressure data being presented here today.

Q Is the interpretation that you have placed upon this pressure data a fair and equitable interpretation in your opinion?

A Yes, it certainly is.

Q Have you treated all wells in similar circumstances the same?

A Yes, I did.

Q Have you prepared a map which reflects these pressure data?

A Yes, I have.

(Whereupon, Merrion's Exhibit 3-A was marked for identification.)

Q I hand you what has been marked your Exhibit 3-A and ask you if this is the map to which you just referred.

A It is.

Q Would you please explain this exhibit?

A This is what I call an Iso-Piestic map. I don't know if that's the right term or not. It is a map with lines drawn through points of equal pressure. The pressures which are written beside each well are those pressures which are previously tabulated on the last exhibit as the best estimate of reservoir pressure. The pressure contours were drawn across the field between the field limits which are outlined on here the same as indicated on my previously exhibited Iso-Vol map.

The indications are that the average pressure in the gas cap is about 1514 pounds, with not too much variation, the minimum pressure being 1473 at Paul Rutledge 1-A Miller and maximum pressure being 1542 in the Redfern and Herd No. 3.

Q Mr. Merrion, does this include the one well which you did not believe to be in the Devils Fork Pool?

A Yes, I didn't put the Byrd 5-A in the pressure survey. The pressure we figured at 756 pounds.

Q What was your reason for that?

A I believe it belongs in the Escrito. I believe that pressure conforms more to the Escrito and everything about it indicates it does not belong in Devils Fork.

Q Go ahead.

A The exhibit indicates that the west part of the Rutledge B lease and the Pan American B lease, the average

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reservoir pressure is about 1350 pounds, or about 150 pounds lower than the average gas cap pressure of 1514.

Q What specific area is that, would you point it out by township, range and section?

A It would be the East Half of Section 11 and the West Half of Section 12 in Township 24 North, Range 7 West.

Q That would be the upper left-hand corner?

A The upper left-hand corner of the map.

Q Is that in the oil column?

A Yes, it is.

Q Would you reiterate that testimony?

A The average pressure in that area appears to be 1350 pounds, 164 pounds lower than the average gas cap pressure, indicating that due to the thinner pay here and to the early time of development and denser development this area has stayed slightly ahead of the gas cap on the volumetric formula.

Moving over to the right, the Edna lease, the average pressure appears to be about 1750 pounds, indicating about a 236 pound gradient in favor of the gas cap, which would, of course, allow oil to migrate into the gas cap.

Q Again identify this area by section.

A Section 7, 24 North, Range 6 West.

Q Is this speaking with respect to average gas cap pressures?

A I average arithmetically all the gas cap pressure at 1414 pounds per square inch. This is about 236 pounds lower than the average pressure on the Edna lease in Section 7.

Q How did this compare with individual well pressure in Section 18 immediately across the gas-oil contact?

A Immediately across the gas-oil contact the pressure is 1500 measured in Skelly New Mexico Federal 1-G.

Q This reflects even a greater gradient between the Edna lease and the gas cap portion of Section 18, does it not?

A Yes, yes, it does.

Q Proceeding to the remainder of oil column and gas column, what are your observations?

A We have only two more pressures to the east on the Canyon Largo 118 and NCRA State. Both of these pressures were in the vicinity of 1940 pounds per square inch, which left us with 426 pounds gradient from the oil column toward the gas cap. This is in the area where most of the Devils Fork oil appears to be. The large gradient has a tendency to move that oil into the dry gas cap, resulting in considerable waste over about a five-mile border there.

Q Mr. Merrion, do you have any particular observations to draw with respect to pressure gradients as we near the gas-oil contact?

A Yes. Throughout the gas cap the pressures seem fairly steady at 1500 pounds and you cross the gas-oil contact into the oil column into this undeveloped area you get 1940 pounds, which is 60 pounds less than virgin pressure, and yet there's about a 426-pound gradient right in the vicinity of the gas-oil contact.

This is certainly a fortunate thing because if this reservoir had come to equilibrium our waste would have been many, many times what it is. It is considerable as it is, but it would have been many times had the reservoir come into the equilibrium.

My reason for the large gradient is that the gas cap was originally 100% saturated with gas. The oil column was 100% saturated with oil, and the relative permeability characteristics are such that it's very difficult to move the oil into the gas cap until you adduce gas saturation and get the two-phase flow.

Q Now, Mr. Merrion, at this point, this concept of relative permeability is a rather involved one. I think this tremendous pressure gradient right at the gas-oil contact is of great significance. Would you please go into considerably more detail as to what in your opinion causes this great pressure gradient as it crosses this line and the actual function of relative permeability gas and oil?

A The permeability of the rock to one fluid is a function of the fluid saturation of the rock. The rock must saturate itself with oil before oil can move. It will move microscopically very small permeability to oil in a dry rock, but this is the only thing that has saved us here. It is gradually slowly saturating the gas cap, and as it does the permeability will become greater and the flow into the gas cap will become greater. The pressure differential is there, the harm is waiting to be done. There's very little we can do about it except to develop the oil column quickly and possibly shut in the gas cap before this thing occurs.

Q In your opinion has there actually been an encroachment or a movement of oil into the gas cap?

A Yes. Yes, very definitely there has.

Q Would this movement have been even greater were it not for this function of KGKO or relative permeability of rock to gas and oil?

A It would have been much greater.

Q In your opinion do you have any conclusions as to the actual amount of oil that already has migrated into the gas cap column and what the prospects are of recovering that oil in the future?

A Yes. I have a page of calculations which I didn't get a chance to have typed up as an exhibit. If I may be permitted, I will read them off. Considering only the area which previous to June 15 had not been developed in the oil area, apparently there were 6800 acres of oil area undeveloped. The apparent average porosity feet, 1.6; apparent average pressure on August 6, 1962 was 1940 pounds per square inch; total stock tank barrels of oil in place in this area was 38,300,000 barrels.

Normally we would expect a primary recovery out of this area of 4,800,000 or 12½% of the oil in place.

Q What do you mean by normally?

A Under a solution gas drive unaffected, if the gas cap wasn't there and we were producing under our own steam without any help or any harm from the gas cap.

Q Proceed.

A The normal recovery after water flood from this would be expected to be about 30% of the oil in place or 11,500,000 barrels. The gas saturation induced by pressure drawdown in the gas cap which dropped the pressure in this undeveloped area from 2,000 pounds virgin to 1940 pounds present pressure was calculated to be 2.33%. I used a formation volume factor at 2,000 of 1.434, a formation volume factor at 1940 of 1.428 for oil and .0334 for gas.

The gas saturation was calculated, assuming that the gas that was liberated stayed where it was and oil moved, this would essentially be true because of the relative permeability characteristics.

Q Explain that further, Mr. Merrion. From whence did this gas come that you are talking about?

A This gas came out of solution in the oil as the pressure dropped from 2,000 to 1940.

Q Does gas start coming out of solution in a reservoir where you have completely saturated oil as we did here immediately upon a pressure drawdown?

A Yes. The bubble point is virgin pressure in a saturated reservoir such as Devils Fork, and the minute you start taking fluids from the reservoir the pressure drops from virgin and the gas starts coming out of solution and forming an oil.

Q In the reservoir? A Right.

Q What is the effect of the gas phase in the reservoir upon the permeability of the rock to oil?

A It's very detrimental, I have an exhibit to show that later.

Q Does a very slight, or how much pressure drawdown is required to effect a considerable detriment to the permeability of the rock to the oil in this area?

A I don't have any relative permeability data on this particular reservoir. I have some relative permeability data on a similar reservoir with similar characteristics.

Q What reservoir is this?

A This is the Gallup Marye sand reservoir in the Bisti field.

Q This is the same sand?

A This is the same sand of the same age, has similar characteristics.

Q Is the oil of similar characteristic?

A Well, except that it is not saturated oil in Bisti, I don't believe. That would have no effect on the characteristics of the relative permeability.

Q Would you proceed to explain to the Commission what this effect of introducing gas in a gaseous state in a reservoir has upon the productivity of oil?

A Well, a small saturation induced in an oil reservoir with a characteristic -- shall we depart from this and discuss this now? Do you want to pass out the exhibits and come back to the calculations later?

(Whereupon, Merrion's Exhibit 4-A was marked for identification.)

Q I hand you an exhibit that has been marked 4-A to portray the effect of the relative permeability.

A With the permission of the British American Oil

Producing Company I am presenting a graph which was prepared for them by Petroleum Technologists, Inc. on a sample of a core from their Marye B No. 4 in the Bisti field. The depth of the sample is 4920 to 4921. The measured porosity was 16.3%, the permeability to air was 17 millidarcies, the permeability to oil with the presence of connate water was 13.7 millidarcies.

The dark circles are data which was measured on permeability of the rock to oil in the presence of a gas phase saturation and indicates that the permeability which started out at 1.0 or 100% of permeability to oil dropped to 28% on a 2½%. Gas saturation was induced and thereafter gradually leveled off to where the further drop was not quite so bad.

On this particular sample the equilibrium saturation or that saturation at which gas started to flow, would start to flow in this rock, was somewhere between three and three and a half percent.

Q Will you compare this to the present reservoir? Are we, in your opinion, coming close to this point of equilibrium?

A Well, the Canyon Largo 118 has an IP of gas-oil of 1655. The IP in State No. 1 was 1719 as compared to a solution ratio of 935. We are obviously past the equilibrium gas saturation. Gas is flowing, now beginning to flow in this undeveloped area.

Q As the flow of gas increases, what happens to the flow of oil?

A It decreases.

Q Markedly?

A At first very markedly from 100% down to about 25% with very small gas saturation induced.

Q In your opinion, is this function of relative permeability, is that the greatest hazard in this area?

A I think the greatest hazard in the area is the premature production of gas from the gas cap. That's something we can do something about. There's nothing we can do about the relative permeability.

Q Isn't it true that the premature production of gas from the gas cap will precipitate this change of relative permeability in the rock?

A It will allow oil to flow from the area and reducing the gas saturation from 100% to 125% in very little time.

Q Have you made calculations based on all these data as to how much oil has already been forever lost?

A Yes, I have. Proceeding again in the middle of my exhibit we were working on when we diverged here, I had used a formation volume factor 2,000 pounds per square inch at 1.434, a formation volume factor at 1940 of 1.428 for oil and .0334 for gas. The calculated gas saturation was .0334 over 1.434 times 100 or 2.33%. In making this calculation it was assumed that only oil had flowed from this area since it was above equilibrium gas saturation when the pressure was drawn down.

The oil permeability from the graph at 2.33% is 35% of virgin.

Q Repeat that.

A The oil permeability at 2.33% gas saturation is 35% of virgin.

Q Is that a present gas saturation?

A That's the present gas saturation in the area of NCRA and Canyon Largo Unit 118.

Q This change from virgin pressure in the situation where you had no gas saturation has caused a reduction in your relative permeability to what extent again?

A Relative permeability to oil was reduced from 100% to 35%, as the gas saturation increased from 0 to 2.33%.

Q This occurred before the well was ever drilled, didn't it?

A That's correct. A part of this gas saturation was due to shrinkage of the oil and part was due to oil migration. The calculated gas saturation due to shrinkage as the formation volume factor of oil dropped from 1.34 to 1.28 was 0.2%, which left a gas saturation due to oil migration of 1.91%.

Q The great majority then of the difference being as a result of oil migration?

A Most of it, yes.

Q Proceed.

A Calculating the amount of oil which has migrated from the underdeveloped area 1.91% times 38,300,000 is 732 stock tank barrels of oil which has migrated from the underdeveloped area.

Q How much is this again?

A 732,000 barrels, almost three-quarters of a million barrels of stock tank oil.

Q What are the prospects of now recovering this oil since it has already migrated into the gas cap area?

A Well, as I cited before, the recovery factor on primary is 12½%, so we would recover about 12½% of this back on primary if we ceased further migrations into the gas cap now, by some means leaving 641,000 barrels forever lost to primary recovery. In the event we can flood this reservoir, eventually we ought to get about 30% of that oil which has gone into gas cap back, which leaves 70% of it lost forever to any means of recovery, or about 513,000 barrels of oil lost forever to any means of recovery. There is a greater value of this oil which would have been recoverable in the wells instead of producing into gas cap.

Q This is recoverable oil? A Yes.

Q That has been lost?

A Yes, that's the type of stuff that flows in the rock and instead of letting it flow to well bores we let it flow to gas cap. The economic value is greater than all the oil produced from the Devils Fork gas cap. This is just the start. If this reservoir were allowed to come to equilibrium and this gas locking situation that the gas-oil contact gets to the point where it allows the oil to flow into the gas cap more readily, the reservoir pressure would come to equilibrium at 1713 pounds per square inch by material balance.

I have not had a chance to calculate how much oil will be lost. It is rather a complex calculation because you get part oil and part gas flowing into the gas cap. I'm sure it would be very large indeed. We have already lost one-sixth of our primary recovery from this undeveloped area. Another 200 pound drop if this thing comes to equilibrium would be, I'm sure, more hazardous than that.

Q In view of the data that have been made available to you and those that you have developed and your analyses of these data, do you have any recommendations at this time with respect to what should be done with regard to the proration formula and the pool rules in general in the Devils Fork Pool?

A First of all, as Mr. Woodruff had mentioned in the hearing of August of 1960, we should certainly, we have analyzed

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the data and we should do something about this imbalance that has been created. The only way to prevent the potential waste which has been created here, the potential additional waste from occurring, is to shut in the gas cap and immediately start putting gas back into it so that this pressure differential can not come to equilibrium before you can recover the oil. That would, of course, require unitization which takes time. I don't think it can be done. About the only practical thing to do is to shut in the gas cap entirely until equilibrium is taken. Possibly in the meantime we can do something about unitization of the reservoir.

Once equilibrium is again attained, we should not limit the recognized developed oil acres to 80 acres per well. We should use a little geological inference, a little sense, if people are developing 160 acres, it's obviously productive, it should be included in the formula. The formula can't work unless you insert the right factors. It's a wonderful formula, it's theoretically correct, but won't come out with the right answer unless you insert the right figures.

Q In your opinion are the oil reserves, whether actually now drilled or not, without any question of coubt in your mind there in this field?

A Yes, yes.

Q Should, in your opinion, the total oil reserves that are in the pool be recognized from an acreage standpoint in the formula?

A Very definitely. I don't think we should limit our conservation to the oil which has been drilled. This is kind of an unusual situation. Normally we try to formulate rules which will permit the operators in an area to get what's coming to them and protect correlative rights and to promote conservation. However, it's up to the operator to drill up his acreage and take advantage of the rules.

In this particular case there's a lot of people who didn't think there was any oil in Devils Fork at all to begin with and then they thought it was only a little oil rim. Now it appears to be a hell of a lot bigger than the gas cap. By not recognizing the undeveloped area we are in effect confiscating that oil. I don't think that's good conservation. I don't think it's good correlative rights.

Q If the Commission doesn't recognize today that it exists there today, it won't be there tomorrow, will it?

A That's correct. That's correct.

Q Then to summarize your recommendations with regard to the formula and how it should be operated, one, when equilibrium is again attained it is your recommendation that the oil acreage that is reasonably proven to be there by virtue of the Iso-Vol maps which you have presented to this Commission be considered in this formula as being oil acreage, is that correct?

A Very definitely.

Q And that the gas acreage, whether developed or not, that you indicate as being present in your Iso-Vol map, also be considered in this formula?

A That's correct.

Q But before applying this formula with the full recognition of each type of productive acreage, what in your opinion is required in order to prevent a tremendous amount of waste?

A We've got to shut in any gas cap right now. That's the only answer until this thing comes to equilibrium.

Q In your opinion, if this pool is produced for another year under the present pool rules, what's going to be the effect upon the oil column?

A It will be very detrimental to be sure. I haven't calculated the extent of it, but if no more gas is produced and if we don't develop the oil column and get going or put gas in the gas cap, there's going to be a tremendous amount of waste due to the production which has already occurred from the gas cap. We don't have to produce any more, there's a lot more waste going to occur.

Q Again summarizing your testimony, in your opinion how many barrels of recoverable oil either by primary or secondary methods are present in this pool?

A Well, now, I was just talking about the undeveloped area a while ago in the entire pool I figured 8280 acres with an average of 1.5 porosity feet for a total of 62,630,000 reservoir barrels, or 43,605,000 stock tank barrels in place ordinarily recoverable by normal means would be 12½% or 5,500,000 barrels.

Q By primary?

A By primary. We've recovered less than 10% of that to date.

Q By secondary operation?

A An additional seven million, well, roughly an additional seven and a half million for a total of thirteen million barrels.

Q We are talking about thirteen million barrels of oil in this pool that are recoverable?

A That should be recoverable, yes.

Q I mean if it's operating.

A That should have been recovered.

Q In accordance with good conservation practices?

A That's correct.

Q In your opinion isn't there a great risk of losing more than half of this recoverable oil if there isn't something done about this gas cap?

A Very definitely.

Q Do you feel that there is a considerable amount of urgency with regard to when this relief must be granted?

A Very definitely, it should be right now.

MR. COOLEY: No further questions of this witness.

MR. PORTER: Do you intend to offer your exhibits at this time?

MR. COOLEY: Yes, Mr. Commissioner. With your permission we offer Merrion's Exhibits No. 1-A, 2-A, 3-A and 4-A into evidence. With your permission we would also like an opportunity to tabulate the penciled information, the very complicated penciled information which Mr. Merrion has testified in regard to the number of barrels of oil that will be wasted and submit those to the Commission sometime next week as an exhibit. These figures are in the record, but as a tabulated exhibit they are not.

MR. PORTER: Any objection to admission of the exhibits or to the submission of the tabulation of figures next week? The exhibits will be admitted and permission is granted for submission of the tabulation of figures.

MR. COOLEY: Thank you, Mr. Commissioner.

(Whereupon, Merrion's Exhibits Nos. 1-A, 2-A, 3-A and 4-A were admitted into evidence.)

MR. PORTER: Any questions? Mr. Kellahin.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Merrion, you don't have a potential on your Edna No. 4?

A I have not perforated or fracked it yet, Mr. Kellahin. I had to shut down operations to prepare for the hearing.

Q On your exhibit, I believe 1-A and also on 3-A, you showed a gas-oil contact. Is that the same gas-oil contact as shown on your exhibit at the previous hearing, is it in the same location?

A I moved it a little bit, the NCRA State No. 1 came in at a plus 1002 and I estimate the gas-oil contact at a plus 1050, which would move it much nearer the Canyon Largo Unit, or somewhat nearer the Canyon Largo Unit 89, so in that area it should be slightly different. It's approximate, I used a few control points and roughed that in, there might be two or three maps, it might be a fraction off, but that's roughly where the gas-oil contact is in the reservoir.

Q Without regard to the precise accuracy of the exhibit, you did move it to the south?

A Yes, due to the control over in NCRA State No. 1.

Q At the time that you made that up were you aware of the increase in gas production in the Rutledge 4-B and 5-B wells?

A I noticed that they have been producing a very high gas-oil ratio. Of course, in the 2-B and 5-B there may be a little gas cap gas coming in there; of course the relative permeability curves would certainly explain the increased gas-oil ratio in those wells and the increased gas, it doesn't necessarily have to be gas cap gas.

Q You wouldn't attribute that to the migration of the gas-oil contact --

A Not necessarily, no.

Q --in a northerly direction?

A No.

Q You've discussed this question of relative permeabilities and have stated that withdrawals of gas cause a reduction in the permeability in the oil zone?

A Withdrawals of gas result in a drop in pressure in the oil column which allows solution gas to break out of solution, increasing the gas saturation and thereby reducing the permeability of the rock to oil.

Q Well, now, do you get precisely the same effect for every barrel of oil withdrawn from the oil zone?

A Qualitatively, yes. When you withdraw barrels of oil from the oil zone it reduces pressure.

Q It is just a matter of degrees which you are drawing?

A Right, our pressure map indicates that there was a tremendous pressure differential in favor of the gas cap. We calculated 732,000 stock tank barrels that migrated from the undeveloped area. It certainly hasn't shown up in the oil well.

Q You say 732 barrels?

A 732,000 stock tank barrels of oil.

Q Have migrated from what area of the pool into what area?

A They have migrated from the area east of Section 8, well, the area east of Sections 7 and 8 into the gas cap along this four-mile gas-oil contact.

Q Is that conclusion based solely on your interpretation of the pressure information?

A Yes. Of course, if you'll calculate, I ran a rough calculation and I'm not too sure of my answer. You wouldn't have to move the gas-oil contact too many feet to account for 732,000 stock tank barrels, or it would be a little over a million reservoir barrels. It probably wouldn't show up in a well. By the time it shows up in a well it's going to be way too late.

Q If the increase in gas production in the Rutledge wells we've discussed is due rather to a migration of the gas-oil contact in a northerly direction, that would wipe out your conclusion that there has been a migration of oil?

A No, it certainly wouldn't. Of course, my pressure map indicated there was a pressure differential in favor of the Rutledge and Dashko-B area. I would imagine the gas contact has moved slightly in that direction.

Q You would actually expect it, wouldn't you?

A Yes, there's a differential, they are ahead due to thinner pay, due to the denser development and earlier time of the development they are ahead of the gas cap. That represents a very, very small percentage of the oil in this reservoir which we are trying to conserve.

Q Now, on this pressure information you didn't have any information on the 1-19 Lybrook well, did you?

A Yes. I had some information on that. In my tabulation the 1-19 Lybrook, apparently that didn't get tabulated on the map. I had figured that that well had been shut in long enough to reach stabilized pressure of 1522 pounds and that is what should be on the map.

MR. COOLEY: Mr. Merrion, in your exhibit on what page is that?

A Exhibit 2-A, Lybrook, the second well from the bottom, the highest measured pressure was 1522, the extrapolated pressure method was not applicable due to the long shut-in time, it was apparent that the well had reached stabilized pressure. Pressure by Horner's method, of course, was not applicable because there's no straight line to calculate it with. The estimated reservoir pressure is 1522.

Q You took that as a stabilized pressure because of the long shut-in time?

A Yes.

Q Didn't you have the same situation in regard to the Largo Spur No. 1? I believe your exhibit shows.

A I have shown conflicting information, the C-115 which Redfern turned in on the Largo Spur 1 indicated no production for July. But the pipeline company, Southern Union informed me that the well had produced in July, and let's see if I can find that information. My calculations were based on --

Q Could that production have been from the Dakota rather than --

A I question that because of the difference in the C-115, and what Southern Union told me, and they said definitely no, it's definitely a Gallup gas. They gave me the producing time, the number of days produced during July, I assumed that was right and possibly the other was wrong.

Q Mr. Merrion, that well was initially shut in in April, wasn't it, the 1-19 Lybrook?

A Yes, April 26 I think.

Q On the bottom hole pressure information it does show a pressure buildup between the 1st and the 6th of August?

A The Horner method of calculation of extrapolating pressures, and calculating a pressure in a closed reservoir within the radius drainage of the well is based upon the pressure waves coming in towards the well bore from the radius of drainage. The buildup method is not applicable when there are gradients across the reservoir, the actual point measured as these pressure waves came across the reservoir on August 6 would be the best figure we need for the type of map we want. Even though there is a buildup during the period of time having been shut in, April, May, June, July, August, that's four months, 120 days when you calculate it, you are way out near the infinite shut-in time and it's got to be pretty well stabilized. Change in pressure over the period of days is due to gradients across the reservoir rather than the pressure waves coming in from the radius of drainage.

Q You don't recognize this as being an eight-pound pressure buildup?

A Yes, I recognize it as being an eight-pound pressure buildup, but not due to the pressure waves coming in from the radius of drainage. It's due to pressure waves going across the

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reservoir, they're not radial.

Q As a matter of fact, since 1961 and 1962 most of the gas wells have been shut-in for substantial periods of time, have they not?

A Some of them have. Some of them have been wide open for substantial periods of time.

Q Well, relatively speaking most of them have been shut-in?

A Yes, some of them were over produced three years, during the first five months they were producing at five million feet a day.

Q And are presently shut-in and have been shut-in, many of them?

A Many of them such as the well we just mentioned there.

MR. KELLAHIN: Thank you, Mr. Merrion.

MR. PORTER: Any further questions of this witness? Mr. Nutter.

BY MR. NUTTER:

Q Mr. Merrion, in your opinion is there communication between the Devils Fork field and the Escrito field?

A I think they're separate reservoirs, they were initially, I think this is brought about or evidenced by the fact that we can not find any well where the two sands merge. We have different pressures in the two reservoirs right now. The

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oil in Devils Fork was saturated with a bubble point of 2,000. I'm not sure exactly what the bubble point figure is in Escrito, but I believe it's around 1200 whereas compared to the IP of 12,000, in this vicinity. I don't think that it's likely that the oil in Escrito was in communication with a gas cap or it would have been saturated. Possibly there is some communication between the two reservoirs in well bores. I don't think that's a good reason for putting the two fields together, but on the pressure map we see that this Reese No. 1-A Byrd has an 1100 pound pressure, it extrapolates to 1330, that could be due to, that pressure is, let's see, it's 1017 is the pressure, that is the lowest Devils Fork pressure. There might be a leak out there. If there is I think it's due to communication in the well bore not in the sands in the reservoir.

Q What was the pressure, and did you extrapolate the pressure on that No. 5 well down there in Section 23?

A It extrapolated to 955 pounds.

Q That's correct, you mentioned that. Now you've answered the question with regard to communication between the Devils Fork and the Escrito, have you made any study, and if you have or even if you haven't, do you have an opinion as to whether there's a communication between Devils Fork and Otero?

A That's a point I was going to bring up a while ago, if by virtue of the fact you perforate two different sands in the well bore, you want to put the two fields together, you might as well put Otero in too. There's definitely in my mind no reservoir communication down below except possibly in well bores. In my opinion it has Devils Fork-Otero pay, it is perforated in both, fracked in both. The New Mexico Federal A-1 the same. The Canyon Largo, I believe, perforated the upper Otero type pay, that's about two or three miles across. I don't know if that communicates with Otero or not.

Q You said the New Mexico Federal A-1 is perforated in the same sand as the Otero?

A It's got Devils Fork sand and Otero sand, is perforated in both and fracked in both.

Q Has that Otero sand faded out by the time it gets to your NCRA State 1?

A No, it's present there. I didn't perforate it because I didn't want to commingle the reservoirs. I felt like that was primarily the gas producing sand and it would mess up the volumetric formula, give the gas cap a higher allowable, I feel like several of my wells have productive upper sand in them.

Q By the time you get to your NCRA State No. 1, the Otero sand is the upper pay and you have perforated the NCRA in the lower pay?

A Well, the Otero sand in my opinion is, well, I got a log here. NCRA State No. 1, I believe that the Gallup is productive in the interval 57, 5630 to 65, about thirty-five feet of upper stuff, a few intervals in that interval, and I think that correlates with Otero.

The Marye sand, which I perforated and fracked and which is producing in the NCRA State No. 1 is 5760. So there is a good hundred feet of shale in between them.

Q Your computation of reserves in the undeveloped area, have you included the Otero sand?

A No, I have not, it's only the Marye sand.

MR. NUTTER: Thank you.

MR. PORTER: Anyone else have a question?

MR. COOLEY: I have.

MR. PORTER: Mr. Cooley.

REDIRECT EXAMINATION

BY MR. COOLEY:

Q Mr. Merrion, in Mr. Jameson's testimony this morning he has testified that there was communication, he testified that he believed, between the Escrito sand and the Devils Fork sand. He further testified that in his opinion the majority of this communication was occurring in a well bore and that this was communication, to him was communication. Is it also true that if you were to drill a well that penetrated the Gallup sand and say the Dakota sand and drilled a sufficient number in a localized area that you would have substantial communication between those two pools?

A Yes, we have a communication in Miller 5-B as evidenced by the pressure buildup, or at least that's what the Conservation Commission concluded between the Dakota and Gallup, but I don't think it's a good reason to include the Dakota in Devils Fork.

Q Now, Mr. Merrion, you have testified as to the number of barrels of oil in the oil column, let's for a moment dwell on the amount of gas that's in the oil column as for any given cubic area in the oil column as compared with any given cubic area of similar size or identical size in the gas column, disregarding the oil now entirely, what is the comparative quantity of gas in the two areas?

A Oh, I have got that figure. I think as you questioned Mr. Jameson before, it's kind of amazing when you do some calculating you realize that a cubic foot of reservoir surface in the oil column contains 1.343 cubic feet, contains one stock tank barrel of oil and 935 cubic feet of gas and 1.434 cubic foot of net reservoir in the gas cap, doesn't contain a heck of a lot more gas and doesn't contain any more oil. According to my figures the total gas reserve in Devils Fork initially --

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Q Is this in the gas cap now?

A Yes, in the gas cap. Roughly on a cubic foot of reservoir basis there is almost as much gas in the oil column per cubic foot of net reservoir as there is per cubic foot of reservoir in a gas cap. We have a lot more acre feet. I think there's more gas in the oil column than there is in the gas cap.

Q This gas that these oil wells produce, as their GOR's go up, is that gas that was there when the reservoir was in its virgin state in the gas cap or underlying the gas cap operators' acreage?

A Well, it's normal in a reservoir with no gas cap, as the reservoir depletes your permeability of the rock to gas increases, the permeability of oil to gas decreases, and the gas-oil ratio goes up to solution gas, not gas cap gas.

Q Whose property was the gas under that's being produced from the oil wells, was it gas cap operators' gas or oil operators' gas?

A I believe it's oil operators' gas.

Q In your opinion, with the possible exception of the area to the very northwest of your map where the Rutledge wells are, has there been any migration of gas cap gas into the oil column?

A There possibly might have been a little bit. I don't think it has appeared in any wells, it may have. The pressure map indicates the pressure is lower up there and when there's pressure gradient there's bound to be movement.

Q With the possible exception of that area, has there been any migration of gas cap gas into the oil column?

A No, definitely not. Well, if you call the Byrd 1-A oil column which they originally classified as an oil well, that's certainly a lower pressure there, and as Mr. Jameson testified, it was going to gas. Gas has increased there. According to my interpretation it was just a little pip of oil trapped up there in a kind of a pinched position, and they apparently depleted that little portion of it. It's not connected to the main reservoir.

Q Now, they are producing gas cap gas?

A Now they are producing gas cap gas. Apparently that is the gas has gone into that portion of oil area.

Q Isn't it true that the gas for all practical purposes, that all of the gas that the oil wells are producing is gas that was in solution in the oil and not gas cap gas?

A I believe that's right.

Q And that the oil operators are not producing or stealing any of the gas cap operators' gas?

A Definitely not.

MR. COOLEY: No further questions.

MR. PORTER: Mr. Kellahin.

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RECROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Merrion, on your redirect testimony you said that the gas that is being produced is coming out of the oil column. Is that your testimony, that is in the oil zone?

A In general the gas being produced out of the oil wells is solution gas.

Q Solution gas. If just the normal increase in GOR's occurred, would there be a reduction in the amount of oil being produced?

A Generally, yes.

Q Then has the oil production reduced in these wells?

A I haven't plotted up any curves trying to figure that out, Mr. Kellahin.

Q Well, let's take, for example, this Rutledge 4-B Miller well in Section 12, 24 North, 7 West, in January it shows 446 barrels of oil as against 1,656 MCF, dropped down into June, and we got 296 barrels of oil as against 7,156 MCF. Would that be what you would expect on just the increase on the GOR of the well on solution gas?

A Give me those figures again, will you?

Q January, 446 barrels of oil, 1,656 MCF.

A All right.

Q June, 296 barrels of oil, 7,156 MCF of gas.

A Was that a steady decline or was it very erratic over the months in between?

Q No, I'll give you the other figures if you would like. February, 191 barrels of oil, 1,183 MCF of gas; March, 536 barrels of oil, 5,261 MCF of gas; April, 386 barrels of oil, 1,859 MCF.

A How many?

Q 1,859. May, 267 barrels of oil, 9,454 MCF.

A Well, it's obvious that the reported data is very erratic and probably based on estimates of splits between wells. However, let's assume that it is correct and this thing went from 446 of oil in January to 296 in June and went from 1656 MCF in January to 7156 MCF in June. Refer to the KGKO data which was presented as Exhibit 4. You will notice that the reduction of permeability to oil drops to about 20% of virgin permeability before gas starts to flow. From then on your further reduction in oil permeability is rather gradual. Now, if you move over to the right, as gas saturation increases your permeability to gas starts increasing rather rapidly. So it is possible that that could represent solution gas due to these relative permeability characteristics, the oil had quit declining rapidly, the gas was beginning to incline rapidly due to the relative permeability characteristics.

Q Would that be supported by the pressure differential you show in your other exhibits?

A Would what be supported?

Q I mean your theory in regard to this conclusion.

A This is no theory.

Q Where this extra gas came from. Do you understand the question?

A I'm trying to, if I understand the words, but not quite what he's driving at. I don't think the pressure map belies this explanation at all.

MR. KELLAHIN: That's all.

MR. PORTER: Any further questions? The witness may be excused.

(Witness excused.)

MR. PORTER: We'll take a short recess.

(Whereupon, a recess was taken.)

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

MR. BUELL: May it please the Commission, Pan American has one witness who has not been sworn.

(Witness sworn.)

(Whereupon, Pan American's Exhibits GWE 1 and GWE 2 were marked for identification.)

GEORGE W. EATON, JR.

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

DIRECT EXAMINATION

BY MR. BUELL:

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

A George W. Eaton, Jr., senior petroleum engineer for Pan American Petroleum Corporation in Farmington, New Mexico.

Q Mr. Eaton, you've testified at many prior Commission hearings and your qualifications as a petroleum engineer are a matter of public record, are they not?

A Yes. I have previously testified in this case.

Q Right at the outset, Mr. Eaton, let me ask you this, what will be your recommendation to the Commission here today with respect to the Devils Fork-Gallup Oil Pool rule?

A The recommendation which I will make will be to continue the present rules in force.

Q In your opinion, Mr. Eaton, is the present rule serving conservation by preventing waste or mitigating waste and at the same time protecting correlative rights consistent and commensurate with that conservation effort?

A Yes, sir, those rules are effective in those two respects.

Q Let me ask you this, Mr. Eaton, you were here in the room and you heard Mr. Jameson's recommendation to the Commission as to the method with which he would prorate the Devils Fork gas wells, did you not?

A Yes, I heard that testimony.

Q In your opinion if the Commission should adopt the Jameson method, do you think that would result in waste of oil in the Devils Fork-Gallup Pool?

A Yes, sir, I do.

Q Now, a general question, let's get it out of the way right now, what is your opinion with regard to the separateness or the oneness of the Devils Fork Pool and the Escrito Pool?

A It is my opinion that the Devils Fork Pool and the Escrito Pool are separate reservoirs.

Q Do you agree with Mr. Jameson's testimony when he said that he realized that the weight of the engineering literature would also hold that the two pools were separate?

A Yes, sir, I would concur with that.

Q Do you also recall where Mr. Jameson, in the sophisticated language of the New Frontier said the contact is moving again?

A The best evidence that we have is that the contact has

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remained relatively stationary. I think I pointed out in my testimony at the June hearing that our only doubt with respect to whether or not the contact has moved lies primarily in the fact that our data upon which we based our estimate that the contact was at an initial location of plus 1,025 feet was not based on the very best information that was available.

Well, that isn't exactly right, it was the best information that was available at that time, but subsequent events have given us better information.

What I'm getting at is that we really can't say that the gas-oil contact has not moved because we didn't know exactly where it was to begin with. But the best evidence we have suggests to me that the location has remained relatively constant although it is not at the location that we depicted in 1960 at the plus 1,025 feet.

Q Do you agree with Mr. Merrion's testimony which is to the effect that gas-oil ratios can increase in reservoirs where there is not even a gas cap?

A That's the normal expectation in any solution gas drive reservoir, which includes all reservoirs, all oil reservoirs which do not have a completely active water drive or a completely active segregation mechanism. The normal expectation in those solution gas drive reservoirs is for a gas saturation to be established upon the initial pressure depletion, permitting gas flowage to the producing wells with an increase in gas-oil ratio. That's the normal expectation. It occurs in every one of them. The Gallup reservoir is, as a rule, of a more rapid increase in gas-oil ratio than are a number of others with which I am familiar.

Q Mr. Eaton, I got the impression from Mr. Jameson's testimony that his opinion was primarily based on data obtained from the Byrd 1-23 well. Let me ask you this, in connection with that well, do you feel that any valid engineering opinions can be drawn with respect to movement of the gas-oil contact based on data obtained from that well?

A I don't believe that that well could be used as a basis for a valid engineering interpretation of a gas-oil contact movement.

Q Mr. Eaton, would you assume for the purpose of this question that the gas-oil contact in Devils Fork has moved into the oil area. Under those circumstances has any waste resulted?

A No, sir.

Q Actually the most efficient way, as you stated before I believe, to produce this Devils Fork Pool, disregarding correlative rights. would be to deplete the entire reservoir through the oil well?

A That would result in the greatest oil recovery. Of course, it would be a serious violation of correlative rights.

Q So, with regard to this volumetric formula, if it doesn't work perfectly and there is a movement of the gas-oil contact in one direction or the other, you, as an engineer, would rather see it move into the oil area than for the oil to move into the gas area?

A Yes, sir. There would be no wastage of gas if the gas-oil contact moved downward into a previously oil-saturated interval. There would be wastage of oil should the gas-oil contact move upward into a previously unoil-saturated interval.

Q Mr. Eaton, in connection with your opinion that you gave at the outset that this current rule is serving conservation by preventing or mitigating waste, would you look now at what has been marked as Pan American's Exhibit GWE No. 1 and state briefly what that exhibit reflects?

A Yes, sir. The Exhibit GWE No. 1 is simply a plot of the bottom hole pressure data which have been obtained from the Devils Fork Pool as a function of the cumulative production from the gas portion of the pool expressed in billions of cubic feet.

I think the pressure data themselves, as well as the actual production statistics up to that third from last point, are relatively straightforward since they are purely statistical data. The pressure points, excluding the last three, are those which appear in the periodic proration schedules which make the equivalent volumetric withdrawal calculation. The significant portion of this exhibit is contained in the last three points.

Q Let me interrupt, Mr. Eaton, and ask you this with respect to the pressure data plotted on this exhibit, are those the measured pressures or are they extrapolated pressures?

A All of these pressures are the measured pressures. There are no extrapolations represented on this graph.

Q Would you go ahead then and discuss the significance of the last three plots on the lower right-hand portion of your curve?

A Yes, sir, I will call your attention to the third from the last pressure point, which on this graph appears at a cumulative production at about 4.8 billion cubic feet and a pressure of approximately 1480 psi. That is the raw, unextrapolated pressure data obtained from the gas wells during the special pressure survey of July and August of 1962.

On this same graph the next point that would be the point next to last on this graph appearing at a pressure datum of approximately 1300 psi and a cumulative gas production of about 6.4 billion cubic feet as the average pressure taken from the oil wells at the time of the special pressure survey. In other words, the unextrapolated pressure data show that the gas well pressures are some 180 psi greater than the average pressure in the oil area.

As I've explained previously, from a conservation standpoint that's a favorable pressure gradient. Now, then, on the assumption --

Q Let me interrupt. So if you assume that the measured pressures on the oil wells represent absolute buildup, then the formula is working toward effecting conservation at this time?

A Yes, sir. Although there is a pressure differential, the differential is in such a direction that conservation is being served.

Q What is the significance of the last point to the right on your curve?

A The last point on this curve represents the pressure which would exist in the gas area should nominations that have been made in the Devils Fork Pool be produced rather than actual production which have been adjusted which represents nominations that have been adjusted to the equivalent volumetric withdrawal rate. In other words, what I've done in constructing this, what might be called a fictitious point, is assumed that nominations that have been made by the purchasers actually represents market demand. If we did not have the formula in effect, the market demand would not have changed. It would have been the same. But had the nominations not been adjusted to the equivalent volumetric withdrawal rate and allowables for the various wells had been assigned on the basis of actual nominations and production had been equal to allowables, then instead of having an actual cumulative production from the pool of about 4.8 billion cubic feet there would have been some 7.45 billion cubic feet produced.

Now, just extrapolation of this pressure decline trend through the known points down to a cumulative production of 7.45 billion cubic feet yields a reservoir pressure of about 1180 psi. Now, this number is some 120 psi less than the actual pressure which was measured in the oil area during the special pressure survey of July and August, 1962. That means that instead of the volumetric equivalent being produced from the gas area, instead of that had nominations been produced, then we would have had this unfavorable pressure differential with a higher pressure in the oil area than we did in the gas cap, and that would lead to wastage of the oil that did move from the previously oil-saturated zone into one which was not originally saturated in oil.

Q So actually, Mr. Eaton, then if the last two points on your exhibit, the last two points on the right were actually reflecting reservoir conditions, then tremendous waste would be occurring today in Devils Fork Pool?

A Yes, sir. Now, then, I might point out that had we used extrapolated pressures as did Mr. Merrion, the differential would have been more pronounced, but to illustrate the point of what would have occurred, it wasn't necessary to make any extrapolation of the pressure data.

Q So even if you assume that the measured data represent actual complete buildup conditions, this exhibit shows that it wouldn't be safe to increase gas allowable by any significant degree?

A That is true.

Q Mr. Eaton, would you go now -- let me ask you this before we leave this exhibit. As I recall, the Jameson method would increase gas allowables about 300%, or I believe in his own words he said a little less than 300%. Do you know whether or not that figure would equal or exceed what past nominations have been?

A It would be my opinion that it would be in excess of past nominations. I don't believe I have the actual nominations.

Q So actually, if the Jameson method were adopted by the Commission, the picture would be much worse than is reflected on our Exhibit GWE No. 1?

A Yes, sir.

Q All right, now, would you go to what has been marked as Pan American's Exhibit GWE No. 2 and state briefly what that exhibit reflects?

A Yes. This exhibit simply is a bar graph showing the average daily allowable in three of the gas pools in the San Juan Basin, one of which is the Devils Fork-Gallup Pool. I call it a gas pool, I really should refer to it as an associated reservoir. The other two are the Blanco-Mesaverde Gas Pool and the Basin-Dakota Gas Pool.

Q Both of those later pools are non-associated gas reservoirs and their production is controlled completely by allowable set in an attempt to meet or equal market demand?

A That is true. In addition I might point out that the reason that I selected the Blanco-Mesaverde and the Basin-Dakota Pools for comparison is that they, like the Devils Fork-Gallup Pool, have 320-acre spacing set for the gas wells. So, on a per well basis, each well represents an approximately equal number of acres so that the comparison might be a little more valid for these two true gas pools with Devils Fork than it would be for such pools as the various Pictured Cliffs pools, for example, which are spaced on 160 acres.

On this Exhibit GWE No. 2, the yellow line represents the average daily gas allowable for a well for the average well in the Blanco-Mesaverde Pool. The green line, the green bar represents the average daily allowable for the average well in the Basin-Dakota Pool. The red line, the red bar represents the average daily allowable for a well in the Devils Fork-Gallup

Pool based on the equivalent volumetric withdrawal calculation. The left-hand portion of this exhibit covers the period February through December of 1961. The reason that that particular time interval was used is that, instead of the entire calendar year, is that the Basin-Dakota Pool did not become prorated until February 1st, 1961. I only intended that it should cover that period that proration was in effect.

This exhibit shows that during a period February through December, 1961, the average production from the Blanco-Mesaverde Pool was 216 MCF per well per day, pardon me, I should have said the average allowable is 216 MCF per well per day; the average allowable in the Basin-Dakota Pool is 342 MCF per well per day; and in the Devils Fork-Gallup Pool the average allowable is 310 MCF per well per day.

Q So for that period of time, Mr. Eaton, we see that the Devils Fork gas wells had a higher allowable than the Blanco-Mesaverde wells and slightly less than Basin-Dakota?

A Yes, sir. Moving along to the right-hand portion of this exhibit, which covers the period January through August of 1962, we find that the average allowable in the Blanco-Mesaverde Pool is 201 MCF per well per day; in the Basin-Dakota Pool the average allowable has been 386 MCF per well per day, and in the Devils Fork-Gallup Pool, 399 MCF per well per day. In the case of the current year, the Devils Fork-Gallup Pool is slightly in excess of the Basin-Dakota Gas Pool and well over the Blanco-Mesaverde Gas Pool.

Q Certainly then, Mr. Eaton, when you consider the significant conservation effort that this volumetric formula is attempting to accomplish, and then when you compare the allowables of Devils Fork gas wells with the allowables of non-associated gas wells in the same area, certainly then correlative rights are being protected?

A Yes, sir. I think, and the purpose of this exhibit is to show that the allowables computed under the volumetric formula compare favorably with the allowables in some of the other gas pools in the San Juan Basin. We all recognize that none of the gas allowables in the San Juan Basin in any of the pools is as high as we would like to have them, but on this basis it appears that the Devils Fork-Gallup allowables are certainly not out of line with the small market that we all have to live with in the San Juan Basin now.

Q Mr. Eaton, do you feel from an engineering standpoint there would be any merit in metering all gas produced from the Devils Fork-Gallup reservoir regardless of whether it was gas well gas or casinghead gas?

A Yes, sir. In fact, in order for this volumetric equivalent formula to function properly, all production has got to be accounted for and gas that's vented is something lost to the reservoir just the same as if it had gone into a pipeline. I think it should be, all gas should be metered and measured and accounted for in the volumetric formula calculation.

Q So to that extent you would have no objection to amending the current order, the current rule in that regard?

A No, sir.

Q Do you have anything else you would like to add to your testimony, Mr. Eaton?

A I don't believe so.

MR. BUELL: That's all we have on direct from Mr. Eaton at this time. I would like to formally offer Pan American's Exhibits GWE 1 and GWE 2.

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

(Whereupon, Pan American's Exhibits GWE No. 1 and GWE No. 2 were admitted into evidence.)

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

CROSS EXAMINATION

BY MR. NUTTER:

Q According to the formula proposed by Mr. Jameson, where would the Devils Fork formula be on your graph?

A I believe according to his testimony it would be something like 1,280,000 cubic feet per day which would be off my graph.

Q As a matter of fact, you would have to have a graph again as big as this one to include it, would you not?

A As a matter of fact, that wouldn't quite cover it.

MR. NUTTER: Thank you.

MR. PORTER: Mr. Kellahin.

BY MR. KELLAHIN:

Q Mr. Eaton, you said that according to Mr. Jameson's formula the average allowable would be 1,300,000 MCF?

A Yes, sir, that's my recollection. I believe I said one million two hundred eighty, but I didn't actually make the calculation.

Q Actually, will the wells in that pool make that much gas?

A I have no doubt but there are a number of wells that would be making it.

Q But all of them would not?

A No, all of them would not.

Q The average would be considerably below that?

A The average undoubtedly would be less than that.

Q You were testifying as to gas-oil ratio earlier in your testimony. The GOR's of the oil wells in this pool have shown an increase since the inception of production, have they not?

A I haven't made a complete study of each one of them individually, but it would be my expectation that every one of them have gone up.

Q Being a solution gas reservoir you would expect them to continue to go up, wouldn't you?

A Yes, sir.

Q On that basis they would continue to produce more and more volumes of gas, would they not?

A Up to the gas limit.

Q Up to the gas limit? A Yes, sir.

Q What is that gas limit?

A I believe Mr. Jameson made a quick calculation of 328 MCF per well per day.

Q Mr. Eaton, on the figure you just gave us, would that all be solution gas or would that include free gas that was moving into the oil zone?

A You mean insofar as putting that data into the formula?

Q Yes.

A Or would the reservoir itself be producing free gas and solution gas?

Q Would the reservoir itself be producing free gas, it would, wouldn't it?

A Not necessarily.

Q What would keep it out of there, out of the oil zone?

A What would keep it out of the oil zone?

Q Yes.

A Let me say this, the normal expectation of a Gallup reservoir is to have an increasing gas-oil ratio performance characteristic that it would be an oil well; a normal oil well would be capable of gas production far in excess of 328 MCF per well per day. Now then --

Q Pardon me.

A Excuse me. As to whether or not that gas represents free gas or solution gas, as far as the formula is concerned it would make no difference.

Q It would indicate that there was a migration of the gas-oil contact, wouldn't it?

A That's right.

Q You say that is not significant. Isn't that what we are trying to establish on a permeability basis, relatively speaking?

A I did not say it was not significant. I said that the fact that the well produces at the gas limit does not mean it's producing free gas. Now, free gas I'm going to define as gas that has been gas in the gas area from the inception of the discovery

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of the reservoir. Free gas can also have the connotation of being gas that has escaped from solution in the oil and gone to make up saturation in the oil zone, but it was originally contained in the oil. When I speak of free gas, to answer your question, I'm talking about free gas that has moved from the original gas area down to the oil area, as far as the formula is concerned that gas is fed into it just like it had been solution gas originally.

Q In the normal production of an oil well and production of gas from the oil well, would you expect the gas to triple over a period of a few months?

A Triple?

Q Yes, sir.

A All depends on the rate of depletion of the reservoir.

Q We are talking about this reservoir.

A In this one right here?

Q Yes.

A I wouldn't think it would, just off-hand. I'm not saying it couldn't, but I wouldn't think it would because not too many of the oil wells have capability of producing the top allowable rate which would then incur this rapid degree of depletion, but you take a reservoir like the Cha Cha-Gallup Pool and the Totah-Gallup Pool, gas production quadrupled in those pools in just a few months' time.

Q Mr. Eaton, we are talking about this pool that's before the Commission for the moment, you know that gas production did approximately triple in the two Byrd wells, the Kenney well and the Miller well, don't you, with no decline in the oil production?

A I believe, yes, sir, I believe I recollect it did.

Q If this increase in production of gas is not significant of a movement of gas in the reservoir, then what would you attribute it to?

A I attribute it to normal completion of a solution gas drive reservoir.

Q But you just testified you would not expect that rapid an increase.

A I testified that I wouldn't believe it, but that's what I would attribute it to.

Q You say that it's not normal, but you attribute it to that in this case?

A Yes. In other words, my point I'm getting at is this, as thin as this Devils Fork-Gallup sand is, once free gas breaks through into a well bore I wouldn't look for appreciably more oil production.

Q You are again using the term free gas, you are talking about gas-free gas cap?

A Yes, I am going back to the gas-free gas cap.

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Q If free gas has reached the wells that we have mentioned, it is significant of moving of gas in the reservoir?

A If free gas has reached those wells, it has moved.

Q On your bar graph, your Exhibit GWE No. 2, the Angels' Peak is an associated reservoir, is it not?

A Yes, sir, it is.

Q And the Escrito is, is it not?

A Yes.

Q You didn't see fit to make a comparison on a bar graph on those two pools?

A No, sir, I did not.

Q They are handled on a formula which is different from the normal dry gas pool, aren't they?

A Yes, sir. Oh, yes. In fact, the Angel Peak formula is the basis for the one recommended by Mr. Jameson.

Q Don't you think that it would be more appropriate to compare two associated reservoirs as to gas allowables than associated reservoir with a dry gas reservoir?

A No, sir, I do not. I was of the opinion that it would be more appropriate to show the actual gas allowable in the two reservoirs which were not associated. In other words, this is what would happen to Devils Fork had the oil rim not ever been discovered, that would be my impression of a normal expectation for what would happen at Devils Fork had the rim not been discovered.

Q In comparing it to the Tapicito Pool, then, it wouldn't have showed the same comparison, would it?

A No, sir. I picked out these two particular gas reservoirs because they, like Devils Fork, are 320-acre proration units.

Q That's the one factor they have in common?

A Yes, sir.

Q Do you know how the allowables are set for the pools?

A You mean the Blanco-Mesaverde and the Basin-Dakota?

Q For all the pools in the northwest.

A Yes, sir.

Q Are they under a blanket proration order?

A No, each of the pools has its own special rules.

Q Each pool is prorated separately, isn't it?

A Yes, sir.

Q And the allowable assigned to that pool is based on what factor?

A The allowables assigned to that pool are based on nominations of purchasers for that pool.

Q Wouldn't the nominations of the purchasers be far more significant in arriving at an average per well allowable than the acreage attributed to the well?

A I don't know if I follow that. These bar graphs represent the non-marginal allocation.

Q Yes, sir, but that is arrived at on the basis of the purchasers' nominations?

A Yes, sir.

Q And it also has some bearing on the ability of the pool to produce, does it not?

A Nominations?

Q Yes.

A Presumably they represent market demand.

Q Well, would market demand be the same on a per unit basis in the Blanco-Mesaverde, the Basin-Dakota and the Devils Fork Pool, in your opinion?

A I'm not a purchaser of gas, but I would say no, in my opinion.

Q Well, actually, Mr. Eaton, aren't you comparing nominations, the results of nominations on this bar graph rather than any other factor?

A That's true insofar as non-marginal allocation to individual wells or the total non-marginal allocation for the entire pool is geared primarily to purchaser nominations, that's true. I would have to go along with that.

Q I believe you have testified you do not believe that the gas-oil contact has moved. What evidence are you waiting for to determine whether it has or hasn't, Mr. Eaton?

A I'm waiting for some oil well previously classified as an oil well to exhibit characteristics that show me conclusively that gas has invaded into that area. I'm looking for some previously classified gas well which suddenly produces low ratio oil, black oil. I haven't seen those conditions yet.

Q You don't consider that has happened in the Byrd, the Kenney or the Miller wells?

A Not to the extent that I think would show conclusively.

MR. KELLAHIN: That's all I have. Thank you, Mr. Eaton.

MR. PORTER: Mr. Selinger.

BY MR. SELINGER:

Q Mr. Eaton, I was interested in your recommendation for changing the existing rules so as to measure all gas whether it's produced from oil wells or gas wells regardless of whether it's solution gas or whether it's gas cap gas, is that right?

A This is gas produced from oil wells is a factor that goes into this equivalent volumetric formula, and if we can't account for all the fluids that are produced from the reservoir, including gas and oil, then we can't expect the formula to be equivalent.

Q That's because it's all produced from the Devils Fork-Gallup common reservoir?

A Yes, sir.

Q I was also interested in your comments about each oil well would be permitted into the future, the maximum gas limit of 328,000 cubic feet per day. That's on an 80-acre basis, isn't that correct?

A That is true.

Q If you had four oil wells on a South Half of a Section or 320 acres, it would get four times that, wouldn't it?

A That is true.

Q The rate of withdrawal from the entire 320 acres from those four oil wells would be four times the 328,000?

A That's true.

Q At the present time one gas well on a 320 acres is restricted to 399,000 cubic feet a day as shown by your bar graph?

A That's true.

MR. SELINGER: Thank you.

MR. PORTER: Any further questions of Mr. Eaton? Mr. Cooley? Mr. Buell.

REDIRECT EXAMINATION

BY MR. BUELL:

Q Would you take your answer to Mr. Selinger's last question one step farther and point out to Mr. Selinger that the 399 MCF per day allowable for a gas well is calculated on the withdrawals from the oil well and that if suddenly all of this gas started coming out of the oil area that 399 would also sky-rocket, would you tell him that?

A Mr. Selinger, will you consider that you've been told?

MR. SELINGER: If the Commission please, I reserve the right to make statements, unsworn. I don't think Mr. Buell should have that right. This man is under oath.

Q (By Mr. Buell) May I ask, Mr. Eaton, this, do you agree with that question, Mr. Eaton?

A Yes, I would concur with that question. The point is that if there were four wells on, four oil wells on a 320-acre tract, then there would be different numbers that go into the volumetric calculation and that would affect the gas allowables.

RECROSS EXAMINATION

BY MR. SELINGER:

Q Would those calculations go up for the gas well?

A It could have an effect either way.

Q Would it go up, that's all I'm asking you, would it go up at all?

A That's my answer too. It could decrease the gas allowable, it could increase it. It all depends on whether the new wells have producing characteristics that give them a volumetric equivalent withdrawal rate per well greater than the average or less than the average of the existing wells.

Q Could it go up to the extent where a gas well would have an allowable of a million four hundred thousand a day?

A Yes, sir.

MR. PORTER: Mr. Cooley.

BY MR. COOLEY:

Q Mr. Eaton, on the same point about which Mr. Selinger has been questioning you, isn't it true that the volumetric equivalent of the volumetric formula is set up to give the producers in both the gas cap and the oil columns equivalent volumetric production, not equivalent volumetric allowables?

A That is true. The way the formula is set up, the actual volumetric withdrawals from the oil wells are used as a basis for computing the allowable production from the gas wells.

Q But if the production does not remain eqquivalent volumetrically speaking, you are going to have an imbalance one way or the other, is that true?

A That is true.

Q The fact that the allowables might be different one way or the other would be immaterial, is that correct?

A That's true. Everything always gets compensated for

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at the time of the new calculation.

Q Then it's equal volumes of production rather than equal allowables that we're looking for to maintain this stability?

A Equal rates of withdrawal.

MR. PORTER: Mr. Selinger.

BY MR. SELINGER:

Q In that connection, will you have equal production from the gas wells as well as equal production from the gas wells, or do you calculate the actual production of the oil wells and use that as a base for determining the allowable for the gas well?

A We do what you said last. The actual production from the oil wells is taken and fed into the volumetric formula out of which comes the allowable for the gas wells.

Q The allowable for the gas wells. If you used allowable in both instances, both the oil wells and the gas wells, you'd come up with a different answer, wouldn't you?

A Yes, sir. Then you would be getting back to Mr. Jameson's recommended rules.

Q Regardless of whether it's Mr. Jameson's recommended rules or not, I am asking you if you used allowable in both instances rather than production in one and allowable in another, you have a different answer?

A Yes, sir.

MR. PORTER: Mr. Cooley.

BY MR. COOLEY:

Q If you used that system, would you have equivalent withdrawals?

A No, because we have limited oil wells. We have limited gas wells too, but our limited gas wells are limited to a less extent than some of our limited oil wells.

Q If you do not have equivalent withdrawals, you would have a moving of the gas-oil contact. The oil moving into the gas column and causing waste, would you not?

A Yes, sir.

Q Mr. Eaton, your Exhibit No. GWE No. 1 was not offered, nor does it purport to show stabilized or actual pressures in the reservoir, does it?

A No, sir. This exhibit simply takes the raw data which were obtained during the July, August, 1962 survey and averages the two points, the one point for the gas wells, the other point for the oil wells. The remaining points on this graph, those are the two points that I refer to as the second and third from the last point. The last point is kind of a computed point.

Q But as to the, excuse me --

A Excuse me.

Q Do you want to --

A Yes, I want to say one other thing. The other points on this graph are the averages which are published in the proration schedule that contains the volumetric calculation.

Q Average actual measured pressure?

A Yes, sir. There's no extrapolation, there's no buildup curves drawn on any of these points.

Q For the limited purpose for which you intended to use this exhibit, it was not necessary for you to attempt to determine actual pressures in the reservoir, was it?

A That's true. I tried to keep the exhibit as simple as possible without too many technicaclities in it and using the raw data proved the point that I wanted to make.

Q The point that I want to make perfectly clear is that the 180 psi greater gas pressure than the pressure in the oil column is not in your opinion an actual stabilized pressure--

A No, sir.

Q -- differential?

A No, it probably does not represent true reservoir pressure. Excuse me. True reservoir pressure is probably somewhat higher than this pressure that I have shown as the average pressure in the oil area.

Q For purposes of your presentation it would have been necessary for you to attempt to determine what the actual stabilized pressures in the reservoir would be based upon the data available today, would it not have been necessary for you to extrapolate?

A Yes, sir.

Q Is this a commonly accepted method of determining stabilized pressures in the oil industry?

A As a matter of fact, I don't know any way to get at reservoir pressure from a practical standpoint without doing extrapolation. In other words--excuse me.

Q Does your company consider this an accurate basis, the extrapolation of pressures, they use them and consider them an accurate basis upon which to formulate their decisions?

A To refer to the particular method that was used by Mr. Merrion, or do you --

Q No particular method.

A Just extrapolation of pressures to buildup. Certainly extrapolation of pressures to attain buildup are a common thing.

Q Are you familiar with the Horner method which Mr. Merrion used for extrapolating the pressures set forth in his Exhibit No. 1-A?

A That's certainly an acceptable procedure, in fact one that is used by Pan American engineers quite extensively.

Q That's the method that your company uses also?

A Not altogether, but we use it.

Q Have you had an opportunity to examine Mr. Merrion's Exhibit No. 2-A?

A Yes, I have seen a copy of that exhibit.

Q Do you consider that this exhibit, considering the fact of the limited amount of information that is available, that this exhibit portrays the best picture that we can obtain at this time of the actual stabilized pressures that are in this field?

A Of course, I haven't had a chance to check Mr. Merrion's arithmetic, but presuming that there's nothing wrong with it, certainly those data represent something that pretty closely approximates reservoir pressure.

Q At least it's the best we can come up with right now, isn't it?

A Yes, sir.

Q Have you had an opportunity to examine his Exhibit No. 3 where he put this in the form of a map?

A Yes, sir, I have a copy of that exhibit.

Q Does it correctly transcribe in your opinion the information shown here onto that map?

A Again, I haven't checked to see that the pressure data were transcribed onto the map in all instances properly, but I presume that it is and certainly plotting pressure data on a map and contouring is a common thing and should represent a picture of reservoir pressure as it exists.

Q Do you consider that his Exhibits No. 2 and 3 are any way contradictory to your Exhibit No. 1?

A No, sir, I don't think so, when you take into consideration the explanation that I have made of my use of the pressure data which were obtained from the same survey that his data were.

Q The exhibits do not contradict each other?

A No, sir.

Q They just show different things?

A Yes, sir.

Q Moving now to your Exhibit No. 2, Mr. Eaton, in your experience as petroleum engineer for Pan American Petroleum Corporation in the San Juan Basin, have you had an opportunity to get average approximations of the reserves attributable to the average well in the Mesaverde-Dakota and Devils Fork Pools respectively?

A No, sir, I don't believe I've --

Q Can you compare them as to which in your opinion have greater reserves and which have lesser reserves?

A There was some testimony given in this previous case on Devils Fork that the average well had reserves of about 1.6 billion cubic feet, is my recollection, on 320-acre spacing, which in my opinion would be less than the average in the other two reservoirs, but I don't have any data.

Q In your opinion the Devils Fork has less reserves than either the Mesaverde or the Dakota on 320 acres or any equal area?

A That would be my opinion.

Q Still, even though it has in your opinion less reserves than the other two, it has almost as much allowable production in the period of February through December as the Basin-Dakota and considerably more than the Mesaverde, is that correct?

A That is correct.

Q And for the period --

MR. KELLAHIN: I object to this line of questioning. The nomination and allowable are not based on reserves. The witness has already testified they are based on nominations, and there's no basis for comparing the reserves between the different pools. They are not prorated on the same basis, they are not prorated together, each pool is prorated on an individual poolwide basis. The reserves here have no significance.

MR. COOLEY: That's the precise significance of this is that Mr. Kellahin and his clients are here arguing that the particular formula that we have in the Devils Fork is very unfair to them. The point I'm trying to make is that it's not only fair, it's giving them more allowable per reserve than either the Basin-Dakota Pool or the Mesaverde Pool.

MR. KELLAHIN: We are here talking about our relative position in the Devils Fork Pool. We are not talking about our relative position comparing the Mesaverde or Tapicito or any other pool and the allowables considered any greater in the Tapicito. We would look kind of in bad shape in the Tapicito, for example. That has no bearing on this case. We are not comparing the pools. We are comparing the relative position of the producers in the one single pool before this Commission today. The other has nothing to do with it.

MR. SELINGER: I would like to further add to that objection that we have not yet reached in this state whether or not we have proration between gas pools in the state. It may be a desirable thing, but under the statute you determine the nominations of each individual pool, and if and when the statutory authority is given to you to prorate equitably amongst gas pools, well, then, that question may be pertinent.

MR. PORTER: Objection sustained. Mr. Cooley, would you change your line of questioning, please?

MR. COOLEY: Yes, sir, Mr. Commissioner.

Q (By Mr. Cooley) Mr. Eaton, in response to a question by Mr. Kellahin that you were waiting to see how this formula was going to work and that you were going to determine or make your own judgment as to how it had worked when either an oil

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well started gassing out from gas cap gas, or to the contrary, it reversed, a gas well started producing oil, is that correct?

A I believe that's correct, yes.

Q Mr. Eaton, if the imbalance is in favor of the gas operators as Mr. Merrion maintains, and oil is actually moving into the gas cap and wetting those sands, is it not true that by the time this column of oil along this four mile front, or five mile front reaches any given gas well, that it's then far too late to save literally millions of barrels of oil?

A Under the circumstances that you outline, that would be true. I don't think that would occur that way myself.

Q But if it did occur that way it would be too late?

A You are right.

MR. COOLEY: No further questions.

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

(Witness excused.)

MR. PORTER: Anyone else desire to present testimony? Mr. Howell.

MR. HOWELL: We will offer no testimony.

MR. PORTER: Anyone desire to make a statement in the case?

MR. DURRETT: Mr. Commissioner, I have a communication here that the Commission has in its file, a letter received from Redfern and Herd, received on September 12, and I would like to read it into the record, a paragraph of this letter. Reading as follows: "We wish to recommend that the present field rules be continued on a temporary basis. We support the recommendation that all gas produced be metered." Signed by John J. Redfern, Jr.

MR. PORTER: Anyone else desire to make a statement? Mr. Woodruff.

MR. WOODRUFF: Norman Woodruff on behalf of El Paso Natural Gas Company. El Paso Natural Gas Company is operator of the Canyon Largo Unit, on behalf of itself and other owners. We have both oil and gas wells in the Devils Fork-Gallup Pool. At the time of the original hearing it was El Paso's recommendation that we establish a formula which to the best of our ability would maintain the gas-oil contact stationary, thereby resulting in the greatest ultimate recovery of the hydrocarbons to be recovered from that reservoir.

A review by our engineers to date of the data accumulated since that hearing, including the most recent pressure data, has led us not to be alarmed, but rather to consider that the existing formula is the most practical means of maintaining the gas-oil contact and control of this pool.

Consequently, we would recommend the continuation of the

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present formula. El Paso previously has also recommended that the existing limits of the Devils Fork-Gallup Pool be recognized and that the Escrito Pool be carried as a separate and distinct reservoir and we consider that is appropriate and we recommend that continue to be done by this Commission.

If we assume that Mr. Merrion's pressures indicate a drainage from the oil to the gas area, unless they concluded that the drainage is coming from the area which has not been developed, where the operators have not elected to exercise their prerogative to drill. The benefit then is to be derived from those who have developed, both oil operators and gas operators. His conclusion that the oil area should be developed seems to be a valid one. El Paso and other owners in the Canyon Largo field have a substantial area of this portion of the oil zone which he considers should be developed, and certainly we will take cognizance of his recommendation in outlining our future program.

It certainly appears that oil operators must exercise self-preservation both in developing the oil area and if there is any way to see propriety of it, to come in and have the Commission consider the adoption of under spacing for oil wells. We know of no precedent to the establishment of a rule in the nature that Mr. Merrion has recommended. We would ask that the Commission not consider the application of such a rule at this time, but rather

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to permit those who have the right to drill to exercise the self help necessary to protect their interest.

MR. SELINGER: I would like to say one thing.

MR. WOODRUFF: Excuse me, Mr. Selinger. We would like to concur in the recommendations of others that all gas be measured, whether purchased or vented, and we would also urge the Commission that the rules do not presently require to require taking of bottom hole pressures on all wells, both oil and gas-oil wells, both pumping and flowing during all future pressure surveys.

MR. PORTER: Mr. Selinger.

MR. SELINGER: The only point I wish to emphasize, and I have emphasized during the course of this hearing, is the fact that the September schedule shows seven out of the ten wells are consistently overproduced and are charged with overproduction. Likewise your September schedule for oil shows that every one of the eleven scheduled wells have what's called non-effective gas-oil ratio penalty. That means that not each barrel of oil from the oil wells are produced at a 2,000 ratio. Some of them produce at a 24,615 cubic feet per barrel ratio.

The unfairness about it is that you are restricting the gas wells that are capable by the deficient oil wells who are going down, who are not inhibited by any of the regulations of the Commission because they are entitled to produce a top oil

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allowable of 164 barrels plus a 2,000 ratio, a gas limit of 328,000 cubic feet. You have a permissive for oil wells to produce which is taken away from the gas wells. All I say is that both the oil wells and gas wells should have an equal opportunity.

Now, the answer to that equality statement is the fact that the allowables for gas wells would go way out of reason, that's assuming that you are going to continue a 2,000 limitation. It occurs to me that if the proportionate ratio to gas wells will permit its allowable to be up so high to reduce the limiting gas-oil ratio from 2,000 to 1,000, or 500. If you are afraid of the equality between those two to make it too high for one type of well over the other. So all I am pointing out is that we think that the gas wells should have the equal opportunity as the oil wells, and as Mr. Eaton said, you are using the actual oil production to determine the gas allowable.

Let us use both, if you are going to use allowable for gas computations, then you should use allowable from the oil to base that gas computation on.

MR. PORTER: Does anyone else want to make a statement? Mr. Kellahin.

MR. KELLAHIN: This case, like others that have come before the Commission, presents some divergent points of view. There are those in the case that would see the present rules continued on the temporary basis, there's the position of Mr. Merrion and the position of Val Reese and Associates and Bco, Inc., which I represent.

The testimony in regard to this gas-oil contact is really the significant factor of the entire case. The purpose of these rules is to protect the oil zone against the encroachment of the gas, or the oil going into the dry gas area with resultant loss. I think that the figures which are before the Commission on the Byrd 1-23, the Byrd 5-23, the Kenney well and the Miller 4-B and 2-B wells speaks for more volumes than all the other testimony that has been presented. The changes in the gas-oil ratios of those wells, the rapid increases in volumes of gas produced as compared to very little change in the oil is very strong evidence that there has been encroachment of this gas cap into the oil zone.

The adjacent Love 23, which is next to the Kenney well, generally agreed to be an Escrito well, and it has not increased while its production actually exceeds that of the Kenney well. Now, certainly those facts are significant and consideration that the Commission must give as to whether the present rules are effective. We recommend that, first that the rules be changed and that the same, that the Devils Fork be placed under the same rules as those in effect in the Escrito, and we do that on the position that they are one common source of supply.

The Escrito Pool rules are patterned after the Angel Peak rules which also take into consideration a situation similar to that found in this reservoir. They would be adaptable to the reservoir and be more effective to those now in effect.

In that the Commission wants to continue the present rules in effect, it is our recommendation, and I think on this we are finding that most of us are in agreement, that bottom hole pressure tests be continued and that in addition that all gas be metered whether it be dry gas, whether it be sold or vented or whether it be casinghead gas, sold or vented. This gas production should be included in the volumetric formula. Thank you.

MR. PORTER: Mr. Cooley.

MR. COOLEY: If it please the Commission, I would recall to the Commission the facts and occasions that brought the Commission to the conclusion it should continue this case from the regular June hearing to this date. If you will recall, there was a motion made by Mr. Kellahin representing several operators in the gas cap, concurred in by Redfern and Herd, and other operators in the gas cap, that a pressure study be made because this was the only way we could find out what was happening to the gas-oil contact, whether it was moving one way or moving the other. The Commission, in its wisdom, called for a continuation, called upon the operators to conduct such tests.

At that time Mr. Merrion called to the Commission's attention that a one-point test was of very little if any value in determining stabilized pressures in this area because of the length of time required to build up to a static pressure. Whereupon the Commission requested the operators to take more than one point in their test, possibly three. These tests were run, the data was available several weeks ago. Every operator in this pool. I think it is significant that Mr. J. Gregory Merrion is the only operator in the entire pool that has come forth today with any type of tabulation as to what those pressures revealed.

Now, if the Commission didn't want to know what they were going to reveal, they shouldn't have requested it. If Mr. Kellahin and his client didn't want to know what they would reveal and use this as an excuse for postponing the case, why didn't they present it here today? The reason they didn't present it here today is because it was damning evidence, it supports one proposition and one proposition alone, that of Mr. J. Gregory Merrion.

The gas-oil contact is moving and it is moving into the gas column and that we are day by day losing hundres of thousand of barrels of oil natural resources of the State of New Mexico.

Even in the initial hearings the proponent and the person who testified in favor of this system that we now have were El Paso Natural Gas Company, Mr. Norman Woodruff, who testified as we read from an excerpt today, that there's only one way to tell where is the gas-oil contact, and that's all we have been looking for through all these months of hearing and continuation and hearings and continuations, is find the gas-oil contact.

In Mr. Woodruff's testimony in 1960, initial hearing upon which these rules are now based, he himself said that we would have a guidepost every six months if the formula which he advanced was improper, and this guidepost, of course, was pressure, pressure tests, and that every six months we could look at these pressure tests and have a guidepost to tell us whether the formula was working or whether it was not working.

Now why is it that nobody else today has had one word to say about what these pressures reveal? Now Mr. Merrion does not advance his Exhibit No. 2 as an absolute proof or exact computation of the existing pressures of these wells, but based upon the information that is available, it is the very best that can be done. It's fair, it uses a commonly used and accepted method in the oil industry. Pan American's witness, Mr. Eaton, has testified that in his opinion the methods used to extrapolate these pressures were completely fair and proper, and in many cases were used by his company. They did not choose to make these studies. Had they made them they might have found out the same things. We took the time and effort and the money to make them. We have made them and we presented them to the Commission.

This pressure information is uncontroverted in this record and it's uncontroverted in its importance and in the direction it points. Unquestionably based upon this information there has been an encroachment or movement of the oil column into the gas column. This is not the tail wagging the dog that people thought some two years ago when there was envisioned a small oil ring to the north of this pool. It has now become almost conclusively developed that there are at least thirteen million barrels of recoverable oil, that is they're recoverable if you'll let us recover them. If you don't permit the gas cap operators to deplete the gas cap, reduce the pressures and accordingly reduce the pressures on the oil column and forever destroy the possibility of recovering this oil.

True Mr. Merrion has recommended a very harsh type of solution to this problem. He has recommended to you that the gas cap should be shut in. He is very sincere in his belief that this is the only thing that can be done in the interest of conservation. He has not recommended that they be shut in forever, but for a limited period of time until there can be regained an equilibrium of pressure between the gas column and the oil column.

Even at this, if the Commission feels that even a temporary shut in of the gas cap is too harsh, that it puts too much emphasis on the prevention of waste and too little emphasis on the correlative rights, a prayer for a type of relief such as this, certainly the greater includes the lesser and in all honesty and in all due service to the dictates of the statutes of this state, there must at least be some curtailment of the gas production or we are going to lose seven or eight million barrels of oil that we would otherwise recover, some of which is owned by the State of New Mexico, I might point out.

Now, the second point in Mr. Merrion's recommendation is completely separate and apart. His recommendation with respect to shut in or, as I say, possible curtailment goes to the shut in or curtailment for the period of time only so long as is necessary to accomplish an equilibrium of pressure between the two zones. At that time everyone would then be permitted to produce again, but his second recommendation goes to this point, what happens when everyone starts producing again? The present formula recognizes only a fraction of the acreage that is unquestionably proven by this point to be oil productive, while it recognizes nearly 80% of the proven gas reserves. Now, by

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proven I don't mean drilled, I mean that by geologic inference and all the tools that the engineer and the geologist has at his disposal, this acreage is productive as shown on Mr. Merrion's exhibits.

Without doubt, when this Commission permits the operators in the gas cap to commence producing again, or if they permit them to continue to produce, there is no question but what there should be recognized in this formula all of the productive oil acreage, all the productive gas acreage, only in this way can there be preserved this gas-oil contact which we all so dearly covet.

If you do otherwise, if you wait until the oil is piecemeal developed well by well, there will be a tremendous percentage of this now productive oil acreage by the time we get to it and drill a hole to it, it will have vanished before our eyes.

In summary, let me remind you that Mr. Merrion is not a fly-by-night operator coming up here with a crackpot idea. He's a graduate petroleum engineer with nine years' experience as a petroleum engineer with a major oil company, four years of which he was district engineer over our Southeast New Mexico and West Texas. This is a man with great knowledge and great experience. He doesn't hold himself out to be the smartest man in town, but he does have knowledge about this pool because he lives with it day and night. He's not a big operator and his wells are in this pool and as this pool goes, so goes his career. Thank you.

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

The Commission has serious doubts as to whether it can conclude the docket today. Since the Commission does have to have a short conference immediately concerning another matter, we will adjourn the hearing until 9:00 o'clock tomorrow morning, at which time we will take up Case 2504.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

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

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 31st day of October, 1962.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:
June 19, 1963.

Sept Reg.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
June 14, 1962

REGULAR HEARING

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IN THE MATTER OF: (Reopened) Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico. Case 2049 will be reopened pursuant to Order No. R-1670-B to permit interested parties to appear and present testimony relative to the effectiveness of the special rules and regulations for the Devils Fork-Gallup Pool.	CASE 2049

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BEFORE:

Governor Edwin L. Mechem
Mr. A. L. (Pete) Porter
Mr. E. S. (Johnny) Walker

TRANSCRIPT OF PROCEEDINGS

MR. PORTER: Call Case 2049.

MR. MORRIS: Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico.

MR. PORTER: I want to ask for appearances in this case and then we are going to have a short recess.

MR. WHITWORTH: Garrett Whitworth and the law firm of Seth, Montgomery, Federici and Andrews for El Paso Natural Gas

Company.

MR. PORTER: Mr. Cooley.

MR. COOLEY: William J. Cooley of the firm of Verity, Burr, Cooley, Farmington, New Mexico, on behalf of J. Gregory Merrion and Associates.

MR. BUELL: For Pan American Petroleum Corporation, Guy Buell.

MR. SELINGER: For Skelly Oil Company, George W. Selinger; L. C. White, local resident.

MR. BRATTON: Redfern and Herd, Howard Bratton.

MR. PORTER: How many intend to present testimony? Mr. Buell? Mr. Cooley, yes. Redfern and Herd? Mr. Kellahin.

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox, Santa Fe, appearing for Val R. Reese and Associates and BCO, Inc., in association with Matias Zamora and Charles D. Olmsted.. We probably will present testimony.

MR. PORTER: We'll take a ten-minute recess.

(Whereupon, a short recess was taken.)

(Whereupon, Merrion Exhibits 1 through 9 marked for identification.)

MR. PORTER: The hearing will come to order, please. I would like to ask all of the witnesses to stand and be sworn at one time.

(Witnesses sworn.)

MR. PORTER: Mr. Cooley.

MR. COOLEY: My first witness will be J. Gregory Merrion.

J. GREGORY MERRION

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

DIRECT EXAMINATION

BY MR. COOLEY:

Q Would you state your full name for the Commission?

A J. Gregory Merrion.

Q Where do you reside, Mr. Merrion?

A Farmington, New Mexico.

Q By whom are you employed?

A I'm self-employed.

Q What group do you represent?

A J. Gregory Merrion and Associates.

Q Does J. Gregory Merrion and Associates have any production in the Devils Fork Pool?

A It does.

Q Mr. Merrion, would you briefly outline your educational background?

A I graduated from the University of Tulsa in 1951 with a Bachelor of Science Degree in Petroleum Engineering.

Q What were your activities subsequent to that time?

A I was employed by the British American Oil Producing Company for nine years in various capacities ranging from roustabout trainee to District Petroleum Engineer. Subsequent to that, I moved to Farmington and became a consulting petroleum engineer and independent oil operator.

Q Have you prepared an exhibit showing the general area of the Devils Fork Pool and the wells drilled therein?

A I have.

Q I hand you what has been marked as Exhibit No. 1, and ask you if this is the exhibit to which you refer?

A Yes.

Q Will you outline what is shown on Exhibit No. 1?

A Exhibit No. 1 is my interpretation of an Iso-vol map of the Devils Fork-Gallup Oil and Gas Field. It represents net effective porosity times pay thickness in the Marye Pay Sand zone of the Gallup formation.

It also shows the wells which had been completed at the time of the last hearing on this field, from which the pool rules were adopted. It also shows wells circled in red which have been drilled and completed since that hearing. Outlined on the map is my interpretation of the approximate position of the gas-oil contact in red. Also there are shown two locations which I propose to drill shortly in the Devils Fork-Gallup Field. There is one omission on this map; included in the Devils Fork Field is the Val Reese and Associates Bird No. 5-A in the Southeast Quarter of Section 23, Township 24 North, Range 7 West. It was omitted from the map, since I could not find any Devils Fork pay in it, and it appears to me that it is an Escrito well and belongs in that field rather than in the Devils Fork Field.

MR. BRATTON: I wonder if we could have a copy of the map on the board or available somehow for the other interested parties.

MR. PORTER: You can have this one. Would you hand that to Mr. Bratton, please?

Q (By Mr. Cooley) How does your portrayal of the Iso-vol reserves, with respect to the oil column, compare with the gas reserves in the gas cap?

A Considering only developed acreage, the economic value of the oil reserves as calculated volumetrically, using approximately a 12-1/2 percent recovery factor, are approximately equal to the economic value of the gas in the gas cap.

Q Is that total gas in the gas cap or developed wells in the gas cap?

A That's the developed gas cap. It appears from my interpretation that the field has not reached its final development, that it is wide open to the east and that a good deal of the undeveloped acreage will fall in the oil column. It is possible that eventually the economic value of the recoverable oil will far exceed the economic value of the recoverable gas.

Q Considering only the presently developed oil wells and presently developed gas wells, how do the economic values compare?

A Oh, as I before stated, they are about equal.

Q Considering the undeveloped portion of what you interpret to be the oil column, as opposed to the undeveloped portion of what you interpret to be gas cap, what is the relative degree of development in the two areas?

A Well, according to my interpretation, the gas cap appears to be about 80 percent developed, and the oil column appears to be possibly 25 percent developed. I would like also to point out, I believe as a member of the Canyon Largo Unit, I know that the Canyon Largo Unit has proposed a Gallup well in the Southwest Quarter of Section 8, so there's three Gallup wells which are proposed in or adjacent to the Devils Fork Field for this year.

Q Do you have anything further you wish to bring out with respect to Exhibit No. 1?

A I would like to point out that, noticing the wells which are encircled in red, that the pool rules adopted two years ago have given the operator courage to go ahead and develop a certain amount of the oil column. There has been six oil wells drilled since the last hearing, two gas wells, and two wells which are classified as oil and are, according to the pool rules, oil wells although they might be kind of edgy.

I would like further to recommend at this time that the Commission give consideration to eliminating the Val Reese and Associates Bird No. 5-A from the Devils Fork Field, since it does not appear to actually be in that reservoir; and since it is included in the volumetric equivalent withdrawal formula, it introduces an erroneous figure to that formula.

Q Do you have an exhibit prepared showing the production and pressure history of the Devils Fork-Gallup Pool?

A I do.

Q I hand you what has been marked as Exhibit No. 2 and ask you if that is the data to which you refer?

A It is.

Q Would you please explain what is shown on that exhibit?

A I have plotted against time several factors in the performance of the Devils Fork Field from the date of first production, which was August of 1959, through April of 1962. Beginning at the bottom, I have monthly oil production rate from the oil column plotted versus time: I have the oil column weighted average gas-oil ratio plotted versus time. At the top of the graph I have the gas cap production rate in MMCF per month at a 15025 psi pressure base plotted versus time; and I have the mean bottom hole pressure in the gas cap plotted versus time. I have an additional point on that which was omitted inadvertently from the plot. The mean bottom hole pressure in the gas cap in April of 1962 is 1475 pounds.

I have also tabulated the cumulative gas production from the gas cap which is not very legible, but is supposed to be 4,779,816 MCF as of May 1st, 1962.

MR. PORTER: That's 4 million, 779 --

A -- 816.

MR. PORTER: Thank you.

A I have tabulated the cumulative oil production from the oil column at 159,199 barrels as of May, 1962.

Q (By Mr. Cooley) Does this exhibit reflect the presence of communication in this pool between gas wells and oil wells?

A Well, there are so many factors involved here, it's rather difficult to draw too much. However, commencing in December of 1961, you'll notice that as the gas cap production rises, the oil production falls and also the gas-oil ratio in the oil column falls, which is some evidence of the relief of the pressure of the gas cap on the oil column, which to me is an indication of fairly good communication.

Q Have you tabulated the total gas allowable, total gas production, and the status of the Devils Fork Field as a whole?

A I have.

Q I hand you what has been marked as Exhibit No. 3 and ask you if this is a tabulation to which you refer?

A It is.

Q Would you please explain that exhibit?

A I have taken the gas cap allowable as calculated at each adjustment period, and tabulated it by months since the beginning of proration in November of 1960 through May of 1962 in the first column. I have tabulated the total gas cap production by months since the inception of proration in 1960 through May of 1962, and I have tabulated the status of the gas cap as a whole by month since the inception of proration in November of 1960 through May of 1962. As a matter of explanation, the status column refers to the cumulative overproduction or underproduction of the gas cap as a whole, and the figures in parentheses represent overproduction. You'll notice that all the figures since the inception of proration in the status column are in parentheses and do represent continual overproduction.

Q Does the total figure shown at the bottom of the status column purport to represent status as of any given date?

A No, that's the figure which involves time,and something that I would like to refer to later; if we can disregard that for the present, I would like to refer back to it.

Q Have you prepared an exhibit which graphically shows the pool production versus the allowable as a whole?

A I have.

Q I hand you what has been marked as Exhibit No. 4 and ask you if that's what you refer to?

A Yes, that is the exhibit.

Q Please explain that exhibit.

A I have plotted on this exhibit the figures from the previous exhibit, cumulative gas versus time. The top line represents cumulative allowable gas. The bottom line represents cumulative produced gas from the gas cap in the Devils Fork Field. You'll note that my zero intercept is at the top of the paper and increases downward. I did this for a purpose, since pressure

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in the reservoir is a function of cumulative gas and it would decrease as cumulative gas increases. You'll note that the cumulative gas figure is continually in excess of the cumulative allowable figure, as reflected in the previous exhibit by the figures all being in parentheses.

Q What, in your opinion, is the primary reservoir energy or drive for the oil wells in Devils Fork Field?

A It's primarily a gas cap expansion reservoir.

Q Does, in your opinion, the premature production of gas from the gas cap, or in other words, overproduction beyond and above allowable production, have an adverse effect upon oil production in the oil column?

A It very definitely does. The premature production, and as you can see, after a few months production the Devils Fork Field was 1,120,000 MCF overproduced, draws down the pressure prematurely allowing less pressure available to push oil to the well bore in the oil column, and it keeps the pressure down continually below where it would be if field rules were complied with to the letter.

Therefore, it gives the oil operators less pressure and less time to get their oil. As a result, their cumulative production and their ultimate production is affected.

Q Have you prepared an exhibit which purports to show the effect of gas production on your Edna No. 1 Well?

A I have.

Q I hand you what has been marked as Exhibit No. 5 and ask you if this is the exhibit to which you refer?

A It is.

Q Will you please explain that exhibit?

A I have plotted monthly oil production on my Edna No. 1 Well versus time in months at the bottom of the page. These figures are outlined with a solid line. I have given my interpretation of the average performance over intervals with a dashed line or a series of dashed lines. About the only explanation of that interpretation is that during the months May 1st, 1961 through October 1st, 1961, the well was producing through a high pressure separator against 300 pounds pressure, and hence the oil production was somewhat reduced; and my dotted line represents what I estimate the capacity of the well to be during that period.

At the top of the page I have re-plotted the gas cap production rate in MMCF per month versus time from the date of first proration in November of 1960 through April of 1962. The purpose of the exhibit, of course, is to show the relation between the producing rate in this well and the rate of withdrawals from the gas cap. You will note that for the first period of time from January 1st, 1961 to May 1st, 1961, I had a severe rate of decline in production from the well. This was during or shortly after a period when the gas cap production rate was in the neighborhood of 400 million MMCF per month, the highest rate at

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which the Field had ever produced before or since. After that period, during the period May 1st, 1961 to December 1st, 1961, my interpretation of the capacity of the well is that it was essentially without decline,or fairly level. During that period the gas cap withdrawal rates were very low.

Commencing on December 1st, 1961, the gas cap was produced at a higher rate, in the vicinity of 200 million per month, and a decline set in in the well again, not quite as severe as before when it was producing at 400 million a month, but very definitely a noticeable decline, whereas there had been no noticeable decline for the previous six or seven months. It appears that the decline rate in this well is very much profoundly influenced by the rate of gas withdrawals in the gas cap.

Q Were the two periods of high withdrawals to which you refer and which are depicted on Exhibit No. 5 in excess of gas allowable under the existing rules?

A Well, of course, we figure individual well gas allowables, but, yes, essentially certain wells were greatly overproduced during these periods.

Q Have you prepared an exhibit which shows a similar effect on your Edna No. 2 Well?

A I have.

Q I hand you what has been marked as Exhibit No. 6 and ask you if this is the exhibit to which you refer?

A Yes, that is the exhibit to which I refer.

Q Will you please explain Exhibit No. 6?

A I have again plotted monthly oil producing rate, this time for my No. 2 Well, versus time in months at the lower part of the graph. At the upper part of the graph I have again plotted gas cap producing rate in MMCF per month versus time in months. One explanation on the performance of this well, I had an explanation on the performance of the other well. During the period when the well first started producing in May of '61 through approximately October 1st, the well was flowing naturally; and in the latter part of September, prior to October 1st, I installed a pumping unit and the well was produced by the pump after that.

I feel that the erratic production during the first four or five months is due to the natural flow and that the production in October and November and henceforth represents essentially well capacity. Here again you see that, according to my interpretation, the capacity of the well remained essentially level during the summer months when gas withdrawal rates were very low, and commencing about December 1st, 1961, the decline set in as gas withdrawal rates in the gas cap were up to the vicinity of 200 million feet per month. It again appears, although we have less production history of this well, that production rate is profoundly influenced by gas cap withdrawals.

Q If premature production occurs, that is, overproduction above and beyond the allowable production, are you forever denied the use of that pressure?

A Well, of course, yes. The allowable production, if overproduced each month, would result in a gradual pressure decline in the reservoir, which in turn would result in a gradual oil production decline in my oil wells. Prematurely drawing down the pressure in the gas cap prematurely induces a decline in my oil production and hence they produce at a lower rate during a time when they might otherwise have been producing at a higher rate had the gas cap production been in accord with the Field rules. It results in a loss in oil production to me;unless I get that pressure times time back, I have no way of making up that oil.

Q Does the subsequent shutting in of an overproduced gas well until it reaches balance as far as allowable production is concerned have the effect of restoring that lost pressure to the oil operators?

A No, it doesn't. It brings the pressure in the gas cap back to where it normally would have been, but there is a long period of time at which it has been below normal, and during that period of time my production has been below normal; and since total barrels equal production rate times time, my production having been below normal for a period of time, I have lost some barrels. Now if they just go back to the normal pressure decline in the reservoir, I'm back to where I normally should be production-wise, but I have no way to make up my oil.

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Q Your barrel per day production is where it should be at that time?

A Yes, it is.

Q But your cumulative production is behind?

A Is low, right.

Q Have you prepared status, allowable, and production exhibits with respect to each gas cap well in the Devils Fork Pool?

A I have for each gas cap well with the exception of the Killarney No. 1-24, which is a marginal well and its status is zero each month, since its production is its allowable.

Q I hand you what has been marked as Exhibit No. 7 and ask you if this is the exhibit to which you refer?

A Yes, it is.

Q Would you please explain that exhibit?

A Similarly to the way I did on the Field as a whole, I've tabulated allowable for each well each month as calculated at the time of volumetric equivalent withdrawal adjustment; and I have tabulated the production from each well each month, and these production figures are in MCF, and I've tabulated the status of each well each month. Again the status represents the cumulative under or over production, and those figures in parenthesis represent overproduction, whereas the other figures are underproduction.

Q I notice that on all of these exhibits there appears a figure at the bottom of the status column. Would you please explain what that figure represents?

A That figure incorporates a time factor into the overproduction or underproduction figures. It is mathematically arrived at, merely by adding up the column, the overproduction each month. The units for the figure is in MCF months. In other words, a well which has been overproduced a large amount for a long time would have a higher figure there than a well which became overproduced a large amount and then got back to normal in a short time; the time factor -- well, the time factor is included in here. In other words, this figure was derived for a purpose to show indirectly how much pressure in time has been denied the oil operators during this continual overproduction in the gas cap.

Q Now referring back to Exhibit No. 3, which is the total pool status, would you explain that 10,699,261 figure shown at the bottom of the status column thereon?

A That again is the total MCF months, incorporating the time figure for the Field as a whole. The figure 10,699,261 MCF months represents about 85 allowable months that the gas cap was overproduced. This does not mean that in order to restore my pressure times time to produce my oil that you would have to shut in the gas cap for 85 months. It means that the gas cap might have to get eight months underproduced and stay that way for ten months; therefore,the underproduction times the time would equal this ten million.

Q It's the length of time that the pressure is maintained either too low or too high, as compared with what the pool rules prescribed that has this tremendous effect on the oil production, I take it?

A You referred to pressure; in order not to confuse the Commission, let me reiterate that we're using cumulative gas figures here. I think we'll all recognize that pressure in the reservoir is a function of cumulative gas, and therefore the cumulative gas figures are analogous to pressure; and we, of course, are interested in pressure. This is the way we are driving at that pressure and trying to illustrate it, these cumulative gas figures.

Q Would you please take each well individually, as shown on Exhibit No. 7, and summarize its performance since proration?

A Yes. I don't know whether or not these are arranged with everybody's group. I will start with Skelly's Federal 1-G. Its status as of May, 1962 was that it was 28,204,000 cubic feet overproduced. It had been at one time as high as 55,600,000 cubic feet overproduced. However, on the other hand, it had been at one time, in about August, 1961, 97,381,000 cubic feet underproduced. The net result is that this well has been produced very much in accordance with Field rules. I think at one time, in January of 1962, it was overproduced about four times its monthly allowable, which is in violation of Field rules, but that's very slight compared to some of them; and the net result is that it has been underproduced longer than it has been overproduced, and we have gotten the benefit of reservoir energy from this well more than the Field rules would call for.

Q Then, as I understand it, although this well is presently in an overproduced status, its over or under production, when considered in terms of time and pressure, have rendered a benefit to the oil operator?

A Yes.

Q As shown below here in the 103,266 at the bottom of the status column?

A Since it's not in parenthesis, it represents that the well has on the average been underproduced more than overproduced, and they have given us a little reservoir energy that wasn't called for.

Q This theory is quite complex. Have you prepared an exhibit which portrays graphically the effect of the production rates on the Skelly well?

A You asked me to go through all of these.

Q I want to interrupt at this point.

A Yes, Exhibit No. 8.

Q I hand you that exhibit. Will you please explain what is snown thereon?

A Yes, I will. On Exhibit No. 8 I have plotted the cumulative allowable in MMCF, and I have also plotted the cumulative production in MMCF versus time in months. Again the zero intercept is at the top of the paper, and it increases downward. The fairly straight line represents the cumulative allowable for this well, the erratic line which is labelled "Cumulative Production" represents the cumulative production from the well. As can be seen, it was slightly overproduced to begin with, was shut in and became largely underproduced, was again opened up in about September of 1961, made up its underproduction and became overproduced again, at which time it was curtailed.

I have labelled on this graph Area One and Area Two. The difference between the cumulative allowable and the cumulative production is cumulative status. These areas can be calculated by dividing them into segments, the area of each segment can be calculated by multiplying the status times the month. If you take one month intervals, you just add the status each month and you get the area. This is what we have done on these exhibits, which were Exhibit 7.

In the particular case of the Skelly 1-G, Area One minus Area Two is equal to minus 103,266 MCF per MCF month. I have explai[illegible] that the well has remained over about seven months.

Q Even though its present status is currently overproduced?

A That's right. In other words, if you visualize the cumulative production line as being some function of pressure, you can see that I have had as much as -- and if you visualize that the cumulative allowable line is what the Field pressure should have been had the gas cap been produced according to Field rules, you'll see that the pressure as a result of the production in the Skelly 1-G was over the line as much as it was under the line, or maybe perhaps a little more; and hence everything balanced out, we didn't lose anything reservoir energy-wise.

Q Would you then move on next to the Redfern and Herd Largo Spur No. 2, even though that's not the next one in order?

A Yes. You are referring back to Exhibit No. 7?

Q Yes.

A All right. Redfern and Herd Largo Spur No. 2. Again I have tabulated the allowable by months as calculated by the adjustment period, the production by months, and the status by months. In this case the well was produced at very high rates during the first three or four months and obtained a cumulative overproduction of 350 million feet of gas, in February, 1961. It has been shut in ever since and it's back down to where it's only 90 million overproduced as of June 1st, 1962. However, it has been continually overproduced and we have been continually denied anywhere from rather large amounts of reservoir energy down to reasonable amounts of -- well, I don't know what you call reasonable, but smaller amounts of reservoir energy. The total MCF months is almost four million, which represents about 40 percent of the Field total.

Q Have you prepared a graphic exhibit to show the effect of the production history of this well upon the oil operator?

A Yes, I have. That's Exhibit 9.

Q I hand you that exhibit and ask you to explain same.

A I have plotted cumulative allowable and cumulative production in MMCF per month at 15025 pressure base versus time and months, and shown the actual cumulative allowable and cumulative production by solid line. As can be seen, the cumulative allowable gradually increases and the cumulative production very suddenly reached about 403 million feet and has been shut in ever since.

The total area below the cumulative allowable line is almost four million MCF months, or about 265 allowable months; in other words, the reservoir pressure as a result of the production from this well has been maintained at fairly substantial rate below what it otherwise might have been. I've also extrapolated some dotted lines. The cumulative allowable was extrapolated at the rate of 15 million feet per month estimated future allowable. The cumulative production line is extrapolated at zero production until it meets the cumulative allowable line. I also have an extrapolation beyond that, which was supposed to illustrate a proposal that I'll submit later.

Q Going back, then, to Exhibit No. 7, would you turn to the second sheet shown there on the Redfern Herd No. 3 and proceed through the rest of the wells?

A Yes. The Redfern Herd No. 3, again I have tabulated the allowable by months, production by months, and status by months. This well reached a maximum overproduction of 108 million feet in February of 1961. This represented about five times monthly allowable. It was subsequently shut in until it was 45 million feet underproduced, and then produced again at moderate

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rates. The present status is that it is 55,565,000 feet under-produced.

The cumulative effect has been that it has been over-produced slightly more than it has been underproduced, in spite of the fact that it is underproduced at the present time.

The Val Reese and Associates 1-19 Lybrook gas production figures, again I have tabulated allowable by months, production by months, and status by months. This well was produced initially at fairly high rates, and it became 119 million feet overproduced in February of 1961, which was roughly six times monthly allowable. It was at a period of the next few months, and shut in for several months until it became a maximum of 22,410,000 under-produced, and then was opened up and seems to be produced at rather high rates until it was again almost 127 million or nine months overproduced in April of 1962.

The cumulative effect on this well is that it's fairly substantially been overproduced all the time, 1,186,257 MCF months. This has deprived us of some reservoir energy.

Skipping Redfern and Herd No. 2, which we have already discussed, the Redfern Herd No. 1 Largo Spur, the gas production figures are tabulated, allowables, production, and status by months. This well was produced at very high rates to begin with to where it was 275,975,000 MCF overproduced in February of 1961. This was roughly 24 months. It was shut in for several months and has been produced at somewhat lower rates since; essentially, it has been shut in ever since. It is now only 21 million overproduced. It's almost back to where it should be had it been produced at low rates all during this time, but the cumulative effect is that it has caused a depression in the available reservoir pressure and robbed us of reservoir energy to quite a large extent, 2,706,488 MCF months.

The El Paso Natural Gas Company Canyon Largo Unit No. 89, again the allowable,production, status are tabulated; maximum overproduction is 186,712,000 in January, 1961, which represents approximately nine allowable months. It was subsequently shut in. It has been produced only occasionally; it reached a maximum underproduction of 52 million in April. The present status is 47,476,000 MCF underproduced; however, the cumulative effect is that this has been overproduced much more than it has been underproduced, 1,087,818 MCF months.

The Paul F. Rutledge 1-A Miller production gas figures are presented, allowables by months, production by months, status by months. This well has never gotten quite so far out of line as some of the others. It reached a maximum overproduction of 92 million in February of 1961, which was about four and a half months overproduction; a month or two later it was shut in for about six months and then opened up again for the winter gas take. It reached a maximum underproduction of 34 million just before being opened up for the winter, and has been produced to an extent where it reached a maximum overproduction of 85,688,000 cubic feet in March of 1962. This was in excess of four times its monthly allowable. The cumulative effect is that this well has been overproduced much more than it has been underproduced, to the extent of about 783,719 MCF months.

The El Paso Natural Gas Company Canyon Largo Unit No. 106 gas production figures are presented, the first production was in January of 1962; allowable by months, production by months and status by months are presented. The well was produced continually until it was 55, almost 56 million feet overproduced, which was about four allowable months, and then shut in. It appears as though this well is going to balance out soon. It got a little bit over the permissible overproduction figure, but it appears as though being shut in, the effect should not be too great.

BCO, Inc., Zamora No. 1 gas production figures are presented. The first production was in March, 1961; allowable, production, and status figures are tabulated. The well was overproduced 73,849,000 cubic feet in June, 1961, after which it was shut in until it was underproduced almost 16 million feet. In December it was opened up and produced 60 million, at which time it was 29 million overproduced. In January it produced 42 million, at which time it was 56 million overproduced or four times monthly allowable, which was in excess of the Field rule limit; and yet it was produced at apparent capacity during February, March, April, May, and I think it was still producing at capacity up until

Tuesday when Mr. Arnold called and told somebody to put a padlock on the well.

Of course, these figures, in spite of the short time the well has been producing, its effect on the reservoir energy has been pretty detrimental. The cumulative effect has been 1,017,296 MCF months.

Q Is it your opinion that substantial production in excess of allowable production has an adverse effect on oil wells in this pool, irrespective of the location of the gas well involved?

A Very definitely. I feel there's good communication in the gas cap, and the gas cap pressures have been fairly close to each other each time they're measured. This is evidence of fairly good communication in the gas cap.

Q This is true even though there have been considerable discrepancies between withdrawals from individual wells, total cumulative withdrawals?

A Yes. Oh, there's some pressure sinks to a small degree, not very great, but there seems to be pretty good communication. They seem to come up to fairly much the same pressure in the gas cap.

Q Would you please try to describe how wells here to the south as shown on Exhibit No. 1, when they're greatly overproduced, would affect the oil production some mile or two miles to the north?

A Well, we've shown some exhibits showing the relationship between gas withdrawal rates and decline rates in the oil wells. There was nothing said or indicated or even thought about as far as the location of where the gas was produced, and yet the decline rate seems to be amazingly proportional to the gas withdrawal rate.

Q In your opinion, physically, how does this occur?

A Physically, the production of, for instance, the Zamora Well down at the very south end of the Field creates a pressure sink; when it's produced at very high rates, the gas rushes in from the north and relieves the pressure on the oil column. This gives the oil producers less pressure to get the oil to the well bore, allows gas to come out of solution, decrease permeability to oil, and affects us in many ways, all detrimentally.

Q You mentioned the relative permeability factor. Do you think there has been any substantial change in this factor since the last hearing in this case?

A Very definitely.

Q Would you please go into that?

A Well, the decline rate in my No. 1 Well, which was presented on Exhibit No. --

Q I believe you misunderstand my question. The actual physical function of a change in permeability and how it can affect the production of a given well.

A Well, as pressure is relieved in the oil column, gas comes out of solution, this creates a gas phase and causes two-phase flow in the oil column. Relative permeability to oil decreases, depending on the KGKO relationship; in this case, it appears as though a small decrease in pressure may cause somewhat of a pretty profound decrease in your relative permeability to oil. It also decreases -- well, no, it doesn't. But we've had drops in production in the oil column which have been large, maybe a ten percent drop in pressure in the gas cap may cause a 20 or 30 drop of production in the oil column.

Your production in the oil column, according to Darcy's Law, is proportional to, among other things, your differential pressure, and your permeability to oil. If the permeability to oil didn't change, well, then, you would expect the drop in oil column production to be only directly proportional to the drop in pressure. Therefore, the permeability to oil must have dropped.

Q It's the only possible conclusion--

A Yes.

Q --since the oil production drops disproportionately with the pressure?

A Yes, drops more rapidly.

Q Would this then tend to indicate that this pool is even more sensitive and more dangerous with regard to premature reduction of gas cap pressures than the ordinary?

A I don't know what you would call ordinary, but it seems like it would be very important to keep the pressures high, as would be fair to everybody, as currently and as much as possible.

Q This KGKO factor to which you have just referred is somewhat more extreme than what you would normally expect to encounter, somewhat of a surprise?

A They always drop somewhat more rapidly at first. I can't say quantitatively how it compares with the average sandstone. I imagine it's a little extreme.

Q It nevertheless introduces an additional factor which poses an additional risk to premature pressure reduction in the gas cap?

A Yes.

Q I've previously asked you if you felt that the present rule requirement of forcing the gas operators to return overproduced wells to a zero balance would solve the problem or adjust the loss to your correlative rights, to which you have just referred. Would you please answer this question again?

A No, no, I don't think it will. I have lost reservoir energy and that doesn't get it back. I need pressure and I need time to get it back to the well bores. I lost pressure over the period of time and just putting it back, to me does not give me time to produce that oil which I have lost.

Q Do you have any proposal at this time as to a method whereby the Commission could restore the respective correlative rights, as between the oil and gas operator?

A Yes, I do.

MR. PORTER: May I interrupt, Mr. Cooley, just a minute?

We will allow your witness to get into his proposals after a noon recess. We will recess until 1:30.

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

AFTERNOON SESSION

MR. PORTER: The hearing will come to order, please. Mr. Cooley, would you proceed with your witness?

DIRECT EXAMINATION (Continued)

BY MR. COOLEY:

Q Mr. Merrion, it is self-evident from the records of the Commission, as well as the record in this hearing, that there have been some major violations of the rules in this pool to date with respect to the overproduction of certain gas wells in the gas cap. The present rules merely provide in such instances that these wells be brought back to a zero status; in other words, be brought into balance. Would you again please explain to the Commission why you feel that this is not sufficient to restore to you your proper position and your correlative rights?

A Yes. As I have previously testified, the premature production of gas by these overproduced gas cap wells has prematurely drawn down the pressure and deprived me, over a long period of time, of reservoir pressure upon which my oil production is directly dependent. Restoring these overproduced gas wells to a zero status will, to a certain degree, correct the correlative rights between gas cap well operators, but it will not restore to me the reservoir energy that was denied over a long period of time. I feel that it's necessary to make an additional adjustment; that these wells which have been overproduced, whether they are presently overproduced or not, be underproduced in the future over a period of time to the end that future underproduction expressed in MCF months equal past overproduction expressed in MCF months. This, to a certain extent, will give me a little more pressure over a little more time to produce some oil. My oil rate is down now and I don't think this will restore the oil that I have lost, but it will be a step toward that end. In line with that -- excuse me, go ahead.

Q In what particular would you suggest that this underproduction be required?

A I would like to make the proposal that wells which at the present time have a cumulative overproduction -- let me restate this. I would like to request that at this time wells which have a cumulative overproduction be shut in until such time that they are balanced. At that time I recommend that they be restricted to 25 percent of their normal allowable until such time that the cumulative MCF months are reduced by 25 percent. Thereafter, to be produced at 50 percent of normal allowable until the cumulative MCF months at the time of balancing has been reduced by 50 percent. Thereafter to be produced at 100 percent of normal allowable until the cumulative MCF months have been cumulatively reduced by 75 percent. Thereafter to be permitted to make up their underproduction at a rate which will roughly return them to an un-overproduced and an un-underproduced basis and also a zero cumulative status.

Q Do you feel that this proposal, if granted as requested, will fully restore to the oil column operators the loss of oil that they have suffered thus far as a result of overproduction?

A I rather doubt it. As we before mentioned, these KGKO relationships are such that although we will have the pressure differential back over a period of time equal to the pressure differential we lost over a period of time, we will not during this additional period of time have as high a permeability to oil; and hence we probably won't get all the oil back that we lost, but it will be a step in that direction.

Q Will this proposal, if granted, result in the ultimate decrease in the total cumulative production for these gas well operators throughout the life of the pool?

A No, it will not. I don't believe it will.

Q Is it correct to state that your proposal is merely that they delay the production of this additional quantity of gas till such time as the oil operators have time to take advantage of this additional pressure?

A Yes.

Q But it should not result in any decrease in production to the gas cap operators?

A Not any decrease in ultimate recovery, no.

Q Do you feel that the gas-oil contact for the pool has been measurably altered, moved by the overproduction that has been experienced to date?

A We have no direct evidence of it. There has not to my knowledge been any increase in the oil production of the gas wells which are adjacent to the gas-oil contact. However, theoretically, due to the imbalance which has been maintained, some movement of the gas-oil contact in all possibility did take place. There's about, at least a half a mile between the gas well and the oil well which are nearest to each other on either side of the gas-oil contact. Possibly there was some movement within that distance.

Q In which direction would the gas-oil contact move, if at all?

A It would have moved toward the gas cap, since it produced more than its volumetric equivalent of reservoir space during this period.

Q Would this result in an intrusion of oil into what was formerly the gas cap?

A Yes, it would.

Q Would there be a possibility, since this has occurred, that it resulted in ultimate loss of recovery in oil production?

A Quite often in associated gas reservoirs such as these, if the oil is permitted to enter into what was formerly a gas cap, there is a wetting of the gas cap rock, which wetting results in a permanent loss of oil, oil which can never be recovered again.

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This might have happened in this reservoir.

Q Is there any evidence that this gas cap rock was already saturated with oil?

A Core analyses I have seen have indicated a rather high oil saturation in the gas cap rock. I've heard various theories as to how it got there. Some people think it came out of the gas while the core was coming out of the hole and it was not originally present down there. Other people think it's due to shortcomings in the method of core analysis. I don't know.

Q By "not originally present in the reservoir", do you mean that these people who hold this theory believe it was in a gaseous state in the reservoir?

A Yes. Of course, hydrocarbons are sometimes in a different condition, sometimes gas and sometimes liquid. This might have been a liquid at surface condition, where it might have been gaseous at reservoir. It's a questionable matter as to whether the movement of the oil into the gas cap rock represents a permanent loss or not. It's certainly a possibility.

Q This could be stated that to the extent that it was not already saturated, there would be a loss to that extent of oil?

A Well, I don't think so. If the gas cap had a liquid saturation, an oil saturation to begin with which was equal to the irreducible oil saturation in the oil column, then the remaining oil which moves into the gas cap is all movable and it can move back into the oil column again; so that doesn't represent a loss if that is the case.

Q If the proposal that you make is granted, do you feel that there will be another movement of the gas-oil contact?

A Well, of course, as these wells are brought back into balance, it should restore the gas-oil contact to its original position, allowing for a little bit of time to do it. The rule which I propose will not result in near the total underproduction that these wells were once overproduced. It just may cause them to remain overproduced for a long period of time so that the total area of the curves above and below the cumulative lines is equal. This will cause possibly some minor movement in the gas-oil contact back toward the oil column. But it will, I don't think, be very severe.

Q Would the movement which you testify could possibly occur back towards the oil column in your opinion result in any loss of recovery of either gas or oil?

A No, I don't think so. The formula, the volumetric equivalent formula is a self-adjusting one. If the gas-oil contact were to move toward the oil wells and possibly increase the gas-oil ratio on some of them, this will increase the total volumetric equivalent withdrawal of the oil column and automatically raise the gas cap allowable, which will tend to bring it back again.

Q Would the movement of the gas-oil contact to the degree which you testified result in waste in any form, in your opinion?

A No, it certainly wouldn't.

Q Would it result in a violation or infringement of correlative rights of the gas cap operators in any way?

A No, it certainly wouldn't, it would just prolong the period for which they could receive income from their wells, but the period, the prolonged period would do no more than compensate for the quick income they got when they overproduced initially. It certainly wouldn't be an infringement on their correlative rights.

Q Then, Mr. Merrion, would you please summarize your position with respect to the production history and the resultant effect on the oil column from the date of proration to the present?

A Yes. To begin with, I think that the formula adopted by the Commission in August of 1959, providing for volumetric equivalent withdrawals from the gas cap in the oil column, is the best possible compromise between recognizing the correlative rights of operators and trying to bring about the most conservation of natural resources. There's a lot of things that aren't taken care of, such as wider spacing than 80 acres, undeveloped acreage, and a few other things; but I think it's the best compromise itself. I couldn't offer a better suggestion for a Field rule.

The lack of adherence to the Field rules have caused an infringement on the correlative rights of the oil operators by depriving them of reservoir pressure and reservoir energy over a period of time and as a result depriving them of oil production. That oil production will not be returned to them under the present rules. I think that a temporary adjustment of the rules to compensate for this infringement of correlative rights should be adopted as I have proposed, to cause these wells to be underproduced for a period of time and give the oil operators a little excess pressure differential in return for the differential they borrowed from us.

Q Do you have any recommendations concerning any other provisions of the pool rules as they now exist?

A Yes, I do. First of all, I think Rule 15-B in the Devils Fork Field Rule should be changed to read that "the maximum overproduction allowed for any gas cap well be one times its monthly allowable", rather than three times its monthly allowable.

Second of all, I recommend that since the Bird No. 5-A Well of Val Reese and Associates does not appear to be in the Devils Fork Field reservoir, but rather appears to be in the Escrito reservoir, and that it be removed from the field and that its production not be included in the volumetric equivalent withdrawal formula in the future.

Third of all, in the interest of obtaining additional pressure reservoir information in this reservoir, we have gotten some good information; one thing is lacking. The oil wells in the reservoir which are pumping are exempted from the rule which requires semi-annual bottom hole pressure. These could be obtained by the Sonalog and dead weight tester method. I recommend that they be included. However, as a corollary to that recommendation, I think that in the volumetric equivalent withdrawal formula that the best data be used which is available. I do not think that the present arithmetic average of all pressures in the reservoir represents the best data, for the reason that some of the low capacity wells both in the oil column and in the gas cap will not build up to anywhere near static pressure in three days. This difference between the 72-hour pressure and the true static pressure in the reservoir is further distorted by the high viscosity. It's not really very high as oil goes, but it is very high in comparison with the viscosity of the gas. The higher viscosity of the oil prevents the pressure from reaching true static in 72 hours. Therefore, I suggest that the pressure to be used in the volumetric equivalent withdrawal be a mean pressure of the gas cap wells, and just forget about the oil wells, they're not shut in as long. They have a higher viscosity fluid, therefore they do not come anywhere as close to true reservoir pressures as the gas cap. Take a mean pressure, this will eliminate from the average any abnormal pressures, abnormally low or abnormally high, and I think give you a much better figure to use. It's a good engineering practice to use the best available data. These are the only other recommendations I have at this time.

Q Do you have any further testimony you wish to present on direct?

A No, I don't.

MR. PORTER: Do you wish to offer your exhibits?

MR. COOLEY: Yes, we wish to move admission of all the exhibits, 1 through 9, into evidence.

MR. PORTER: What was Exhibit 8?

MR. COOLEY: It's the graphic production history on the Skelly Federal G-1.

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

(Whereupon, Merrion Exhibits 1 through 9 admitted in evidence.)

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

MR. BRATTON: If the Commission please.

MR. PORTER: Mr. Bratton.

MR. BRATTON: Howard Bratton for Redfern and Herd. For the sake of conserving time, I would like to make a motion at this time that I might otherwise make at a subsequent time. To preface that motion, I would like to review briefly, as I understand, the history of one of Mr. Merrion's suggestions, and that is that some wells in the gas area have been in an overproduced status which has deprived wells in the oil area of reservoir pressure.

I believe that Mr. Merrion in his summation here said that the formula itself is reasonably satisfactory and that lack of adherence to the Field rules has caused a violation of

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correlative rights. Based on that, he made this suggestion which, quite frankly, I don't understand fully, but I do understand this. It is addressed to overproduction which has occurred in the past, and based on that, he suggests a rule be enacted by the Commission today which has the effect of a penalty on the operators who incurred that overproduction before the rule was enacted.

I move that the Commission now rule that that suggestion is out of order and will not be considered by the Commission because it is a suggestion for an ex post facto regulation. I do not believe that it would be legal were the Commission to attempt to do it.

I think very clearly if Mr. Merrion's correlative rights have been violated by a lack of adherence to duly promulgated rules of this Commission, he can seek redress in the courts; and if he can prove his correlative rights have been violated and that he has been damaged by someone's lack of adherence to rules of the Commission, his redress is in the courts in damages, but a suggestion that this Commission now promulgate an ex post facto rule I believe is clearly out of order, and I move that the Commission now rule that it will not accept such a suggestion and will not consider it.

I think further I would move that the Commission rule that all of the testimony of Mr. Merrion and all of his exhibits addressed to that suggestion will not be considered by the

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Commission.

MR. KELLAHIN: If the Commission please, Jason Kellahin, appearing for Val Reese and Associates and BCO., Inc. We join in the motion which has been made by Mr. Bratton.

MR. BRATTON: In the absence of Mr. Whitworth, who will be here in a moment, he has sent a message through an emissary that El Paso joins in that motion.

MR. PORTER: Mr. Cooley.

MR. COOLEY: In response to Mr. Bratton's motion, we would state that the Oil Conservation Commission of New Mexico is not only the proper body but the only authorized agency of the State of New Mexico to adjust correlative rights between various operators in the oil and gas industry in the State of New Mexico; that this is not a problem of which the courts of this State are educated in, that the expartes, the experience and the ability to understand what has happened to Mr. Merrion and the other oil operators in the Devils Fork-Gallup Pool lies solely with this Commission, and that most certainly any matter affecting correlative rights is a matter properly cognizable by this Commission.

I wish to rush to deny that we're urging any penalty upon gas operators, but merely requesting that the Commission adjust the manner in which the pool is produced henceforth, and thus adjust the correlative rights of the parties who have an interest therein, both oil operators and gas operators. We feel that this matter is quite properly brought before this Commission and therefore request that Mr. Bratton's motion be denied.

MR. PORTER: Mr. Bratton.

MR. BRATTON: I would just say one thing, if the Commission please. There isn't any doubt in my mind but what the courts of this State understand what an ex post facto regulation is and that it is illegal and unconstitutional.

MR. PORTER: The Commission will overrule the motion and you may proceed with your cross examination of the witness. Anybody who cares to question him at this time? Does anyone have a question? The witness may be excused.

MR. BRATTON: If the Commission please.

MR. PORTER: You are a little slow today, Mr. Bratton.

MR. BRATTON: I'm a little surprised, if the Commission please. On behalf of Redfern and Herd, in view of the Commission's ruling, I would move that this case be continued for one month. I would state in support of that motion that a meeting of the operators in this pool was had some three months ago, at which tentative expressions of views as to the rules, as to the effect and the workings of the rules were exchanged; and at that time, to the best of my knowledge, everybody agreed as to some form of continuation of the present rules.

It is my understanding that Mr. Merrion discovered these facts upon which he based this suggestion sometime within the last week or few days, and to the best of my knowledge, the first one of the group that I am speaking for heard of it was the night before last, and the first information that some of the others had was yesterday, and some today. This is not a situation, if the Commission please, where we have been advised from the time that the matter was set for hearing, or a year ago, that there would be a controversy of the nature, of this kind. This is truly a case of surprise as to this suggestion, no fault on the part of Mr. Merrion, he apparently just came upon these facts; but we are legitimately and bona fidely surprised as to the suggestion.

I might add as to the full scope of the suggestion, I don't believe that we were fully apprised of that until Mr. Merrion outlined it on the stand. For that reason, I move that this case be continued until the July hearing.

MR. KELLAHIN: If the Commission please, Val Reese and Associates and BCO, Inc. join in the motion, and we would also like to point out that, in the main, testimony offered here today consists largely of conclusions which call for certain basic information for the support of which has not been offered, that information; and what I had particularly in mind was oil and gas data in the oil and gas zones, whether that information is available or not, I frankly do not know. I think that before any intelligent decision can be made by this Commission on the proposal made by the applicant, that information is going to have to be available.

It would be our suggestion that the Commission require that both pressure tests be made in both the oil and gas zones in order that the information be available to pass on the merits of the proposals that have been made.

MR. PORTER: Mr. Kellahin, you propose that this pressure information be available at the next hearing?

MR. KELLAHIN: I seriously doubt it could be done by that time. Mr. Bratton had asked for a 30-day continuance. I had in mind asking for a longer continuance in order to supply this particular information to the Commission.

MR. BRATTON: I have no objection to the additional time. The 30 days was just a suggestion.

MR. PORTER: Mr. Cooley.

MR. COOLEY: Just one minute.

MR. BRATTON: I have a further message from Mr. Whitworth that he concurs in the motion.

MR. BUELL: May it please the Commission, I would like to sincerely request that in your consideration of this continuation you would also consider letting Pan American put on its little bit, it will take about 15 minutes, and I assure you it's almost non-controversial and we would like to get it into the record at this time, if we might.

MR. PORTER: Mr. Cooley.

MR. COOLEY: Mr. Commissioner, we have no objection whatsoever to a continuation of this case to permit those who hold views contrary to ours to prepare their direct testimony, because we are fully aware that they are caught by surprise here to a certain extent. They're not surprised, however, by the present status of their wells. They know how long they have been overproduced. I think it is grossly unfair to give them three months or two months or one month in which to concoct various questions to propound to Mr. Merrion on cross examination. We would strenuously oppose continuation of this case until cross examination of Mr. Merrion has been concluded.

MR. BRATTON: If the Commission please, I do believe that, one, we have no desire to spend three months concocting questions for Mr. Merrion. I in truth believe that if we have time to develop the basic data and the information which would be developed by these tests, I think the cross examination of Mr. Merrion could be very sharply reduced, and I believe it's in the interest of the saving of time that the matter be post-poned right at this moment.

MR. PORTER: Mr. Bratton, it's your position that there probably would be less cross examination at that time than there would be now?

MR. BRATTON: I don't think there's any doubt about it. I propose at that time to put on most of our case by our own witnesses. I might have some questions of Mr. Merrion, based on the data that's developed and on some data here today, but I think it would certainly be much briefer at that time than it would at this time.

MR. PORTER: Mr. Cooley.

MR. COOLEY: Well, again I oppose continuation of this case until conclusion of cross examination of Mr. Merrion. I think it's definitely an unfair advantage to permit this today. If there are parties involved in this pool who hold views contrary to that of Mr. Merrion, let them put it on in direct testimony of their own and then it will be encumbent on the Commission to decide whose witnesses are nearest the truth; but I think it is grossly unfair to permit a delay in the cross examination of this witness.

MR. PORTER: Mr. Buell, all you are looking for is an opportunity to put on your testimony?

MR. BUELL: Yes, and Mr. Bratton has no objection to our going ahead. He didn't mean to infer in his motion that he wanted to cut us off.

MR. BRATTON: I assume it is that little dab of non-controversial evidence.

MR. PORTER: The Commission rules that the witness is now available for cross examination on whatever he has testified hereto here today, and that you can go ahead and cross examine on that basis if you care to; that anyone who cares to present testimony today may do so, and that after the testimony has been presented you may renew, if you want to, the motion for continuation.

Let the record show that the witness has not been excused, in spite of my words to the contrary previously. Mr. Kellahin.

MR. KELLAHIN: If the Commission please, I have some questions of the witness.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Merrion, on your Exhibit No. 1 you have called it an Iso-volumetric map; that's what it is, isn't it?

A That's correct.

Q On what do you base your porosities for the purpose of drawing that?

A I base them on log analyses, electric log analyses, sonic log and induction.

Q On your experience in this pool, have you been able to pick your porisity on the logs with a high degree of accuracy?

A I think so, yes.

Q How did you determine that you had this accuracy?

A I compared and this is interpretive, mind you, I scratch out things on core analyses which to me are not pay but I have compared log analyses porosities against core analyses porosities on some wells.

Q How many wells did you have a core analysis on?

A I think I had a total of three available to me, the Skelly 1-G, the El Paso Gas Canyon Largo Unit No. 9, and this

Killarney well. Excuse me for laughing.

Q Was there a sonic log available on all those wells?

A There isn't on the Killarney well.

Q Then you had two on which you compared it?

A That's right.

Q You took that as being a firm figure which you applied throughout on your correlation?

A I used, as I recall, the log analysis porosity times feet on the map throughout, just as check points, tying in core analysis porosity feet on Skelly 1-G and El Paso No. 9.

Q How many logs did you examine for that purpose?

A I examined all the logs that I have figures for on this map, plus some other wells that, as it turns out, I didn't consider belonged in the field.

Q Your Exhibit No. 1 also shows a gas-oil contact. How did you determine that?

A That's just my estimate. I drew a structure map and I picked a point intermediate structure-wise between the highest oil well and the lowest gas well. The highest oil well being my No. 1 Edna, and the lowest gas well being the Rutledge 1-A Miller "B" -- wait a second. It's the Rutledge 1-A Miller, yes.

Q And that was just your control points?

A To my knowledge, the gas-oil contact has not even been tied down either in a core or drillstem test. It's a matter of interpretation where it lies. I think it was originally "guess-timated" to be at a plus 1025, and I think I have it at about a plus 1075 or something like that. I can't remember.

Q You wouldn't quarrel with movement of that estimate one way or another, some considerable distance, would you?

A I think Pan American has done more work on the gas-oil contact, and they might throw a little light on the matter. I think that in my opinion this is my best estimate of where the gas-oil contact is, where it intersects the top of the sand.

Q You define one area as being the gas cap, the other as being the oil zone. I assume by that, then, you mean one area lying on the one side of the gas-oil contact is the gas cap and the other is the oil zone?

A That's right.

Q And when you are referring to gas cap, you are not referring to production from oil wells in the oil zone?

A No.

Q Is there any kind of a gas cap that does exist in that zone?

A In the oil zone?

Q Yes.

A Well, there seems to be, possibly the Paul F. Rutledge Miller 5-B seems to be a very high gas-oil ratio well.

Q Now on the --

A I don't know whether the gas cap or just what the situation there, its unusual behavior; other than that I don't know of any individual gas cap in the oil zone, no.

Q Now you referred to the oil zone as being 25 percent developed as against 75 percent developed in the gas zone, is that correct?

A I thought I said 80 percent in the gas zone.

Q 80 and 25?

A 80 and 25 are the figures I think I quoted.

Q How did you arrive at the 25 percent figure for your oil zone?

A Just a horseback estimate, looking at my map here. It looks like it extends over the Federal No. 10 in Section 10, 26. I have log cross sections, which appears to me it's part of the same animal, that's part of the same reservoir. I think it will eventually prove out that way.

Q What is the pressure in the oil zone? Do you have any figures on that?

A I don't think we have any true pressure figures on the oil zone ever. The only thing we have are 72-hour shut in pressures, which in my opinion do not represent true pressure, not like the gas cap wells which build up more rapidly, because the lack of two-phase flow because of the higher viscosity of the gas and because of the longer -- they get closer to static pressure because of the longer shut in time. The only pressures measured in April in the oil zone, let's see, the Redfern Herd 1-A, which is classified an oil well although it's kind of a halfbreed, the

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pressure was 1275 in April. The Bird No. 1-A, which is kind of a halfbreed, the pressure was 840. The only other two pressures in April were measured on my Edna No. 1 and Edna No. 3, and those pressures were after 72 hours at a plus 1025. The Edna No. 1 measured 933 pounds and the Edna No. 3 measured 1347 pounds.

Q Quite a wide discrepancy, then, in pressures, is there not?

A Some wells have wide discrepancy in pressures, yes.

Q Is there cumulative production which would cause that variation?

A Yes, yes, there is.

Q As I understand your testimony, Mr. Merrion, it is your position that the overproduction of the gas wells has adversely affected the production in the oil wells, is that correct?

A That's correct.

Q Would you not then anticipate that the pressures in the oil wells would be lowered as a result of this overproduction?

A Well, that was, of course, my -- the point of most of my testimony was that, that the reservoir pressure as a whole had been drawn down below what it should have been had the gas cap been produced at allowable rather than way over allowable.

Q You are talking about reservoir pressures, but you are talking about only the pressures in the gas cap, is that correct?

A Well, of course, I also stated or recommended that we use a mean gas cap pressure in the formula, since to me when you shut a well in for 365 days or six months, and you have a gas well without two-phase flow and without the high viscosity of your oil, it will build up quicker and due to longer shut in period it represents a truer reservoir pressure.

Q Would it represent the actual pressure that existed in the oil zone?

A There undoubtedly is some, if you shut the whole reservoir in, all the gas wells and all the oil wells, and then pressure buildup and then extrapolated to true reservoir pressure, I imagine there still might be some small discrepancies, but -- and there would be some gradients in the reservoir but I think there would be much less than the pressure that we have.

Q Mr. Merrion, if you use the mean gas pressure as being the pressure for the oil zone, is that what you are saying?

A Yes, yes, I am.

Q Then you don't know whether the production in the gas zone is adversely affecting the oil zone or not, do you?

A I don't follow you there at all. Just because I don't use it in the formula is no reason not to know.

Q How would you --

A I recommend that they be taken on all oil wells. I don't think the 72-hour tests mean a thing.

~~Q But you recommended it anyway?~~

A I think Mr. Redfern requested it, and I took it.

Q Would you recommend a long shut in to give a more stabilized pressure or more stabilized pressure?

A No, I wouldn't.

Q Then you don't consider pressure in the oil zone of any significance whatever?

A It's certainly significant as far as how much oil I can produce out of my wells.

Q But you are not sufficiently curious about what you can produce to take the pressure test?

A Just because I know what my pressure is isn't going to help me to produce any more, Mr. Kellahin.

Q It would enable you to keep track of what your situation is?

A I can keep track of it just by looking at my oil production.

Q Does any other factor affect your oil production other than the pressure which may be available to your well bore?

A There's a lot of factors that affect it.

Q Will you name some of them?

A As I mentioned before, the relative permeability to oil affects it, which is affected by gas saturation and fluid saturation in the reservoir. The viscosity of the fluid affects it. The completion, the amount of restriction around the well bore or the effectiveness of a sand frac treatment affects the production, and of course --

Q You refer -- I am sorry, am I interrupting?

A Those are the main things.

Q You refer to relative permeability. Do you mean by that the permeability in relation to the viscosity of the fluid?

A Relative permeability is generally conceded to mean the comparative permeability, the ratio of the permeability of the rock to oil to the permeability of the rock to gas.

Q That is not a factor which would change, is it?

A Oh, yes, yes, it changes with saturation.

Q With saturation?

A Yes. Well, actually, relative permeability is the ratio of permeability of the rock to oil to the permeability of the rock to gas. Perhaps, of course, this ratio doesn't affect my production, but the absolute production, the permeability of oil to the rock does affect my production. As gas saturation increases, permeability of the oil to the rock decreases, generally it decreases sharply at first and then eventually levels off.

Q Is that because of the change in the ratio of the permeability or change in the viscosity of the fluid?

A That's a function of gas saturation more than anything. As more gas bubbles appear in the porous rock, the impede the flow of oil. The viscosity changes somewhat, but the viscosities is figured elsewhere in your flow formula, the permeability of your rock to oil as such is no function of viscosity.

Q That would be affected by the rate of production of the individual well, too, would it not?

A Viscosity would affect it?

Q No, the situation which you have described to be created by a high ratc of production, gas coming out of solution from your well bore?

A Will you repeat the question?

Q As I understand your testimony, you are talking about the effect of this gas saturation in the reservoir rock. Gas was in solution in the oil, I assume, is that right?

A To begin with, yes, we think so.

Q But gas coming out of solution, then, has affected your relative permeability, is that correct?

A That's correct.

Q Would that effect by achieved by a high rate of production of your oil in that particular well bore?

A Well, if there's no gas cap available, as pressure declines gas comes out of solution, whether there's a gas cap there or not. A high rate of production of oil would cause the gas to come out of solution and would cause the permeability of the rock to oil to decline. I think the answer to your question is yes.

Q And that in turn would reduce the production from your individual oil wells?

A That is correct.

Q Now would it not also affect the viscosity of the fluid in the well bore?

A Well, as gas comes out of solution, the oil becomes more viscous, yes, generally.

Q That again would be a factor which would reduce the oil recovery from that individual well?

A Well, it always happens; it influences the rate, yes.

Q Now, are all your wells top allowable wells?

A No, they're not.

Q What is the allowable?

A The top unit allowable for an 80-acre space is 164 barrels of oil per calendar day.

Q That's under the current allowable figure. Has that been the allowable all the way through?

A Well, yes, it has never changed. Well, since I've drilled, I think the unit allowable has been 70 barrels unit allowable, which with your depth factor and acreage amounts to 164. Prior to the time I drilled my wells, there was a period when the field was at 40-acre spacing, and the top oil well allowable was only 94 barrels a day.

Q Are any of your wells top allowable wells?

A No, they're not.

Q Do they have rather high gas-oil ratios?

A I'll let you decide what's high.

Q Could you give us some of them?

A Gas-oil ratio on my No. 1 well is 3850,as of April, cubic feet per barrel;on No. 2 is 1795 cubic feet per barrel;

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on the No. 3 is 2400 cubic feet per barrel as compared to a solution ratio in the vicinity of 900 to 1,000.

Q How do those compare to actual produced gas-oil ratios?

A Well, you have obviously calculated it; quite closely, I believe.

Q It would be somewhat less, actually, I believe?

A Which?

Q The produced gas-oil ratios?

A Would be somewhat less than this.

Q No, it would be higher than this?

A Higher than my measured gas-oil ratio?

Q Yes.

A When I got all my wells producing, I make 450 MCF per day.

Q What do you do with the gas?

A I put it through a compressor and sell it to the gas company.

Q It's all metered?

A Occasionally the compressor goes down and some is vented; some is used to run the compressor. Occasionally in the winter-time I use a heater, some is used in the heater. Some is used to run gas engines to run pumping units.

Q Is that reported to the Commission?

A Yes, all of it is. The vented gas and the gas used on the lease has always been reported to the Commission.

Q You have used a decline curve to show the effect of the gas production on your oil wells, that is correct, isn't it?

A Yes, yes.

Q How does that decline curve compare with the normal curve of the Gallup oil production, or have you made that comparison?

A Normal Gallup oil production?

Q Yes. You get a normal decline curve on any oil in this area, don't you?

A No, I don't think there's such a thing as a normal decline curve, Mr. Kellahin. It depends a lot on your pay thickness as opposed to your allowable producing rate, upon your spacing and upon such things as whether you have a gas cap and how it's produced, or not. These things all affect a decline curve and I don't know that there is such a thing as a normal decline curve in any province.

Q You presented two exhibits, one relating to your Edna No. 1, the other to your Edna No. 2?

A Yes.

Q Have you made the same comparisons on any other wells in this pool?

A I made it on the Edna No. 3; however, the producing time of the Edna No. 3 was completed just before the gas cap was opened up for the winter take, and I don't have any comparison, it didn't tend to show anything so I didn't present it.

Q On your other exhibits, without going into any detail, I believe No. 7 and some of the others,you used allowable figures and production figures on each well in the gas cap. What is the source of your information on those figures?

A The gas proration schedule which is put out by the Conservation Commission supplied the monthly production in most cases, some of it I got from the New Mexico Oil and Gas Engineering Committee Reports. The allowable was taken as calculated at each six-month -- well, the three month interval to begin with, and the subsequent six months interval. On the volumetric equivalent withdrawal formula, I took the allowable for the period and prorated it back on a monthly basis on a per diem.

Q You did use the calculated volumetric figure?

A Yes, I did.

Q Where did you get your information on the overproduced or underproduced status of the wells?

A I calculated that and compared it with what the Commission had at each adjustment period.

Q Did you carry it down to date?

A Well, I carried it up to either May or June there.

Q Would you accept this correction as to the Lybrook No. 1-19 as having a status of 86,522 over, as against your figure of 113,721 as shown by the Commission records?

A Well, I got these figures as best I could.

Q This is the May figure, I might add.

A This is what?

Q The May figure.

A The May figure?

Q Yes.

A As of the end of May, you are 86?

Q Yes.

A The Lybrook, I believe, was okay at the end of January. The figure I got is all right. I am either wrong on my allowable figures or production figures or my addition if that's right. Where am I wrong?

Q I think the Commission's records will speak for themselves as to the over or underproduced status of the wells.

A If there's an error, I apologize. These were compiled between 5:00 o'clock yesterday and 11:00 o'clock last night, as were all of the exhibits. I attempted to do the best I could.

Q You made a recommendation as to the Bird No.5-23, you say it does not appear to be in the Devils Fork. Why?

A My examination of the logs indicates that there isn't any Devils Fork sand in it, and that their sand correlates more closely with the Escrito wells.

Q You say there's a difference between the Escrito and the Devils Fork?

A Yes.

Q What is the fundamental nature of that difference?

A Well, they're both roughly of comparable age. The

Escrito zone produces a little bit lower in the Gallup section. It doesn't correlate across to the Devils Fork Field.

Q Where would the field limits between the Escrito and the Devils Fork be if you removed that well?

A I presume that it would all depend on the proration unit assigned to the Bird No. 1-A. I presume that would be a north-south unit, and the field limits of Devils Fork would include only the East Half of the Northeast Quarter of Section 23, and that the -- I don't know, whatever proration unit you gave to the Bird 5-A might be horizontal or vertical, I don't know which one. It looks like horizontal would be more logical because it trends more east-west than north-south. I have excluded all the Escrito wells from my map since I thought it would just confuse the issue.

Q Actually your Escrito and Gallup would be directly offsetting, would they not?

A Well, you would have an edge Devils Fork well three-quarters of a mile from an edge Escrito well.

Q With the proration unit so dedicated, then the two pools would be directly offsetting each other?

A You could make your proration unit go that way if you so desired.

Q It's your opinion there's a barrier between the two zones?

A Yes.

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Q If it shows that the Devils Fork had an opening in the pay section, would your opinion be different; if the facts show that the 5-23 actually had the pay sand open?

A You mean if it was a dually completed Escrito-Devils Fork well?

Q Pardon?

A You mean if it was a dually completed Escrito-Devils Fork well?

Q If you want to put it that way, yes, sir. Would you put it in both pools?

A We get down to a pretty touchy subject and kind of a deal. It may be that there's a small amount of tight Devils Fork sand in the 5-A, and some pretty good Escrito sand in there.

Q You have examined the log of the well, haven't you, Mr. Merrion?

A Yes.

Q Actually there is a Devils Fork sand in there, isn't there?

A To my recollection, there might be. All through the Escrito Field I can see a sand which to me looks fairly comparable to Devils F rk, but it's very tight. Whether it actually connects up with Devils Fork, I don't know. I haven't studied the area real closely and tried to draw the heavy inference in that area, but to me this is an Escrito well 99 percent.

Q Just one further question, Mr. Merrion, to clarify a point. You do not say that you can show gas withdrawals have had any effect on bottom hole pressure in the oil zone, can you? You testified to that?

A I have testified that gas withdrawals have had a direct effect. The rate of gas withdrawal has had a direct effect on the decline of my oil production; when gas withdrawal rates is high, my decline is steep; when they're low my decline is negligible. When they are intermediate, my decline is intermediate.

Q You presented information on two wells to support that?

A That's right.

MR. KELLAHIN: Thank you.

MR. PORTER: Anyone else have a question?

MR. BRATTON: Yes, sir.

MR. PORTER: Mr. Bratton.

BY MR. BRATTON:

Q Mr. Merrion, as I understand, basically, your proposition on the rule that you have proposed, it amounts to a penalty in time against the gas operators who have been overproduced as you calculate it?

A I propose no penalty at all, Mr. Bratton.

Q You propose a penalty of underproduction, that they have to be underproduced for a period of time, is that not correct?

A I don't call that a penalty. I just propose that they forego --

Q Do you propose --

A -- that they -- If you want me to answer your question, let me go ahead. I propose they forego some production for a period of time just like they got ahead of their production for a period of time. If this is a penalty, all right. It doesn't hurt them.

Q Mr. Merrion, let me ask my question this way. You are proposing to this Commission a rule that would require these operators who have been overproduced, according to your calculation, that they be underproduced, required by the rule to be underproduced for a period of time?

A Yes, I have proposed that.

Q Referring to the Redfern and Herd wells, Mr. Merrion, were all three of those wells completed when prorationing went into effect in this pool?

A There are four Redfern and Herd wells. Three of them were completed at the inception of proration, to my recollection.

Q Is the fourth one an oil well?

A It is so classified.

Q Referring to your Exhibit No. 7 where you give the tabulations of this overproduction by time, as you calculate it --

A Yes.

Q Let's refer first to the Redfern and Herd No. 2. As I read that exhibit, it shows that that well produced from November of 1960 when these rules went into effect until a portion of February, 1961, and that it has been shut in ever since,

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is that correct?

A To my knowledge, that's correct. Those were the figures I gleaned from various reports.

Q Now the rules went into effect in November of 1960, is that correct?

A That's correct.

Q When was the first balancing period?

A January 31, 1961.

Q What were the allowables tentative during that time, during that first period, do you know?

A I don't have the available information. To my recollection the total allowable they posted for the pool was something in the neighborhood of 300 million for the entire pool, and I don't remember how many wells there were, but I believe there were probably about eight gas wells at that time, which would make about 35 to 40 million a month. Now how they arrived at such a high figure as an estimate, I don't know. Everybody estimated that the allowable per gas well would average 20 million.

Q They were a little optimistic in their initial estimate, is that correct?

A Well, optimistic or pessimistic, they were high.

Q Now, that well has not been produced, or shut in since February of 1961, is that correct?

A According to my records, that's correct.

Q You have three oil wells in the pool, is that correct?

A That's correct.

Q When were those wells placed on production?

A My No. 1 Well was placed on production approximately December 27, 1960. My No. 2 Well was placed on production the latter part of May, 1961. My No. 3 Well was placed on production, I believe, around the 1st of October, 1961.

Q As I understand it, then, Mr. Merrion, your proposal contemplates that this No. 2 Well which has been shut in since February of 1961 owes some kind of an obligation to two of your wells that weren't even completed then, weren't drilled, weren't completed until some months afterwards, but we owed some obligation to be deliberately underproduced for some length of time, is that correct?

A Yes, that's correct. The thing is this --

Q Does this well owe some obligation --

MR. COOLEY: Let him answer the question.

A We were entitled to some virgin reservoir pressure or some existing pressure when we drilled into the reservoir, had the rules been complied with. Our KGKO oil had already declined when we drilled in. That's why we didn't have any top allowable wells.

Q (By Mr. Bratton) As I understand it, this production that had occurred during those four months incurred some kind of obligation on the part of this well to the two wells that you are drilling now, is that correct?

A Let's say they have produced in excess of what the Field rules called for. They have prematurely drawn down the reservoir pressure; it has been detrimental not only to the existing wells but any additional wells, and all the reserves which are contained in the Devils Fork oil column. If you want to call that an obligation to wells which have not yet been drilled, it certainly is going to discourage operators from drilling any more wells and proving up the reservoir, if we go ahead and produce off the gas cap. Obligation or what, I don't know what you call it, the fact is that the Field rules were not adhered to. It caused an injustice and infringement on correlative rights of the existing oil operators as well as the operators who have not yet drilled in the reservoir. I don't know.

Q Mr. Merrion, am I correct in assuming that the idea of this volumetric formula was to produce a stabilized gas-oil contact line?

A The primary idea, as I understood it, in the volumetric equivalent withdrawal formula was to allow the oil column to produce under its own pressure and not get any benefits of gas cap expansion, but not be penalized by premature gas cap expansion. It was, as I have before stated, a compromise between conservation which would have dictated shutting in the gas cap until all the oil was produced to protect correlative rights, which entitled the gas cap operators to get their gas at some reasonable rate, and I thought it was a good formula if it was adhered to.

Q Mr. Merrion, does that all boil down to an essentially

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stabilized gas-oil contact?

A Well, if those -- well, of course, the stabilized gas-oil contact was not the initial or the prime idea in the thing. Of course, if we are to have a first use of reservoir energy, it will result and if the volumetric equivalent withdrawal formula was completely adhered to, it would keep a stable gas-oil contact.

Q If the gas above the volumetric equivalent of the oil that's produced is produced from the gas cap, the gas-oil contact will move over to the gas area, is that correct?

A Yes.

Q I take it that that is your testimony, that is what has happened, or in theory, that is what has happened?

A Of course, I'm not affected so much by the movement of this thing and not so immediately affected as by the premature pressure drawdown. I am not kicking about the thing moving. It may have wasted some oil. It may have kicked the gas cap and lost some oil forever. I don't know that has happened to me; the evidence is questionable. The gas cap may have originally been filled with oil and the gas cap displaced the oil out of there. I don't know if the gas cap has been wetting the oil and lost it forever, but there's a possibility that we have. There's no direct evidence to me, I haven't seen any increased oil production in any of the fringe gas wells, so I don't know that this thing has moved, but the pressure has certainly been relieved on the oil area by the premature gas withdrawals, and affected my production, for one. I didn't have time to study all the oil wells in there, but my production has been affected by the premature gas withdrawal.

Q Did you happen to study the Pan American Dasco Wells, Mr. Merrion?

A I'm familiar with their pressure decline, and I know that the Pan American Dasco B-1 was a very good oil well, initially potentialled for 325 barrels a day, I believe. It was prorated to 94 and made top allowable up until about November, when this gas cap was opened up at 400 million cubic feet per month, and a good deal of that high gas withdrawal was from Redfern and Herd No. 2 Largo Spur, which was probably the closest gas well to the Pan American Dasco B-1.

Q Have you made a decline curve?

A I haven't, no. My time was limited.

Q Are you familiar, Mr. Merrion, with the finding of the Commission Order of R-1670-B which established this pool, reading "that the volumetric withdrawal formula proposed by the parties is designed to keep the gas-oil contact substantially constant, thereby preventing waste and protecting correlative rights."? Assuming that is the finding, Mr. Merrion, let me ask if the proposal which you have made, is that not designed to deliberately, by regulation, move the gas-oil contact towards the oil side for what you deem an equivalent period of time?

A To a certain degree, yes, to a certain degree, no. I want to see the overproduction in MCF months be balanced by underproduction in MCF months. I have proposed that once the oil, gas-oil contact is essentially returned to its original place, that we calculate the cumulative overproduction in MCF months and then henceforth balance it with a similar underproduction in MCF months. I don't propose that the instantaneous underproduction ever reach proportions of 350 million per well. I propose that they be produced at one-quarter of their allowable until they're 25 percent made up, and 50 percent of their allowable until they're 50 percent made up, and 100 percent of their allowable thereafter until they are 75 percent made up. This will move it a small amount, but nowhere near as much as the oil column might have moved in the other direction.

Q The effect of that regulation would be to move the oil-gas contact line towards the oil area?

A It will move it a little bit, yes.

Q Have you calculated, Mr. Merrion, the effects of this proposed order of yours on the wells in the gas area, how long they would be penalized?

A I haven't calculated it no. Until they get back to 100 percent of allowable, I don't think it will be too long unless they were grossly overproduced, and it probably wouldn't be too long in that case.

Q Let's look at the Redfern and Herd No. 3 Well in your list of exhibits, Mr. Merrion. That well exhibited production from November of 1960 through a portion of March, 1961. Thereafter it was shut in until November of 1961, although it came into balance in July of 1961, is that correct?

A That's correct. Well, it came into balance in August of 1961, according to my sheet here.

Q And that well has been and is underproduced to date?

A Yes.

Q Now the effect of your regulation would be that that well would have to be deliberately further underproduced at this time?

A Well, this well is already a good deal of the way toward returning -- well, let's see, according to my rule, your total underproduction at one time, I have to add up another column. Let's see, you were 188, 190 -- you were at one time, had a cumulative overproduction of roughly 610,000 MCF months. According to my proposed rule, after 75 percent of that, or 50 percent was made up, you would have 100 percent of allowable; and after 75 percent of that was made up, you would be able to produce all of your underproduction until you were back to your zero status.

Now the present status of that well is that it has already made up 50 percent, and henceforth it would have 100 percent of allowable currently until the cumulative status in MCF months was, instead of 226, 152, which shouldn't be too far off, at which time you could make up all your underproduction at will.

Q You lost me back there, Mr. Merrion.

A Is there any particular point I can review?

Q All I want to know is, would the effect of your rule be to require that well to now produce less than what the rules as they're now established would allow it to produce?

A Well, the rules as they're now established would allow this well to make up its underproduction right away.

Q And your rule would deny it that privilege?

A That's correct. It would allow it to produce one hundred percent of its current allowable until we reduced this MCF months from 226 to 152, after which it could make up its underproduction.

Q So that the effect of your rule, again, Mr. Merrion, would be to restrict the production from that well as of now to less than it would be permitted now under the current rules?

A That's correct.

MR. BRATTON: If the Commission please, those are all the questions that I would want to ask on behalf of Redfern and Herd.

MR. PORTER: Mr. Whitworth.

BY MR. WHITWORTH:

Q Mr. Merrion, under your system of penalizing these gas wells, they would accumulate underproduction, is that right?

A Well, if you want to use the term "penalize". I don't figure it would be penalizing, but under this proposal I have made, underproduction would be accumulated for a period of time, yes.

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Q If this underproduction accumulated for a proration period, it's subject to cancellation at the end of that period, is it not?

A I guess maybe the rules are to that effect. I would not propose that it be cancelled. I would propose that it continue to accumulate and not be cancelled so that it could eventually be made up.

Q Cancellation of underproduction, then, if the rules so provide now, is not a part of your recommendation?

A That's correct.

Q And you would recommend that rules be made to eliminate that present portion of the rule in order that any production --

A Well, as far as these penalized wells are concerned, yes. On marginal wells, I have no objection one way or another.

Q Would you recommend amendment of 5-B of existing rules to permit accumulation of overproduction equivalent to the current month's allowable, is that correct?

A Are you talking about 15-B?

Q 15-B, I think you are correct.

A I have recommended that the permissible overproduction be changed from three times current monthly allowable to one time current monthly allowable.

Q Why do you consider this to be necessary?

A It appears that we have to tighten down on these regulations in order to prevent reoccurrence of this gross overproduction that's occurred in the past; and as I have shown, it is very important that these wells not be maintained in a constant overproduced state.

Q Well, if that is done, do you think that that would be an undue restriction on the flexibility of the purchaser of gas to meet seasonable market demands?

A No, I don't think so. I don't think the gas purchaser should look at an associated gas reservoir as a primary source of supply and use it as something to balance their highs and lows. There are plenty of gas wells in the area they can get their gas from without using this. This is a highly permeable reservoir, and that may be one of the reasons these wells have become so far overproduced. I don't think there's too much of a consideration is involved as far as the pipeline purchaser is concerned. I think that's a very, very minor consideration. We have much more important matters here than the flexibility of an associated gas reservoir for the convenience of a pipeline.

MR. WHITWORTH: That's all we have at this time.

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

(Witness excused.)

MR. PORTER: We'll take a short recess and we will take your testimony next, Mr. Buell.

(Short recess taken.)

MR. PORTER: Mr. Buell.

MR. BUELL: If it please the Commission, I would like to make this brief statement at the outset. I feel rather sure that a motion will be re-urged to continue this case, so in view of that, we'll confine our direct testimony to the physical facts in this reservoir as they exist today in relation with the current rules, and will not in our direct testimony comment in any way on what, for want of a more descriptive term, I'll refer to as the "Merrion proposal." We will restrict our testimony to the factual field conditions in relation to the current rules.

GEORGE W. EATON, JR.

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

DIRECT EXAMINATION

BY MR. BUELL:

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

A George W. Eaton, Jr., Senior Petroleum Engineer for the Pan American Petroleum Corporation in Farmington, New Mexico.

Q Mr. Eaton, you have testified at prior Commission hearings and your qualifications as a petroleum engineer are a matter of public record, are they not?

A Yes, sir, I have testified previously in this particular case.

MR. PORTER: The Commission considers Mr. Eaton qualified.

(Whereupon, Pan American's Exhibit 1-A marked for identification.)

Q (By Mr. Buell) Would you look at what has been marked as Pan American's 1-A, and briefly explain for the record what that exhibit reflects?

A Our Exhibit 1-A is a map of that portion of the San Juan Basin of Rio Arriba County, New Mexico, in which the Devils Fork-Gallup Pool is located. The map is contoured structurally on top of the Devils Fork-Gallup sand.

Q Mr. Eaton, so that we'll fully understand the significance of that, would you briefly distinguish why you have picked the top of the Devils Fork sand itself to contour, rather than say the Gallup marker that you engineers and geologists sometimes use in contouring the Gallup?

A Yes, sir. When we make a regional study of a portion or a total of a particular area, we use a correlative marker on which to base our contours. The reason for this is that the marker exists throughout the entire area. In this particular area of the San Juan Basin, there is a Gallup marker which is consistently present over a large area and exists somewhere between 75 and 100 feet above the Devils Fork sand.

In the particular instance at hand here, we're concerned only with the very limited area in the vicinity of the Devils Fork-Gallup Pool. We have, therefore, chosen to contour our map upon the Devils Fork sand itself.

This map then represents the structural conditions of the Devils Fork-Gallup sand, not necessarily the regional or structural conditions of the Gallup formation.

Q This results in a more precise and rigorous look at the sub-surface conditions in the Devils Fork-Gallup pay itself?

A Yes, sir.

Q Mr. Eaton, how have you distinguished the wells that are shown on this exhibit which are completed in the Devils Fork-Gallup Pool?

A The Devils Fork-Gallup Pool wells are colored in yellow. The defined boundary of the Devils Fork-Gallup Pool through Commission Order No. R-2173 is shown on Exhibit No. 1-A in the heavy red line.

Q Mr. Eaton, I notice some wells colored in brown at the southwestern portion of your exhibit. What pool are those wells completed in?

A The wells colored in brown are in the Escrito-Gallup Pool.

Q We now come to that part of your testimony that might be controversial. Mr. Eaton, in your opinion, and I direct your attention to the Reese Bird No. 5 Well which is currently classed by the Commission in Devils Fork, in your opinion is that well completed and producing from the Devils Fork-Gallup Oil Pool?

A Yes, sir, it is my opinion that that is an Escrito Pool well and should be so classified.

Q Can you see any engineering basis whatsoever to use production from that well in the volumetric calculation for the

Devils Fork formula?

A No, sir. It becomes more critical to have the well properly classified because we are concerned with the equivalent volumetric withdrawal formula in the Devils Fork-Gallup Pool, so we want to be certain that no extraneous production is put into that formula for use in calculations.

Q So it is your recommendation to the Commission that, regardless of the pool they put that well in, that its production not be considered in the volumetric formula?

A That is my recommendation.

Q What is the significance of the wide orange band that traverses the Devils Fork Pool on your Exhibit No. 1-A?

A The wide orange band which is shown to exist between the structural elevation of plus 1[illegible]0 feet and plus 1100 feet on top of the Devils Fork-Gallup sand as shown on our Exhibit No. 1-A is the gas-oil transition zone. In other words, somewhere within this band lies the gas-oil contact; within that band there may be and actually are both oil and gas wells.

Q Mr. Eaton, you mean when you engineers and we laymen speak of a gas-oil contact, we're not talking about a precise definable interval; one foot above you'll get all gas and one foot below you'll get all oil?

A That is true within a particular band in any reservoir, and the thickness of that band varies somewhat between one reservoir and another. There is actually no sharp line of demarca-

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tion above which it's a hundred percent gas saturation and below which it has 100 percent oil saturation. It always exists as a transition zone. In the particular case of this Devils Fork-Gallup Pool, we aren't confident that the location of this band is exactly precise, not even the entire band. We're certainly not confident we can pick a particular structure contour line and say, "This is the gas-oil contact." We're confident it does exist as a transition zone.

Q Mr. Eaton, has data been acquired since the last hearing on this matter which have allowed you to more precisely locate this transition zone that you have depicted on your Exhibit 1-A?

A Yes, sir. At the time of the last hearing, our highest oil well was the Rutledge Miller No. 2-B. That well is located in the Northwest Quarter Southwest Quarter of Section 12. Our lowest gas well was the Skelly Oil Company New Mexico Federal No. 1-G, which is located in the Southeast Quarter Northwest Quarter of Section 18. We had no data on which to pinpoint the location of the original gas-oil contact between these two structural elevations. We only knew that the gas-oil contact lay somewhere between these two wells.

It was arbitrarily estimated that it lay midway between these two wells. That placed the original gas-oil contact at plus 1,025 feet. Subsequent data, primarily the drilling of additional oil wells in the vicinity of the estimated gas-oil contact, has shown that our original estimate of that gas-oil

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contact was not precise. As a matter of fact, it evidently lies much closer to the lowest gas well than it does to the highest oil well. For that reason, we've shown the gas-oil contact as existing somewhere in the range of 1,060 to plus 1100, as contoured on top of the Devils Fork-Gallup sand. That means that the gas-oil contact, rather than being at plus 1025 feet, actually is some 35 to 40 feet higher than that original estimate.

Q Mr. Eaton, I notice on your Exhibit 1-A that opposite each well you plotted gas-oil ratio information. What are those data?

A The red number beside each well is the initial gas-oil ratio for that well. The green number beside each well is the latest gas-oil ratio data. I had better qualify that, for the most part these gas-oil ratio data shown in green are those obtained in January, 1962. There was an additional survey run in April, 1962, for which I did not update my map.

Q Have you seen those ratios that have been filed with the Commission?

A I have examined the gas-oil ratios which have been filed from the April survey.

Q Were there any significant changes from the general picture as shown on your Exhibit 1-A, based on your January ratios?

A No, sir, there were no significant changes.

Q Mr. Eaton, based on your study of this associated oil and gas reservoir, have you seen any evidence which has been obtained in this interim period since the last hearing, which would indicate to you there has been any substantial movement in one direction or another of the gas-oil contact?

A No, sir. I have seen nothing that would so indicate. I want to reiterate again, although I am now depicting the gas-oil contact some 35 to 40 feet above that zone at the time of the last hearing, I don't think that that represents a change. I think it represents a fact that we didn't know where it was at that time.

Q Mr. Eaton, in dealing with an associated oil and gas reservoir, I can think of several ways, perhaps, that the Commission, if it wants to consider only one factor and ignore all others, could prorate it. The first that comes to my mind is that if the Commission would choose to completely ignore correlative rights or property rights, and simply prorate and regulate this Pool to achieve the maximum recovery of oil and gas, how would they go about doing that?

A That would be accomplished by shutting in all of the gas wells completely and depleting the entire reservoir through the oil wells.

Q And that would result in the greatest amount of maximum ultimate recovery?

A Yes, sir.

Q But to do that, you would have to turn your back on correlative rights?

obtained in this interim period since the last hearing, which would indicate to you there has been any substantial movement in one direction or another of the gas-oil contact?

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A You would have to forget correlative rights completely.

Q Mr. Eaton, another way that the Commission could regulate this Pool is, let's call it, say, the law of the jungle, and just turn the oil operators loose and the gas operators loose to produce their wells and protect your correlative rights. What do you think would happen in that event?

A In that event, there would be waste occur.

Q Each operator would have the maximum opportunity to protect his individual correlative rights, but we would suffer from a conservation standpoint due to waste?

A Yes, sir.

Q Well, then, a compromise between those two extreme methods would be to regulate and operate the Field in such a way that it would result in the maximum conservation effort consistent with protection of correlative rights?

A That is true. It is the purpose of the equivalent volumetric withdrawal formula to accomplish that end, exactly.

Q Do you feel, and I know you did a year and a half ago when the formula was recommended to the Commission, do you still feel it is a workable formula?

A Yes, I do.

Q Do you still feel it will result in the maximum amount of ultimate recovery consistent with protection of correlative rights?

A I believe that that formula and the present Field rules will result in protection of correlative rights of the gas operators as well as prevent the waste that would occur under the wide-open production of the gas cap, of the oil in the oil portion of the reservoir.

Q Do you also feel, as an engineer, Mr. Eaton, that to allow us and the Commission to be able to ascertain whether or not the formula is working, that not only the letter of the rules but the spirit of the rules should be adhered to?

A Yes, sir. This formula should be given every opportunity to function properly if for no other reason than it's the first time that it has been tried, and we never will know whether or not it's workable unless the rules that are set up to properly administer the formula are properly adhered to.

Q So it is your engineering recommendation to the Commission that these rules be continued in effect and that you feel that they will be workable rules?

A It is my recommendation that these rules be continued in effect.

Q Do you have anything else you would like to add, Mr. Eaton?

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

MR. BUELL: May it please the Commission, that's all we have at this time on direct. I would like to formally offer our Exhibit No. 1-A.

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

(Whereupon, Pan American's Exhibit 1-A admitted in evidence.)

MR. PORTER: Mr. Eaton, the only change that you would recommend is that the Val Reese Well not be considered in the formula?

A Yes, sir, that's my only change.

MR. BUELL: May it please the Commission, perhaps I should have included this in the brief opening statement I made, but Pan American, as was the case with the other operators, was not aware of the Merrion proposals until recently. We have not had a chance to evaluate them. If the case is continued, Pan American will comment with respect to those proposals.

MR. PORTER: Anyone else have a question? Mr. Kellahin.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q I would like to cover the controversial points here, Mr. Eaton. It's your suggestion, as I understand it, that the Bird 5-23 not be considered in the volumetric calculations in this Pool?

A Yes, sir, that's my recommendation.

Q That's based on your contention that it's not completed in the Devils Fork Pool?

A Yes, sir.

Q The Devils Fork is open in that well bore, is it not?

A I suspect that there is an interval which is equivalent

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to the Devils Fork sand that is open, yes, sir. Excuse me.

Q Are you familiar with the 1-23 Bird? It's in the Northeast Northeast.

A I was going to ask you if that's the well in the Northeast Northeast.

Q Is that above your gas-oil contact?

A Yes, it is.

Q Is it producing oil or gas?

A On the basis of the gas-oil ratio as posted on this map, it would be classified as an oil well.

Q How do you account for that?

A The only way I could account for that, Mr. Kellahin, is like the well in the Huerfano Unit that is an anomalous well.

Q You wouldn't be willing to say it might be completed in some other Pool?

A No, sir, I think it is a true Devils Fork-Gallup Pool well.

Q Above the gas-oil contact?

A Yes, sir. I'm not confident that it does not have an additional Gallup section open to the well bore in it, but I feel confident that it does have the Devils Fork-Gallup sand open to the well bore.

Q Are you confident that the oil is coming from the Devils Fork sand?

A As I say, I'm not really certain how much additional

Gallup perforations there are in the well, so therefore if it has additional perforations in it, then that oil might be coming from some of those other perforations.

Q Would you then draw a distinction between that well and the 5-23?

A Yes, sir, I do, for this reason. I find no correlative Devils Fork-Gallup sand in the No. 5, where I do find correlative Devils Fork sand in the No. 1.

Q Now it's my understanding you testified you don't know as of today if the formula is workable, is that your position?

A Mr. Kellahin, my position is this, that there's no evidence that we have seen yet that shows to me that the formula is not workable. On the other hand, there is this question about whether or not the gas-oil contact has moved because these later data have indicated to us or to me that we didn't make a very good estimate as to its original location. Now these subsequent data are very valuable because now we can pin it down much closer, and with continuation of these rules we can, or should be able to determine whether or not it's being maintained relatively stable or not.

Now that we have a good starting point, we can see what the effect of the continuation will be, where we weren't or are not able at this time to tell whether the rules have been completely effective in preventing movement, since we didn't know where the gas-oil contact was to begin with.

Q Well, in order to evaluate these rules, Mr. Eaton, would it be necessary to have additional information you do not now have?

A That is true.

Q If you were going to make an effort to determine the effect of these rules,adversely or otherwise,on the oil wells, what information would you need, in your opinion?

A In my opinion the only information that we need to really effectively evaluate whether or not the gas-oil contact is being maintained at a stable location is continued production under the rules.

Q If we assume that the gas-oil contact has been stabilized then does that in and of itself show that no adverse effect is being worked against the oil wells?

A If you can safely make that assumption, yes, sir. Continued production would tell us whether or not that is a good assumption.

Q You talk about continued production of oil wells or gas wells or both?

A Continued production under the rules.

Q Would pressure information of the oil wells be of any significance?

A Only in determining whether or not there is a pressure differential in favor of the oil zone, or whether that pressure differential is in favor of the gas zone, --

Q Mr. Eaton --

A Excuse me.

Q Go ahead.

A -- together with the benefit that would be derived from having that additional pressure data for use in computing the equivalent volumetric withdrawal under the formula. As you know, pressure is a pretty important factor in the equivalent volumetric withdrawal formula.

Q Wouldn't that information be essential to determination as to whether your gas-oil contact had been stabilized?

A I fail to see how you would use pressure data directly in determining the location of a gas-oil contact.

Q It would do this, would it not, Mr. Eaton, would it not reflect whether there is a tendency for it to move one way or the other?

A I would say it would reflect this, Mr. Kellahin, more than anything else; if we found that the pressure in the oil zone was approximately equal to the pressure in the gas zone, then we could safely conclude there is excellent communication in this reservoir, we could safely assume that there would be an effect of an imbalance in either oil or gas production, which would result in movement of the gas-oil contact. I hope I didn't go around the barn.

Q The gas-oil contact is just not going to move unless there's a pressure differential, is it?

A It's a good point. No, sir.

MR. KELLAHIN: That's all.

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

BY MR. UTZ:

Q Mr. Eaton, have you taken any bottom hole pressures in your oil area?

A Both of our oil wells have been on the pump for a good while. I kind of believe we took one bottom hole pressure on our Dasco B-1 after this formula went into effect. I don't believe there's been more than one. We have not taken any since the pumping units were installed, and as I say, both of these wells have been on pump for practically ever since the Pool was prorated.

Q Do you have any information available to you to indicate how long it takes to stabilize the pressure in the oil area?

A No, sir, I sure don't.

MR. UTZ: That's all.

MR. PORTER: Mr. Cooley, did you have a question of the witness?

MR. COOLEY: Yes, Mr. Commissioner.

BY MR. COOLEY:

Q Mr. Eaton, I direct your attention to Greg Merrion's Exhibit No. 1 and in particular the Bird well in the, the Reese Bird well in the Northeast Northeast of 23, and ask you if a possible explanation of the anomaly to which you have just testified with respect to that well might not be a permeability barrier which prevents the oil from seeking its natural level, or what is commonly referred to as perched oil?

A That's possible if it has additional Gallup section open other than the Devils Fork-Gallup Pool sand. It would be my opinion that only gas would come from the Devils Fork-Gallup Pool pay in that well since it lies so well above the other gas wells in the Pool structurally, or a number of other wells.

Q The nose to which I direct your attention, projecting into the northwest corner of Section 23, represents Mr. Merrion's interpretation of a permeability barrier. If that nose and permeability barrier does exist, would this not prevent the oil from seeking its natural level?

A I see what you mean. Yes, it could.

Q And that could be a possible explanation of this anomaly?

A It could possibly be.

MR. COOLEY: Thank you.

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

BY MR. NUTTER:

Q What is the Reese Bird No. 5 presently classified as?

A It's classified as a Devils Fork-Gallup Pool oil well.

Q What is the ratio on it, do you know?

A Yes, sir, I believe I do. According to my data, the gas-oil ratio is 21,823 cubic feet per barrel.

Q Was that the initial ratio on the well?

A This is the most recent, Mr. Nutter. It's the April gas-oil ratio.

Q I notice on all your other wells you have a green figure and a red figure. Do you have a comparable figure for the No. 5 to the red figure on the other well?

A No, sir, I sure don't. We didn't compile that because we didn't feel that well was properly in the Devils Fork-Gallup Pool.

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

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

(Witness excused.)

MR. PORTER: Does that conclude his testimony?

MR. BUELL: Yes, sir, it does.

MR. PORTER: Mr. Bratton, do you intend to present testimony?

MR. BRATTON: If the Commission please, at the risk of boring the Commission, I would again renew my motion that, as Mr. Buell said, described it, the "Merrion proposal" not be accepted or contemplated by this Commission. I think the cross examination of the witness has further emphasized the point to which I directed my previous motion, and this is a request for an ex post facto regulation by this Commission and, as such, it should not be considered or contemplated by the Commission. I don't know whether that was the motion which the Commission gave me leave to renew or not, but I would renew it at this point.

MR. PORTER: We have ruled on that motion.

MR. BRATTON: I would like an exception for the record.

MR. PORTER: The motion I had reference to was as to the continuation after all the testimony has been presented here today.

MR. BRATTON: If the Commission please, I would then move for a continuance of the case until -- and I'm frankly at a loss as to which hearing. I would say until the September hearing. I would further suggest that during that period of time, the Commission should order pressure tests in the Pool of all the wells in the oil area, and possibly as to the gas area, those that are not now shut in and stabilized.

MR. PORTER: Before I rule on your motion, I would like to ask if anyone else desires to present testimony here today.

MR. BRATTON: I renew that motion on the basis of the facts as to which I previously advised the Commission. The Merrion proposal came as a new one to us and within a very short time previous to this hearing.

MR. PORTER: Mr. Cooley, did you wish to comment on the counsel's motion?

MR. COOLEY: Yes. As previously stated, my client, Mr. Merrion, has no objection to a reasonable continuation of this case. However, we do feel that extension to September is somewhat longer than required in this case, and feel that the relief that we have requested here is urgently needed and that if it is to be granted, that the sooner granted the more effect it will have; so that an unreasonable delay does operate to our disadvantage, we feel.

If the Commission feels that pressure data, additional pressure data should be taken between now and the next hearing, I too seriously doubt that could be accomplished in thirty days. If they feel that this data should be taken, well, I'll state that we have no objection to the continuation until August, which would be sixty days, roughly. If the Commission does not deem it advisable at this time to require this additional pressure data, we feel that the matter should come on for hearing at the next regular hearing of the Commission in July.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: We want to join in the motion that was made by Mr. Bratton.

MR. PORTER: Mr. Whitworth.

MR. WHITWORTH: El Paso Natural Gas Company would like to concur in the motion made by Mr. Bratton. We first learned of the so-called "Merrion proposal" last night. Frankly, El Paso has been surprised, and it's not too unusual for me to be surprised, but Mr. Woodruff has been surprised and that is unusual. In view of that, and in view of the additional pressure data that needs to be accumulated, El Paso would like to concur in the motion made by Mr. Bratton.

MR. BRATTON: If the Commission please, I initially suggested July, and then I changed it to September, and I'll advise the Commission of the reason, because as a battle-scarred veteran of the Devils Fork I would hate to lose my charter membership in the society. The good Lord willing, I will be in California in August at the American Bar Association meeting and subsequent relaxation out there, and will not be in the presence of this august body in August.

MR. PORTER: We're going to take a short recess here.

(Short recess taken.)

MR. PORTER: The meeting will come to order, please. The Commission has ruled that the case will be continued until September, the regular hearing date in September. I don't remember what date that is, but you can look at your calendar. That will be September 13th.

MR. KELLAHIN: If the Commission please, was any decision made in regard to requiring the tests to be made?

MR. PORTER: Yes, Mr. Kellahin, excuse my oversight. The Commission will ask that pressure tests be taken between now and that time, to be available at the hearing.

MR. KELLAHIN: We would request that they be filed with the Commission in advance of the hearing in order that they may be examined prior to the hearing.

MR. PORTER: In a case of this nature, a ruling of this nature, it's customary that the Commission put out a memorandum stating, setting forth deadlines for the filing of such tests, and this will take place in this instance. We will put out a memorandum or directive to all of the companies concerning the taking of the tests and when they should be filed. We'll try to get them in in ample time.

* * * * *

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, 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 under my personal supervision; that the same is a true and correct record of said proceedings to the best of my knowledge, skill and ability.

WITNESS my Hand and Notarial Seal this 25th day of June, 1962.

Ada Dearnley
NOTARY PUBLIC

My Commission Expires:
June 19, 1963.

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FARMINGTON, N. M. PHONE 325-1182

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
April 19, 1962

REGULAR HEARING

- -

IN THE MATTER OF: Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico. Case 2049 will be reopened pursuant to Order No. R-1670-B to permit interested parties to appeal and present testimony relative to the effectiveness of the special rules and regulations for the Devils Fork-Gallup Pool.	Case 2049 (Reopened)

- -

BEFORE: Honorable Edwin L. Mechem
A. L. "Pete" Porter
E. S. "Johnny" Walker

TRANSCRIPT OF HEARING

MR. MORRIS: Before we proceed with the testimony of Mr. Utz, the attorney for Pan American, Mr. Buell, would like to make a motion in connection with Case 2049 and 1641. Mr. Buell.

MR. BUELL: May it please the Commission, with respect to both of those cases and considering the lateness of the hour and the day of the week and the fact that we are at the present

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
April 19, 1962

REGULAR HEARING

IN THE MATTER OF:

Application of the Oil Conservation Commission on its own motion to reconsider the special rules and regulations for the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico.

Case 2049 will be reopened pursuant to Order No. R-1670-B to permit interested parties to appeal and present testimony relative to the effectiveness of the special rules and regulations for the Devils Fork-Gallup Pool.

Case 2049
(Reopened)

BEFORE: Honorable Edwin L. Mechem
A. L. "Pete" Porter
E. S. "Johnny" Walker

TRANSCRIPT OF HEARING

MR. MORRIS: Before we proceed with the testimony of Mr. Utz, the attorney for Pan American, Mr. Buell, would like to make a motion in connection with Case 2049 and 1641. Mr. Buell.

MR. BUELL: May it please the Commission, with respect to both of those cases and considering the lateness of the hour and the day of the week and the fact that we are at the present time at about the half-way mark in the Basin-Dakota case, I would like to respectfully move that both of these cases be continued until the regular May hearing.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: Jason Kellahin, Kellahin & Fox for Val Reese and Associates. We join in Mr. Buell's motion.

MR. BRATTON: Howard Bratton for Redfern & Herd. We join in the motion.

MR. MORRIS: Before the concurrences proceed, may I ask if the Commission wants to consider these cases at the May regular or defer them to the June regular when it will be heard here in Santa Fe, inasmuch as the Commission hearing in May will be in Hobbs?

MR. PORTER: Mr. Morris, the Commission is concerned, it appears that we'll have a short hearing in Hobbs next month. Probably the cases which we anticipate which we advertised will not cause us to run past noon. So it seems that May would be a good time to have them. Mr. Howell.

MR. HOWELL: El Paso Natural Gas Company would concur in the request for continuance.

MR. PORTER: Are there any objections to the counsel's motion? Mr. Cooley?

MR. COOLEY: William J. Cooley for Great American

Associates. We would strongly urge that it be continued to the June hearing due to the geography involved. That's about eight hundred miles round trip.

MR. PORTER: Mr. Buell, would you care to express yourself as to the date?

MR. BUELL: May it please the Commission, on behalf of Pan American, we would have no objection to a continuance to either date. It is the consensus of the operators that the present rules will be recommended to be continued for another year, so I do not see that a two-month delay will hurt anyone at all.

MR. PORTER: Mr. Morris, do you anticipate any cases for the June docket that might be time consuming other than these two?

MR. MORRIS: No, sir, I do not.

MR. PORTER: The June hearing will be heard on Thursday, which is one day later in the week. How would the June date suit you, Mr. Kellahin?

MR. KELLAHIN: I think that will be satisfactory.

MR. PORTER: Mr. Howell?

MR. HOWELL: Completely satisfactory.

MR. PORTER: In that case, Cases 2049 and 1641 will be continued until the June regular hearing date. The orders are such that the rules will remain in effect until further orders are issued.

Back to Case 2504.

STATE OF NEW MEXICO)
) SS
COUNTY OF BERNALILLO)

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

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 9th day of May, 1962.

Ada Dearnley
Notary Public-Court Reporter

My Commission Expires:
June 19, 1963.

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
August 17, 1960

IN THE MATTER OF:

The hearing called by the Oil Conservation Commission on its own motion to permit any interested party to appear and present testimony relative to the drilling, spacing, and production of wells in the Devils Fork-Gallup Pool, Rio Arriba County, New Mexico.

Case No. 2049

BEFORE:

Honorable John Burroughs
Mr. A. L. Porter
Mr. Murray Morgan

TRANSCRIPT OF HEARING

MR. PAYNE: 2049, which is a hearing called by the Oil Conservation Commission on its own motion relative to rules governing the Devils Fork-Gallup Pool in Rio Arriba County, New Mexico.

MR. NEWMAN: May it please the Commission, Kirk Newman, Atwood and Malone, Roswell, New Mexico, and representing Pan American Petroleum Company, Mr. Guy Buell.

MR. BRATTON: Howard Bratton, Hervy, Dow & Hinkle, appearing on behalf of Redfern & Herd.

MR. WHITE: M. C. White, Gilbert, White & Gilbert, and George W. Selinger of Skelly Oil Company.

MR. ERREBO: Burns Errebo of Albuquerque, appearing on behalf of Val R. Reese and Associates.

MR. HOWELL: Ben Howell, Oliver Seth and Garrett Whitworth, El Paso Natural Gas.

MR. PAYNE: Any other appearances?

MR. MERRION: J. G. Merrion, appearing on behalf of myself.

MR. HOWELL: We are ready to proceed, but the first witness which we proposed to offer has testimony that, in my judgment, will run considerably over an hour, and on account of the present hour, which is approximately 4:30, I would suggest that we might get a fresh start and move more rapidly actually if we waited until morning to start.

MR. PAYNE: Does anyone have an objection? It is well taken, and we will hear that case at 9:00 o'clock A.M. tomorrow morning.

(Hearing of Case No. 2049 was continued until 9:00 o'clock A.M., August 18, 1960.)

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TRANSCRIPT OF HEARING

MR. PORTER: The Hearing will come to order, please. The Commission will consider first this morning Case 2049. As I understand from the record we already have had appearances in the Case. El Paso desires to present testimony first.

MR. HOWELL: Ben Howell, representing El Paso Natural Gas Company. I think that a brief preliminary statement is in order since this is the third, and what the operators hope, is the last inning of a game that has gone on, and we might recite what happened in the first inning and the second inning, how we got to where we are now, before we start talking about where we hope to get from here. For that purpose we would like to introduce first Commission Order No. R-1641 in Case No. 1915. Briefly, this is the Order which, upon the application of Redfern and Herd, established the Devils Fork-Gallup Gas Pool. That was the first inning. The second inning is reflected by Order No. R-1641-A, in Case No. 1967, which was entered after a hearing called pursuant to application of Redfern and Herd, Val R. Reese and Associates, and El Paso Natural Gas Company for the promulgation of Special Rules and Regulations covering the Devils Fork-Gallup Gas Pool.

I may call attention to certain of the Commission's findings that were contained in that Order. We think that one significant finding is Finding No. 5, which is that the evidence presented established that a gas well in the said Devils Fork-Gallup Pool will efficiently and economically drain a 320-acre tract. We also wish to call attention to the Order, the portions of the Order and particularly Paragraph 4, which reads that a Case is hereby docketed for the regular Commission Hearing on August 17, 1960, at which time interested parties should appear and present their views on classification, spacing, drilling and production of wells in the said Devils Fork-Gallup Pool.

The Commission adopted certain rules. Particularly we call attention to Rule 2, which provides: "Each gas well completed or recompleted in the Devils Fork-Gallup Pool shall be located on a tract consisting of approximately 320 acres, comprising any two contiguous quarter sections of a single governmental section, being a legal subdivision (half section) of the U. S. Public Land Surveys. For purposes of these Rules, a unit consisting of between 316 and 324 surface contiguous acres shall be considered a standard unit."

3 (A): "Each well completed or recompleted in the Devils Fork-Gallup Pool shall be located no nearer than 790 feet to the boundary of the 320 acre unit, and no nearer than 330 feet to a governmental quarter-quarter section line or subdivision inner boundary line."

The Rules further provide that the director shall have authority to grant exceptions upon proper application.

Rule 4 then provides that a well "shall be classified as a gas well if said well has a gas-liquid ratio of 100,000 cubic feet of gas per barrel of liquid hydrocarbons or more, or if said well produces liquid hydrocarbons possessing a gravity of 60 degrees API or greater. Any well subject to these Special Rules and Regulations shall be classified as an oil well if said well has a gas-liquid ratio of less than 100,000 cubic feet of gas per barrel of liquid hydrocarbons and if it produces liquid hydrocarbons possessing a gravity of less than 60 degrees API."

Rule 5 limits the monthly production from any gas well to the number of days in the month multiplied by 1,000,000 cubic feet.

Rule 6 provides that any well classified as an oil well shall be subject to the statewide rules governing acreage dedication allowables, gas-oil ratio limitations, and the proportional depth factor would be 1.33.

That, briefly, summarizes what, to us, seemed to be the significant points that have been determined by the Commission in the past, and brings us to where we are now. El Paso Natural Gas Company proposes now to submit rules to the Commission, proposed rules pursuant to the provisions of the Order in Case No. 1967. For that reason we think that possibly attention can be concentrated on the material points by putting the rules on first, and then supporting the rules with testimony. It seems that the testimony would be more pertinent when we have before the Commission the rules which we propose. So we propose to offer Mr. Woodruff as a witness. I don't believe he has been sworn.

(Witness sworn.)

S. NORMAN WOODRUFF

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

DIRECT EXAMINATION

BY MR. HOWELL:

Q Will you state your name for the record?

A S. Norman Woodruff.

Q And by whom and in what capacity are you employed?

A I am employed by El Paso Natural Gas Company as their Manager of Gas Proration Operations.

Q You have testified many times before this Commission as an expert witness and your qualifications are a matter of record?

A That is correct.

MR. HOWELL: If it please the Commission, we submit Mr. Woodruff as an expert witness.

MR. PORTER: His qualifications are acceptable to the Commission.

Q (BY MR. HOWELL) Mr. Woodruff, have you prepared proposed rules for the Devils Fork-Gallup Pool?

A Yes, sir, I have.

Q Will they be identified as El Paso's Exhibit Number 1?

A Yes, sir, they will be.

Q And, in referring to the rules we can then identify them as El Paso's Exhibit Number 1. With that introduction, will you please call the Commission's attention to the proposed rules, and I would suggest that first you tell, in general, what you hope to accomplish by the rules and then go down pointing out the individual rules and discussing them.

A Yes, sir, I will do so. First, let me say that we have indicated that I have prepared these rules, which is correct, but I have done it in conjunction with other operators in the Pool, including both the oil operators and the gas operators, so that we have come up with a set of rules which we all consider are reasonable and workable. I know of no indication of opposition unless it may be in the question of allocation of the gas between the gas wells, and if there is any opposition, of course, it can be expressed during this Hearing, but this is a set of rules which has been worked up so as to satisfy the needs of all parties in the Pool. Now, it looks rather voluminous from the Exhibit Number 1 we have given you in that we have conformed these rules to the General Rules adopted by the Commission by Order No. R-1617 applicable to the prorated gas pools in the San Juan Basin, or, I believe it was referred to as Northwest New Mexico. I will refer only to those rules which I have shown here as referred to especially; in other words, you might notice that Special Rule Number 2 is shown there. Where we just show a rule and do not define it as special it will be identical to the comparable rule in the General Rules adopted by the Commission.

Special Rule 2 provides further location of any well drilled within the defined boundaries of the Devils Fork-Gallup Gas Pool, and is at variance with Rule 3 (A) referred to by Mr. Howell as being adopted by the Commission in Order R-1641-A to this extent: That we propose that a well may be located no closer than 660 feet to the boundary line of the tract nor closer than 330 feet to a quarter-quarter section line or subdivision inner boundary line. Now, the existing rule provides for 790 feet to the boundary line and no nearer than 330 feet to a governmental quarter-quarter section line or subdivision inner boundary line. We have recommended a change to 660 feet, realizing that we do have oil wells on the rim of this gas reservoir, and that wells drilled which may be either oil or gas in the vicinity of what would be estimated to be gas-oil contact would be appropriately located on an 80-acre tract for oil, assuming 80-acre units are adopted. Then we would need to have 660 from either side. In other words, if you went 790 you would be closer to one side of the tract since the 80-acre tract would be only 1320 feet wide, so the 660 would hit it in the middle. The rules as we are recommending would provide that, were being drilled for oil, that it could be located anywhere on two 330 foot lines, one 330 foot line would be in the center of the one 40-acre section; the other 330 foot line would be in the center of the other 40-acre tract of the 80 acres.

Going to Rule 5(A). This rule provides for 320 acre spacing for gas wells, which is the same provision as adopted by the Commission in Rule 2, Order No. R-1641-A, except that we have gone farther and provide for a well to be drilled for oil. You will notice about the middle of the Rule, we start "and each well completed or recompleted in the Devils Fork-Gallup Gas Pool on a standard proration unit as an oil well shall be located on a proration unit of approximately 80 acres comprising any two contiguous quarter-quarter sections of a single governmental section being a legal subdivision of the U. S. Public Land Surveys."

Unless the Commission has objection, I will try to brief these rules as I go through them rather than read them in their entirety. Is that acceptable?

MR. PORTER: That is satisfactory to the Commission, Mr. Woodruff.

A On the second page you will notice there are no Special Rules. However, under "B" you will notice we provide for Nominations and Proration Schedule. We are proposing that the General Rules be applied, and these rules here, as you see, refer to the General Rules and say that they are applicable. We are proposing market demand proration for the gas wells in the gas area of this Pool.

On Page 3 we have Special Rule 8(B) 3, which provides for the granting of an oil allowable to an oil well.

Special Rule 8(B) 4 provides that the allowable shall be determined in accordance with the provisions of Statewide Rule 505.

Special Rule 8(D) provides for the determination of an allowable for a well which is changed from oil to gas. It provides that deliverability tests will be taken and the necessary plats be prepared to identify the unit.

Special Rule 8(E) provides for the assignment of allowable for a well which might change from gas to oil.

Turning to Page 4, Special Rule 9(E) we provide for the determination of the oil allowable for an oil well in this Pool.

It would be the normal unit allowable times the proportional factor of 2.33 and would be also limited by the gas-oil ratio for the Devils Fork-Gallup Gas Pool.

I believe, to more clearly state the meaning of this rule, I should refer to it as a rule providing for the gas limit permitted for an oil well, which would be determined by multiplying the three factors shown in there, the normal unit allowable times the proportional factor times the limiting gas-oil ratio. Now, I have, and would like to identify as El Paso's Exhibit 1-A, Rules to substitute for Rule 10(C) as provided in the Exhibit 1. The Rule 10(C) as shown originally on Exhibit 1 would have provided for a deliverability test to be taken on each gas well in the same manner as that prescribed for a Mesaverde well in the San Juan Basin. Since coming to Santa Fe and being furnished data showing the stabilization characteristics of gas wells, it has been determined by me and agreed in by others, that it is not necessary to test wells of the characteristics of these gas wells in the Angels--Devils Fork-Gallup Gas Pool. You might say any reference to the Angels-Gallup Pool will mean Devils Fork-Gallup Gas Pool.

Q Might I interject a question, Mr. Woodruff? As I understand you, then, El Paso's Exhibit 1-A, which changes the Rule 10(C) as shown in the Exhibit 1 of El Paso was prepared after you had had more information about the particular characteristics of gas wells in the Devils Fork-Gallup Pool?

A That is correct.

Q Now, will you go ahead and outline briefly what is contained in El Paso's Exhibit 1-A, what this proposed rule provides and how it differs from the general Northwest rules of the Mesaverde wells?

A Yes, I will do so. We have provided in this Exhibit 1-A, which provides for the deliverability tests of Devils Fork-Gallup Gas Pool gas wells for a 3-hour pre-flow or conditioning period. I said 3-hour--I should have said 3-day conditioning period, and a 1-day test flow period. This differs from the Mesaverde rules, for instance, in that they require a 14-day pre-flow, and 7-day flow, but the data which has been made available to me since arriving reflects that at least on two of the wells there have been successfully taken 4-point by pressure tests which reflect on one of them that it was able to stabilize in three hours, and on the other well that it was able to stabilize within a 24-hour period. The purpose of a conditioning period is to clean it up, get it stabilized so that the test period will be a stabilized flow condition. Providing for a 3-day conditioning period is excessive for the wells we have information on, but we do not know what might be the characteristics of some of the wells that have not yet started producing, which may be completed in the future. So we are recommending rules which may take a little more time than is absolutely necessary, but which we think is reasonable, much more so than had we adopted the Mesaverde rules. One other feature involved is, if you produce a well for twenty-one days, and it is producing at 5,000,000 rates, you have produced 105,000,000 cubic feet, and we expect the average allowable resulting from the application of these rules for a well to be less than a million cubic feet a day. So you can see that just during the taking of a deliverability test you would produce more than three months allowable, which we think is unreasonable and, of course, unnecessary.

We vary also from the Mesaverde rules in that we recommend that the pressures to be utilized will be those pressures recorded at the end of the 1-day test flow period, where, from the Mesaverde—which I will use continuously as an example--we take the average rate for the full 7-day test period. But the rate will be determined from the actual conditions existing at the end of the 1-day test period. Other than that, these rules represented by Exhibit 1-A are just prepared to present to the Commission a complete test procedure utilizing the 3-day conditioning period and the 1-day flow period.

Stating that I have learned various things since I have come here applies to even after I started writing these rules, in that I would recommend to the Commission on the bottom of the page where we provide for the determination of the static wellhead working pressure (P_w) of any well--let me read it as it is, continuing: "of any well under test shall be the calculated static tubing pressure if the well is flowing through the casing; or the calculated static casing pressure if the well is flowing through the tubing."

Q Just a minute. From what are you reading, from Page 2 of

El Paso's Exhibit 1, or from the General Northwest Rules?

A I am reading from Page 2 of El Paso's Exhibit 1-A.

Q 1-A?

A Yes, sir, the bottom paragraph on Page 2. This, in brief, provides that if the flow is through the tubing you calculate the static wellhead working pressure on the casing by formula. Now, I would recommend that in all wells where both the working wellhead pressure on the tubing and the static wellhead working pressure on the casing can actually be measured, that we utilize the measured volume rather than resort to the calculated pressure. I said, "to the measured volume," I should have said to the measured pressure rather than the calculated pressure. I consider that the P_W can be accurately measured by a deadweight tester if there is no packer preventing communication between the formation and the annulus, and that we should utilize that rather than attempt to calculate the P_W.

MR. WHITE: From my copy of 1-A, I think that is on the bottom of Page 1, not Page 2. You are talking about static wellhead working pressure; it is, on my copy, on Page 1.

A I am fortunate enough to have two copies of Page 1.

Q (BY MR. HOWELL) Would your testimony be correct that you are referring to the paragraph at the bottom of Page 1 of Exhibit 1-A?

A Yes, it should be. I believe that briefly summarizes the extent of our Exhibit 1-A with the additional recommendation as it pertains to the determination of the static wellhead working pressure

Pw.

Continuing on Page 5 of the recommended rules, which is Exhibit Number 1, and referring to Special Rule 14(C) we are providing in this rule for determining the status of the gas area as defined in the following formula, and providing that it shall be determined twice a year as of February 1, and August 1 in the following manner; and I will read, beginning at the bottom of Page 5, with 1): "The volumetric equivalent of gas for the gas area, based on the total production from the oil area, shall be calculated from the formula below:

$$V = \frac{A \times Q}{a} \times C \qquad \text{where } C = r_1 - r_2 + \left(\frac{0.3199\, P_r B}{Z} \right)$$

A = The gas area which is the total acreage dedicated to gas wells.

Q (BY MR. HOWELL) That is capital 'A'?

A Capital 'A' is a gas area which is a total acreage dedicated to gas wells. Little 'a' is the oil area which is the total acreage dedicated to oil wells.

Note: The acreage to be added for any oil or gas well which receives its first allowable during a six month balancing period, for that period only, shall be calculated by the following formula:

$$\Delta a \text{ or } \Delta A = a \left(\frac{d}{D} \right) \text{ or } A \left(\frac{d}{D} \right)$$

where Δa or ΔA = acreage to be added to oil or gas area respectively.

a or A = Acreage dedicated to the well.

d = Days well received allowable during proration period.

D = Total days during proration period.

Q = Total oil production from oil area (bbl./6 months).

r_1= Average produced GOR for the oil area determined by dividing the total gas production of the oil area by the total oil production of the oil area for the previous six months proration period (cu. ft./bbl.).

r_2= Solution GOR determined from the characteristic performance curve for the oil at P_r(cu. ft./bbl.).

P_r= Average reservoir pressure based on the pressures obtained on the most recent bottom hole pressure survey as provided in Special Rule 29.

B = The oil reservoir volume factor determined from the characteristic performance curve for the oil at P_r.

Z = Deviation factor for gas at P_r and 147° F for average gravity of produced gas from gas wells.

V = The volumetric equivalent of gas for the gas area, cubic feet for the six months rounded off to the nearest MCF.

MR. WOODRUFF: Turn to Page 7:

$$0.3199 = \text{constant} = \frac{520 \times 5.61}{15.025 \times 607} \quad (607 = 147^\circ \text{ F} + 460^\circ \text{ R})$$

where 147° = the initial bottom hole temperature, assumed to remain constant.

Q May I interrupt? Is 147° bottom hole temperature that has been found in this particular Pool?

A Yes, sir.

Q You are using the actual Pool temperature here?

A Yes, sir, and we expect it to remain constant.

2) The volumetric equivalent of gas for the gas area determined in 1) above shall be compared with the actual production from the gas area.

a) If the actual production from the gas area exceeds such volumetric equivalent plus any permitted production remaining as determined in b) below, then the nominations by gas purchasers during the succeeding six month period shall be adjusted by the Commission so that the volumetric withdrawals from the gas area shall be restricted for the purpose of balancing the cumulative equivalent volumetric withdrawals from each area.

b) If the actual production from the gas area is less than the volumetric equivalent for the gas area, then no adjustments will be made but the difference between the volumes will be carried forward as permitted production of gas from the gas area in subsequent balancing periods.

Q Mr. Woodruff, would you just state now, generally, what this formula is designed to do? As I understand the purpose, from your testimony, it is to provide a rule and means of limiting gas produced from the gas area to a volumetric equivalent of the space voided in the oil area by production of oil, and gas from the oil

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area?

A That is correct.

Q And, the formula which you have put up here is a formula which determines or translates the production of oil and gas which is associated with it, from the oil area into a volume of gas that can be compared to the gas production from the gas area?

A That is correct.

Q Well, I was sure that all the lawyers would understand this formula, but I wasn't quite sure about the engineers.

A I am very pleased that my explanation was adequate for you to understand, Mr. Howell.

Q Now, have you amplified and illustrated the method in which you actually can calculate this, or do you prefer to discuss the formula more before you go into that?

A I do have a sample calculation if you want to refer to it at this time, or I could go through the rest of the rules and then refer to it if you desire.

Q While we are talking, let us just show how that calculation works.

A Yes, sir.

Q Is that El Paso's Exhibit 2, which is a sample calculation?

A Yes, sir, El Paso's Exhibit 2 is entitled "Calculations to Determine Equivalent Volumetric Withdrawals". It would be well, in listening to my explanation, to turn to Page 6 of Exhibit Number 1 on which is defined the various factors utilized in the formula.

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You will notice that I show first the formula $V = \frac{A \times Q}{a} \times C$. But here you will note that I have shown 'C' in its component parts rather than utilizing the constant as recommended in Exhibit 1, Special Rule 14(C). We show that where $C = r_1 - r_2 + \frac{(T_h)}{(T_r)} \frac{(P_r)}{(P_b)} \frac{(B)}{(Z)} (5.61)$.

Let me explain what these portions of 'C' represent. r_1, as previously defined is the average producing ratio in the oil area.

Q That is gas-oil ratio?

A That is correct. r_2 is the solution gas-oil ratio of the oil under the conditions prevailing at the time the calculation is made. The condition would be the pressure existing. A difference between r_1 and r_2 would be the cubic feet of free gas produced with every barrel of oil. The portion of 'C' on the righthand side of the plus factor is the factor which converts a barrel of stock tank oil to the equivalent volume of reservoir space which would be occupied by it, and its dissolved solution gas, and then converts that volume of reservoir space to the equivalent volume of gas at standard conditions, which would occupy that space. In order to understand how it works, we have prepared an example based on one barrel of stock tank oil. You will notice in the first square that one barrel of stock tank oil is equal to 5.61 cubic feet, and for your ease in following, we might just circle up here in 'C', 5.61. We have taken care of that factor. Next, we correct for 'B', the oil reservoir volume factor. It increases the volume to 8.02. Now, that 8.02 is the cubic foot of reservoir space occupied by the barrel of stock tank oil and its dissolved gas.

Q That is under the conditions which actually exist in the Devils Fork Pool?

A That is correct. Let me make a correction there. Actually, the 'B', as utilized in this example, is an estimated volume. The oil reservoir volume factor will be represented by a curve, and the solution gas-oil ratio will be represented by a curve which are characteristics of the actual oil found in the Devils Fork-Gallup Pool. A sample has been taken and an analysis is being made to establish these two curves and they will be furnished to the Commission with the request that they be adopted along with this Order as curves to be applied as pressures decline for utilization in this formula.

Now, going on to the example, this 8.02 cubic feet of reservoir space exists at 2,015 psia. This is the original bottom hole pressure, and 147° F., which is the bottom hole temperature, and must be corrected to 15.025 and 60° F., and for deviation from perfect gas.

In our next example we take the 8.02 feet and correct it for the temperature factor. $\frac{(T_b)}{(T_r)}$. You notice we can circle it, we can do so in our formula. That is a reducing factor, reduces it to 6.87 cubic feet. Next, we correct for the pressure, and it converts the 6.87 cubic feet to 921.33 cubic. Then, the 921.33 cubic feet is corrected for deviation from the perfect gas by the factor $\frac{(1)}{(Z)}$ with the result we arrive at 1,143.37 cubic feet. Now, this is the volume of gas which will occupy the same reservoir space as one barrel of stock tank oil, and its solution gas.

Q That is, Mr. Woodruff, this volume of 1143.37 cubic feet of gas is gas measured at the surface at a pressure of 15.025 and at the temperature of 60° F., as gas is measured when it is brought to the surface?

A Those are cubic feet of gas at the standard conditions prescribed in New Mexico. Now, I just completed reading (1) explaining that the volume we are discussing is the volume of gas which will occupy the same reservoir space as one barrel of stock tank oil and its solution gas.

(2) The volume determined in (1) is added to the volume of free gas ($r_1 - r_2$) to obtain the total volume voided by the actual production of one barrel of oil.

(3) In order to determine the total volume voided by the oil area, the volume determined in (2) is then multiplied by <u>Q</u>--the total oil production from the oil area during the six month period, Bbls.

(4) Next, the total space voided by the oil area is reduced to a per-acre basis by dividing the volume determined in (3) by <u>a</u>--the total acreage dedicated to oil wells.

(5) The volumetric equivalent of gas for the gas area is determined by multiplying the volume determined in (4) by <u>A</u>--the total acreage dedicated to gas wells.

Now, the recommended formula, as indicated in the proposed

Special Rule 14(C) provides for the use of the constant 0.3199. That constant combines the temperature correction factor, $\frac{T_b}{T_r}$, the 5.61, which converts from barrels to cubic feet, and the base pressure in a manner shown on Exhibit Number 2.

I believe that completes my explanation of Exhibit Number 2, and if I may return to Exhibit Number 1, I will continue with the Special Rules.

The next Special Rule occurs on Page 9, Special Rule 25, which provides that the vertical limits of the Devils Fork-Gallup Gas Pool shall be the Gallup Formation.

Special Rule 26: "A gas well in the Devils Fork-Gallup Gas Pool shall be any well producing with a gas liquid ratio of 30,000 cubic feet of gas per barrel of liquid hydrocarbons or more; or, any well which produces liquid hydrocarbons with a gravity of 60° API or greater."

Special Rule 27: "An oil well in the Devils Fork-Gallup Gas Pool shall be a well producing with a gas liquid ratio of less than 30,000 cubic feet of gas per barrel of liquid hydrocarbons, and the liquid hydrocarbons have a gravity of less than 60° API."

Special Rule 28 provides for the taking of gas-oil ratio tests quarterly in January, April, July and October of each year.

Special Rule 29 provides that the average reservoir pressure shall be determined twice a year, during April and October, in the following manner: "Subsurface pressure tests shall be taken on all flowing oil wells (pumping wells exempted) in accordance with

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the procedure outlined in Statewide Rule 302, except with respect to shut-in time and datum as provided above."

The shut-in time was a minimum of three days, and I will later explain the datum.

Number 2), "Wellhead shut-in pressure shall be obtained on all gas wells and calculated to bottom hole conditions at the subsea datum of the gas-oil contact in accordance with the standard procedure as outlined in the Manual for Back Pressure Tests for Natural Gas Wells in the State of New Mexico."

We referred to the subsea datum of the gas-oil contact. At this time we do not know exactly where the gas-oil contact is. We know it is somewhere between the bottom of the perforations in the lowest Gallup well and the top of the perforations in the highest oil well. The distance between such perforations is 72 feet. We would recommend that the Commission utilize that as a datum until such time as it can be possibly established by drilling the average point between the bottom perforations in the gas well nearest to the contact, and the top perforations of the oil well nearest to the contact. Now, this would be at a plus 1022 feet subsea. We then provide for the information to be reported on C-124 in compliance with the applicable rules.

Special Rule Number 30: "No acreage shall be simultaneously dedicated to an oil well and to a gas well in the Devils Fork-Gallup Gas Pool."

Special Rule Number 31: "In order to prevent waste, the gas-oil ratio limitation for the Devils Fork-Gallup Gas Pool shall be 2,000 cubic feet of gas per barrel of oil produced."

That concludes my resume of Exhibit Number 1, except for the following recommendation which would be applicable thereto, that the deliverability tests required of the gas wells be taken during the month of October, which would coincide with one of the bottom hole pressure surveys. That way we could utilize the pressure taking during the deliverability tests for the required pressure in calculating bottom hole pressures.

Q Do you regard these rules as practical and workable?

A I certainly do.

Q And, do you regard the formula for equalizing the withdrawals from the gas area with those from the oil area as being the best practical formula that could be devised for this Pool?

A I consider that it is.

Q Now, having gone over the rules, we propose to now ask you concerning the study that you have made, and the facts which you have learned about the Pool which support the conclusions which you have reached, and I ask you first to outline to the Commission the history of the Pool, beginning with the first production and other pertinent data that you have accumulated?

A This Pool was discovered in 1958 by the drilling of the Val Reese Killarney-Brown Number 1-24 Well. If I may refer to the map which is shown on the board--

Q That is an Exhibit which, you understand, will be later introduced by Pan American, which you have seen before?

A That is correct. The Brown No. 1 Well exists in Section 24 of Range 7, Township 24.

Q The correct designation is Township 24 North, Range 7 West?

A That is correct, in Section 24, Southeast quarter. Now, there was no production from the time of the completion of this well in 1958 until the completion of the Redfern and Herd Largo Spur No. 1 Well, which was completed in December of 1959. That well is in the Southeast quarter of the Section 18 of Township 24 North, Range 6 West. At the time of that well's completion--first, let me say, the next well completed was the Redfern and Herd Spur No. 2 Well, and in my explanation here I'd like to refer to the Spur 1 and the Spur 2 without going through the complete definition--the Spur No. 2 Well was the next well completed, and was located in the S.E. 1/4 of Section 13 of Township 24 North, Range 7 West. At the time of its completion the Spur 1 Well had a bottom hole pressure of 2,015 pounds.

Q Now, was that pressure before there had been any production from the Field?

A That is correct. The Spur 1 Well was the first well to produce except for such gas as was produced in completing and testing wells. The Spur No. 2 Well on January 20, exhibited a shut-in pressure, bottom hole pressure of 1,993 pounds. That was approximately after a month's production from the Spur No. 1 Well, during which time it produced approximately 80,000,000 cubic feet. The No.

2 Well was produced, another bottom hole pressure was taken on March 20, 1960, at which time it exhibited a bottom hole pressure of 1,959 pounds. Now, we know that there was a pressure drop on the No. 2 Well by the actual bottom hole pressure measurements of 34 pounds from the time it was completed up until the time of March 20, 1960, on bottom hole pressure test. We also know that it indicates a pressure draw down of 56 pounds, which is the difference between the bottom hole pressure of the Redfern and Herd Spur No. 1 Well before it started production, and the pressure of the Spur 2 Well on March 20, 1960. Now, this draw down in pressure could be attributed only to the production from the Spur No. 1 Well, and such other minor production as may have come from wells being drilled and completed, so we have positive proof of pressure draw down between the Spur No. 1 and the Spur No. 2 wells, which is a distance of 4,311 feet. Now, were we to take this distance between these two wells, the 4,311 feet, and utilize that as a radius of a circle, we would calculate the drainage area reflected there to be 1,320 acres.

Q Would that be the total area, or would you say at least 1,320 acres?

A It would calculate to be exactly 1320. We know it is draining that area very effectively. How much further, we don't know. That is the maximum distance between those two wells.

Then we have drilled in Section 17 of Township 24 North, Range 6 West, the El Paso Natural Gas Canyon Largo Unit No. 89 Well, which I will refer to as Unit 89. That well is a distance of 3,054 feet from this nearest well, the Largo Spur No. 1 Well. We had no bottom hole pressure on that well, but we had an initial shut-in pressure which was 1,585 pounds, and all the pressures I will give you will be in absolute pounds, psia. Now, we know that the No. 1 Well, before it started production, had an initial shut-in wellhead pressure of 1,749 pounds. That is the difference between the initial wellhead pressure of the No. 1 Spur Well and the Unit 89 Well, between the December, '59, pressure date of the Spur 1 and the May 12, '60, pressure date of the Unit 89 of 164 pounds. There has been a pressure drop in the No. 89 Well without any production from it during that period of 164 pounds. We now have drilled and completed as a gas well the McElvain and Miller No. 1-A Well, which is located in the N. E. 1/4 of Section 13, Township 24 North, 37 West. The nearest well to that is the Spur No. 2 Well, which is approximately 2600 feet distant. The initial wellhead pressure of the Miller 1-A Well was 1,557 pounds, which, when compared with the initial pressure of the Spur 1 Well would show a difference of 192 pounds. That is wellhead pressure. The McElvain 1-A Well was 192 pounds less than the pressure exhibited by the Spur 1 Well before there was production from this Pool. We now have completed the Redfern and Herd Largo Spur No. 3 Well in Section 19, 24 North, Range 6 West. Now, the nearest well to it is the Val Reese Lybrook 1-19 Well located in the N. W. 1/4 of the same Section 19, and at a distance of approximately 2700 feet. The initial shut-in wellhead pressure of the No. 3 Well was 1,573 pounds, which differs from the initial wellhead pressure of the Spur 1, 176 pounds. We had the Val Reese Lybrook 1-19 Well, previously referred to in the N. W. 1/4 of Section 19, which had an initial wellhead pressure taken in December of 1959 and showed a 1,654 pound pressure, which differs from the pressure in the No. 1 Spur of 95 pounds. There is a special significance to me in this latter figure, in that the Lybrook 1-19 and the Spur 1 both had their pressures taken in December of '59, during periods where there had been little, if any, production in the Pool. Essentially, they should be the same, but they show 95 pounds pressure difference. This leads me to conclude that the advice of the operator that this well was not clean when they initially produced it and took its initial potential test was correct. Apparently, it was loaded up with the fluids utilized in packing the well.

Now, each of these wells existed at distances from off-set wells which would result in the calculation, were that distance utilized as a radius of acreage, greatly in excess of 320 acres. There is no question but that this reservoir has shown the ability of one well to drain very large areas. As I said, the history, comparing the Spur 1 and Spur 2 Wells, showed 1,320 acres as a drainage area, at least that, and it is my understanding that the next witness, or the Pan American witness will present evidence to show that there has been pressure influences, possibly over even greater distances than that. This is actually the finest performing reservoir I have studied in the San Juan Basin. Its reservoir characteristics are very good.

Q As a result of your studies, you are convinced that one well will efficiently drain in excess of 320 acres, and that any closer spacing in the gas area would mean the drilling of unnecessary wells?

A That is correct. Now, I have also compared the characteristics of the Devils Fork-Gallup Reservoir as indicated by a core analysis taken on the Unit 89 Well of El Paso, with the average reservoir characteristics of the Mesaverde and Dakota Reservoirs. The Mesaverde and Dakota Reservoirs both have 320 acre spacing, and the comparison was to see how the characteristics of the Devils Fork-Gallup compared. This comparison shows that the Devils Fork-Gallup exhibits a porosity of 12.4% compared to a Mesaverde average porosity of 9.1% and a Dakota average of 7.2%. Water for the Gallup is 29%; for the Mesaverde, 28.6%; and for the Dakota, 34.6%. Thickness average for the wells presently completed in the Devils Fork-Gallup is approximately ten feet.

Q That is effective pay?

A That is net effective pay. That compares with the net effective pay in the Mesaverde of 51 feet, and with the average for the Dakota of 40 feet. Initial reservoir pressure for the Gallup is 2,015; for the Mesaverde, 1,362 pounds; and for the Dakota, 2,877 pounds. Reservoir temperature for the Gallup is 147°; for the Mesaverde, 154°; and for the Dakota 165°, all being Fahrenheit. Permeability for the Gallup is 14.65 millidarcies. That was taken from the core analysis of the Largo No. 89. The average for the various cores available from the Mesaverde is 4.38, and the average for the various cores available from the Dakota is 4.12. Utilizing the reservoir characteristics for these various reservoirs indicates a recoverable reserve in MCF per acre foot of 530 for the Gallup, 235.9 for the Mesaverde, and 329.9 for the Dakota. This data reflects the Devils Fork Reservoir has better reservoir characteristics, based on the wells producing therein than is true of either the Mesaverde or the Dakota.

I consider the performance history to date has shown the justification of 320-acre spacing in the Mesaverde and Dakota, and certainly with the better reservoir characteristics of the Gallup it is at least as applicable there.

Q Have you made any estimate of the recoverable reserves in the Devils Fork underlying the 320-acre unit?

A Yes, sir, I have done so, and the results, utilizing the reservoir characteristics previously described for the Gallup show that for 160-acre tract the reserve would be 848,000,000 cu. ft. and for a 320-acre tract that the reserve would be 1,696 MCF.

Q Now, have you made any investigation and study to attempt to determine the relationship between net effective pay attributable to wells in this Devils Fork Pool and the initial potential of the gas wells?

A Yes, sir, I have done so.

Q Have you made a chart or graph illustrating your studies?

A Yes, sir, I have done so.

Q Is that El Paso's Exhibit Number 3?

A Yes, sir, it is exhibited by both Exhibit Number 3 and Exhibit Number 4.

Q Will you state to the Commission just what Exhibit 3 reflects?

A Exhibit Number 3 is a comparison of the net effective pay with the initial potential for each well completed in the Devils Fork-Gallup Gas Pool, and an analysis of what the reasonable average would be for this reservoir.

Q You say, for each well completed; is that each well completed in the gas area?

A That is correct.

Q And, have you identified wells on Exhibit 3 by showing the name of each well and giving it a number?

A Yes, sir, we have done so.

Q And, the schedule of wells appears in the upper righthand corner of the Exhibit?

A It does, and before I explain this Exhibit, I would like to describe the basis on which I approached this problem. We have reservoir characteristics for only one well in the Devils Fork-Gallup, except for net effective pay. The core analysis of the Unit 89 Well shows the other reservoir characteristics. All the wells have electric logs from which net effective pay can be determined. Now, I have assumed in my example that all of the variables utilized in calculating recoverable reserves are constant, other than net effec-

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tive pay, which we can determine for each well. Consequently, if the other variables were constant, the variable in net effective pay would be in proportion to the variable in the recoverable reserves and could have been plotted in place of net effective pay, the initial potential, to determine whether the initial potential reflects recoverable reserves. That is the purpose of this Exhibit, to make that analysis and see what it reflects.

The first well, going from left to right, that we find is the Brown-Federal No. 1 Well, which had an initial potential of 1,876,000 MCF, and a net effective pay of 5 feet. You will note that I have inscribed a straight line on this page, which also goes through Well No. 7, which is the Canyon Largo No. 89, which shows a 9,053,000 cubic foot initial potential and 11 feet thickness, and the No. 6 Well, which is the Largo Spur No. 1 Well, which has a 10,466,000 cubic foot initial potential and thickness of 12 feet. Directly above the No. 6 Well is a well described as No. 3, which is the Largo Spur No. 2, which had an initial potential of 14,375 MCF. The Largo Spur No. 2 has a 14,375 MCF initial potential. Now, you can see grouped below the line, Nos. 2, 4 and 5. No. 2 is the Val Reese Lybrook-Federal No. 1 Well, which initially exhibited 3,476 MCF initial potential. This is the same well which I referred to on the map as having its initial pressure taken at, essentially, the same time as the Spur 1 Well, but yet showed a substantial pressure difference, a difference of 95 pounds. The operator of this well has advised me that, in his opinion, the Lybrook-Federal No. 1 Well was not cleaned out at the time of the initial potential, and that the initial potential is not a true reflection of the well's ability. We have been advised by the operator that during the latest month's production available to it that it did average producing approximately 3,000,000 a day, which would show a producing capacity almost equal to its initial potential.

I have made a calculation relating the stabilized producing characteristics of the Spur 1 and Spur 2 Wells obtained during the taking of deliverability tests with their initial potentials, showing that the relationship between their stabilized delivery capacity and initial potential was 2.33. Now, were we to apply this 2.33 factor to the Lybrook Well it would calculate an IP of approximately 6.6, which would show it to be much nearer to the line drawn. The No. 4 Well is the Largo Spur No. 3, which shows in the tabulation in the upper righthand corner an IP of 2,707 MCF. Here, again, the operator has advised that he considers the IP was not characteristic of the well's actual potential because it was not cleaned up at the time of its test. I am advised that this well continues to increase in productivity, and actually is producing at the rate of 3.6 MCF a day, which, as you can see, is in excess of the indicated IP. Were we to apply the same 2.3 factor to this well, it would indicate a calculated IP of 8.3, which would fall slightly above this line.

The No. 5 Well is the Miller 1-A, which initially reported an IP of 2,870 MCF. I have been advised by the operator of this well that it was not cleaned up, that at the time of the IP there were still 1200 barrels of frac oil remaining in the reservoir. What its IP would have been had it been cleaned, we do not know, but we do know the first four days it produced after it was put on the line it averaged 2.3 MCF a day rate. If we use that 2.3 MCF a day rate, if we applied the same 2.3 factor to that, we would get a 5.4, which would place this well nearer to the curve established.

I anticipate that as this well continues to produce and cleans out the frac oil that is contained in it, that its delivery characteristics will continue to increase, and that we will find the calculated IP to be much nearer to falling on the line that has been drawn here.

The line that has been drawn is, essentially, a one to one ratio, which I consider reasonably reflects the characteristics of this reservoir when relating net effective pay to initial potential, and also reflects that for these wells that have been completed to date the primary factor influencing its recoverable reserves appears to be the net effective pay. The other factors apparently remain fairly constant. I have used initial potential plotted against net effective pay in an effort to justify the utilization of deliverability in the allocation formula. Actually, you do not get deliverability tests until the wells are connected and produced into the line, and for this particular reservoir deliverability tests are not required, so that for those that have been on the line we have only had two tests that have been completed, and the third, I understand, has been authorized by the Commission to be taken and is presently being taken. So I do not have deliverabilities to relate to net effective pay. However, it is my opinion, that with the characteristics exhibited by this reservoir that we can assume that the initial potential will be directly related to the calculated deliverability, and that deliverability in turn will be related to recoverable reserves.

Q Then, in your opinion, there is such a relationship between the recoverable gas reserves in place and the deliverabilities that would justify using the same allocation formula as has been adopted in the San Juan Basin for the Mesaverde wells?

A That is correct. All prorated pools in the San Juan Basin at this time utilize a 75% acreage times deliverability plus 25% acreage formula. We are requesting, in the General Rules, that the name of this Pool be added to those others covered by the General Rules so that the same rules will apply.

Q Now, Mr. Woodruff, would you tell the Commission what El Paso's Exhibit Number 4 consists of?

A Exhibit Number 4 reflects an attempt by me to relate initial potential and net effective pay in still a different manner. I have plotted the initial potential and the net effective pay for each well with relationship to the present existing boundary of the Devils Fork-Gallup Gas Pool.

Q That is the Southwestern boundary?

A That is the Southwestern boundary of the Devils Fork Gas

Pool, and the distances are related in terms of miles. The distances at the bottom of the page are in terms of miles from the present boundary of the Pool and reflect the location of each well.

First, let me state that I have arbitrarily drawn, in preparing this analysis, a line at 45° through the Killarney-Brown 1-24 Well, 45°, which is approximately on dip with the reservoir. Then I have brought each well in perpendicularly to that line to find what its relationship is from the present boundary of the Pool, so I brought all of these wells into a common line. Net effective pay for each of the wells is shown by the squares, and the initial potential for each of the wells is shown by the circles. The line drawn through the No. 1 Well with a square is my interpretation of the average characteristic of increase and decrease of net effective pay exhibited by the wells in this reservoir, based on the assumption that I have explained. The curve starting from the circle Number 1 is a curve which, in my interpretation, reflects the characteristic of the initial potential of the wells in this reservoir, showing to me that there is a reasonable relationship between net effective pay and initial potential shown as we go from the present defined edge of the Pool across the Pool.

I think this further shows and verifies the relationship between that effective pay and initial potential.

Q Then, as I understand you, from this Exhibit 4 and your studies in connection with it, you have concluded that the net effective pay thickness as you go from the Southwest boundary up to the Northeast, and then after coming to a thicker part begins to pinch out again towards the Northeast?

A That appears to be the case.

Q And, the initial potentials of the wells drilled in that area, again, reflect a relationship between the initial potential or deliverability and the recoverable gas in place.

A That is what I intended to reflect.

Q Now, Mr. Woodruff, what administrative difficulties would there be in administering these rules you have proposed, particularly with regard to your formula for equalizing the volumetric withdrawal?

A I consider that there would be a minimum of administrative difficulty. The only thing that would be required, other than that normally done for a gas pool, would be to maintain a cumulative oil and gas produced from oil wells in the oil area, and the cumulative volume of gas produced from the gas wells in the gas area. Then, each six months, we will take the volumes produced during that six-month period and apply them in this formula that we have recommended, so that twice a year we will take the data and apply them in this formula. Those are the only additional administrative responsibilities that this type of rule will require, other than comparing the volumes determined in that manner with the volumetric equivalent to see whether the gas area is over-produced or under-produced with relationship to the equivalent volume calculated for that area.

Q In your opinion, will the application of this formula

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reasonably maintain the gas-oil contact in place without allowing it to move substantially?

A I consider that it will, to the best of our ability. May I explain that, to the best of our ability, I say we have all tried to combine in determining this formula, both oil operators and gas operators, with one objective in mind, and that is to maintain a constant location of the gas-oil contact so that we will get the maximum recovery of oil, and so we will get the maximum recovery of gas. We will prevent the migration of one substance, the oil to the gas zone, or the gas to the oil zone. We will maintain that gas-oil contact constant, and we all think this formula will come the nearest to it of any type of application we can conceive of, and we have further provided in the rules for the taking of pressures twice a year. Now, those pressures would be guideposts to us to determine the effectiveness of this formula. If this formula isn't one hundred percent effective the pressure performance history in the oil zones and the gas zone will tell us it isn't, then we can analyze what, if anything, needs to be done to correct for it, but now, we think it will work perfectly. We do know a formula of this type has worked perfectly elsewhere, and we are asking that we be permitted to utilize it in this Pool.

Q Mr. Woodruff, there were four points that the Commission set out in its Order. I'd, briefly, like to have you just summarize those recommendations. First, the Commission asked, I believe, about classifications. What do you think this Pool should be classified as at the present time?

A I consider it should be classified as a gas pool.

Q Why is that?

A A predominance of the area within this Pool, and of the presently known hydrocarbons is gas. There are eight gas wells with 320 acres each dedicated to them, and two oil wells which presently have 40, but if the recommendation of the oil operators will be adopted there will be 80 acres attributed to each one. Assuming each oil well had 80, there would be a total of 160 acres to the oil area, and for the eight gas wells there would be a total of 2,560, so there is sixteen times as much gas acreage today dedicated to gas wells than we anticipate will be dedicated to oil wells.

Q As to the classification of wells, in your rules you have recommended 30,000 to 1 ratio as the breaking point. Why have you selected that?

A We have selected 30 to 1 as being a reasonable breaking point at which the predominant gas produced will be gas from the gas area. That is gas which could possibly be attributed to solution gas, or free gas attributable to the oil area would be a much smaller percent of the total 30,000 to 1. I would estimate the maximum ratio ever to be anticipated through performance of the oil reservoir with no gas cap to influence it, would be in the range of 8 to 10 MCF per barrel of oil. That would be the maximum ever reached, not the average, but the maximum, so that 30 to 1, even if it were producing at a maximum ratio of 10,000 to 1, 20,000 of the gas would

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be coming from the gas area.

Q Now, you have, in these recommended rules, given your recommendations as to proper spacing?

A Yes, sir, I have.

Q And, as to drilling, by that I assume that the Commission meant the location where wells would be drilled with reference to the boundary lines?

A Yes, sir, I have given that.

Q And, as to production, which is the final point the Commission has asked about, you have given that by proposing this formula and related rules to insure equality?

A Yes, sir, I have.

Q We would like to offer into evidence El Paso's Exhibits 1, 1-A, 2, 3 and 4.

MR. PORTER: Without objection the Exhibits will be admitted to the record.

(Whereupon a ten minute recess was had.)

MR. PORTER: Please come to order.

MR. WOODRUFF: Mr. Porter, a member of the Commission's staff has pointed out an inconsistency in my recommended rules which I would like to correct, if I may do so. It will be on Page 3 of Exhibit 1, Special Rule 8(D), sub 1). I would like to change that to read: "A deliverability test is taken in conformance with the provisions of Rule 10(C) hereof."

Q (BY MR. HOWELL) You mean, to strike everything below that?

A Everything below the first line would be stricken.

Q You have just incorporated the provisions of these Orders to which your rule refers?

A Yes, sir.

Q What is that Order number?

A Rule 10(C); I would add the words of Rule 10(C) hereof. Now, that is Rule 10(C) shown on Exhibit 1-A, which we ask be made a part of Exhibit 1.

Q Does anyone have a question of Mr. Woodruff?

CROSS EXAMINATION

BY MR. PAYNE:

Q Mr. Woodruff, as I understand your proposed rule, gas withdrawals are based on oil production?

A That is correct.

Q So that the net effect is that you really don't have market demand prorationing for gas?

A That is not correct.

Q Well, explain it, will you?

A We would provide for market demand proration of gas from gas wells, permitting the gas wells to produce fluctuating each month as market demand fluctuated for gas, but each six months we would determine how much gas the gas reservoir had produced and we would compare that volume with the volumetric equivalent of gas calculated for the gas reservoir, based on the production from the oil reservoir, and we would not permit the gas area to produce more than that volumetric equivalent. If they produce more during the next six months, the allowables would be cut to bring it back in line. If the gas area produced less than the volumetric equivalent, then that difference could be carried forward as permitted production for gas wells during some subsequent six month period. In other words, let me give a simple example. If the equivalent volumetric withdrawals from the gas area was 10, and the gas area only produced 8--it was permitted, it had the opportunity to produce the 10--but it only produced 8; 10 would have been the maximum. The difference between the 8 and the 10, or 2, would be carried forward so that if, during some six month's balancing period in the future, gas demand increased so as to require that it would be available to be produced at that time.

Q But it should have been produced. The demand for the 2 is arising at a later date. You had the demand for the 2 back at the other time, too, so you are still 2 under the market demand.

A No, sir, not as I visualize market demand. Market demand would be the actual volume required by gas purchasers from the gas wells, and it may or may not be the volumetric equivalent, because you don't know in a six-month period what it is going to be. You are going to prepare the actual production during that period with the volumetric permitted to be drawn, based on the oil production. So you place a ceiling on how much it can take from the gas area, and I might say that the ceiling, under the reservoir conditions now prevailing, will average about 750 MCF for gas wells. In other words, the restriction placed on the gas area by this formula under existing conditions is a greater restriction than what the Commission has placed on it by limiting it to a million per well, but at some subsequent date as gas-oil ratios increase on the oil wells, the permitted production from the gas wells would be increased.

Q If I understand you correctly, then, you have marketing and prorationing for gas up to a ceiling?

A Correct.

Q Now, referring to your formula, big 'A' and small 'a', don't you have to assume that the entire 320 acres dedicated to a gas well is productive only of gas, and that the 80 acres dedicated to an oil well is productive only of oil?

A That is the assumption that would follow, yes.

Q Now, let's say a well had a producing gas-oil ratio of 25,000 to 1, and it goes to 35,000 to 1. It changes from an oil well to a gas well. Now, in both instances, isn't it going to be producing both gas and oil?

A I would expect it to.

Q So that would throw your formula off that much, wouldn't it?

A No, sir, I don't consider that you are throwing the formula off.

Q When you put 320 into your large 'A', you are putting that in there because that acreage is productive of gas?

A You put that acreage in there only if that acreage is at-

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tributable to that well. In other words, you have 80 acres attributable to an oil well. It may not have an additional amount to go to 320, but if it does, the operator would be able to dedicate up to 320 acres. The production contributing to this well's performance is primarily coming from the gas area at the time it reaches 30,000 to 1, as I explained during my direct testimony.

Q Well, primarily it is, but it is also producing liquids, and to that extent the formula is off because your large 'A' and small 'a' both have to assume that acreage is not only entirely productive, but that it's productive only of either gas or oil.

A You state that the formula is off, and I can see the point you are making, that we have in your example taken 80 acres away from the oil area and added 320 acres to the gas area. Now, the assumption we are making through the application of this formula is that when this well goes primarily to gas that the acreage formerly dedicated to it for oil production has essentially become gas productive. That is a necessary assumption to apply this formula.

Q We also have to be very careful in using the formula to not permit the dedication of dry acreage, isn't that correct?

A That is certainly correct.

Q What happens to the over-production or under-production that an individual well has when it is reclassified?

MR. PORTER: You are referring to gas?

Q (BY MR. PAYNE) Either way. You could have a gas well go to an oil well, but first, take an oil well. Five days over-produced under the permissible monthly tolerance, and at that time it has to be reclassified as a gas well because it passes 30,000 to 1?

A I would believe that if the oil well remains within the permitted tolerance for an oil well within the General Rules of the Commission, that you could ignore it without having any significant inequities resulting.

Q In other words, it wouldn't throw the gas-oil contact off substantially?

A That is correct.

Q Mr. Woodruff, actually you are basing your formula on this one Gallup sand stringer in this area, are you not?

A We are basing it on the Devils Fork-Gallup Pool, which consists primarily of this one productive stringer.

Q Now, your rulings do apply, however, to the entire Gallup Formation?

A That is correct.

Q What happens if there are two other productive stringers in this area, as shown by various well locations?

A I understand that there are two other stringers which may be contributing to the production.

Q What happens if an operator drills an oil well and he perforates two or more of the stringers? Doesn't that throw your formula off?

A Under the conditions existing today, we don't think it will have any significant effect, but we don't know. We think this formula is the best means of operating to determine what the situation is; that it has a better chance of maintaining a constant gas-oil contact than any other means we know. Now, as I previously pointed out, we are going to take pressures twice a year, which will be guideposts to us to see whether the formula is actually accomplishing the maintenance of equalization of pressures between the two areas. If you have some extraneous source coming in it may throw your formula off. We are going to have these check points. If it does, we will have to apply some adjustment to compensate.

Q Perhaps you can compensate for it initially instead of having the rules apply to the entire Gallup Formation, have them apply to this particular sand?

A I certainly would not recommend that in this Pool because I do not think it would be proper to prohibit an operator from completing in the entire Gallup Formation in whatever productive intervals may be in the entire Gallup Formation, so as to ultimately recover the maximum amount of hydrocarbons from it, like the other two stringers you mentioned. They are of such insignificant size, as I am told, that you couldn't complete in them separately. In fact, some operators have just cased them off entirely so as not to have to worry with them.

Q Within the immediate area, within the Pool we are discussing, part of it extends outward, those stringers might become more predominant. Assume you complete an oil well in two sands, and it is really producing 50 barrels in each sand, and under your formula the whole 100 barrels is charged to this one sand.

A It is charged to the oil area.

Q Now, really only 50 of it is being produced from this sand, so that you have a disproportionate withdrawal from the gas area which could then, in turn, cause the oil to migrate into the dry gas sand; isn't that right?

A I don't believe it is right. I see the point you are making, but I think we are ignoring the fact that if this second reservoir can contribute the 50 barrels, that it is also contributing pressure and volume and capacity to the oil area, that it is in effect connected with the oil area and will reflect itself on the oil area.

Q On the oil area, yes, but how about the gas area?

A The gas, it is just as if you have a bottle up here and a bottle down here, interconnected with a hose, and you were trying to equalize it with another big bottle over here. It doesn't matter whether the volume of these two bottles are included in one or whether it is included in two separate ones. They are interconnected and the flow will be felt on the larger bottle the same way.

Q You are saying there will be communication between the sand bodies?

A There will be communication through the well bore permitting 50 barrels to come from each formation in your example.

Q Do you propose to place any ceiling on the gas takes from any particular well?

A No ceiling other than as would be provided in the General Rules pertaining to prorated gas wells. In other words, we are asking that the General Rules applicable to the Northwest New Mexico area be applied.

Q Do you think, perhaps, in a gas capped pool there ought to be some maximum per well withdrawal because if a well in a certain area had no ceiling, had a high deliverability, it might produce so much gas or in such a manner that it would cause the gas-oil contact to move one way or the other?

A I see no need in this reservoir with the conditions we have to date.

Q Do we have any estimate here on the percentage of oil and gas in this reservoir? I mean, it is predominantly gas, you testified; could you give an estimate?

A I have no estimate other than that which would be reflected by acreage within the present designated limits, which came into the designated limits because of oil or gas production. We have two quarter sections that have been brought into the Pool as the result of the drilling of two oil wells. We have five and a half Sections within the gas area, brought into the Pool as a result of the drilling of gas wells. We have, then, eleven half Sections of gas within the present designated limits as compared to one half Section of oil. Now, your question may have been, can I predict what ultimately will occur, and I can't.

Q Mr. Woodruff, do we have any information as to the acreage that an oil well will efficiently drain?

A Yes, we do, and a witness of Pan American will present that evidence.

Q I see. Now, in a Pool of this kind, and under your proposed rules, do you think that an operator might drill a well and say it has a 20,000 to 1 ratio, and the ratios are increasing; would the net results be that you would end up with 320-acre spacing for oil wells?

A You are asking me if, ultimately, all of the oil wells may go to gas?

Q That, first, yes.

A If we assume that all of the oil wells will ultimately go to gas, and that each of the oil wells has 320 acres attributable to it within the limits of the Pool, then you would have 320 acres for all of the wells.

Q But I am not to the point yet where they have all gone to gas. You drill a well, and it has 15 or 20,000 to 1. The operator feels eventually that well will go to gas, so why should he drill another oil well?

A I am not an oil operator, but let me say that I certainly am not convinced that you might not be able to drain 320 acres with an oil well with the type of characteristics they have.

Q Over how great a period of time?

A Over a reasonable period of time. I have not studied the oil reservoir, the oil wells and their particular peculiar characteristics, but based on the type of formation that we have evidenced in the gas area and the communication that has been exhibited there, and the apparent communication that has been exhibited between the gas area and the oil area, as will be testified to, I understand, by the Pan American witnesses, we have a very good reservoir. They may be missing the boat as far as I know if they come in and ask for 80 acre spacing. They maybe should be here for 160 or 220.

Q Your proposal is for 80-acre spacing for oil wells?

A The rules which the operators proposed and I presented are for 80 acres for oil wells. Now, the oil operators will justify that 80-acre spacing.

Q You admit, don't you, there is a possibility that when you have two spacings in a Pool, one for oil, larger for gas, that when the gas-oil ratios are raising, an operator may well decide not to drill an additional well on a 320-acre tract, even though he only has 80 acres at that time, because that well is liable to become a gas well. You might end up with one well for each 320 acres regardless of whether it is an oil or gas well.

A I think that that is a rather broad assumption, because each oil operator has to judge on the performance of the well to date, whether he wants to risk the drilling of an additional oil well. You have to see what the performance is, the pay out characteristics; you may not be able to afford to drill oil wells out there on 80-acre spacing.

Q They have drilled some on 40, haven't they?

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A They have drilled wells in the area under Statewide Rule, which is 40-acre spacing, but where acreage is attributable to the wells I would assume at least up to 320--I mean they just drilled a well under Statewide spacing rules.

Q Well, they have 40 acres dedicated, and they knew that was what was going to be dedicated to it.

A Until there were rules, that's right.

MR. PORTER: Mr. Woodruff, I read your definition of what a gas well is: "A gas well in the Devils Fork-Gallup Gas Pool shall be any well producing with a gas-liquid ratio of 30,000 cubic feet of gas per barrel of liquid hydrocarbons or more; or, any well which produces liquid hydrocarbons with a gravity of 60° API or greater."

What is the gravity of the liquid from the oil wells, do you know?

A The oil wells are producing at a gravity of 40 to 42, I am advised.

Q And, what about the gas?

A Gas wells are producing at a gravity of approximately 70.

Q Then you are assuming that any well in here with a gas-liquid ratio of below 30,000 feet would produce liquids of less than 60°?

A No, sir, I don't believe so, if I understood your question correctly. A gas well can be either a well that produces in excess of 30,000 to 1 and produces a liquid ratio of less than 60, or it can be a well which produces at 50,000 to 1 with any type.

Q From your study of this situation, would you think that a well, say with a GOR of 20,000 to 1 in here, or gas-liquid ratio of 20,000 to 1, would have a gravity of less than 60?

A I believe probably it would have a ratio in the vicinity of 60.

Q You mean gravity?

A Gravity in the vicinity of 60. We might try to visualize it. This 60, if you had 40° oil and 70° gas, would be two-thirds condensate and one-third oil; I mean, in those general proportions.

Q My next question was, as far as the gas wells in there today, the ones that are actually defined as gas wells, with a GOR in excess of 100,000 to 1, are the liquids that those wells are producing liquids in the reservoir?

A No, sir.

MR. PORTER: I believe that is all.

Q (BY MR. NUTTER) Mr. Woodruff, you propose that there be no simultaneous dedication of acreage to the oil well and a gas well. In the event an operator should have a 320 acre gas unit and decides he had an oil well location, would the rules permit him to reduce the size of his gas unit and drill another one?

A Not without authorization of the Commission to do so. The rules do provide exceptions to the spacing provisions, at the discretion of the Secretary-Director, and without objection of other operators who may offset the tract.

Q In other words, there is provision for administrative approval, then, if the operator that wants to take 80 acres, assume

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80 acres, assume 40-acre spacing, off his gas unit and dedicate that acreage to a proposed oil well, then?

A I believe that I am correct in saying that the General Rules applicable to a Northwest area would permit that to occur if the Secretary-Director would approve it, and no offset operator object to it. If there was an objection, then they would go to hearing and it would have to be approved on that basis.

Q In the event you got an oil well, this gas acreage factor would be reduced?

A That is correct.

Q What would happen if he got a gas well?

A The operator, under those circumstances, would have to determine which of the acreage within the 320-acre tract would be applicable to each gas well.

Q Maybe he would want to create two 160-acre, or 180 and one 240?

A That is correct.

Q Mr. Woodruff, do your rules provide that the liquids which may be produced with the gas from the gas area would be included in the total measured hydrocarbons that are taken from the gas area?

A No, sir, they do not provide that.

Q You do provide that a gas well be classified as such if it has a ratio of 30,000 or more?

A Correct.

Q A well producing with 30,000 to 1 under the assumed amount

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of gas that is going to be withdrawn from the gas area may produce quite a bit of liquids?

A Yes, it could.

Q But you are not charging that?

A We have not proposed to charge the liquids produced from gas wells.

Q You do, however, charge liquids produced from oil wells, and also gas produced from oil wells?

A Right.

Q This is a one-sided affair?

A It is one-sided in that all of us who have approached this matter consider that it is an unnecessary complication of the formula to try to compensate for minimum amounts of liquids which are, at this time, being produced from gas wells, and our rules certainly cover conditions as they exist today with reasonableness. Should, in the future, we see we have a condition which necessitates the compensation for liquids produced from gas wells, the formula can be amended to compensate for it, but at this time we do not have it, nor do we visualize a need for complicating the formula by accounting for the liquids produced along with the gas. A barrel of condensate would be the equivalent of about one MCF, and the well is producing at 100,000 to 1 ratio, and having about an average of, say, 800 MCF a day allowable, would only produce eight barrels or eight MCF. It is an insignificant volume.

Q I realize it is not of great magnitude. What are the existing gas-liquid ratios in the gas pool at this time?

A For the wells producing to date, which have cleaned up, which have produced all of their frac oil, or whatever frac liquid they used, it is in the vicinity of 100,000 to 1.

Q This 30,000 to 1 is quite low for the actual existing ratios in the gas areas?

A Yes.

Q You have repeatedly stated that as conditions changed these rules could be changed to meet new conditions. Wouldn't it be as well to leave a high ratio classification in the Pool rules at this time, and then, as conditions change, and maybe warrant lowering the ratio classifications later on, do it at that time?

A We do not consider that it is appropriate to do that. We consider the 30,000 to 1 rule is what we should look at there today; that the predominant production under conditions where a well produces at 30,000 to 1 will be withdrawal, primarily, of hydrocarbons from the gas portion of the reservoir rather than the oil portion of the reservoir.

Q You don't have any low ratio gas wells, do you?

A No, sir.

Q You don't have any high ratio oil wells yet, do you?

A No, sir.

Q Mr. Woodruff, assuming that you mentioned awhile ago the gas equivalent for the gas area would be 10, assuming also that you had five wells in there, all of equal acreage and equal deliverability, each one would have two points of this total of 10 that the gas equivalent amounts to?

A Correct.

Q Supposing one of the gas wells is under-produced to a minus 4, and that the other wells are over-produced to a plus 14. Now, the net status of the Pool would be 10. Would the under-produced have its under-production cancelled at that time?

A If the under-produced well did not come in balance in accordance with the General Rules applying to gas wells of balancing within a six-month period, the under-produced well would have its underage cancelled just as would be true of any gas well in any pool.

Q What about the over-produced?

A They would have to come in balance within the six months.

Q You go by the General Rules, the six times over-production?

A Yes, sir.

Q If an individual well had an overbalanced condition, but the pool was unbalanced, that individual well would have to be balanced?

A That is correct.

Q Supposing you had a case where market demand was low in the pool for an extended period of time, and you had a large amount of under-production accrued to the gas area, would you have, due to the high volumes of withdrawal from the oil area, would you have a pool-wide cancellation of that under-production?

A No, sir.

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Q You would continuously carry that forward?

A That is correct.

Q Now, you state that if the gas area should become over-produced, that the nominations would be reduced; would it also follow that the withdrawals from the gas area would be reduced?

A They would have to be reduced accordingly for the wells would become over-produced, and have to be shut-in according to General Rules, which require a well to be brought into balance or shut it in until it is brought into balance.

Q (BY MR. MURRAY) Mr. Woodruff, does your formula contemplate the simultaneous depletion of both oil and gas in this reservoir?

A I might explain this, Mr. Murray, that it does provide for the simultaneous depletion. It has a ceiling on what the gas can produce, which is a permissive figure. It is not a required, it is a limit, and the gas will be produced according to the market demand up to that ceiling.

Q Actually, then, the market demand would influence the operation of the reservoir actually only during the initial six-month's period in which this formula is not in effect, because then the formula takes over after that, the way I understood your formula?

A The formula would take over if the gas wells have produced in excess of the volumetric equivalent for the gas area, but if the gas area has produced less than its volumetric equivalent you can carry that as a credit, which may be produced later on as permissive production from the gas area in some subsequent period.

Q Adjustments made every six months, based on the formula, after the first six months, which is strictly market demand?

A That is correct.

MR. PORTER: Are you familiar with the Angels Peak Pool?

A Yes, sir.

Q Do you consider this Pool and the Angels Peak Pool similar?

A Yes, sir.

Q Do you know why your Company is recommending one formula for one Pool and another for the other?

A Yes, sir.

Q Will you explain it, please?

A Yes, sir, I would be happy to do so. We find the Angels Peak Pool today in a condition considerably different than the Devils Fork-Gallup. It is a pool well on towards depletion; it is a pool where, through the operation under the rules that have existed to date, has permitted gas from the gas area to migrate into the oil area and caused the ratios to go extremely high. We have a pool which we must take under the conditions we find today, and we have tried to provide rules by which we will try to stop what has happened and to correct things, or to make reasonable allocation of production between the oil and gas area or oil and gas wells in the future.

Now, in the Devils Fork-Gallup we caught it at initial conditions, essentially. We will know through the analysis of the oil what its formation volume factor is, and what its solution gas-oil ratio characteristics are. We can establish them by curves based on initial conditions. If we had that same information available on Angels Peak I can't see any reason why we couldn't put the same rule into application there, but we don't have this data.

Q The chief difference is the state of depletion of the two reservoirs?

A Yes, sir.

Q (BY MR. NUTTER) Mr. Woodruff, assuming that you had a high demand for gas from the area and your nominations were high and started withdrawing at a relative high rate, we'd have to wait until six months have gone by before we know what the proper amount of gas to be assigned to the gas area was?

A You say "we". Do you mean the Commission?

Q The operators, gas purchasers, Commission, everyone.

A Let me say, the gas purchasers should be pretty well aware of what the gas equivalent, gas volume for the gas area is going to be, because they are going to know what the oil wells are going to be permitted to produce. We can pretty well visualize what the permitted volume is going to be, and I anticipate that we will try to hold our takes within reasonable limits of what we anticipate that maximum permitted production to be.

Q So, while you said awhile ago your gas nominations are going to be based on market demand, you are also going to keep your eye on oil production?

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A That is true.

Q Is there more than one gas purchaser?

A Yes, sir, Southern Union, El Paso is purchasing.

Q (BY MR. PAYNE) Are you going to redistribute the cancelled under-production?

A Yes, sir.

Q (BY MR. NUTTER) Mr. Woodruff, if it takes six months of oil production to know what the gas equivalent for the gas area should be, then the wells have to make up their over-production within the following six months?

A That is correct.

Q This could be a total of one year of gas purchases before there would be a final shut-in of the gas wells, is that correct?

A That's correct.

Q Supposing the gas had been depleted in that length of time, it wouldn't do any good to shut it in or curtail it; you would end up with an unbalanced condition; perhaps the oil would have migrated, is that possible?

A Under your hypothetical question, yes.

Q I recall in the last Hearing, there was some rather pessimistic outlooks on the life of the Pool.

A I heard some of the attorneys testifying to that, I believe.

Q You don't necessarily agree with their testimony? Is that correct?

A That is correct. May I state, we do not think this is a large reserve within this Pool. We think, I mean in terms of Mesaverde or Dakota, but we do think we have good reserves for the pool that will exist there which will warrant the justification of the drilling of the wells and will make them economically feasible to produce.

Q On 160 acres?

A No, sir, not on 160 acres.

Q Have you made any calculations, as the reservoirs, the two areas, exist at the present time, on what the anticipated gas withdrawals from the gas wells is going to amount to?

A During what period of time have you reference to?

Q Well, assuming we put the order in effect as you proposed it now, for the next six month's period?

A I would anticipate that the average withdrawals from the gas area will equal approximately 750 times the number of gas wells, times the number of days in the six month's period. In other words, the formula we recommend today will result in the assignment to the average gas well of approximately 750 MCF a day allowable. That, you might note, is less than the 1,000 MCF or million cubic feet figure which the Commission is presently limiting wells to.

Q That is based on two oil wells at the present time?

A Yes, sir.

Q Are both of those oil wells top allowable, do you know?

A It is my understanding that they both potential volumes

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in excess of the top oil allowable at this time.

Q Mr. Woodruff, in the formula, the gas acreage is a critical factor in determining how much gas withdrawal you will have. Now, how does the Commission know that the entire 320 acres that is figured on the acreage dedication plat is productive of gas?

A The Commission only knows through their judgment and the representations made by the producer, who is desiring to allocate that 320 acres to it. In other words, you know through the history of drilling in the reservoir what may reasonably be considered to be its productive limits. You don't know now, because we haven't reached the extent possible to it. In certain areas there the major portion of the reservoir is still open to definition.

Q Is it your opinion that there is any acreage dedicated at the present time that may be productive of gas?

A I, frankly, do not know just which acreage is dedicated to each gas well, but I consider that all of the acreage within the presently defined gas pool to be productive of gas. Consequently, I would assume that it would follow then that each 320-acre tract presently assigned is productive of gas.

MR. NUTTER: I believe that is all. Thank you.

Q (BY MR. UTZ) Mr. Woodruff, would it be your proposal to handle the gas area in the manner of prorationed schedules in exactly the same manner as each pool is handled at the present time?

A As each prorated gas pool is handled at the present time?

Q Yes.

A Yes.

Q Then the only actual difference in administrative work would be additional adjustment between gas produced in the oil area, or the total volume produced in the oil area and the gas area?

A Yes, sir, twice a year there would be that calculation made.

Q Now, our present rules advise no gas well can be produced more than six times current allowable, is that correct?

A That is my recollection.

Q So, for the first six months, other than the fact that no well can be produced more than that, you would have no curtailment other than market demand in gas production?

A That is correct.

Q However, if, in the first six months you had produced substantially more than your allowable, do you foresee the purchasers would start curtailing and giving the wells back the balance during the second six months?

A Yes, sir.

Q It is highly improbable you would have twelve months?

A That is my belief.

MR. PORTER: Anyone else?

MR. NUTTER: Perhaps Pan American witnesses will testify to this, but do you know what the reservoir potential volume factor is?

A No, sir, that will be determined from the sampling which they have taken and which is presently being analyzed, as I understand it. You probably were right. They could testify to it better than I can.

Q How about the reservoir pressure, that datum plus twenty-two, do you know that?

A No, I do not know what that pressure is at this time.

MR. NUTTER: Thank you.

MR. PORTER: Anyone else?

Q (BY MR. ARNOLD) Mr. Woodruff, you have drawn a relationship between net effective pay and initial potential in the gas area?

A Yes, sir.

Q And, from this you have justified the use of deliverability in the gas formula?

A Yes, sir.

Q Do you think that the same characteristics in the oil reservoir are about the same as those in the gas reservoir?

A What characteristics, Mr. Arnold?

Q Rock characteristics, porosity, permeability, variations in thickness.

A I would expect so.

Q Do you suppose, then, that there might be the relationship between the initial potential of oil wells in net effective pay which would be similar to that shown in the gas area?

A I would not expect it to be. I would not expect you to be able to establish such a similar relationship, but I may be wrong. The oil well flow from an oil well is much more subject to the completion practices and the manner, the size of tubing and such that you have that is not true of a gas well. The potential for a gas well is a theoretical figure which you extrapolate to. Potential for an oil well is an actual figure which the well actually did; isn't extrapolated to theoretical figures.

Q If you did establish that sort of relationship, however, would you be in favor of putting in deliverability factors into the oil proration formula?

A I would not recommend that. I cannot see, in my own mind, that we could establish the relationship, but were I an oil operator and I could establish that relationship, I might want to do it.

Q (BY MR. KENDRICK) Mr. Woodruff, in Special Rule 29 where you request reservoir pressures, you ask for all gas well pressures and oil well pressures for a minimum of three days?

A That is correct.

Q And, in Exhibit 1-A, on my copy, it requires a 7-day shut-in pressure for the gas well tests?

A That is correct.

Q Are the characteristics such that seven days would be required for the deliverability test to reach the maximum or stabilized pressure?

A Let me say, I really questioned that we need seven days, but we don't know what the characteristics of future wells may show.

It really doesn't hurt a gas well to shut it in for seven days.

Q Then, it would require seven days?

A I am not saying it requires seven days shut-in pressure to stabilize the pressure for a gas well in this reservoir, but we are prescribing that as the shut-in period.

Q For the deliverability test?

A For the deliverability test.

Q If the situation arises where the wells are completed in the zone that would require seven days to reach a stabilized or maximum pressure in the gas zone for the deliverability test, would it not be better to require seven days, or the same period, for the annual test to be applied in the formula?

A We have wondered about that ourselves. I mean us in terms of all the operators involved, and it is our judgment that, based on the evidence we have today that, even under those conditions, the seven day pressure would not be warranted because we feel the major portion of the pressure would have been accomplished during the first three days and that any additional pressure built up would be of such small magnitude as to be insignificant in the overall factor.

Q Then, during these testing periods it could require that pressure be taken at three days and another at seven days?

A It would, for those gas wells. This will give us a little history, let us see what is happening. If we cut them off at 72 hours we won't know what is happening after 72 hours.

MR. ERREBO: I have several questions to ask the witness which may carry us into the noon hour. If you desire, I will go ahead. I will be glad to.

MR. PORTER: The Hearing will recess until 1:15.

(Hearing was recessed until 1:15 P.M.)

MR. PORTER: Hearing will come to order, please. Mr. Errebo, I believe you had some questions to ask the witness.

MR. ERREBO: Burns Errebo, representing Val R. Reese and Associates.

Q (BY MR. ERREBO) Mr. Woodruff, you testified this morning with regard to reserves under the average 320-acre tract, did you not?

A Yes, sir, I did.

Q And, you gave specific figures for that?

A Yes, sir.

Q Mr. Woodruff, did you make the calculations of those reserves in order that you could give that figure?

A I had them made.

Q Let me ask you this then: Have you, in your past experience as an engineer, had occasion to make reserves as a part of your duties with the El Paso Natural Gas Company?

A Yes, I have.

Q And, then, you are familiar, of course, with the various factors?

A Yes, I am.

Q Do you consider a net effective pay to be very important in calculating reserves?

A Yes, sir, I do.

Q And, you also feel that the initial potential of a given well is directly proportional to net effective pay, do you not?

A I don't believe that this curve shows that it is directly proportional in every instance, but I think for this reservoir it has exhibited its normal characteristics would be essentially that.

Q And, you also believe that, if you ascertain the potential of a well, that you can determine what its reserves are, is that correct? That is what this Exhibit Number 3 represents, does it not?

A Not that you can determine the reserves in terms of cubic feet, but it will give you a relationship to reserves which can be compared with potentials of other wells so as to show a comparison between wells.

Q Actually, then, you are not saying you can determine reserves from initial potential?

A No, sir, I am not saying that.

Q And, you don't use that in your calculations?

A No, sir.

Q It is not a fact in determining reserves?

A That is correct.

Q Can you tell me, and tell the Commission, Mr. Woodruff--I don't believe you did define it this morning--what you mean by the term "net effective pay"?

A Net effective pay is that portion of the Gallup reservoir available to the well or from which gas would be contributed to production during the life of the field. By life of the field I mean, say, if you take all the gas out in ten years, that is the pay that will produce the gas within the ten year period.

Q So, then, you'd also be referring to the pay on tracts outside of that particular 320-acre tract if the well on a given tract drained the other tracts, too, wouldn't it? That would also be net effective pay, is that right?

A I don't believe I follow your question.

Q You said the net effective pay is the pay that contributed the gas that was produced, is that right?

A That's correct.

Q So, if gas produced from a given well is, in fact, drained from outside the tract on which the well is located, then that net effective pay outside that tract is also net effective pay, is it not?

A Well, you are modifying net effective pay by acreage.

Q Now, will you refer to your Exhibit Number 3 and state the amount of net effective pay which you attributed to the Brown-Federal No. 1?

A Five feet.

Q Now, how did you determine that?

A That was determined from the electric logs available from that well.

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Q Did you have occasion to look at the core log?

A No, I did not. I have never seen the core graph.

Q Do you know whether they were made available to your Company?

A Not to my knowledge.

Q Did you inquire?

A As to whether there were any?

Q Actually, I am informed that the core graph was made available to your Company, and I was just wondering if you had occasion to make use of it in this study.

A I have not had occasion to make use of it.

Q I would like to hand you a core graph of Federal No. 124 which is located in the S. E. 1/2 of Section 24, and I would like to ask you to pick out the five feet of net effective pay that you used in making this Exhibit Number 3?

A Well, I very probably could not pick it out from this core graph. I would have to utilize the logs which we did have available on the well to pick it out. I could attempt to pick it out here.

Q Actually, you did make use of the core analysis on your Largo Number 89, didn't you?

A Yes.

Q By using that did you then go to the electric logs of other wells in the Pool and determine net effective pay?

A Yes, sir.

Q So, actually then, isn't it true that the core analysis is the best means of determining net effective pay?

A I would think so.

Q But you didn't use that on this?

A No, we did not use that.

Q Can you tell me, on the Largo No. 89, how you determined the net effective pay on that well?

A From the use of the core analysis.

Q And, how many feet did you pick out on it?

A I believe it was eleven feet.

Q Now, I will hand you what was labeled here a core analysis on our Canyon Largo No. 89, and ask if you will pick out the eleven feet from that core analysis which you used, and also tell me how you picked it. I have a copy here, Mr. Woodruff, so if you care to refer to particular sample numbers I will know the ones you are picking out. Actually, I won't ask you to do that for the sake of time. I will ask you, though, what perimeters or what measurements, how you would pick out the particular eleven feet, what your criteria is for that?

A Criteria is with limits based on connate water, saturations, and on percents of permeabilities.

Q Percent of permeabilities?

A That is correct.

Q What were the exact figures that you did use?

A My recollection is that it was one-tenth millidarcy of permeability and 40% water saturation.

Q Would you give any consideration to porosity?

A Yes, sir.

Q And, what was that?

A Well, actually, all of it has porosity.

Q By that, I mean, Mr. Woodruff, did you throw out any samples which had a porosity below a certain percent?

A No, sir, not in that analysis.

Q Do any of the engineers of your Company under your supervision ever use porosity as a means for determining net effective pay as you have defined it, or can you tell me whether or not that is a customary method for determining that?

A Certainly, I would think porosity is a significant feature in determining whether there is or is not net effective pay, but with porosity you have to have permeability and void space which can be filled with gas to make net effective pay.

Q Will you refer to this Exhibit and tell me how many feet have one-tenth of a millidarcy, or an excess as shown on this Exhibit?

A I calculate fourteen feet.

Q How many of those samples representing those fourteen feet have water saturation in excess of 50%?

A Of 50%?

Q Yes, isn't that what you said you used?

A 40%. It appears that there are two feet here. This actually does not appear to me to be a copy of our official core analysis.

Q That is a portion of the core analysis; that pertains to the Mayre sand. In other words, if you had the whole thing you might even arrive at a higher number of net effective feet, some might be left off?

A No, I was not inferring that.

Q From what is shown there, how many net effective feet does this well have?

A I believe I have analyzed it here to be twelve.

Q And, how many did you show it on your Exhibit?

A Eleven.

Q Now, do you know whether it is possible that you might have used a different method, and were you to use the method of porosity you might come up with any different number of net effective feet?

A I would not think that I would decrease the net effective pay in this reservoir by application of any porosity factor.

Q What porosity factor would you use if you were to apply one?

A I don't think there is any specific porosity factor to be applied.

Q Have engineers with your Company ever customarily used a 6% factor?

A That I cannot say. I do not recall.

Q I will refer you to the other sheet I handed you on the 124 well, and ask you if you will first of all tell me, in regard to that well, how many feet you attributed to it on your Exhibit 3?

A This is Brown No. 124, as I defined it, and we attributed five feet.

Q Now, will you apply the same perimeters as you used previously and count the number of net effective feet on that Exhibit?

A I believe, in a hurried analysis, that, on the same basis, there would be twenty-two feet shown on this particular core analysis.

Q And, how many did you use on your Exhibit?

A We used five.

Q Now, if you were to plot that twenty-two feet on that Exhibit instead of the five, would you then be able to draw a straight line?

A It wouldn't be located on this sheet. Now, I think, to properly answer your question that it would indicate--I have no indication of where your well was completed with relationship to this interval.

Q Well, if I were to tell you that interval does cover the Mayre sand, then it would be a little difficult, would it not, to make the same observations with your Exhibit Number 3 as you have previously made?

A It would appear so, but I do not believe that this well has net effective pay in the relationship that I have picked it up from this particular log.

Q I beg your pardon. Would you mind repeating that?

A I question that this well has net effective pay of the amount which I said relates from this log here.

Q You question the log, is that it?

A Yes.

Q Who was the log prepared by?

A I do not know.

Q Does it state at the top? Do you know whether it was prepared by the core laboratories?

A Well, it does not say. However, it does say here: "Sample By C. L. I.", which may be Core Laboratories Inc., "Engineer and Representative of Client".

MR. PORTER: Does anyone have any further questions of Mr. Woodruff?

MR. SELINGER: Mr. Selinger, Skelly Oil Company.

Q (BY MR. SELINGER) Mr. Woodruff, in the absence of any field rules at all in this combination pool, under the present rules and regulations applicable statewide, there would be many more wells drilled in this gas area, would there not?

A The Statewide Rules provide for 160-acre spacing. If you had all offsets you would have it developed on a 160-acre basis.

Q So that is one of the necessities for your request for adoption of field rules in this area at this time?

A Yes, sir, that is correct.

Q Now, in the event that the area is extended to the East, or any other direction where you have no control, and should that area be predominantly oil, for exampl , under your proposal what would be the effect on producing the entire reservoir after it is drilled to its final density should the remainder of the area be found to be productive of oil, by adopting your rules to prevent the unnecessary or excessive rate of withdrawal from a gas cap on a large oil area, for example?

A The rules that we have proposed for the purpose of maintaining a constantly located gas-oil contact, it is a rule that all of us feel should be adopted during the formative period of this field. It will restrict the gas production to the equivalent volume as determined from oil production, and will prevent the dissipation of a gas cap of an oil reservoir should it turn out that is what this is.

Q Your present views are that it is predominantly a gas field, and should you be in error and the field proves to be predominantly oil, you would have played safe during this formative development period?

A That is correct.

MR. SELINGER: That is all.

MR. BRATTON: Howard Bratton, Redfern and Herd.

Q (BY MR. BRATTON) Our member, Mr. Howell, one time said, "Lawyers should identify themselves as friends or foe." I shall identify myself as friend in spite of your remarks about lawyers testifying.

Mr. Woodruff, as I understand it, basically the only really new things in the rules you are proposing is in volumetric equivalent type of withdrawal to equalize the withdrawals from the oil area and gas area as far as New Mexico is concerned?

A That is correct, as far as New Mexico is concerned.

Q Is that type of approach, in volumetric equivalent approach, used in a number of States?

A I know only of its use in the adjoining State to the East.

Q Close to Southeastern New Mexico?

A Yes, sir.

Q It is my understanding that it has been done in a few other States, too, but insofar as your allocation formula within the gas area, you are just proposing the type as is in every other prorated Northwest pool in New Mexico?

A Yes, sir.

Q Is there anything about this Pool that you should adopt a different formula?

A No, there is not.

Q Mr. Howell spoke for all us lawyers when he said we understood your computations and calculations. I do understand you are actually going to have to make computations twice a year, is that right?

A In addition to those normally made.

Q And, actually those are not complicated computations from an engineering standpoint, mechanically not going to take anybody a great deal of time?

A Very simple, can be done in half an hour or so.

Q And I did understand you to say this gas area cannot be economically completed on 160-acre spacing?

A Yes.

MR. SELINGER: Skelly Oil has recently completed its well in the North 1/2 of Section 18. We have taken a core analysis of that well. We don't have the core analysis here, but we would like to have permission to file, as Skelly Exhibit 1, the core analysis taken on that well, if there is no objection.

MR. PORTER: Is there any objection to Counsel's motion for introducing in evidence this core analysis? The Commission will put it in the record.

Q (BY MR. SELINGER) Mr. Woodruff, if Skelly's core analysis on the well in the North 1/2 of 18 indicates that that well permeability core showed 38 millidarcies, which is in excess of the 14 plus that you used, would that make you feel better as to your answers both on direct and cross examination as to the ability of a well to drain 320 acres?

A Yes, sir, it would.

MR. SELINGER: That is all, thank you.

Q (BY MR. PAYNE) Mr. Woodruff, would you give a brief resume of the facts that led you to believe there is a general co-relation between deliverability of the gas wells in this Pool and the recoverable reserves?

A I refer you to Exhibit 3, upon which I have plotted the relationship of net effective pay and initial potential, on which I

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have drawn a line. The line, essentially, goes through three of the wells. The three wells below that line, all three, by the operators' own statements did not reflect potentials at the time they were taken which were truly characteristic of the well, and have since indicated by their own production history that they are capable of producing, or capable of performing, their potential's in excess of that initially shown. Were we to calculate what their potentials would be, assuming their most recent rates, stabilized rates of flow, and utilizing the same relationship of stabilized delivery capacity and potential existing for the Spur 1 and Spur 2 Wells, those three wells would come up to where they were much closer to the line. Actually, one of them would be 8.3. That 8.3 would occur on the ten foot line, so if you were to locate that 8.3, that would prevail for the Largo Spur No. 3. You can see it is very close to the line. The Lybrook-Federal No. 1 Well, calculated in the same manner at this time, shows 6.6, also on the ten foot line, which could be plotted and show that it falls a little under the line. The remaining well, No. 1-A Well, had produced only four days at the time any production data was available to us. It showed an average producing capacity during those four days of 2.3 million, and were you to utilize the same factor on that 2.3 million you would have calculated a 5.4 IP, which I really do not think is characteristic of the well, because the operator has advised me they still have 1200 barrels of frac oil yet to recover, which would mean that it is certainly not clean, so that it is capable of performing with normal reservoir characteristics into the well bore. I would imagine that when it cleans up that we will find its indicated IP up near to this line. That leaves only the No. 3, which is considerably above, and as I explained initially, we made, or I made and asked you to, for the sake of this Exhibit, to make the assumption that all factors utilized in the calculation of recoverable reserves were the same for all of these wells, and that the only variable was net effective pay. Well, I'd say for this No. 3 well, this assumption is probably not valid and some of the other factors are at variance and that places this up above there. On the whole, the majority of the wells indicate an ability to perform, based on the three-hour initial potential test, generally along this line that has been projected here.

Q I presume it is too early in the life of the field to have conducted a pressure induction decline curve to tabulate reserves, or has any such study been made?

A Not to my knowledge.

Q Has there been any volume analysis made?

A The reserve I gave you was pure volume, based on that size tract.

MR. PORTER: Any further questions?

Q (BY MR. ERREBO) Mr. Woodruff, you mentioned that the allocation formula which El Paso is proposing is the same found in other areas of the State.

A I thought I answered in the Northwest New Mexico and San Juan Basin.

Q How many other Gallup areas have this deliverability formula which you propose?

A There are no other Gallup pools presently designated as gas.

Q Actually, there are no other gas areas producing from the Gallup which have this?

A That is correct.

Q If the Commission, instead, were to adopt a 100% acreage allocation formula, it would even further reduce the administrative part of the work that Mr. Bratton was referring to?

A Not significantly.

Q Now, going back to your use of a one-tenth millidarcy permeability as a means of picking net effective feet; a millidarcy is the measure of the ability of a fluid to flow through a sand or coarse media, is it not?

A That is correct.

Q It does not necessarily measure pure volume?

A No, sir.

Q That is one of the factors you are using, is it not, for determining pure volume or reserves?

A No, sir.

Q I am wondering why you don't use porosity. In other words, Mr. Woodruff, what permeability reflects, that would be reflected in potential, would it not?

A Well, permeability is a reflection of the fact that you have porosity in the reservoir which enables a fluid to exist there, and to move.

Q They are not necessarily always the same, are they?

A What?

Q Permeability and porosity?

A No.

MR. PORTER: Any further questions?

Q (BY MR. NUTTER) Mr. Woodruff, I presume that after these three wells, which are way below the line, are cleaned up and their points are plotted on Exhibit Number 3 again, that they are going to be closer to the line; was that your statement?

A Yes, sir, that was my statement.

Q That would tend to show a general correlation between net effective feet of pay as calculated by you, and potentials.

A Yes, sir.

Q Would it also follow that you would advise the Commission there would be a relationship between the reserves and the potentials?

A Yes, sir.

Q If we take this first well, which has five feet of net effective pay and the well farther East to the right, which has twelve net feet of pay, and divide the five into the twelve, we get a ratio of something like 2.4. Have you made any calculation as to the production ratio, allowable ratio you would have under a 75% deliverability formula?

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A Actually, I have not, but if the Commission cares to hear what I understood from discussions with others who have made some studies, I will be glad to tell them what they have advised me.

Q We would be interested in knowing if the 75% is the proper deliverability formula, or 100%, or 10%, that ought to be in the formula?

A It is my understanding that were the conditions of the oil reservoir today that the gas allowables would vary from a low of about 400 MCF a day to a maximum of about a million, 400,000 cubic feet per day; 400 MCF to 1,400 MCF.

Q Which is a ratio there of 3.5 to 1, and the reserves ratio is something like 2.4 to 1. Maybe there is a little too much emphasis on deliverability on that formula, then?

A No, I don't think so.

Q Would a lesser deliverability factor reduce that ratio to a lower figure?

A Yes, sir.

Q And, it would approach 2.4 a little closer?

A It would approach 2.4. I might say that we recommended this 2.4 assuming, as I asked you to, when I made the analysis, that there were no other characteristics influencing recoverable reserves that varied for the well. Now, the well which would receive the greatest allowable is the Spur No. 2 Well, which is No. 3 on our curve. It is the one way above the line, which indicates by its own performance here that there is something other than net effective pay influencing its recoverable reserve.

Q Is there any indication as to how long that well will remain the well with the highest deliverability?

A No indication, to my knowledge.

MR. NUTTER: Thank you.

MR. PORTER: Any further questions? The witness may be excused. Mr. Howell, does that conclude El Paso's testimony?

MR. HOWELL: That concludes the testimony. I believe the Exhibits were entered into evidence.

MR. PORTER: They were.

MR. BUELL: Guy Buell, Pan American Petroleum Corporation. We have one witness, Mr. Eaton.

(Witness sworn.)

GEORGE W. EATON, JR.

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

DIRECT EXAMINATION

BY MR. BUELL:

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

A George W. Eaton, Jr. I am employed by Pan American Petroleum Corporation in Farmington, New Mexico, as a Senior Petroleum Engineer.

Q You have testified at prior Commission Hearings, have you not?

A Yes, sir, I have.

Q And, your qualifications as a petroleum engineer are a matter of public record?

A Yes, sir.

MR. PORTER: The witness' qualifications are acceptable.

Q (BY MR. BUELL) Mr. Eaton, you heard Mr. Woodruff review the rules for the Commission that were contained in Exhibits 1 and 1-A, did you not?

A Yes, sir, I did.

Q Have you also had an opportunity to review those rules prior to the Hearing?

A Yes, sir, I have.

Q Actually, as Mr. Woodruff testified, you played a part in forming the rules?

A Yes, sir, I did.

Q Let me direct your attention, now, to what has been marked as Pan American's Exhibit Number 1. What does that Exhibit reflect, Mr. Eaton?

A Pan American's Exhibit Number 1 is simply a location map of the Devils Fork-Gallup Pool, showing the presently defined Pool outline by the heavy dashed blue line, as defined by existing Commission Orders.

Q How have you distinguished the two types of wells we have in this Pool?

A The gas wells are colored in yellow, the two oil wells are

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colored in red.

Q What is the significance of the well in the upper lefthand portion of that Exhibit that simply has a red circle around it, Mr. Eaton?

A This well is an active location for Pan American's John S. Dashko B No. 2, which is a drilling oil well.

Q Does that Exhibit reflect any other thing on it?

A Yes. You will notice the heavy red line beginning at the Northwest end of the plat and extending over to the Redfern and Herd Largo Spur No. 1. That line is named an A prime.

Q Let me direct your attention, then, to what has been marked as Pan American's Exhibit Number 2. Is that the cross section, the trace of which you just mentioned on Exhibit 1?

A Yes, sir, it is.

Q What does that Exhibit reflect?

A Actually, Exhibit 2 consists of two portions; the upper portion is a geologic cross section, the trace of which is shown on Exhibit Number 1. The lower portion is a bottom hole pressure profile, showing the pressure distribution in the Devils Fork-Gallup reservoir.

Q Let's take the upper section first in the testimony. What is reflected by that cross section?

A The shaded line is indicative of a continuity of the Devils Fork-Gallup pay throughout the four wells. A portion of that line has been colored yellow, which is the line as it exists in the wells producing gas. The portion that is producing oil is shown colored in red.

Q Between the McElvain Miller A-1 and Pan American's Dashko B-1, I notice you have a break between your portion of the pay colored in yellow, and the portion colored in red. What is the significance of that?

A This simply indicates that somewhere between these two wells there is a gas-oil contact. We do not know exactly where it is. We have shown this unknown by the discontinuity in the line.

Q By the portion of the Devils Fork pay that you have colored were you attempting to depict net pay, Mr. Eaton?

A No, sir.

Q Would it indicate, as reflected by the cross section, to you from a geologic standpoint that we have an opportunity for communication over large areas in this field?

A The upper portion of the Exhibit is designed to demonstrate that this Devils Fork-Gallup sand is continuous in the four wells and, that, therefore, the opportunity for communication does exist.

Q Let's go now to the lower portion of that Exhibit, what you termed a pressure profile. Have you simply utilized pressure data available from the same wells whose locations composed the upper portion, the geological cross section?

A Yes, sir.

Q Before we discuss the profile in general, let me ask you this: Do these data reflected on the lower portion of Exhibit 2

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show a well completed in the oil area of this Pool will effectively and efficiently drain in excess of 80 acres?

A Actually, the lower portion of Exhibit 2, all data on this portion of Exhibit 2 show the excellent communication over large areas. To answer your specific question, let me direct your attention to the heavy red line which depicts the original reservoir pressure in the Devils Fork-Gallup Pool. It was at 2,000 PSIG. The initial pressure on the Pan American Dashko B No. 1 was recorded at 1930 PSIG, or some 70 pounds below the original reservoir pressure.

Q At the time the Dashko B No. 1 was completed as an oil well, how far away, or how near to that well was the nearest well that had been producing from this Pool?

A More than a mile away.

Q That would certainly indicate and show pretty conclusively, would it not, Mr. Eaton, that even in the oil area we have very effective communication over large areas?

A That is what that indicates, yes, sir.

Q Would you go ahead, now, and discuss your pressure profile generally, Mr. Eaton?

A Let's commence over at the left hand side of Exhibit 2, pressure data obtained on Largo Spur No. 1, August 12, 1960. The bottom hole pressure on Largo No. 1, 1805 psig. This well has been produced and present reservoir pressure was found to be some 200 pounds below the original reservoir pressure of 2,000.

Q Actually, the Redfern and Herd Largo Spur No. 1 was the

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discovery well in the Pool?

A It was the first well which was produced.

Q Go right ahead.

A The next well, the Largo Spur No. 2, had a bottom hole pressure of 1801 psig recorded, same date, August 12, 1960. This well has also been produced in the interim period between November, 1959, and August, 1960. The pressure was 1801 psig, or again, approximately 200 pounds below the original pressure. The third well, the McElvain Miller A No. 1 had a pressure of 1835 psig recorded June 15, 1960. This was immediately after completion of this well, and that well had not been produced. It had, at that time, a reservoir pressure prior to any production of 165 pounds less than the original reservoir pressure.

Q That is a gas well, is it not?

A Yes, sir, it is.

Q How far from that McElvain A No. 1 was the nearest producing well at the time of the completion of that well?

A 2600 feet.

Q Would that indicate to you, Mr. Eaton, that the Commission was right when they adopted 320 gas proration units for this Pool?

A Yes, sir.

Q Certainly all data indicates that a gas well will effectively and efficiently drain in excess of 320 acres; that is what the data show?

A During June, 1960, a bottom hole pressure was run in the

Pan American Dashko B No. 1, which was the original oil well in the Devils Fork-Gallup Pool. Pressure recorded at that time was 1930 psig, or some 70 pounds below the initial reservoir pressure. The Dashko B No. 1 is located more than a mile away from the nearest producing well.

Q I wonder, is not the profile we see on the lower portion of the Exhibit 2, would I be proper in terming that as a classic example of pressure distribution and a reservoir having excellent communication?

A Yes, sir. This profile shows exactly the pressure distribution you would expect when you had had withdrawals from one area of the connected reservoir, but none from another area, although the two were in communication.

Q Do you have any other comments on Exhibit 2, Mr. Eaton?

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

Q I wonder, in connection with adopting oil proration units, have you made an evaluation to see whether or not it is economically feasible to develop the oil portion of this Pool on 40-acre spacing?

A Yes, sir, I have.

Q What were the results of that analysis; is it economic?

A No, sir, it is not.

Q Have you reduced your evaluation to Exhibit form?

A Yes, sir, I have.

Q Is that reflected by what has been marked as Pan American's Exhibit Number 3?

A Yes, sir.

Q Would you briefly review that for the record?

A Exhibit 3 shows for a total investment and operating cost for a well drilled on a 40-acre plan of development, the total such investment and operating cost would be $93,650.00. The total income resulting from 40-acre development would amount to $57,780. Therefore, such a well would have a net loss of $35,870.00.

Q A net loss on each 40-acre well, should we have to develop the 40, would be in excess of $35,000.00?

A That is what the economics show.

Q Let's look at the other side of the spacing coin, the 80-acre side. Is it economically feasible to drill an oil well in this Pool on 80-acre spacing?

A We are not going to get rich at it, but it looks like a well drilled on an 80-acre pattern would pay out and result in some small profit.

Q You could pay out an 80-acre and make a small profit?

A Yes, sir.

Q What has been marked Pan American's Exhibit 4, what does that contain?

A Exhibit 4 is simply a summary of the data which were used to prepare the economic analysis which is shown in Exhibit Number 3.

Q Do you feel that the data contained on Exhibit 4 is self-explanatory?

A Yes, sir, I do.

Q Let's review, generally, now, and get your opinion on the rules as set out in El Paso's Exhibits 1 and 1-A. You have testified that data conclusively show that an oil well in this Pool will effectively and efficiently drain in excess of 80 acres?

A Yes, sir, it will drain considerably in excess of 80 acres.

Q You have also testified that, in your opinion, a gas well in this Pool will effectively and efficiently drain in excess of 320 acres?

A The data show that a gas well will drain considerably in excess of 320 acres.

Q Are you completely familiar with the volumetric formula contained in the rules presented by El Paso?

A Yes, sir, I am.

Q In your opinion, as a reservoir engineer, do you feel the formula is a practical formula as well as being based on sound engineering principals?

A Yes, sir, I do.

Q Does Pan American operate any gas wells in this Pool?

A No, sir.

Q We are strictly an oil operator?

A Pan American is strictly an oil operator in this Pool.

Q You are looking at it from an oil operator's standpoint. Do you feel that formula will prevent the migration of any oil in this Pool into the dry gas area?

A I believe the application of this formula will result in conserving the oil and preventing the migration of the oil into the previously unsaturated portions.

Q There are some things about this Pool you engineers do not know; the productive limits in all directions--

MR. PORTER: Maybe the lawyers could provide that information.

A That is correct.

Q In the event, Mr. Eaton, that some of these unknown factors should act detrimentally so that the formula as proposed now does not provide for completely equivalent volumetric withdrawals, assuming that should occur, do you think the data gathering provided for in the proposed rules will furnish sufficient data for your engineers to get an immediate clue that such is happening?

A The rules provide for the collection of such data that if the formula is not serving the purpose for which it was designed, it should be readily detected and appropriate steps taken.

Q To modify some of the factors?

A Right.

Q Are you in agreement that the limiting gas-oil ratio for the oil wells in this Pool should be 2,000 to 1?

A Yes, sir, I am.

Q The two wells currently completed are both producing with ratios lower than 2,000 to 1, are they not?

A Both wells have a gas-oil ratio currently considerably below 2,000 feet.

Q Do you think it is advisable to set a lower ratio?

A I do not think it is advisable to do so. We would expect an increase in gas-oil ratio with depletion of the oil zone. The gas-oil ratio will exceed 2,000 to 1 sometime in the life of the field. As Mr. Woodruff previously testified, the maximum such ratio, due to completion alone, would probably be in the range of 8 to 10,000 cubic feet per barrel.

Q So you feel that a 2,000 to 1 is a good reasonable, practical ratio even though both wells are currently producing lower than that?

A If it is found, in the future, it is too restrictive, that is one of the factors that can be modified at a later date.

Q It has been recommended by El Paso that this Pool be classified as a gas pool. As an engineer, what is your opinion in that regard?

A Well, sir, from a strict engineering standpoint that is an associated gas and oil reservoir. However, based on the area, relative areas which are developed to date, it is predominantly gas, and I would have no recommendation to change the classification from gas to oil at this time.

Q In other words, you feel if these rules are adopted waste will be prevented and correlative rights protected regardless of the formal definition of the Pool, as to whether it is oil or gas?

A Yes, sir.

Q From that standpoint you would go along, as an engineer, with classifying it as a gas pool, although it is in association with oil?

A I think the most important portion of the rules is this equivalent volumetric withdrawal formula, which will prevent waste of oil and will, at the same time, protect the correlative rights of the people who own gas acreage only.

Q Let's go back to volumetric formula. You are familiar with the provision in that rule that contains the formula that the volumetric equivalent, if it isn't produced by a gas well in a certain proration period, that they can continue to carry it forward to produce it whenever market demand will allow them to. Are you familiar with that provision?

A Yes, sir.

Q Do you feel that is a fair provision for the gas area operators?

A Yes, sir. I don't think that it is absolutely necessary that the total equivalent gas afforded to be made in the same period necessarily that the oil takes place.

Q And, you feel, since the gas area is entitled to that volumetric equivalent, if they can't produce it in one proration period, they should be able to keep it as a credit?

A No, sir. I think if market conditions are poor during the proration period.

Q There are certain provisions in the rules as proposed that relate directly and distinctly to gas wells, since Pan American is not an operator of any gas wells, do you feel that you should comment on any of those particular rules?

A No, sir. We have made no study of the rules that pertain solely to gas wells, since Pan American is not an operator of gas wells.

Q They appear to be workable rules, do they not?

A Yes.

Q And, similar to rules in effect in other pools?

A Yes, sir.

Q Are you in agreement with the definitions of an oil and gas well as provided for in the rules proposed by El Paso?

A Yes, sir, I am. I think the definition of 30,000 cubic feet per barrel as the point at which an oil well would pass into a gas well is reasonable since 30 cubic feet per barrel is considerably greater than we would ever expect from an oil well performance whose gas-oil ratio characteristics are being determined by pressure depletion alone.

Q In other words, if we could effectively physically separate the oil area from the gas area by inserting an impermeable band vertically through the pay formation and effectively seal off the gas area, the gas-oil ratios in the oil would never even approach 30,000 to 1?

A No, sir they would not.

Q If any of the ratios in the oil area do approach 30,000 to 1 you, as an engineer, know only that that is the gas area gas moving into the area?

A That is correct.

Q Do you have anything else you would like to add, Mr. Eaton?

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

MR. BUELL: I believe that is all we have at this time. May I formally offer Pan American's Exhibits 1 through 4 inclusive?

MR. PORTER: Without objection the Exhibits will be admitted.

CROSS EXAMINATION

BY MR. PORTER:

Q Do you agree with Mr. Woodruff that the different stages of completion, different stages of depletion of the Angels Peak and the Devils Fork justifies two different proration formulas?

A Yes, sir. For one reason, that was not mentioned, I don't believe, in Mr. Woodruff's testimony, the proper application of this equivalent volumetric withdrawal formula requires the collection of certain reservoir datum which we cannot obtain in the Angels Peak-Gallup Pool at its present stage of completion. That principal thing I refer to is the bottom hole sampling. I believe every well in the Angels Peak-Gallup Pool had a gas-oil ratio greater than 5,000 cubic feet per barrel under which conditions it would not be possible to get a sampling of the reservoir as it existed in its original state.

REDIRECT EXAMINATION

BY MR. BUELL:

Q Mr. Eaton, there have been several references made to a bottom hole sampling that has been gathered. In order that the record will be clear in that regard, would you state the circumstances around gathering of that sample, and where it is now, and when you will be able to report to the Commission what it reflected?

A Pan American has collected a bottom hole sampling on the Dashko B No. 1. After considerable efforts to make sure that a representative sample would be obtained, which required prolonged stabilization periods, as a result of that long stabilization period the sampling was not collected until last Sunday afternoon. It is now in the Pan American Laboratory in Tulsa undergoing analysis, and I am informed that it probably will take them two weeks to perform the required analysis to provide data for use in this equivalent volumetric withdrawal formula. Just as soon as the sampling data are returned to me it will be furnished to the Commission for their use.

MR. BUELL: That is all.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Eaton, I believe you stated that when your Dashko "B" No. 1 was completed you took a bottom hole pressure test on that and reported a pressure of 1930 pounds, is that correct?

A Yes, sir.

Q Had any production come from the well prior to taking that sample?

Q Mr. Eaton, there have been several references made to a bottom hole sampling that has been gathered. In order that the record will be clear in that regard, would you state the circumstances around gathering of that sample, and where it is now, and when you will be able to report to the Commission what it reflected?

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MR. BUELL: That is all.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Eaton, I believe you stated that when your Dashko "B" No. 1 was completed you took a bottom hole pressure test on that and reported a pressure of 1930 pounds, is that correct?

A Yes, sir.

Q Had any production come from the well prior to taking that sample?

A Yes, sir.

Q How long was the well shut-in?

A A period of four days.

Q So this four-day shut-in occurred after the initial production from the well?

A Yes, sir.

Q How about these other bottom hole pressures you showed on those other three wells; had any production been obtained from the wells prior?

A In the case of McElvain Miller "A" No. 1, of course, there was some production for the final testing and completion. It had not been produced into a pipeline, and it was shut-in seven days prior to taking the bottom hole pressure. Incidentally, all four of these pressures were taken with the Pan American bottom hole pressure bomb by Pan American engineers.

Q All taken by the same people with the same bomb?

A Yes, sir. Now, I don't want to say identical people; Pan American engineers using the same bomb.

Q How about Largo Spur No. 2. Had it produced at the time that pressure was taken?

A No.

Q How long had it been shut-in?

A It had been shut-in from July 28, 1960, until August 12, 1960, a period of about fourteen days. The Largo Spur No. 1 had been shut-in from July 21, 1960, until August 12, 1960, a period of approximately thirty-three days.

Q Now, on your Number 3 Exhibit you have a well cost of $67,000.00?

A Yes, sir.

Q What does that cost represent?

A This represents the actual cost experienced on the John S. Dashko "B" No. 1, which I consider to be a typical well, since no trouble was encountered in drilling and completing that well.

Q I thought that the typical well had trouble. Your actual cost on the "B" 1 was $67,000.00?

A Yes, sir.

Q Do you anticipate the cost will be reduced by any further developments in this area?

A Not appreciably. They could be considerably higher on individual wells because this is such rough country that road costs vary considerably between wells. This is the total cost on the Dashko "B" No. 1.

Q Now, this artificial lift equipment hasn't been installed in this well?

A No, sir.

Q But that is an estimate of what it would cost to install it?

A And, I anticipate it will become eventually necessary to install it.

Q This $5,400.00 operating cost and compressor investment and operating cost, are based on what anticipated time of production?

A Three years.

Q Do you expect to deplete the well in three years?

A On 40-acre spacing, yes, sir.

Q It would take longer than that on 80-acres?

A Yes, sir.

Q Now, your estimate of 25,000 barrels of oil for a 40-acre tract is taken from Exhibit Number 4, correct?

A Yes, sir, that is correct.

Q In determining that 25,000 barrels of oil, you have had 10% porosity, which is taken from a gas well, I believe, the No. 89 Canyon Largo unit?

A Yes, sir.

Q Is there reason to believe the porosity is any different in the oil section?

A The only basis I have for believing that it is the same is the similarity of the various logs in the gas section, and then the oil well and the data obtained on the Dashko "B" No. 1 from a sonic log, which is an excellent porosity tool in certain sandstone formations.

Q Do you anticipate in drilling your "B" No. 2 you will take any cores of that one?

A No, sir.

Q You will still have to rely on this reservoir information from these gas wells at the other end of the field?

A   Yes, sir.

Q   What is this 10 feet of thickness based on, Mr. Eaton?

A   This is based on correlation of the electric logs on the Dashko "B" No. 1 with the electric log on the Canyon Largo Unit No. 89, on which there was a core, and the actual thickness on the Dashko "B" No. 1 as picked by me was only eight feet, but I figured the coverage for the Pan American acreage will be a little bit greater than that.

Q   Is it thickening as it goes up the structure there?

A   I hope so.

Q   The 30% connate water was taken from the core on the 89 Well?

A   Yes, sir.

Q   Any reason to believe the connate water saturation would be any different in the Dashko area?

A   No reason to believe so, though normally the amount expected of connate water is expected to be higher down structure than up structure.

Q   Could conceivably be a little higher?

A   Could be higher.

Q   Your reservoir volume factor, you will have that as soon as you have a sample analyzed from the lab?

A   Yes, sir, that is correct.

Q   This 15% recovery factor, you are not taking into consideration any secondary recovery at all there, are you?

A No, sir, this is primary recovery.

Q As a matter of fact, you state that is analogous with Bisti, and there is considerable recovery operation underway in that Pool?

A Yes, sir, it is intended that it be analogous with the primary recovery factor of Bisti.

Q You are quoting a posted price for oil at $2.75 a barrel; is that your present price on oil?

A Yes, sir.

Q You are also quoting 30¢ a barrel hauling price, is that what is necessary at this time?

A Yes, sir, 30.9¢.

Q Do you anticipate there is going to be any facilities for handling this oil other than trucking it?

A I have heard there is a party who is investigating the economics of constructing a pipeline into this general area. I don't know of any firm plans. I think there is a field survey being done.

Q At the present time some 13% of your total income is being spent for trucking?

A Yes, sir.

Q If that could be lined--

A That would help the completion, to eliminate the trucking, road expense. To keep the roads in shape, to get trucks over, can be a considerable amount. Those things don't show up in the econom-

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ics, but they'd be eliminated with the installation of a pipeline.

Q Have you given any economics here for 80-acre spacing?

A No, sir.

Q It is just your statement, you could make a modest profit?

A You can get an approximate idea of what the economics would be by doubling the expected income on 40-acre spacing. In other words, that shows $57,780.00 income for 40-acre spacing. On that basis, $160,000.00 for 80-acre spacing, compared to $94,000.00 total investment and operating costs.

Q Would your recovery factor of 58% remain constant?

A Yes, sir. There would be no change in that since I believe an oil well will effectively, economically and efficiently drain considerably in excess of 80 acres.

Q If you went to 80-acre spacing you did state your operating costs would be extended over a longer period of time, which would detract from the economics there?

A That would be the only factor that would be increased in these economics.

Q I also note your compressor investment is $22,000.00. Would that be the size of a compressor that could handle only four wells?

A Actually, that is the quotation that Pan American got for a compressor to handle four wells with an 80-acre allowable, with a gas-oil ratio of 1,000 cubic feet per barrel, I believe, but it will handle the gas limit for four wells on 40-acre spacing, so I have that $22,000.00 estimate for a compressor of that size and used it in these economics here.

Q In other words, you mean that this is the minimum compressor investment?

A Yes, sir.

Q And it could be more?

A Yes, sir, this is the minimum.

MR. NUTTER: I believe that is all.

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

Q (BY MR. UTZ) Under the proposed rules El Paso and Pan American have made here, it would be necessary to run deliverability tests on wells with GOR's of 30,000 to 1 or more, is that right?

A Yes, sir, then they would be classified as gas wells.

Q Have you ever experienced any difficulty testing wells with ratios as low as 30,000?

A I was just trying to think if I am familiar with any wells that have ratios that low. I am not familiar with any such wells in the recent past. I have been familiar with some in the distant past, and those wells, there was no difficulty.

Q Testing through tubing?

A Yes, sir.

Q If you didn't test through tubing, you would have difficulty, don't you think?

A Yes, sir, I believe you would.

Q As a matter of fact, the smaller the tubing the better, don't you think?

A I would say up to a limit. If you had a very high capacity well you might have difficulty getting a true indication of deliverability through very small tubing, but normally the answer to your question, normally, yes. You would need considerable vertical velocity to keep that tubing free of all liquid and restabilize conditions.

Q By velocity you would mean actually pretty high producing rate?

A Yes, sir.

MR. UTZ: That is all.

Q (BY MR. NUTTER) Do you concur with Mr. Woodruff's recommendations that the datum for establishing the P_r be set at plus 10.22?

A Actually, our recommendation is it be set at the gas-oil contact, and at such time as we get better datum and can better pin that gas-oil contact down. At the present time I concur with the plus 10.22.

Q Have you made any compilations to what P_r is?

A No, I haven't. I have the data from which it can be computed from bottom hole pressure surveys with Pan American equipment on these four wells.

Q This P_r formula would be the average for all the wells in the Pool, would it not?

A Yes, sir.

Q What is the current GOR on the two wells producing?

A I believe the gas-oil ratio on the Pan American well is around 800 cubic feet per barrel. I don't have any recent information on the McElvain Well, although it reported a gas-oil ratio on completion of 280 cubic feet per barrel.

Q Have you made any estimate as to what the producing GOR will be for the next six months?

A No, sir, I haven't. I would not anticipate large increases.

Q It won't exceed 2,000 to 1 if the wells behave as expected?

A That's right.

MR. NUTTER: I believe that is all.

Q (BY MR. PORTER) Mr. Eaton, did your testimony include support of the allocation formula which El Paso presented?

A No, sir, it did not. We, being an oil operator, have made no analysis of the allocation facts pertaining to gas.

Q So you make no recommendation in that regard?

A No.

Q Don't you think that might affect your oil allowable?

A No, sir.

Q Not at all?

A No, sir.

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

MR. BRATTON: Mr. Bratton, Redfern and Herd. We will have one witness testify, very, very briefly. (Witness sworn.)

JOHN J. REDFERN, JR.

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

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your name, and where you reside, and your occupation?

A John J. Redfern, Jr., Midland, Texas; independent oil operator.

Q And, you are an engineer by education, and have been an independent operator some twenty-odd years?

A I am a civil engineer by education, and I have been an independent oil operator for twenty-three years.

Q Operating in Southeast New Mexico?

A Up until recently, almost exclusively in West Texas and Southeastern New Mexico.

Q And, you are a partner in Redfern and Herd, who own the wells in this Pool?

A I am.

Q With relation to the rules which have been proposed here by El Paso, Mr. Redfern, have you analyzed those rules and are you in concurrence with them?

A We have studied the rules and are in concurrence with them.

Q That would include the volumetric equivalent formula?

A Yes. We studied that in particular because it was something which we weren't too familiar with.

Q And, you concur in the recommendation as to the allocation formula in the gas area?

A We do.

Q And, with reference to spacing, you have made an economic study?

A Yes. In order to study the question of the economics we have endeavored to put down on paper what I think we normally do; maybe not in this formal a manner, and the sheet labeled in the upper right hand corner with a Number 1 is almost a duplicate of what was entered in the previous case, except for the fact that I have endeavored to set up an initial production rate of 800 MCF per day. This is Sheet Number 1, an economic study of a 320-acre spaced gas well that would be considered to be an average well, using the reserve as testified to by Mr. Woodruff as to the 320-acre location. I have endeavored to plot out what might be a production rate. I have used a flat rate until the last two years, when we declined it down. We recognize, in doing this, it wasn't exactly accurate because as the Pool gets older the ratios may rise, and may fall, depending on market demand. The important thing, as far as an independent operator is concerned, if you look at the upper half, the 800 cubic feet per day initial rate, you will see a fair market value of a completed well is approximately $100,000.00. If we used an initial production rate of a million feet per day, the fair market value of the well to the operator is $140,000.00. I don't want to go into all the details. I think it is self-explanatory. I took gas, added liquid value; took royalty, taxes, off to get a net, and used a discount rate of 6%. On the second sheet, labeled number 2, is a duplicate computation if we were to have 160-acre spacing, and based upon the original estimates that the initial rate of an average well is 800 on 320, it would be 400 on a 160-acre based gas well. I think you will see that on that basis, fair market value is somewhere around 47 to $50,000.00. I think, if you will notice the top of each page, we have estimated a completed gas well, including surface equipment, will be approximately $80,000.00. I think the Exhibits in themselves make it quite evident that the only way that this Pool can be operated, at least, as far as an independent operator is concerned, that you could only drill on 320-acre spacing.

Q Do you have anything further you care to add?

A I don't believe so. We concur, as I believe I have already testified, in the rules as proposed, and we certainly believe the 320-acre spacing is essential in the gas area, and I believe that is all I have.

MR. BRATTON: We will offer Redfern and Herd's Exhibits Numbers 1 and 2. You prepared both of those?

A Yes, I did. If there are any errors, mathematical errors, I made them.

MR. BRATTON: We will offer those Exhibits.

MR. PORTER: The Exhibits marked Redfern 1 and 2, without objection, will be admitted to the record. Anyone have a question of Mr. Redfern? You may be excused.

MR. ERREBO: We will have one witness, Mr. Porter.

(Witness sworn.)

VAL R. REESE

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

DIRECT EXAMINATION

BY MR. ERREBO:

Q Would you state your name, please?

A Val R. Reese.

Q What is your occupation, and where are you located?

A Geologist; and I live in Albuquerque.

Q Are you connected with Val R. Reese and Associates?

A Yes.

Q And, what is your capacity with them?

A I am president of Val R. Reese and Associates.

Q Mr. Reese, would you give the Commission a brief resume of your background of education and experience?

A I graduated from Stanford University in 1947 after returning from World War II, and I was employed in 1948 as an exploration geologist by Phillips Petroleum Company, and made district geologist for Phillips Petroleum Company in 1952 in the San Juan Basin. I became chief geologist of Pacific Northwest Pipeline Corporation and

Northwest Production Corporation in 1954. In 1957 I went independent and formed a consulting organization.

Q Now, in your employment with these companies during the 1950's, did you have occasion, as a part of your duties, to make reserve calculations for gas pools?

A Yes, I did. With Phillips Petroleum Corporation I took part in making reserve calculations, along with finding oil and gas reserves for the pipeline to the Northwest.

Q That was actually the one that was built by Pacific Northwest Pipeline Corporation, is that right?

A That's correct.

Q Did you have any other occasion to make studies of reserves of gas?

A Yes, with Pacific Pipeline Corporation I made reserve studies for application to take gas reserves from the San Juan Basin to the East, Chicago, through Colorado Interstate.

Q And, did you testify in connection with those reserves before the Federal Power Commission?

A Yes, I did.

Q How long have you given study, and worked in the San Juan Basin?

A Since 1948.

Q And, what was it that first directed your attention to that particular area?

A The gas reserves in the Eastern part of the San Juan Basin that were, as of that date, undiscovered or undeveloped.

Q And, in connection with the consulting work which your firm does, do you also have occasion to do some engineering work and supervise it?

A Yes, I have. My engineering background has been learned through practical experience.

Q Now, you have been here and heard the testimony, have you not, which has been given by the El Paso and Pan American witnesses?

A Yes, I have.

Q And, you have also heard the rules outlined and discussed? Is that correct?

A Yes, sir.

Q Actually, you have been furnished copies of these rules in advance of the Hearing, had you not?

A That is correct.

Q Have you made a study of the Devils Fork Pool as presently defined?

A Yes, I have.

Q And, what is your opinion with regard to the adequacy of these rules to meet the problems which exist in this Pool?

A I feel that they are adequate with the exception of the gas take within the Devils Fork Gas Pool on a per well basis.

Q Actually, you are referring to the allocation formula?

A That is correct.

Q And, you fully support all other phases of the rules as

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proposed by El Paso, is that correct?

A That's right.

Q Have you made a study to determine what would be the proper allocation formula for the gas area in this Pool?

A We have made a study, based on reserves for five wells.

Q And, what conclusion have you reached as a result of that study, and what do you recommend to the Commission that they adopt for an allocation formula?

A From the study of the recoverable reserves of these five wells, we conclude that the reserves throughout the Devils Fork Gas field are approximately equal, and on the basis of this we would recommend a straight acreage deliverability per well.

Q Now, you mean a straight acreage allocation formula, is that correct?

A Yes, sir.

Q You do not advocate the inclusion of a deliverability factor in that formula, do you?

A We would like to recommend, as near as possible, that the deliverability, the take from each well be taken so as to fit everyone's picture, and we would feel that if the deliverability formula was adopted that the factor of 75% deliverability and 25% acreage should be reversed to 25% deliverability and 75% acreage.

Q That, actually, is your second choice, is that correct?

A Yes, sir.

Q Will you refer to your Exhibit Number 1 and state, just briefly, to the Commission what that represents?

A This Exhibit shows the wells in the Devils Fork Gas field, and the potentials beside the wells, and it also has a figure beside the wells underlined in red, which represented the reserve calculated beside the wells.

Q And, what does the color blue underlined mean?

A That is the open flow gauge.

Q And, do you also show the deliverability of these wells insofar as you have that information?

A That is correct. That is just pencilled underneath.

Q Now, have you with you and have you prepared Exhibits reflecting the calculations of the reserves attributable to each of these wells or tracts which you have shown on your Exhibit Number 1?

A Yes, I have.

Q And, is that represented by Exhibits 2-A through 2-E?

A That is correct.

Q Would you refer to those Exhibits and briefly point out to the Commission the highlights of what is shown?

A Referring to Exhibit 2-A, the reserves are calculated on the lower sand of the Gallup, termed the Mayre sand, which is the sand that is commonly completed throughout the reservoir. Acreage and well-site, shown as 320 feet, net sand thickness, shown in the case of Canyon Largo 89, taken at 19 feet. Porosity, oil saturation, water saturation of the sand are all taken from the core analyses which are shown in Exhibits 3 and 4. Calculated bottom hole pressure is actually based on Mr. Redfern's No. 1 Spur bottom hole pressure reading. The bottom hole temperature of 118° is determined from electric logs; that is temperature when the electric logs were run that was recorded. The compressibility factor is derived from the charts common to the industry. The GOR per acre foot originally in place has been calculated, and gas per acre foot remaining at 250 pounds psia. Abandonment pressure has also been calculated in the same No. 89 Well. Recoverable gas per foot was arrived at by subtracting the gas per acre foot originally in place from the gas remaining. The recoverable gas figure was derived, per acre, by multiplying the net sand thickness and then the total recoverable gas into the 320 acres. Oil content was estimated at 10 barrels per million cubic feet of gas.

Q Now, in determining the net sand thickness which you show, Mr. Reese, what measures or what rules did you go by?

A We went by the rules of a maximum of 60% water saturation as determined from core analyses, and minimum porosity of 5%, and there was very little sand with that low percentage of porosity in the core analysis present in the two cored wells, which are the El Paso Canyon Largo No. 89 and the Escrito-Federal No. 24, 1-24, Brown Well.

Q Actually, those two core analyses are shown on Exhibits 3 and 4 respectively, are they not?

A That is right. As to determining what our pay footage was from the core analysis, we correlated that with the electric log.

The 89 Well added two more feet at the bottom in addition to the core analyses from the electric log. We came up with a total of 19 feet of pay sand in the 89 Well.

Q How does that compare with the number of feet shown by the El Paso on their Exhibit Number 3?

A It is 9 feet more of net pay sand. This extra footage results in our having probably a higher water saturation and lower average porosity than compared with El Paso's method of determining net pay.

Q And, what is the comparison between what the El Paso shows on their Exhibit Number 3 as to the 1-24 Killarney Well? How many feet of net productive sand did you pick in making your reserve calculations?

A On the No. 1-24 Killarney Well we arrived at 37 feet of net productive sand.

Q And, what did the El Paso get for that well?

A Five feet. Our average porosity for this 37 feet is 10.6%; the water saturation is 30.3%--excuse me, that is the residual oil saturation, 30.3%; water saturation, 38.7%. The permeability shown on the No. 1-24 averages .23 millidarcies, which can be compared with the Canyon Largo 89 average of 13.5 millidarcies.

Q Mr. Reese, is the method which you used here a standard method of calculating reserves?

A Yes, sir, it is.

Q And, to what extent are you familiar with the use of a

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one-tenth millidarcy limitation, as used by El Paso?

A The lower limit of millidarcies is a matter of judgment. .001 could be used to determine whether or not fluids or gas could pass through rock, or one-tenth millidarcy. I think there, one-tenth is a good lower limit.

Q In other words, however, you don't prefer to use that limit, do you?

A No, we base most of our volumetric calculations on the porosity.

Q You feel that porosity is a better measure in picking net sand thickness than the use of permeability?

A Yes, sir, I do.

Q Do you know which of the two methods is most commonly used by gas reserve engineers, based on your experience in this type of work?

A The porosity.

MR. PORTER: Before we proceed with this case, I'd like to announce the Commission has decided that September oil allowables will be 33 for the Southeast and 70 for the Northwest, and that we will continue to authorize back allowables in the Southeast. Also, I would like to announce at this time that Case 1634 will not come on until in the morning, so those people who are waiting here for that Case may be released for the rest of the day.

Mr. Errebo, would you proceed with your examination of the witness?

Q (BY MR. ERREBO) Mr. Reese, you have determined the recoverable pipeline reserves as to each of four wells as shown on your Exhibit A, is that not correct?

A Yes, five wells.

Q And, have those reserves been shown underlined by red on Exhibit Number 1?

A Yes, they have.

Q Now, rather than have you enumerate each one of them, can you state whether or not, in your opinion, an examination of the reserves attributable to those five wells shows that they are about the same for each of those tracts?

A They show that they are about the same.

Q There are certain other wells you haven't made those calculations on. Will you state why you have not done so?

A I feel these five wells were representative, and also the other wells are new wells and we don't have, in some cases, enough information.

Q So, then, is it your opinion, based upon this study, that the reserves attributable to each of the wells drilled in this Pool on a 320-acre basis are approximately the same?

A That's correct.

Q Now, have you also shown on Exhibit Number 1 the deliverability of these same five wells?

A Yes.

Q And, have you been able to detect any trend of high perme-

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ability in any part of this Pool?

A Yes, I have. The North part of the Devils Fork Pool in Section 17, 18 and 13 are in a high deliverability area, while the South part, the West 1/2 of Section 20, 19 and 24 are, as of this date, a low deliverability area.

Q In other words, Section 13 contains the Redfern-Herd No. 2 Well, which has deliverability of 10,000,000 cubic feet, is that correct?

A That's correct. The 10,000,000 cubic foot deliverability figure is approximate, as we did not have the exact figure, so we asked Mr. Dugan, Mr. Redfern's engineer, concerning this deliverability and he said it is approximately correct.

Q And, what is the deliverability of the well in Section 18?

A It is 6,000,000 cubic feet.

Q And the deliverability of the well in Section 17?

A That is an estimate on our part, and we feel it will deliver at least 5,000,000 a day.

Q That is the El Paso Well in Section 17?

A That's right.

Q Those wells, in your opinion, then, lie in a relatively high permeability trend, is that right?

A That's correct. The high permeability in the core analyses on the El Paso 89 Well and the high permeability indicated in the 1-G Skelly Well indicate that the high deliverablity of the wells is due to high permeability.

Q And, the wells in Sections 24 and 19 have relatively low permeabilities, don't they?

A That is correct.

Q Based upon their deliverabilities?

A Yes. The actual deliverability of the 1-24 is 411,000 cubic feet.

Q That is the Killarney 1-24 in Section 24?

A That's right.

Q And, that has a deliverability of 411,000 cubic feet?

A That is correct, per day.

Q Look on the North in Section 13 and state what deliverability of that well is?

A Estimated 10,000,000.

Q And, how do the reserves of those two wells compare with each other?

A The reserves are very similar. In Largo No. 2 Well the reserves are 2,173,120 MCF, and the reserves in the Killarney 1-24, 2,395,520.

Q The Killarney Well has actually slightly higher reserve figure than than the Redfern-Herd No. 2 Well, does it not?

A Yes.

Q Yet its deliverability is less than one-tenth of the Redfern No. 2 Well, is it not?

A That's correct.

Q Have you had occasion to consider which of these two wells would produce their reserves first that you have attributed to them under the formula which the El Paso has recommended?

A Yes, I have. The Largo No. 1 Well in Section 13 would produce its reserves first.

Q And, then, after it had produced its reserves, actually, of course, the well wouldn't know when it had produced them, would it? It would continue producing like it had in the past; it wouldn't stop, would it?

A No, it wouldn't.

Q Actually, the gas which it produced after it had produced the reserves which you have calculated for it would come from some other lease?

A That's right.

Q And, would it be most likely to come from leases having lower deliverabilities?

A Yes, most likely come from the South area of the Devils Fork.

Q And, do you find similar comparisons among other wells in the same Pool?

A I believe reserves would be produced from the entire South area into the North area of the Pool.

Q So the drainage would occur from the South to the North, is that correct?

A That's correct.

Q Actually, does the sand thicken as you go from North to

South?

A That's right.

Q So, although you may have a lower permeability to the South, you have more sand section, is that correct?

A That's correct.

Q And, it is your opinion that, nevertheless, the wells to the South have approximately the same reserves as the wells to the North; that is shown on this Exhibit, is it not?

A That's right.

Q This being the case, do you see any need for deliverability factor in the formula?

A No, I don't.

Q Do you see any relation between reserves and the open flow potential or the deliverability of a well?

A No, I don't. The only relation I see between the deliverability is that the one area has higher permeability than the other.

Q Then, is it your opinion that a formula which provided for a heavier acreage factor, say a straight acreage factor, would be more desirable for this area?

A Yes, sir.

Q Do you believe that the allocation formula should be tailored to the particular conditions which exist in a particular field?

A Yes, I do.

Q So your testimony here today doesn't necessarily mean, does it, that you are a straight acreage man?

A No, it doesn't.

Q You feel that, under certain conditions, deliverability would have a place in the formula, but not here, is that correct?

A That is correct.

Q What is your recommendation, then, to this Commission concerning a proper allocation formula which would prevent the drainage you foresee under the formula which El Paso advocates?

A My recommendation would be to place the allocation on straight acreage or a modified percentage of straight acreage.

Q And, you do support all of the rest of the rules which El Paso has advocated, is that correct?

A Yes, I do.

Q Do you have anything further that you want to add to your testimony?

A Yes, I would like to state that our 1-25 Mesa Well, located in the Northwest of Section 25, outside of the present limits of the Pool, produces 42 gravity oil and its gas-oil ratio is probably around 75,000 to 1.

Q And, what does significance does that have in the record?

A I believe that would answer a question that came up today, if there was any known deviation from 60 gravity distillate and the 100,000 cubic feet. This is a case of where the gas-oil ratio will probably be less than 100,000 to 1. We don't exactly know yet, because the well is not on pipeline.

MR. PORTER: In this case, then, you are pretty sure it is oil in the reservoir?

A Yes, sir, it appears to be.

Q (BY MR. ERREBO) Mr. Reese, you were here this morning when I was asking questions of Mr. Woodruff, were you not?

A Yes, I was.

Q And, are Exhibits 3 and 4 the Exhibits which I handed to Mr. Woodruff and ask that he examine and give information from?

A That is correct.

Q Were Exhibits 1 through 4 prepared by you, or under your supervision?

A Yes.

MR. ERREBO: We offer them in evidence.

MR. PORTER: Without objection the Exhibits will be admitted.

MR. ERREBO: That is all we have.

MR. PORTER: Anyone have any questions of Mr. Reese?

CROSS EXAMINATION

BY MR. BRATTON:

Q Having identified myself to Mr. Woodruff, I don't believe I need to say I come, not in support of your position. Did I understand you, Mr. Reese, during Mr. Errebo's testimony, to say that these calculations of recoverable reserves were a standard method of calculating reserves, which I understand is by a pure volume study?

A It is based on a volume.

Q Now, in that there are many factors, but one factor that is very significant is the net sand thickness, is that not right?

A That's correct.

Q Now, as that sand thickens and thins that affects the ultimate reserve you come out with?

A That's right.

Q How many engineers agree on how you pick net sand thickness; is there one standard method of picking that?

A No, there isn't. There are various methods.

Q Your sand thicknesses you have picked here differ drastically from those picked by Mr. Woodruff.

A Not a great deal. I believe our sand pick results in about 25% more reserve than El Paso's.

Q Well, but from well to well, they differ quite a bit, do they not?

A Not that I know of.

Q That will develop. I did not recall. I thought they did.

A His volumetric reserves came to one million six hundred ninety-some thousand cubic feet for 320-acre spacing, and he stated that that was an average for the five wells which are shown on our Exhibit 1.

Q Now, in calculating your net thickness, net sand thickness or net pay, I think you said you took everything up to a 60% water saturation?

A Yes, we did, and a minimum of 5% porosity of the sand.

Q Is that 60% figure higher than some other engineers would use?

A Yes, I believe El Paso uses 40%.

Q So that you come up with varying figures on reserves depending upon your computation of that sand thickness and the methods of computing that differ from engineer to engineer?

A That's right. Our reserves seem to differ about 25%.

Q Now, Mr. Reese, you have the two wells, as I recall it, in the Southwest part of the Pool, is that correct?

A I have one well; Killarney Oil Company has a well in Section 24.

Q And, then your well is located where?

A In the Northwest of Section 19, No. 1 Lybrook.

Q Now, did you complete the Killarney Well for them; didn't you have something to do with that?

A We drilled that well for Killarney Oil Company.

Q How much interval did you have open in the Killarney Well and in your well; what are your perforated intervals?

A We perforated the lower sand, the Mayre sand, and the one we have been talking about, and we perforated the two upper sands above the Mayre sand.

Q How much total footage would you say, Mr. Reese?

A About 80 feet, I would say, without looking it up.

Q Do you have any idea how much it is perforated in the other wells up above?

A Yes, I would say about 20 feet in the lower sand.

Q So that actually, in your estimate of the net sand thickness, it is worthwhile perforating considerably below the others?

A It does in this case because of the low permeability. I felt that taking any larger net sand perforating zone would result in obtaining a well that would be commercial.

Q Going to the Killarney Oil Company 1-24 Well, Mr. Reese, based on the normal type of contract in that area, could you tell me offhand approximately how long it might take to produce the recoverable reserves you have under that tract?

A About eighteen years, or even longer.

Q What is going to happen to that gas and the gas through the whole gas zone if it is produced at that type of a rate?

A The gas in the North part of that Section would be drained into the wells to the North. Evidence of drainage has already taken place by the fact the 1-24 Well dropped in pressure before it was put on the line, while the Redfern Wells were being produced.

Q Under the whole scheme, total allowable is tied on the oil production, is it not?

A Yes, that's right.

Q And, I don't remember what was testified to, but certainly that oil production is not going to last eighteen years, is that correct?

A That is correct. However, if the wells in the North produced unrestricted they might only last a year.

Q This is, basically, the same dispute that has been fought in so many areas, is it not, Mr. Reese, as to the allocation formula between the people whose wells do not exhibit the highest deliverability and those who do have higher deliverabilities?

A Yes, it is.

Q Other than that you agree with the El Paso rules?

A That's correct.

MR. BRATTON: I have nothing further.

Q (BY MR. HOWELL) Mr. Reese, about the only point of difference that you have in calculating your estimates of reserves with Mr. Woodruff is on the net sand thickness, isn't it?

A That's correct.

Q You have used approximately the same figures, based upon cores for the porosity and for the connate waters, that is correct, isn't it?

A Yes, we used the same information.

Q Now, there is, however, a marked distinction between the net sand thickness that you used and which Mr. Woodruff used, comparing, first of all, El Paso's Canyon Largo No. 89. You gave that a net thickness of nineteen feet, and Mr. Woodruff's estimate gives it a net thickness of eleven, I believe?

A That's right.

Q And, then, when we come to the Redfern and Herd No. 1, which you give a net thickness of 23 feet, Mr. Woodruff's calculations give that a net thickness of twelve feet, which is the highest given to any one in the Pool, isn't it?

A That's right.

Q Likewise, when we get to the Val Reese 119 Lybrook, your calculations give that a net thickness of twenty-nine feet, while Mr. Woodruff gives it a net thickness of ten?

A That's correct.

Q And, with the Redfern and Herd No. 2 Largo, you gave that a net thickness of twenty as compared with twelve given by Mr. Woodruff?

A That's right.

Q And, finally, the Killarney 1-24 Well, which Mr. Woodruff gives a net thickness of five feet, you give thirty-seven feet?

A That's correct.

Q So that the difference in the recoverable reserves between your study and his is attributable almost entirely to the different interpretations as to the net pay thickness, is it not?

A That's right. We based ours on core information.

Q Now, how many feet did you say were open in this 1-24 Well?

A I estimated about eighty feet.

Q Now, about what depth do you find the same sand in that well as is the producing sand in the Largo 1, the Largo 2, Largo 3, and the Unit 89, about what depth?

A The top of the lower sand in the 1-24, as indicated by core analyses, is about 5439, and the Canyon Largo indication from the core analyses is 5485.

Q Well, now, what sand do you find down around 5500 in that 1-24 Well; is that sand open to the well bore?

A Yes, sir, it is. That is what we call the Number 1 sand, and that is the same sand that is in the Skelly area to the North in the Otero field. Below that is a second sand, Number 2 sand.

MR. ERREBO: I will let him look at the log on this for accuracy, perhaps.

MR. HOWELL: Certainly.

Q (BY MR. HOWELL) Now, the 93 feet of net pay that you give in the 1-24 Well has an average permeability, I believe, of 2400ths of a millidarcy, is that correct?

A 2300ths of a millidarcy.

Q And, the average for the Pool, as a whole, is somewhat above 13 millidarcies?

A Well, that is taken into account in both areas. When you weigh the high millidarcy area in the North, and take into account the low millidarcy area, it would still be about the same average, but it would be weighted toward the North part of the field.

Q Now, the low permeability areas reflect the fact that the rock there just will not give up the gas at the same rate of time as the area having the higher permeability, isn't that correct?

A That's right.

Q And, you mentioned you could have as low as eleven thousandths of a millidarcy and still have some permeability, I believe, in your direct testimony?

A That's correct.

Q There isn't anyone sitting here in this room that would ever see the depletion of a field that had one 1,000th of a millidarcy, is there?

A No, but there isn't anyone who could say there wouldn't be some contribution to a reservoir from that low millidarcy.

Q Now, from the gas surrounding the 1-24 Well which can't be produced in the well bore of the well that is right there, wouldn't that same low permeability keep it from moving on up into another area?

A That would be que[illegible]ble, because the indications are that the permeability would increase Northward from that well toward the Redfern Well.

Q That is an assumption you make?

A It is not an assumption so much as because of the fact there has already been a drop in the wellhead pressure of the 1-24 Well, which indicates movement of gas.

Q But there is, I think all of the testimony shows, there is communication throughout the reservoir?

A That's right. That would show, no matter what the measured permeability is, there is some communication.

Q I believe the deliverability of the 1-24 Well, as was established by you, was about 441,000, wasn't it?

A 411,000.

Q And, the average production was estimated under the formula in order to equalize with the oil at somewhere around three-quarters of a million, isn't that correct?

A The average production would be that high. However, that well couldn't produce that much.

Q So that that well would have great difficulty in producing its allowable in any event if it were to get it, would it not?

A That's right.

MR. HOWELL: I think that is all.

Q (BY MR. NUTTER) Mr. Reese, at the Hearing on the classification of the gas pool in this area in March, 1950, there was some reference made to an extremely shaley member that separated the Escrito and the Devils Fork areas. I wonder where this Reese No. 1-25, in the N. W. 1/4 of the N. W. 1/4 of Section 25, laid in respect to that impermeable area?

A The 1-25 well lays in an area of low permeability. However, the porosities are similar to the 1-24. In fact, they are probably better. As far as the shaley area, I believe that would be reference to an area of low permeability. That is, that would be the way I interpret it.

Q Would the characteristics of this well indicate it properly belongs in the Escrito or Devils Fork?

A I'd say Devils Fork. It is a gas well.

Q But you said it produces what gravity of fluid?

A 42 gravity.

Q It may be a high ratio well in the Escrito-Gallup Pool, however?

A Well, when we potentialed it, the well, the volume of gas that we got out of it would indicate that it would more properly belong in the Devils Fork field, and if it was in the Escrito field, as far as the volume of oil goes, that would be produced, it would be a non-commercial well.

Q What is the vertical interval that is perforated in that one?

A We have the main sand, or Mayre sand, and the Number 1 and 2 sands perforated above it.

Q (BY MR. PAYNE) There is at least one well in this area, and I gather two. This main sand body on which this formula is based is open to the well bore?

A Yes, that's right.

Q More than one sand?

A There is more than one sand in the area; was that your question?

Q Yes, which is open to the well bore?

A Yes, sir. Our wells in the South have more than one sand open.

Q What, in your opinion, does that do to the relative withdrawals of oil and gas under the proposed formula?

A I don't believe it will affect it in the main sand at all.

Q Isn't the formula based on the characteristics of the main sand body?

A That's right.

Q Now, unless those other two are identical, it is going to affect the formula?

A Well, I don't know how it would; it may affect it.

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

MR. BUELL: May it please the Commission, during Mr. Reese's testimony several references to made to his 1-25 Well with respect to which pool it belongs in. I want the record to reflect that Pan American's silence on that point here should not be construed as inferring that we agree his 1-25 Well should be in Devils Fork.

MR. PORTER: Anyone have any further testimony in Case 2049? Any statements?

MR. CUNNINGHAM: Dan Cunningham, representing Killarney. It seems like the Killarney Well has been going over the coals today, but we are just a bunch of little Irish boys from San Francisco, and we'd like to get a little gas out of that hole we drilled there, and we feel, in view of the expert testimony that has been rendered here that these holes with high permeability and high deliverability will drain 320 acres. It is a cinch they will drain our well; undoubtedly, if they are allowed to produce in the volume they have in the past. I think Mr. Reese demonstrated we have had a drop in our pressure, in our well, even before it went on the pipeline, so evidently it has had some draining prior to that time, so we will support the rules as asked for by the El Paso Gas, but we'd certainly like some consideration in the formula which would restrict drainage from our present wells.

MR. PORTER: Anyone else have a statement?

MR. BRATTON: If the Commission please, briefly, I'd like to say we are, first and foremost, in support of the volumetric equivalent formula as proposed by El Paso here. I know that there are some doubts on certain aspects of it because it is something new in New Mexico. This is the first Pool in which this approach has been suggested to this Commission in New Mexico. I certainly think the ends to which it is aimed are loyal, and I think the Commission agrees with us that every effort should be bent to equalizing the withdrawals from the two areas. I am confident that the problems which are presented are not insurmountable, and that if this Commission is ever going to attempt a volumetric equivalent withdrawal formula, this is the ideal situation in a reservoir in its inception, and one in which all of the operators agree that it should be tried. Certainly there are adequate safeguards for the oil area, and we feel that the gas area will also be adequately protected. Certainly there are safeguards to where, if it is shown that there is anything awry, steps can be taken to correct it. As to the rest of the formula, proposed by El Paso, we certainly support it. As to the allocation formula within the 75 acres times deliverability and 25, we support that as it is in the standard formula throughout the Northwest. We see no difference in this Pool, and there are differences between engineering testimony, of course, as to whether you have a flat volume of gas under each tract, or whether it varies. It is simply our position that this is the allocation formula through the Northwest, and part of the Standard Rules, and we advocate its adoption here. Thank you.

MR. HOWELL: I shall not attempt to again review testimony that Mr. Bratton has mentioned. I will try to direct myself primarily to a factor which we think has been proved so conclusively that there isn't a shadow of a doubt, and I refer to the ability of wells to drain an area equal to at least 320 acres, and to adopt any rules which could have the possible affect of forcing any operator to drill on a closer spacing pattern would be flying directly in the face of uncontradicted testimony, and we feel that there is ample authority and ample precedent in the pools in the Southeast that have been delineated as gas pools to establish an oil unit and to relate an allowable of gas that may be produced from an oil unit to the gas allowable that is produced from the larger gas unit. The Commission should continue the classification which it has given this Pool as the Devils Fork-Gallup Gas Pool, and that the rules should definitely permit 320 acres to be allocated to a gas well, up to that amount, and at least 80 acres to an oil well.

With reference to the allocation formula, the only difference in testimony seems to be different interpretations from logs as to the net effective pay, and we submit that the majority of the weight of the testimony, the weight of the testimony supports adopting for this Pool the same deliverability factor which is then incorporated in rules governing other pools in the Northwest.

MR. ERREBO: May it please the Commission, in spite of the controversy on the allocation formula, Val Reese supports in every regard the proposals which have been made by El Paso. Certainly, the Commission well knows it will be faced with the same problem in the future. We think El Paso has presented here, today, a good solution to a tough problem, and one that will be workable. I believe the testimony on the cross examination has not shown any weaknesses or any difficulties that would prevent a reasonably easy application of the formula which they proposed.

As to the allocation formula, we do differ on that. El Paso's whole case, or at least a large amount of it, was based upon their showing by their Exhibit Number 3, I think it was, the relationship between initial potential and the effective net pay in a well of permeability. We were able to show in one instance where we had a log, a core analysis on a well, and by the El Paso witness himself, that where his Exhibit showed five feet he actually picked twenty-two feet off that well. I wonder, then, if that doesn't cast doubt upon the other assumptions they have made for the wells on which they do not have the core analysis, and that doubt being the case, then I wonder if it does not cast doubt on their entire theory that initial potential is reflected and does show reserves in place. We believe, on the other hand, the information and the testimony which we gave was based upon reserve calculations that are in common use. Certainly there are different ones. These have been used quite commonly by this witness in other types of calculations, and they do show relatively similar reserves under each tract. That being the case, we feel that the inclusion of deliverability has no real basis, no substantial basis, and if it should be included it should only be included to a very minor extent.

MR. BUELL: May it please the Commission, it seems to me that the Commission here in the Devils Fork-Gallup Pool has an excellent opportunity to prorate and regulate this Pool so as to prevent waste, as well as afford the maximum amount of protection of correlative rights. The volumetric formula, as has been proposed here today, is scientifically sound. It is based on valid engineering principles, yet it is a practical method of regulating this Pool. Pan American sincerely hopes that the Commission adopts the rules that were proposed.

MR. SELINGER: May it please the Commission, representing Skelly Oil Company, we likewise agree with the El Paso position as expressed by Judge Howell. If there is one thing this case did show, that was the excellent drainage that a well will have in this field. In this particular reservoir we think that the only testimony that is in the record now is that one well will drain 320 acres in the gas. Now, as brought out by Mr. Woodruff in cross examination, in the event an error is made as to the classification of the type of this field, and it turns out to be predominantly oil, the principle of volumetric equivalent, which hasn't been denied by any engineer in any State, is a proper method of allocating between oil wells and gas wells as classified by those respective State Commissions as being proper, not only for the prevention of waste, which is very self-evident in that you do not blow off the gas cap off the oil reservoir and permit the oil to migrate into dry area, but you permit the protection of correlative rights. The matter of prorating combination fields is, in itself, very simple. To my way of thinking it is surprising that this State has gone as long as it has without adopting a volumetric equivalent basis for combination pools. I think it should have been done years back. I think the Commission missed an opportunity in Gallegos to do that, and I think now is the most appropriate time to establish the principle of volumetric equivalency, particularly where you have testimony so vivid and so evident, without any contradiction from any source, at least, in the gas cap a well will drain in excess of 320 acres, and we certainly urge the Commission's continuation of the adoption of the present current 320-acre spacing for gas wells in that field.

With respect to other aspects of the application, the Commission well knows historically Skelly's position, particularly with respect to a formula within the field. Our view today is the same as it was years back when we fought it. We just don't like deliverability.

MR. MERRION: May it please the Commission, J. G. Merrion. I'd like to explain to the Commission that my interest stems from the fact my brother and I own operating rights in Section 27, Township 24. We are very much in favor of the 320-acre gas cap spacing, and the volumetric equivalent withdrawal from the gas cap, as proposed by El Paso. We favor 80-acre and wider spacing in the oil area, and we favor a gas proration factor based on 25% deliverabilities and 75% acreage.

MR. PORTER: Does anyone else have anything to offer in this case? The Commission will take the case under advisement.

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I, JUNE PAIGE, court reporter, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and Notarial Seal this 26th day of September, 1960.

June Paige
NOTARY PUBLIC-COURT REPORTER

My Commission Expires:

May 11, 1964.