BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

April 10, 1962

CASE NO. 2504

VOLUME TWO

MORNING SESSION
April 20, 1962

MR. PORTER: The hearing will come to order, please. We will continue with Case 2504. There was something in the paper this morning to the effect that if we did not conclude the hearing this afternoon it would resume at some later date. That date might be in the morning. We'll postpone that decision as long as we can.

Mr. Keleher, would you call your next witness?

MR. KELEHER: Someone else may have questions of Mr. Street.

MR. PORTER: That's right. We weren't through with the witness on the stand, Mr. Street. I was about to let him get off too easy. Anyone have a question?

MR. KELLAHIN: I would like to ask Mr. Street some questions.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Street, on your direct testimony you stated, as I recall, that there is a direct relationship between deliverability and reserves, is that correct?

A Yes.

Q So we all understand just what we're talking about, would you please define reserves for us?

A Reserves are the hydrocarbons in the reservoir rock under a given tract of land, and there is a difference between

reserves and recoverable reserves, as we are all aware. The in place reserves or reserves as such will not all be recoverable.

Q Now in drawing the conclusion you did, this relationship between deliverability and reserves, were you then referring to producible reserves?

A Yes.

Q Are those producible reserves the reserves, producible reserves underlying the tract dedicated to the well?

A Yes.

Q Those are the reserves we are talking about?

A For each individual well.

Q Yes. That is the reserves on which you base your relationship between deliverability and reserves?

A Yes.

Q Direct relationship. On what factors do you base your conclusion that this relationship exists?

A I believe if you would also recall it, the thickness or the isopach map indicated direct proportional relationship between the deliverability map, which is the index to the reserves, the recoverable reserves.

Q This isopach map you are talking about is based on the gross sand thickness, is that right?

A Yes, sir.

Q Didn't you testify yesterday that there was no relationship between gross sand thickness and net pay?

A I believe I made the statement that the gross sand was the maximum sand in the bore hole which could contain hydrocarbons, and that it was not, it could not, this gross isopach could not be used to calculate reserves; however, by it being the maximum amount, that it was the most optimistic consideration that could be given, and that because the net could never be greater than the gross, then it seemed reasonable if there was a relationship it wasn't the maximum possible in the deliverability. With the thickness parameter which I have attempted to give consideration to here, then there should be even better consideration for net and deliverability for this one reserve parameter, thickness.

Q Then in other words you are saying that while it does not necessarily reflect the reserves, you are using it for that purpose?

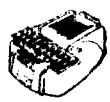
A For this one parameter.

Q For this one parameter, and that is the information upon which you find this direct relationship you are talking about?

A Yes, sir.

Q Now referring to this deliverability map that you prepared, and your gross sand thickness map, in effect they both just outline the developed area of the Pool, don't they?

A That was the attempt. Even within the developed areas of the Pool, there was, due to lack of control either through data or drilled locations, there is some interpretation.



Q Now your deliverability map is contoured on an interval of 500 MCF, is that correct?

A Yes, up to 2,500 MCF.

Q You did not go beyond the 2,500?

A No, sir.

Q Do you know how many wells that would leave not represented in the Pool?

A In what manner, sir, the dry holes or the producers?

Q No, sir, I'm talking about wells in excess of 2,500.

A I believe the percentage figures have been given by others in previous testimony.

Q Well, your next interval of cores, had you gone on on the same scale, would have been 3,000 MCF?

A Yes, sir.

Q Would you accept a statement that this would leave some sixty-one wells in excess of 3,000 MCF that are not represented on your map?

A All wells are represented on the map with the deliverability number indicated by that particular well bore, so it has not been eliminated from the map.

Q Then what you have done is taken the high deliverability wells and averaged them in with the low, in order to arrive at what you say is the best area?

A No.

Q Did you use that figure in making your calculation on

deliverability?

A I did not make any calculation on deliverability. I took the deliverability for each well as indicated on the 1961 deliverability schedule, and placed them by each well that had given deliverability, and contoured them accordingly.

Q In other words, what I'm saying is, you took the high deliverability figures, averaged them in with the low ones in the same area to find out what your average deliverability was?

A No, there was no average on this. As I say, every well that has a deliverability figure has that deliverability figure written by the well symbol which it represents, and those numbers are on the map, on all maps; every deliverability number that was on the 1961 deliverability schedule is shown on the map.

Q Then you took the high deliverability figure in some instances and ignored an offsetting low deliverability, did you not, in drawing your contours?

A Not for the intervals contoured, no, sir.

Q Would you step over to your deliverability map, Mr. Street, and look at Section 27 in 29 North, 13 West? There are two wells on that section, are there not?

A Yes, sir.

Q What are their deliverabilities?

A The one in the Southeast Quarter was listed as 4,293 MCF; the one in the Northwest Quarter was listed as 3,511 MCF.

Q Does that mean that the one in the Northwest has

approximately eight times the reserves as the one in the South --

A I'm not --

Q You said 3,000, it's not 3,000.

A 30,511 MCF.

Q Does it mean that well has approximately eight times the reserves as the one in the South in the same section?

A I believe there you are talking in terms of the total reserves present. I believe I have always been quite clear that we are talking about one major parameter; the consideration for porosity and the saturation will have to be taken into consideration.

Q You didn't take them into consideration in drawing the conclusion there was a relationship between reserves and deliverability?

A These maps show that the thicker sand bodies occupy similar positions to the better deliverabilities of a million or above, which shows a direct proportional consideration between the thickness parameter and the deliverability.

Q Then the well in the South Half of Section 27 doesn't have as thick a sand body, is that correct?

A On the gross isopach map, if you will refer to it on Exhibit 1, it shows the major portion of Section 27 falling above a gross thickness of 60 feet.

Q For which well, or is that for both wells?

A The interpretation is that both wells would have in

excess of 60 feet gross.

Q So your relationship between gross sand and deliverability is not borne out there?

A Well, as I say, for the actual reserves, the reserve calculation, you would have to have the other parameters.

Q But you don't have them?

A I don't have them.

Q You haven't offered them in any instance to this Commission in regard to your calculation of relationship between reserves and deliverability?

A I have said there is, that the thickness and the deliverability indicates a direct proportional consideration to the deliverability.

Q But not in this instance?

A I would say so.

Q Well, let's look at a couple of more wells. In 27, 11 and 26, 11, where they join there, you have one contour surrounding wells ranging from 2,860 to 12,894, is that correct?

A Would you repeat where those wells are located?

Q Where 27 North, 11 West and 26 North, 11 West join.

A Would you continue with your question?

Q In one contour interval there, you have wells ranging from 2,860 up to 12,894, isn't that right?

A That is correct.

Q And in that one section where the 12,894 well is located,

you have another well of 5,995, is that correct?

A That is correct.

Q Do you show a comparable difference on your gross sand thickness in that area?

A They are shown to fall within the 20 to 40 foot gross isopach interval.

Q There again, all you are basing your difference on is the deliverability of the well, then, not on sand thickness at all?

A I believe that what is taking place is that we're attempting to establish on a very minor scale when you consider the areal extent of the Basin-Dakota Field as defined, these erratics as they were, I believe, referred to in previous testimony. And we're talking about a tremendously large area. We're trying to set up the best consideration for a tremendous area, not for an isolated erratic variance. Here again there's the possibility of the difference in porosity and saturations that should be given definite consideration, because I wish to point out that without being a reservoir engineer, I believe that these dry holes as indicated on both plats 1 and 2, or Exhibits 1 and 5, show what is happening just immediately to the west and to the southwest of these producing areas; and I believe that you will see there a tremendous number of dry holes.

Now those dry holes indicate a lack of hydrocarbons present, or they would surely have been completed as producers, so we are seeing these exceptions which you are bringing up along

the margins of a major producing area.

Q Was the section I pointed to, the last example I brought up, along the margin of the producing area?

A Right here is the producing area that you are discussing, and I would like to point out that in less than two miles from this particular section, which happens to be Section 29 of 27 North, Range 11 West, there are three dry holes --

Q The area we are talking about -- Pardon me.

A -- and to the east of it there are dry holes. In fact, in this particular producing area that you are discussing, occupying a position in 26 and 27 North, Range 11 West, this particular area has dry holes both to the east of the area and to the west, and the producing area that has been proved is approximately four miles wide.

Q There are a number of pools larger than five miles wide in this State?

A But that is the indication of the variable which is another consideration I wish to point out, that this is not a homogenous continuous reservoir situation, and as a consequence, every section in the Basin-Dakota Field as defined is not of equivalent value; and I believe that this particular discussion points this out very readily.

Q Mr. Street, you say that they are not of equivalent value, and yet the area that we're talking about is all in the red color which you defined as being the best area in the Pool, is that

right?

A I would say the better areas, yes, are outlined in red, using the arbitrary deliverability number of 1,000 MCF. This, I believe, was brought out in earlier testimony and I had no knowledge that it would be done, but the figures 500 MCF and 1,000 MCF were the figures discussed as to the economics and that sort of thing, which is a rather interesting thing to me because I developed these maps solely upon a geological basis.

Q Mr. Street, why did you not contour the intervals above 2500 MCF?

A The reason for that, as I say, I used an arbitrary figure on my part, that anything above a million, that there was very little consideration or concern about what area does that well's a million or greater in deliverability have in relation to the areas which have less than that. The isopach contours could be drawn. It would just show the steeper gradient at this particular scale, the contour spacing would be much more intense and would be just a greater mass of lines.

Q As a matter of fact, it would just be completely erratic with high deliverability wells offset by low, and your map would become meaningless, isn't that right?

A That was not the consideration given. I think that all geological maps are prepared on the basis of the scale used and the interval used to best clearly illustrate, and it would be not a physical impossibility but it would be a tremendously unwieldy

map, say if this scale instead of a one to eight thousand were a one to two thousand scale, which would make it easier to interpret but it would be roughly eight times the size of this one.

Q I think that completes my questions as to that exhibit. Would you like to sit down, please? Now referring to your cross section A-A', that's the small eight-well exhibit, is it not?

A It's the twenty-one well exhibit. A-A' is Exhibit No. 3.

Q Well, let's get on the other one. What's the number of that one?

A C-C'.

Q C-C'.

A Exhibit No. 2.

Q That covers a distance of some 76 miles?

A Yes, sir.

Q With eight wells spread out through the entire area?

A Yes.

Q Actually many of those wells are in what you would call fringe areas, too?

A Yes, sir.

Q Would you not expect substantial differences in that distance in the various locations that you have picked?

A That is exactly the situation that does exist. These were not, the logs were not culled through to select them for this cross section. Well, you realize the scale of this cross section

A-A' over a small area. Had we attempted to put every log from the C-C' over a distance of 75 miles, I don't believe we would be able to use it in here, so that it became necessary to take what appeared to be just a reasonable stepping out of wells to give the gross idea as to stratigraphic changes within the Dakota formation.

Q Now confining your answer to that cross section C-C', that would not in itself indicate there is not a gradual change from location to location across the length of that pool, would it?

A I believe so, in that by the stratigraphic datum which has been defined by the Commission as the basis of the Greenhorn, which is an interpretable and easily picked datum throughout the Basin-Dakota Pool, any variance from this datum would indicate a stratigraphic, a different stratigraphic position within the Dakota as defined, being 400 foot, an interval occuping 400 feet below the base of the Greenhorn.

Q What is the closest distance between wells?

A Two miles.

Q What is the greatest distance between wells?

A I believe it's fourteen.

Q Now referring to the exhibit A-A', that is the cross section which goes across the center of the field?

A It is across the center of the better proved producing area.

Q Now that cross section runs in a northeast-southwest direction?

A Yes.

Q Are you familiar with the sand bodies in the Basin-Dakota?

A Yes, sir.

Q Do they lay in a northeast-southwest direction?

A From individual sand isopaching, it would appear that the sand developments are more on a northwest-southeast, which would make this cross section normal or perpendicular to these sand developments.

Q In other words, then, your cross section would of necessity cross sand bars where the well to well location would appear and disappear, whereas if you had run it in the direction of the sand bodies, it changes, or the lower sand bodies would have appeared on the adjacent wells, isn't that correct?

A These lower sand bodies that you are referring to --

Q The upper ones, too, Mr. Street.

A That they would appear?

Q Yes.

A Not necessarily.

Q Not necessarily, but they would be more apt to appear if you were not cutting across them, if you went the longitudinal direction of them as you testified the sand bodies lay in the ground?

A These sand bodies may have, because of their apparent width as indicated on this cross section, their length is corres-

pondingly small. I would like to point out that this is commonly referred to by the operators as the Angel Peak zone, which is also the common log of 14 represented on Exhibit 3, which is cross section A-A^1, and on Exhibit 2, cross section C-C^1, as Number 3.

Now the well to the northwest some fourteen miles has a stratigraphically equivalent sand represented here, and it has been so correlated, shown as being probably the Angel Peak zone. So that I believe that would answer your question as to this cross section northwest-southeast.

Q Now this main sand body you referred to, your exhibit -- with the exception of that Well No. 7 which we will come back to -- shows it to be fairly continuous and contiguous across that section, doesn't it?

A With vertical, with thickening and thinning.

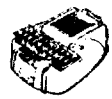
Q Now your maps over here would indicate that that main sand body is much longer than it is wide?

A Yes.

Q But yet you say that the smaller sand bodies would probably be about the same length as they are width?

A I believe because of the nature of the surveys, with sections being square or approximately square, that even if this sand body did extend two miles northwest-southeast, it is still very definite that the sand is not present in offset wells southwest and northeast.

Q Yet this has been defined as a common source of supply,



hasn't it, Mr. Street?

A It has been defined as a reservoir, yes, sir.

Q That means a common source of supply in the Basin-Dakota Pool?

A That would be I suppose the legal definition.

Q I believe it was your testimony yesterday that this main sand body is not continuous?

A I believe that is --

Q Did you base that on the situation in your Well Number 7 on your exhibit, that is, the A-A^1?

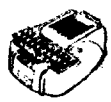
A Not on Well No. 7, which shows the shaling out of the producing sandstone, but I believe it is also shown on the gross producing -- I mean on the larger areal extent cross section, C-C^1, which if you care to refer to that cross section you can see the Angel Peak zone is not represented as a continuous body.

Q On what do you base your conclusion that the No. 7 Well shows an absence --

A The low resistivity and the low SP, plus the fact that this member was perforated and production was not obtained. I have confined my discussion to the gross producing sandstones, and this, in effect, it's not producing and consequently has not been classified as a producer.

Q Do you know what efforts were made to complete that well?

A No, sir, no more than what is reported in the Commercial



Scouting Service.

Q You don't know the result of their frac job?

A It was my consideration in that, not knowing the circumstances involved in every dry hole in the Basin-Dakota Field, that inasmuch as the operator did not elect to complete it, or attempted to complete it and didn't get production, and the State sanctioned the plugging, that was valid enough for me to say that it was not a producing well.

Q That's only one of two dry holes you show on your exhibit?

A On this exhibit here, yes.

MR. KELLAHIN: If the Commission please, at this time I would like to ask the Commission to take notice of its own records on the B. A. Fullerton Well No. 8. I have obtained the Commission's files, and ask them to take notice of the report therein which showed that that well was in the process of being attempted to be completed, killed four times; a Baker Model "D" Production Packer with an expendable knockout plug was set; the Dakota Formation, by the report of the operator, temporarily abandoned and the log shows that the top of the Dakota pay is at 6445.

On the basis of that report, of course, the operator does not consider it a dry hole in the Dakota, although it was not completed, admittedly. In connection with the completion of the well, the well file also shows that a tracer survey was made

which showed frac fluid at 6602 feet, or 32 feet below the lowest perforation, and into the water zone. On the basis of that, we submit that the well is not a dry hole in the sense that we are dealing with it here.

MR. PORTER: From which form were you reading, Mr. Kellahin?

MR. KELLAHIN: That's on the USGS Form 930 and on the notes attached to the Summary Report on the well.

MR. PORTER: That's 9330, I believe.

MR. KELLAHIN: 9330, pardon me.

Q (By Mr. Kellahin) Mr. Street, you testified that you need factors other than gross pay to determine reserves, don't you?

A Yes, sir.

Q Would you state what factors are needed?

A You need the net thickness, the porosity, the permeability, the saturation, and pressures in this case.

Q Those are the factors?

A Those are the major parameters. There are many refinements on a volumetric basis, is my understanding.

Q Do you have all that information?

A I believe that we are prepared to present expert testimony on those considerations.

Q But you did not take them into consideration in drawing your conclusions as to the relationship between reserves and

deliverability, did you?

A Not in toto.

Q Well, not in toto, what did you take into consideration?

A With the thickness being a major parameter, and as I discussed earlier in the direct testimony, that without thickness which would mean without a sand body or a reservoir body being present in a bore hole, that the result will be a dry hole. So that thickness in the presence of the reservoir is a necessity or you have nothing to calculate, even using the finer parameters.

Q You say you don't have any thickness whatever in the Well No. 7?

A Under the definitions which I have outlined, no, sir.

Q In other words, you confine thickness to a producing horizon, is that what you are saying?

A Yes. In this particular study, that is true, because it is my feeling that in glancing over the area which Exhibits 1 and 5 show, that there were in the neighborhood of 100 dry holes, which if one has to be considered potentially productive, then consideration would have to be given to every one of them.

Q Just on the basis of the log, it does show sand present, doesn't it?

A Sandy shale, yes, sir.

MR. PORTER: The Commission will take administrative notice of the British American Government No. 8 well file.

MR. KELLAHIN: Thank you.

Q (By Mr. Kellahin) Now in connection with that same exhibit, I would like to have you make a couple of more comparisons as you did yesterday, Mr. Street. Would you make a comparison of the net pay and the deliverability of the wells that you designated 9 and 10 on the exhibit?

A Well No. 9 has a deliverability, as reported in the 1961 deliverability schedule, of 935 MCF; and Well No. 10 has 138. The net pay as I reported for 9, 12 feet; and for 10, 20 feet.

Q Does that mean then that there's nine times difference in the reserves of those two adjacent wells?

A With the other parameters which would have to be taken into consideration, I believe that there would be that possibility. However, I would like to point out at this moment that Well No. 10 was producing in 1960, whereas Well No. 9 doesn't start production until in 1961; which would mean that if there is a comparison to be made directly of deliverabilities in the net sand, that one should consider the first deliverability run on the test, in other words, keeping them in numerical order.

In other words, if you have the deliverability on a well that started production in 1958, that's the number that should be used to compare with the 1961 completion.

Q Do you know what the cumulative production on those wells is?

A Yes, sir.

Q Would you give it to us, please?

A Well No. 9, as indicated on the published cumulative production figures, is 40,143 MCF of gas, and 575 barrels of oil; whereas Well No. 10 has a cumulative of 70,663 MCF and 1,069 barrels of oil.

Q Now, Mr. Street, on the basis of your answer, I would assume you are saying that originally the deliverability test on the Well No. 10 should have been approximately the same as on the Well No. 9, is that right?

A That would be correct.

Q Wouldn't that mean that the Well No. 10 today has produced approximately 83 percent of its reserves?

A I don't know where you get the percentage figures.

Q Well, on the basis of the reduction, proportional reduction in its deliverability. That's the only figure that you are giving us to determine reserves on.

A I don't follow that the 1961 deliverability and the production, cumulative production gives a percentage figure as to the point of depletion.

Q I'm not talking about -- you said that you assumed that originally that well had approximately the same deliverability as the Well No. 9?

A No, sir, I did not.

Q I misunderstood your answer; then does it? Would you assume that?

A No, sir. The point that I made is that if you are

going to make a comparison or attempt a direct comparison of deliverability and the net sands or the thickness parameter, that it should be the initial one, or if -- Well, just leave it that way.

Q Yet this is the deliverability that you are going to use on this well to make an assignment of the allowable to get the reserves under the tract dedicated to that well?

A That would be the index to the remaining reserves, because you have already produced a certain quantity of gas.

Q All right. That is an index to the remaining reserves. How would you determine what the reserves were originally in this situation?

A There we would go to the reservoir engineer --

Q In other words, the deliverability figure is meaningless?

A No, sir.

Q What does it mean, then? Your answer --

A The relationship of deliverability to the one parameter which, as I pointed out, is a major consideration, is quite good.

Q Well, now, Mr. Street, in answer to my question as to whether there was this nine times difference in reserves between these two wells, your answer was that the first well had been on production for a long period of time. Now what effect does this production have upon your deliverability figure?

A Reserves produced from under a lease reduces the amount of remaining recoverable reserves.

Q Now to what extent have the recoverable reserves in the No. 10 been reduced, and on what do you base your calculation?

A That I believe is getting into the realm of a total reservoir engineering study.

Q Mr. Street, you've related deliverability to your reserves.

A On a gross Basin-Dakota Field relationship, not on the isolated individual cases; because we are talking about a tremendously large area, and I believe that any data which you or anyone else could develop, you would find erratics because we do know there are differences in the reservoir characteristics, the differences in wells' problems as you have made a point of with the British American test which is represented by Well No. 7; so that mechanically and naturally there are these differences.

Q In effect, then, you are saying that the Well No. 10 never did have the reserves that Well No. 9 did, aren't you?

A No, sir.

Q Wouldn't it be reasonable to assume that on the basis of your testimony, that a well with 20 feet of net pay would have at least as much reserves as one with 12 feet?

A I don't believe it has been disproved.

Q You agree to that, then?

A No, sir, no, sir, I don't believe it has been disproved one way or the other that Well No. 10 has less reserves than Well No. 9.

Q What would you say the situation is?

A At the present time I would say the situation is that Well No. 10 has produced a longer period of time, has produced more total gas than Well No. 9.

Q Well, agreed, the figures show that, don't they?

A Yes, sir.

Q Almost twice as much?

A Yes, sir.

Q Did Well No. 10 have as much reserves to start with as Well No. 9 did?

A If the other reservoir parameters are constant, it would have greater, yes.

Q It would have greater. And yet today it has less,--

A I don't know --

Q -- substantially less?

A I'm not sure where you get the information or the figures that shows it to have less.

Q Well, I'm quoting from your statement that the deliverability in this case has gotten less. If it doesn't indicate that, I don't know what we are talking about.

A It would have the remaining reserves.

Q It would have less remaining reserves; in other words, today the reserves are less than they were?

A Well, if you have produced half of the contents of the reservoir, naturally they will -- or three-quarters, or if you

have completed, it would have less reserves than when it started out initially. I believe that follows.

Q Is 70 million half the reserves?

A I am not in a position to say.

Q Well, do you believe it is, --

A No, sir.

Q --on the basis of the study you made of the Dakota Pool?

A No.

Q What are the reserves, on a rough estimate?

A I'm not in a position to give you the exact reserves on this well, and besides, I feel that that is beyond the scope of this particular testimony, in that the parameters which I have set out to illustrate, I believe have been adequately covered, showing the variation within the Basin-Dakota Field and that the relationship of the gross thickness and deliverabilities are approximately coincident.

Q And yet on gross thickness and deliverability, you cannot calculate reserves, can you?

A No, sir, --

Q Okay.

A -- not on the final form.

Q Calculating the net pay on your exhibits, these cross sections, did you correlate your logs with the core information available to you?

A The empirical approach, as I believe I discussed

yesterday is initially taken off from core information.

Q Would you answer my question now? Did you do that?

A No, I have not.

Q How did you pick your net pay, then, on the logs?

A The empirical relationship which has been used is when the sonic log is available, the gamma ray sonic, a porosity cutoff of six percent was used, which corresponds to a velocity of approximately 17,200, or 66 micro-seconds, and was arced, which would be indicated on the induction log if it is available, or the electric log if the bed is thick enough for resistivity of 40 ohmms, and if only the electric log and no other logs are available, an attempt was made, or the empirical relationship of 56 million on volt SP with corresponding resistivity.

Q You say that is the empirical approach to the problem?

A Yes, sir.

Q Is that the approach that you used?

A Yes, sir.

Q On that basis, then, you are making an assumption that all of the factors throughout the entire reservoir are the same?

A Inasmuch as this cross section is of the major producing area, that seems quite reasonable.

Q Mr. Street, yesterday I believe you testified that you are the chief geologist for Pubco, is that correct?

A Yes.

Q In your duties as a chief geologist, do you recommend to your company as to whether they will or will not drill particular drilling sites?

A Yes, sir.

Q In connection with that recommendation, do you consider whether a well drilled at any given site will be a commercial well?

A Yes, sir.

Q What is a commercial well?

A Depending upon the quality of control for the -- sometimes we attempt to select those areas which would give us maximum sand development and would give us an estimated or guessed deliverability, or IP in excess of two and a half million on an IP basis, or a million or so on deliverability.

Q In other words, you analyze the reservoir with the expectation of finding a well which will give you 2500 on the IP or a thousand on the deliverability, is that correct?

A Yes, sir.

Q And that you consider a commercial well. Would you consider anything less than that commercial?

A I believe on the aspects of commercial considerations, it depends on a lot of factors.

Q It would depend on the company's own individual situation, would it not?

A Right.

Q What is your cutoff point, Mr. Street?

A That would have to vary with the market consideration.

Q But roughly you say a million cubic foot well is what you are looking for?

A We would prefer to stay above it, yes, as I believe all operators would.

Q Would you deliberately drill where you anticipated something less than a million, absent any offset obligation or other consideration?

A We have.

Q With the anticipation you would get less than a million in this pool?

A Inasmuch as there are enough variables that you would not expect to hit exactly --

Q In other words, that is a calculated risk?

A We have fallen slightly below a million.

Q In other words, you sometimes do take a calculated risk?

A Yes.

Q Mr. Street, just one further question. You have not made any reserve calculations, have you?

A I myself have not. However, we did have work done on reservoir engineering which, of course, has been compared with the geological approach.

Q You did not make any calculations?

A I myself have not, for this testimony.

Q And you have not offered this Commission any such calcu-

lations?

A No, sir.

Q And yet you say there is a direct relationship between reserves and deliverabilities?

A The reserves are directly proportional.

Q Directly proportional?

A To the thickness, is the statement that I made.

Q Now, Mr. Street, you've changed the answer. Now you say it's directly proportional to the thickness.

A That's what I have stated in my direct testimony.

Q Your direct testimony, you said that there was a direct relationship between reserves and deliverability; you stated it several times. What is that relationship, that direct relationship?

A That in the thicker sand areas, as evidenced by the comparison of the gross isopach map and the deliverability map, that there is a coincident of thicker sand developments and the deliverability areas of a million or in excess of a million.

Q Now the thicker sand section affects reserves, of course?

A Yes, sir.

Q That is, assuming the net pay is proportional to the gross pay?

A Yes.

Q Does a thicker sand section likewise affect deliverability?

A Normally, yes, I believe that is true.

Q Then factors affecting deliverability and those affecting reserves are in some measure the same, is that correct?

A Yes.

Q What is the direct relationship between reserves and deliverability, forgetting about this sand thickness? It has been used in both calculations, hasn't it?

A Yes, sir.

Q Where is your relationship between reserves and deliverability of the well, what is it? Is it one to one or --

A I do not know of a ratio prepared on that.

Q You don't have it?

A No, sir.

Q You don't know what the relationship is, then?

A Not on a statistical basis, no.

MR. KELLAHIN: That's all the questions I have.

MR. PORTER: Mr. Howell.

MR. HOWELL: Ben Howell, representing El Paso Natural Gas Company.

BY MR. HOWELL:

Q Mr. Street, will you please refer to your Exhibit No. 1? I think that's underneath the Exhibit No. 5. Mr. Street, will you locate on your Exhibit 1 Well No. 7 that is shown on your cross section which is at A-A^1?

A (Witness indicates.)

Q Now, I believe you testified that the direct offset to the northeast was a producing well, and the direct offset to the southeast --

A Yes; southwest.

Q To the southwest. Would you look at the direct offset to the southeast and tell us what you find there?

A It is a dry hole.

Q Now will you look down about a mile and a half to the southwest, and what do you find?

A Another dry hole.

Q And look a mile to the south of that, and what do you find?

A There's another dry hole.

Q Are there any other dry holes in the area?

A There's another dry hole immediately south of that one.

Q Does that indicate to you the existence, not of mechanical difficulties, but of a lack of pay sand in that area?

A That would be the analysis I would make from this map.

Q Is the well which is immediately to the southeast, the southeast offset to your Well No. 7, located between two producing wells?

A There's a producing well on an offset basis to the southeast of it, and to the northeast of it, and one to the west of it. The due south offset to the second dry hole has not been drilled.

Q Does that indicate to you that there is actually in the sand an abrupt variation at this point?

A Yes, sir.

Q And what is the distance there between the dry holes and the area of the thickest sand development, as shown; the approximate distance?

A The distance between the two dry holes and the thicker sand developments?

Q Yes.

A Let's see, it would be approximately a mile to the east and maybe slightly greater than a mile to the west.

MR. HOWELL: That's all. Thank you, Mr. Street.

MR. PORTER: Does anyone else have a question?

MR. STOCKMAR: I would like to ask a few more questions of the witness.

BY MR. STOCKMAR:

Q Mr. Street, in analyzing yesterday's testimony last night, I now have a better feel of what it is you are trying to say, and I've prepared some questions which I think are limited to what you are willing to testify to.

MR. KELEHER: We object, if counsel proposes to again examine the witness on direct examination. He had his opportunity to cross examine. If he wants to examine him on anything that was brought out by Mr. Kellahin -- we ask the Commission to limit what he testifies to now.

MR. STOCKMAR: That will be satisfactory.

MR. KELLAHIN: Just to clarify the record, and maybe perhaps get some ground rules laid down here, it's a matter which frequently comes up before this Commission. On the case yesterday, Mr. Elvis Utz on the witness stand, there's a cross examination by Mr. Stockmar, by Mr. Everett, by Mr. Everett, by Mr. Ben Howell, by Mr. Morris, by Ben Howell, by Mr. Everett, by Mr. Guy Buell, by myself, by Mr. Stockmar. I am inclined to agree somewhat with Mr. Keleher's objection, but the ground rules have been laid out as they have been in this hearing. I think it's not exactly timely.

MR. KELEHER: Well, we object to any second-guessing. If counsel was not prepared to cross examine yesterday and proposes to go over the testimony and re-examine him, cross examine him, we object to it. If he wants to cross examine him on anything that's developed here now, then go ahead.

MR. STOCKMAR: Mr. Chairman, I think for the moment, as far as I know, what I would like to ask the witness is included within the area that Mr. Kellahin was developing this morning.

MR. KELEHER: We would like the Commission to rule.

MR. STOCKMAR: I would like to defer a ruling until I seem to step outside of it.

MR. KELEHER: We would like the Commission to rule on that particular objection.

MR. PORTER: Mr. Keleher, the Commission certainly notes your objection, and it is in the record. However, it has been the policy of the Commission as a regulatory agency to allow free cross examination of the witnesses and redirect at any time and recross, and so we will proceed on that basis. However, I would like to caution all of the attorneys at this point to avoid repetition as much as possible.

MR. KELEHER: Do I understand, Mr. Chairman, that this recross examination is to be unlimited in scope? He can reopen anything that he went into yesterday and again cross examine the witness on that?

MR. PORTER: As long as it's not repetitious.

MR. KELEHER: We would like to enter an exception to the ruling.

MR. PORTER: The record will show it.

Q (By Mr. Street) With respect to your Exhibit 1, I believe you testified that the areas you colored in red are the thicker sections of the reservoir?

A As interpreted from the available well data.

Q And therefore the best part of the reservoir?

A That the better reservoirs occur in this red area?

Q The better part of the reservoir is colored in red.

A The better reservoirs exist in those portions colored red, yes.

Q Do you know who the owners of the wells within the areas

colored in red are?

A That would mean knowing the owner of every well in the Basin; no, I do not.

Q Are you acquainted with the operation of Consolidated, the Applicant, of the producing wells?

A I am aware of sone of them, in the location where Consolidated has acted as operator and consequently has their name on the well log.

Q You are acquainted with Consolidated's operation, then?

A Yes. And at this point I would like to bring up that consideration that Consolidated apparently has not, by their own --

Q I think you have answered my question.

MR. KELEHER: Let the witness answer.

A -- has not made available to the industry, through the commercial reproduction companies, the well logs in one of the areas in which they operate the wells.

Q (By Mr. Stockmar) I hand you, Mr. Street, a copy of your Exhibit No. 1, small scale, upon which we have outlined the producing properties and some other properties operated by Consolidated. Will you accept my statement that these do outline properties operated by Consolidated?

A I do not know if the area in Township 28 North, Range 10 West, is operated by Consolidated. They may have an interest, but I don't recall having seen any Consolidated logs or wells in the Reporting Services indicating Consolidated.

Q Do you have any reason to believe that Consolidated does not own interest in those properties?

A I believe you said "operated" rather than owned interest. I imagine that the majority of the wells in this Basin may have some interest holders, as has been brought out in previous testimony.

Q Mr. Street, is the majority of the acreage which I have marked on here as being owned by Consolidated within the red or the best thickness area of this reservoir?

A The interest properties in Township 28 North, Range 10 West, would fall within a good area, which would be the Angel Peak area. The area to the north in Townships 31 and 32 North, Range 12 and 13 West, I wish to point out that very little well control is available, in that the well logs from these well bores have not been made available.

Q Are you impeaching your own map?

MR. PORTER: Mr. Stockmar, let him finish his answer, please.

MR. STOCKMAR: I am sorry.

A Inasmuch as only the peripheral wells indicating thinner sections or dry holes were in the area, it was, the interpretation was based on very scant control, which would give Consolidated the benefit of a doubt of whether the sands were thicker or thinner, or of what magnitude. There is the indication from smaller areas of gross sand thickness up in Townships 31 and 32 North, Ranges 12

and 13, in that there are the limiting well gross thicknesses derived by dry holes.

Q (By Mr. Stockmar) Are you through?

A Yes.

Q May I restate that question? According to your map, in the northwest portion of the field, isn't almost all of Consolidated's acreage colored in red?

A Not knowing all of Consolidated's acreage --

Q As I have shown it on this map.

A This primarily falls within a red area; and as I say, I have qualified that with the fact that there is little available control because the logs were not made available through the Commercial Reproduction Service.

Q Are you aware that almost all of those logs have been released and made available?

A Probably I was aware that would probably be the case, inasmuch as it does take time to make well logs. From Consolidated's Farmington office, we received this information directly on wells that had not been released, and the statement was added that there are others.

MR. STOCKMAR: I'm making a sincere effort to ask questions that can be answered yes or no, or in a few words. I would certainly hope that we wouldn't get into the ring-around-the-rosy that we had yesterday. I am anxious to shorten the proceeding.

MR. KELEHER: We are, too, but if counsel doesn't get

the answer he expects, he can't complain.

A On a telephone call to the Consolidated Oil and Gas Company in Farmington of April 5th, 1962, wells which had completion dates ranging back to 1959 had not been released; and, of course, logs released to the commercial companies take at least a week or so to be reproduced or be mailed to the participating or purchasing companies, so it was not possible to include the majority of the Consolidated Oil and Gas data, if it has been released now.

Q May I have the map back, please?

MR. STOCKMAR: I would like to offer in evidence and have marked as Consolidated Exhibit No. 5, this re-marked copy of Pubco's Exhibit No. 1, to evidence that the majority of Consolidated's acreage is within the best area of the field, as defined by Mr. Street.

MR. KELEHER: To the introduction of which Pubco objects on the ground that no proper foundation has been laid. Apparently, according to counsel's statement, he has marked it. That is no proper foundation.

(Whereupon, Consolidated Exhibit No. 5 marked for identification.)

MR. PORTER: Object sustained.

MR. STOCKMAR: May I have this back? We will wish to offer it on rebuttal.

MR. PORTER: Yes, sir.

Q (By Mr. Stockmar) Mr. Street, Mr. Kellahin was interrogating you about two wells in Section 27, I believe it's Township 29, 13. Are you familiar with another well located in Section 28 immediately to the west of the Guy Callow No. 1 Well?

A Not on a personal basis, no, sir.

Q From your Exhibit No. 1, do you find such a well in the Northwest Quarter of Section 28, 29 North, 13 West?

A What is the location again?

Q It is in the Northwest Quarter of Section 28, Township 29 North, Range 13 West.

A Yes, sir.

Q What is the thickness of the gross sand as shown from your work?

A The thickness as shown on this well symbol is 70 feet.

Q And you testified that the Guy Callow well immediately to the east in Section 27 was also in excess of 60 feet?

A Yes, sir.

Q Would you now go to your Exhibit 5? What is the deliverability of that Guy Callow well?

A The one in Section 28?

Q In Section 27, that's the Guy Callow well.

A In the Northwest Quarter?

Q Yes, sir.

A That which is reported is 30,511,000.

Q What is the reported deliverability of the well to the

west?

A One hundred and seventy-three.

Q Is it your considered opinion that there can be a variation in reserves between producible wells that close together--

A Yes, sir, I believe --

Q -- of 18,000 percent?

A I'm staying off of mathematical gyrations. Thicknesses and variations do occur, I believe we have gone through this many times, to the point of having dry holes offsetting. Yes, sir, the one thing, or consideration here which you would be required to know would be the other parameters; and again, as I believe Mr. Kellahin got the point across quite well, that as you reach the margin of a producing area that you expect greater erratic conditions to occur, which certainly is true of these two areas which have previously been discussed, as evidenced by the number of dry holes which limit the production to the west and to the south.

Q My same question again, Mr. Street. If it can be answered yes or no, please do. Is it your opinion that two adjacent producing wells in this reservoir can have reserves varying by 18,000 percent?

MR. KELEHER: We object to that on the ground that there's no testimony here that there is a variation of 18,000 percent.

MR. STOCKMAR: The only testimony that we have is Mr. Street's, in which he relates deliverabilities and reserves. From

his own map, we find a variation in these two wells, one of them having a deliverability 182 times that of the other, with the same sand thickness. I submit that that is his testimony, and I was asking him to state it succinctly for the record.

MR. KELEHER: This witness has not testified that there was a difference of 18,000 percent. That's counsel's conclusion.

Q (By Mr. Stockmar) Mr. Street, how many times larger than the 173 deliverability well is the 30,511,000 deliverability in terms of percentage of deliverability?

MR. PORTER: I think we are belaboring a point here, Mr. Stockmar. I think the difference is shown there.

Q (By Mr. Stockmar) Thank you, sir. I think you can take your seat again. One of the other major things to which you testified yesterday and this morning was with respect to the determination of net pay.

A Yes, sir.

Q I don't think we asked you whether you, yourself, made these determinations on the 32 wells shown on Exhibits 2, 3, and 4; did you?

A I myself have not made all of them. I have made some of them.

Q Will the person who made the others be available to us to adopt and confirm your testimony and submit to cross examination?

A No.

MR. STOCKMAR: Gentlemen, I would move stricken from the record as evidence any testimony of Mr. Street based on the work of others, which he did not supervise, who are not here to submit to cross examination. I would like to proceed to find out what work Mr. Street did; and the rest of it, I would ask to be stricken from the record as evidence in this hearing.

MR. KELEHER: May it please the Commission, I would like to ask permission to ask the witness if that exhibit was prepared by him or under his supervision, and if he knows that it is correct.

A I have so testified before the exhibit was introduced into the testimony.

MR. STOCKMAR: I'm sorry. I didn't understand that, Mr. Street.

Q (By Mr. Stockmar) Well, then, Mr. Street, with respect to the determination of net pay, is it necessary to know the permeability of each foot of the gross sand encountered in a well in order to determine if that foot of sand will permit the flow of gas through it into the well bore?

A That would have to do with the recoverable reserves.

Q I think these questions can be answered yes or no. Let's try to do so. To determine which of the footages, feet of gross sand you are going to call net pay, is it necessary foot by foot to know the permeability of each foot before you put it in the net pay category, or throw it out as non-pay?

A No.

Q It is not?

A No.

Q Then if you do not know the permeability of a given foot, which category do you place it in?

A If it is in a single sand body, as illustrated on cross section A-A^1 of Exhibit 3, even to the perforation -- I believe this illustrates the answer -- some of these wells have perforated the entire body with continuous perforations; others have not. Here is even a well in this cross section which shows a notch, a single point of entry into this body; so if the sand reservoir is apparently homogenous and does have some permeability in a portion of it, it would be reasonable to expect the reserves to be drainable, or recoverable.

Q You said if it does have some permeability. How do you know this?

A In this particular testimony I have stayed with producing sands. Those wells which are producing obviously have permeability.

Q Somewhere?

A Yes, or you would have no gas available.

Q So if they are producing, you take all of the lenses as you have shown them and call them all permeable sands?

A I called them gross pay in this aspect.

Q You attribute permeability to all of the feet in that

lens?

A That any reserves present in this particular bed could conceivably be recovered, as long as there are no impermeable barriers indicated on the log.

Q Then your definition of net pay is the same as gross pay --

A No, sir.

Q -- in many, many cases?

A That is possible. I believe there are some examples where the gross pay and the net pay are essentially the same; however, there are other factors which we are ignoring, and that is the shaliness of the sand and the porosity and the saturations.

Q You state that you do not have to know the permeability of each foot, before you count it as net pay?

A That is right.

Q In making whatever determinations of net pay you did make, did you adopt a minimum permeability as a cutoff point?

A No.

Q And include in net pay only those feet of sand having a higher permeability than that minimum?

A No, sir.

Q You did not?

A No, sir.

Q Then you are including in that pay sands having a complete permeability range as far as you know?

A That's right.

Q From zero to whatever a maximum may be?

A That is right.

Q Is it your opinion that a body of sand having zero permeability will give up gas, will produce gas?

A On a natural basis, I would say no, if it has zero permeability.

Q On a natural basis?

A That's on a natural basis.

Q With the permeability determination that you did make of the natural permeabilities?

A No, sir, I believe that you brought out in your cross examination yesterday, and I believe my answer was that you cannot calculate the permeability from the well log; and you disallowed my statement that logging services have done considerable empirical work in determining permeability indices, which was disallowed because they weren't available for cross examination.

Q Let me get this straight. This is very important. You testified that from these logs of these 32 wells, you were able to, by some means, to determine the permeabilities of the sand sections encountered in those wells?

A I have not made any such statement, that I have used producing sand bodies which obviously have permeabilities or they would not be capable of producing gas, and they are gas wells.

Q But you have no idea of the permeability, then, is that

correct?

A I personally do not have any idea of the permeability, other than that they are producing gas.

Q Did you use any porosity cutoff in determining net pay through your method?

A I believe if you would have listened to Mr. Kellahin's cross examination, that that has been testified to.

Q What was your minimum porosity below which you considered that there was no pore space which would contribute gas to the well?

A I believe my statement was that based on the sonic cutoff of six percent.

Q Six percent?

A Yes.

Q What is the maximum porosity you have encountered in any of the wells studied in your three cross section exhibits?

A It would be on the order of twelve percent.

Q Twelve percent?

A Yes.

Q What is the minimum porosity which you have encountered?

A Essentially zero.

Q What is the average porosity?

A I have not averaged the porosity.

Q Of these wells, of these 32 wells?

A I have not averaged the porosity.

Q Does a sand section with six percent porosity contain gas?

A Providing the water saturations are not indicated to be filling the pore space.

Q What is the maximum water saturation percentage which you encountered in your studies of these 32 wells, what percentage of the available pore space?

A From a log calculation basis rather than converting it to water saturation, we have used the empirical resistivity of 40 ohmms.

Q Can you state in terms of the percentage of the pore space, which I gather is a little hole in the rock that may or may not have water in it, or water and gas, or all gas, what is the maximum percentage of that pore space in any of the pores covered by all of these 32 wells which you encountered in your study; maximum percentage of water content?

A In the producing interval as indicated?

Q Yes.

A Yes, sir. I don't have those figures available, but I believe it would be somewhere in the neighborhood of 35 to 40 percent.

Q 35 to 40 percent. What was the minimum?

A It would be in the order of 30.

MR. STOCKMAR: I think that's all.

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

MR. UTZ: I have one short question.

MR. PORTER: Mr. Utz.

BY MR. UTZ:

Q Mr. Street, do you concede that net pay is a parameter in calculation of volumetric reserves?

A Yes, sir.

Q Referring to your Exhibit 3, I believe it is, your cross section A-A^1, you read into the record certain net pays below each log, did you not?

A Yes, sir.

Q Are those the net pays that you would furnish your Engineering Department to calculate volumetric reserves?

A Yes, sir.

Q I believe the lowest net pay which you gave on that cross section was 12 feet.

A Yes, sir.

Q That is discounting the dry hole, because no allowable would be assigned to a dry hole. The highest net pay was 69 feet?

A Yes, sir.

Q Would you consider this cross section to be representative of the spread in net pays in the Basin-Dakota Pool?

A No, I really would not, from this standpoint. This is of the best producing area, the Angel Peak area of the Basin-Dakota Field. The extreme variations would be, well, obviously from zero to perhaps even greater; in this particular cross section

Well No. 14 has the greatest single reservoir section.

Q Would you have an opinion as to what the minimum net pay would be in order to have a commercial well?

A No, sir, Mr. Utz, because from this standpoint, that the differences in the saturations and the porosities could make a difference in the reserves in a given sand thickness.

Q But you don't have that information available on each and every well?

A No, sir, I don't.

Q The cross section A-A^1, then, you say would not be representative of the net pay ratio?

A That is right.

Q In your opinion, would it be higher?

A I would expect this to be slightly higher than the average for the Basin-Dakota.

Q The ratio of net pays would be higher?

A No, that the quantity of net pay here would be higher, because this is of the better producing area.

Q Then a ratio of net pays on this would be conservative, is that what you would say?

A May I ask a question to see if I understand?

MR. PORTER: Yes.

A You mean there would be less variation in this cross sectional area than could be expected from all the producing, comparing, say, a well from one producing area to this area?

Q Yes, sir.

A Then that should be conservative.

Q And the ratio shown on this cross section here would be in the order of .175?

A Well, it would be almost six times.

MR. UTZ: That's all I have.

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

(Witness excused.)

MR. PORTER: We'll take a ten-minute break.

(Whereupon, a short recess was taken.)

MR. PORTER: The hearing will come to order, please. Now, Mr. Keleher, I guess we are ready for your second witness.

MR. KELEHER: Pubco would like to introduce the next witness, Mr. Dan Cleveland, who has already been sworn.

DAN CLEVELAND

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

DIRECT EXAMINATION

BY MR. KELEHER:

Q Mr. Cleveland, will you state your name, occupation, your present employer?

A My name is Dan Cleveland. I am a Petroleum Reservoir Engineer for Pubco Petroleum Corporation.

Q Will you state your educational experience and background?

A I attended four years at Texas A & M College, and graduated in 1955 with a Bachelor of Science Degree in Petroleum Engineering. After graduation, I went to work for Humble Oil and Refining Company in Central Texas; and the first one and a half years was spent primarily concerned with production engineering problems. After that I attended their nine-month reservoir engineering course in Houston, Texas, after which I was assigned to the reservoir analysis group in Humble's Midland Area Office in Midland, Texas. I stayed there in that capacity until 1958 -- excuse me, I went there in 1958 and stayed there until March of 1961, at which time I went with Pubco Petroleum Corporation as the company's reservoir engineer, and I have been in that capacity since that time.

Q Are you familiar with the Basin-Dakota Gas Field in San Juan County?

A Yes, sir.

Q Will you state, as of April, 1961, how many wells there were in that pool?

A In April, 1962, there were about 572 wells, I believe, shown on the April proration schedule; and this, roughly, at 320 acres per well, this is around 187,000 acres that is presently developed in the Basin-Dakota Field.

Q What is the present proration formula that has been used in the Basin-Dakota Field?

A Each month the total pool nomination is determined and

the allowables are assigned to marginal and non-marginal wells. After deducting the total allowable assigned to the marginal wells, the remaining pool allowable is then assigned to the non-marginal wells. 75 percent of that remaining pool allowable for the non-marginal wells is allocated to those wells in the proportion that each well's acreage times deliverability factor bears to the total acreage times deliverability factor for all of the non-marginal wells. Then 25 percent of that remaining pool allowable for non-marginal wells is allocated in a proportion that each well's acreage factor bears to the total acreage factor for all of the non-marginal wells.

Q In your opinion, is such a formula based primarily on deliverability a just and equitable method in assigning allowables in this particular pool?

A Yes, I certainly do, because in my opinion the deliverability is proportional to recoverable gas reserves; and for this reason, a proration formula based primarily upon deliverability as a factor provides proper weight and value to uncertain rock characteristics such as water saturation, porosity, thickness of pay, permeability, and pressure, all of which are to be considered in determining the volumetric estimate of reserves.

The deliverability is actually the only nearly exact data measurement at our disposal for determining the quality of a well. All these other parameters, porosity, net thickness, water saturation and so forth, of course they're open to quite a

bit of controversy, and generally speaking, there are a few number of core analyses over the field, so when you boil it all down, deliverability is the only thing, it's the only tangible piece of data that we have for every well in the field.

Allocation of production based primarily on deliverability, I feel is necessary and desirable in order to enable each well to produce its fair share of the market in proportion to the recoverable reserves underlying that well.

Now although the assigned acreage for each well is about 320 acres for each well, you do have some variation, but it's certain in my own mind that those pertinent rock characteristics which define the amount of gas that can be recovered from that well are not the same throughout the field, and consequently, it cannot be said that all tracts have equivalent value.

Now conversely, the proposed change in formula giving additional credit to acreage, I feel will certainly permit non-ratable taking of gas from the pool, and drainage between tracts. The present formula does not create waste in my opinion, inasmuch as the 25 percent acreage factor permits the well to produce an allowable well in excess of a reasonable economic producing rate. If the gas is there and the well bore has actually been connected to those reserves, and those reserves can be recovered at an economic rate, in my opinion there just isn't any waste.

Now the economics of paying out one of these wells in a reasonable period of time is a problem that must be weighed and

risked by the individual operator when he decides to drill a well, based on the current market proration rules in effect at the time, and pertinent geological factor. The current formula has worked very well in times of better market conditions in this pool, and in other pools in Northwest New Mexico. Actually, the amount of gas that's been required that I've gathered from testimony yesterday was that the market hadn't particularly changed, it was just as a result of additional wells being drilled. Now this is a risk that all of us have to face whenever we drill a well. There is no good reason, in my opinion, to change the formula now that the current market seems to be unfavorable to all of us.

Again I would like to say that the present formula does not create waste because of the direct correlation of deliverability and recoverable reserves. The present formula distributes the allowable among the producers on a reasonable, just, and equitable basis. It does not violate correlative rights, inasmuch as the allowable is based primarily on that factor, deliverability, which in my opinion comes closest to recognizing and giving credit to that well having more recoverable gas by virtue of its better rock characteristics such as porosity, permeability, thickness, and water saturation.

Q Mr. Cleveland, what is the variation in the various rock characteristics that determines the amount of gas in place under a tract?

A Well, Mr. Keleher, it's possible for the variation to be

very large across the field, based on core data from about 25 productive wells in the Basin-Dakota, data that were made available to me on a general basis, not strictly on a per well basis. However, I have reviewed and studied about 15 or 16 wells in the field where we have the core analysis data, and concur with these general overall statistics.

These data have been provided to me through a third party, core analysts, who advise me that they plan to make this data available to the industry within a short time. I think it's normal practice that they do this. However, naturally, as you can well see, they can't release this data on an individual well basis.

The average well porosity ranges from 3.9 up to 15.9 percent, for which I calculated a maximum to minimum ratio of about four times, or four to one; while the average porosity is about eight percent. The net thickness ranges from four up to 50 feet, or in a ratio of twelve and a half times, and this net thickness corresponds to a porosity cutoff of three and a half percent from core analysis, or at least it's tied in with core analysis.

The average net pay is 32 feet, and again it corresponds to a three and a half percent porosity cutoff. Water saturation ranges from 28 up to 50 percent for a hydrocarbon content ratio of 1.4 times. The average water saturation is about 34 percent. The permeability ranges from .01 up to 11 millidarcies for an

average of about 1.4 millidarcies.

Now, with the exception of using the permeability in a volumetric calculation in order to describe to you the range of net reserves that we could be looking at, and I feel it is quite possible that the minimum of these parameters could exist in a particular well -- Now, I have no well that I've found these in, I haven't looked for it, but I am trying to give you a maximum to minimum variation in calculated reserves, provided all the wells had the same pressure initially and the same recovery factor could be assumed. I roughly estimated that the reserves could range from 164 million cubic feet up to about 12 billion cubic feet, or in a maximum to minimum ratio of about 75 to 1. These variations in rock properties across the field show that all tracts, although having about the same surface acreage, do not necessarily have the same quality of rock below or the same amount of recoverable gas in place.

Q You estimate, Mr. Cleveland, that in your opinion deliverability is proportional to the reserves. Do you have any evidence to support that opinion?

A Yes, sir, I have prepared a couple of exhibits.

Q I will ask you to place the first exhibit from which you will testify, and mark it Pubco Exhibit 6.

A You asked that that be marked Exhibit No. what?

Q No. 6.

(Whereupon, Pubco Exhibit No. 6 marked for identification.)

Q Directing your attention to Pubco's Exhibit 6, will you tell the Commission what that purports to show?

A This is a well location map of a portion of the Basin-Dakota Gas Field, San Juan Basin, New Mexico; and on this map I have shown those wells colored in red which is the location of about 33 wells on which I have made a pressure production -- or I have made a reserve study on those wells and compared it with their 1961 deliverability.

Q Now from what source did you obtain the data that is reflected on that Exhibit 6?

A Well, for each of these wells I have obtained pressures, production data, various deliverability data, from the actual operator's report that's submitted to the Commission.

Q Was this Exhibit 6 prepared by you or under your direction or supervision?

A It was prepared by me.

Q Do you state that that truly reflects the testimony which you propose to give?

A Yes, sir, along with the No. 7 Exhibit; and the purpose in this exhibit is to give you an idea where these 33 wells that I'm working with, where those wells are located across the field.

Q Are they scattered across the field?

A Yes, sir. I think this represents a pret y fair sampling of wells across the field. Perhaps you can't see them out here, but I have got a few up in here and a few down in here,

some right in here, and two or three up in this corner (indicating).

Q Now explain to the Commission further, that exhibit.

A Well, I think as far as this exhibit is concerned, its purpose was to demonstrate the location of the wells across the field that I'm working with now, the wells which I'm primarily interested in.

MR. KELEHER: I ask you to place that on the board and identify it as Pubco Exhibit No. 7.

(Whereupon, Pubco Exhibit No. 7 marked for identification.)

Q (By Mr. Keleher) How did you determine the reserves by the pressure production?

A Well, these 33 wells across the field were selected for this study because those wells had at least three pressure points from which that I could extrapolate pressure versus cumulative production, down to an economic limit of approximately 27,000 cubic feet per day, which corresponds to an economic limit or an operating cost of about $1130.00 per year.

Now this 27,000, it's roughly correct, corresponding to this $1130.00 -- I think actually calculated, it might be 26, but the margin of error that I'm looking at here is very negligible. After extrapolating the pressure, shut-in surface pressure taken from the deliverability data submitted to the Commission, extrapolating this data on the best straight-line basis through those points that I could, I then used data from the deliverability sheet or the deliverability report to the Commission, and plotted

a log, log plot of the formula which is analogous to the back pressure equation, which is commonly accepted in the industry.

Now I have used the shut-in surface pressure and the P sub W or flowing pressure at the sand face, and the difference in the squares of those values plotted against the actual measured flow rate, the best straight line was extrapolated through those points to this economic limit of about 27,000 cubic feet per day. Then arbitrarily assuming a line pressure at that time of about 120 pounds, I have back calculated the abandonment pressure.

From this point then I go back to my pressure versus cumulative production curve, and at that abandonment pressure for each of these wells -- Now I'm saying this procedure was used on each well and an abandonment pressure was selected for each well, and the recoverable reserves were determined for that well.

Now in order to show the relationship of deliverability versus remaining recoverable reserves, I have prepared this Exhibit No. 7, which shows the deliverability, 1961 deliverability in thousands of cubic feet per day on the left vertical scale; and on the horizontal scale at the base I have shown the remaining gas reserves in millions of cubic feet. Now for each of these 33 wells I have plotted deliverability versus the remaining gas reserves, and I get this relationship in here, the average relationship between deliverability and the remaining gas reserves was determined very simply by taking the well's line from zero to a billion and arithmetically average those reserves from those wells lying

in that quadrant between zero and 1,000 MCF per day deliverability and zero and one billion cubic feet of gas; arithmetically average the reserves and the corresponding deliverability to arrive at an average point for that quarter.

Then, following right on down the line between one and two million -- excuse me, one billion and two billion, two and three, and so forth, I have arrived or derived this average relationship between deliverability and the gas reserves.

Now, to give you an idea of the number of wells that I've used in each of these ranges, between zero and a billion cubic feet, I have 13 wells, which is about 39 percent -- I'm being rough here in my percentages because I just want to give you an idea of what percentages of these wells I have used in each group. Between one and two billion I have used around 21 percent, or seven wells. Between two and three I've used 9.2 percent for three wells. Between three and four I have used five wells or about 15.2 percent; between four and five I have used three wells or about nine percent; and then out here in this range I have two wells, which represents about six percent.

Now, these 33 wells, which represents a pretty fair sampling across the field, I think, has allowed me to construct this curve, and in my opinion this shows fairly well that deliverability is proportional to the remaining gas reserves. Of course, we only have a couple of points out here. I'm not so fortunate as to have more points out there, but I think that the reason that

this curve is tending to slope over out here may be due to two things: One, that we only had a couple of wells out here at this point, or it could mean that the lower deliverability wells are already receiving more than their fair share of the current market --

MR. STOCKMAR: May I ask that the witness repeat that last statement? I didn't quite hear it.

MR. PORTER: Would you repeat the statement?

A I was saying that I wanted to point out to you -- I'm saying that deliverability is directly proportional to remaining gas reserves. Now then, based on the data that I have here, this is the average relationship that I have, that I've found, I'm saying that by looking at the curve you can tell that it tends to drop off out here slightly. Now I'm saying that this could be as a result of two things. We've only got two wells out here, this is obvious, but it also could be as a result of the lower deliverability wells obtaining a larger portion or more, I should say more than their fair share of the current market. Does that answer your question?

MR. STOCKMAR: Yes, thank you.

A Now, the average deliverability for these 33 wells is about 1240 MCF per day, as compared to an overall field average of about 1407. I would like to state again that for this reason, or based upon this data, which I think is a pretty fair representation. It's a pretty good sampling. I realize it's a small percentage of the total wells in the field, but I think it is a pretty

fair sampling of wells across the field where we have data that we can extrapolate and be fairly confident in.

This data, or an excise, I suppose, of the major portion of the field would be like this, and a larger majority of the points are falling in this area right here. I do have a few of them in here.

For this reason, a proration formula based primarily on deliverability is believed to be just and equitable, because by such a formula a well is given its fair share of the current market in proportion to its remaining reserves. Deliverability is the best tool to combine all factors that are pertinent to the volume of recoverable gas under a tract, those factors defining this gas, such as pressure, porosity, permeability, net thickness, and water saturation.

Q In your opinion, then, allocation on the basis of 75 percent acreage and deliverability plus 25 percent acreage does not violate correlative rights?

A No, sir, it does not violate correlative rights, except to the extent that instead of 75 percent acreage times deliverability plus 25 percent acreage, a more equitable formula should be based on 100 percent deliverability. However, the 75-25 formula is one which in my opinion provides a minimum allowable and by so doing adequately prevents waste.

Q Then in your opinion a minimum allowable is already accounted for in the present formula; should there be an additional

minimum allowable set, in your opinion?

A Well, an additional minimum allowable I feel will in effect change the current formula and will be more serious as time goes along, and before long there will be no proration in the field except on an acreage basis, because the current formula provides more than sufficient operating profit; there is no need for a minimum allowable.

Assuming future allocations to be about the same as the 1961 nominations, or about 56,650,000,000 cubic feet, and using the participating number of wells as shown in the April, 1962 schedule, I believe they used 530.55, but for my purpose here I'm going to use just 530 -- the current formula will provide an acreage allowable of 2,227 MCF per month per well, or 1,462 MCF per month per well over and above a reasonable economic limit.

Now this margin of profit that I've figured here, which is an average on a per month basis, based on prediction for an entire year, is equivalent to a profit of about $2,160.00 per year. By a projection of additional wells to be drilled for a total of about 745 participating wells in 1964, the acreage portion of the formula provides an allowable of about 1,585 MCF per month, or 820 MCF per month above a reasonable operating economic limit.

This is equivalent to an additional profit of about $1200.00 per year.

So it is obvious that an operator can afford to operate his well on the basis of the current formula, that is, if the well

is capable of producing that assigned allowable. Payout of the well is a risk that each operator takes in drilling that well, and should not be a responsibility of those other operators having wells of higher deliverability and higher reserves in a choice portion of the reservoir.

Q Mr. Cleveland, from a broad viewpoint, by the proposed change in the formula, have you made any calculation as to how many dollars a year will be taken from those operators having the higher deliverability wells and given to those having the lower deliverability wells?

A Yes, sir. I have estimated that on the basis of existing wells, that roughly a half a million dollars annually would be taken from 17 different operators and distributed to about 33 other operators in the pool, which in my opinion would be a flagrant violation of correlative rights.

Q How and in what manner will the future operations in the San Juan Basin Dakota Field be affected?

A Well, assuming a continuance of even a modest development program in the Basin-Dakota, any change in the existing formula in favor of acreage as opposed to deliverability, in my opinion will be highly prejudicial against those operators having higher deliverability wells with correspondingly higher reserves and will be unjustly in favor of those operators having lower deliverability wells and correspondingly lower reserves.

MR. KELEHER: I believe that's all this witness will

testify to on direct examination.

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

MR. STOCKMAR: Ted Stockmar.

MR. PORTER: Mr. Stockmar.

MR. STOCKMAR: Appearing for Consolidated.

CROSS EXAMINATION

BY MR. STOCKMAR:

Q Mr. Cleveland, you heard Mr. Street's testimony?

A Yes, sir.

Q Do you subscribe to and adopt his testimony?

MR. KELEHER: Well, we object to that on the ground that a great deal of testimony was given. To ask this witness whether he adopts it is unfair and irrelevant; it is immaterial to this case. He can ask him specifically as regards some phases of it, but to ask a question which calls for such a sweeping area, we object to it.

Q (By Mr. Stockmar) Do you agree with his testimony that Dakota sand with six percent porosity and high permeability will not produce gas?

A Well, in the entirety of the scope of that question, I think we have got to consider that when you are working with logs and a very relatively few number of core analyses, in some way or another you have to correlate this core analysis to your logging data in order to get the best coverage over your field. Now, in doing this, the logging industry has provided tools, or

they have made a considerable amount of research in being able to correlate core data with logging data. Now then, this six percent that Mr. Street is referring to, I'm not so sure that I have the best understanding of what he is referring to there, because he's trying to apply these rules to a large number of wells with a limited number of core analyses.

I think basically, in my own mind, that looking strictly at the core analyses, that I think that a three and a half percent porosity cutoff would generally correspond, now on the well log maybe what Mr. Street is calling a six percent, whether it would compare I'm not for sure. I haven't worked with him that closely on the preparation of these exhibits.

Q Based on your own experience and views, will a sand section which has a six percent porosity and a high permeability produce gas?

A If it has a high permeability?

Q That's what I said.

A Right.

Q It will?

A That's right, yes, sir. I think it will. Now of course, here again -- and you prefaced your question by "if" it has a high permeability. Also I would like to point out that it does have to contain gas. Now the water saturation may be high enough that you are pulling water in and you might not be able to produce much recoverable gas. Now I have tried to answer your

question as directly as I can.

Q Let's say that the water saturation is the average in the Basin-Dakota reservoir; I believe you said it was 35 percent?

A 34 percent, I believe.

Q 34 percent. At that average, then, you do believe that gas will be produced from six percent porosity sand with high permeabilities?

A I think it could be.

Q Mr. Street also testified that sand with over six percent porosity and with zero permeability will produce gas. Is that also your opinion?

A Over six percent?

Q Porosity.

A And zero permeability?

Q He testified that that kind of sand will produce gas. Do you subscribe to that view?

A I think it's rather obvious throughout the field that there could be cases that such a well has produced gas, or other instances where a well with similar characteristics would not produce gas. Now, I think it's entirely possible that on natural flow -- in other words, if you receive no flow, apparently you have no permeability or the gas is not there. Let's assume that it's no permeability. Now if you go in and frac that well and actually connect that well bore with the reserves which are lying away from the well bore, then you have increased your effective permeability

from zero to some higher extent.

Q But you apparently do not believe that the gas can be produced through zero permeability sand, is that correct?

A No, if it's strictly zero permeability, I think it would have to be fracked.

Q In your determination of reserves on Pubco Exhibit No. 7, did you take into account some of the factors which have been referred to as measurements of reserves such as acreage?

A No, sir. The acreage that can be considered as assigned to a well, in this case I think, though, could be 320 acres. Now then, the reason for this is that in initial hearings the spacing in the Dakota was established at 320 acres. Now then, as far as I can tell in my working with the production out there in the San Juan Dakota, I think 320 acres is a good spacing. Now --

Q The determinations you made, however, separately with respect to each well, were based on a pressure decline method, were they not?

A Yes, sir, that's right.

Q Therefore there was no occasion for you to consider acreage, was there?

A And neither was there an occasion to consider what the actual porosity, the permeability, the thickness, the water saturation and so forth is concerned. Now this procedure in calculating reserves is an acceptable procedure in the industry where the other method is by volumetric. Now then, this is a method of

measuring how much recoverable reserves that you have in place, recoverable reserves which can also be defined by the various rock characteristics such as porosity, permeability, thickness, water saturation, pressure.

Q Let us analyze more closely what you mean by reserves. I think you said that on this chart you have determined the remaining recoverable reserves for each well.

A Yes, sir.

Q Is that correct?

A Yes, sir.

Q That means, I assume, the reserves that are recoverable through that well bore?

A They are the reserves that are recoverable that are surrounding that well, and through that well bore.

Q What is it that controls the amount of gas that will flow through that well bore?

A Well --

Q Let me summarize. Is it not the order of this Commission that determines how much gas will flow through that well bore, the allowable order?

A Well, yes, in that sense it is -- well, not altogether. I mean it depends, first of all it depends on how much gas you have got there to start with, or the recoverable reserves that you are looking at. Now then, to the extent that the Commission's proration formula affects this, which at the present time on the

basis of 75-25 allows gas to be produced from that well bore, in my opinion, proportional to the amount of recoverable gas reserves this well has.

Q Your studies are based on the gas produced to date, is that not correct?

A It is based upon the pressures that were taken in 1961. Now then, for the individual well, these wells as you well know have their pressures taken from January through December, but the pressures corresponding to these deliverabilities measured through 1961 were used, and the corresponding production for the individual well up to the time that that pressure measurement and deliverability were made was used in the construction of this graph.

Q Did you make your projection of the recoverable reserves from each of these wells on the basis of the Commission's present allowable formula?

A I wouldn't say that to be true at all. You are looking -- you are concerned in this type of analysis with the amount of gas that has to come out of the ground, and this is what I have determined and used in my exhibit.

Q Well, I'm having trouble following you. Are you saying that each one of these wells could produce the gas reserve that you show for it, let us say in the absence of any proration order, any allowable order, is that what you are saying, or without respect to the order?

A No. I prefaced my statement there that on the basis of the 75-25 formula as we have it right now, the wells are being drained in proportion to the recoverable reserves in place. Now, the gas that has been produced from that well has been used in the construction of this exhibit. Now I think, and of course I have no proof of this, if we had started back some time ago on the formula that your group is proposing, I don't think that we would be able to see this type of correlation.

Q Mr. Cleveland, on Wednesday in my opening statement, I made some fairly blunt remarks about statistical manipulation or something like that. I'm trying to find out from you if these producible reserves, as you have determined them, are based upon the present formula. If so, I'm not the least bit surprised that the resulting line might seem to support the existing formula.

MR. KELEHER: Now we object to that statement. That's practically insulting, and accusing the witness of having manipulated. We ask that question be stricken from the record and that counsel be prevented from pursuing it further.

MR. PORTER: The statement will be stricken.

Q (By Mr. Stockmar) Well, Mr. Cleveland, will any given well in your opinion produce the remaining recoverable reserves you have assigned to it, under or in the absence of any allowable order? If that well were simply allowed to produce without restrictions, are those the reserves it would produce?

A I would say that if this field was to be produced on

the basis, and prorated on the basis of 100 percent deliverability, then we would get even a better picture than what I've shown here. Now then, all I am saying is that it's -- you referred to mathematical gyrations, I think it can be shown mathematically, or I think it's even reasonable to say that when deliverability is proportional to reserves and it is withdrawn on a -- based on a parameter which is proportional to those reserves, then that we will recover the amount of gas that is underlying it.

Q Mr. Cleveland, I honestly have no intent to be insulting or anything, but I'm still trying to find out whether or not these producible reserves would be producible from these particular wells if we had no proration formula, no allowable formula whatsoever. Is this a valid prediction in the absence of consideration of any order?

A If we had no order whatsoever, then I think you can see that each well would then produce at a rate corresponding to its present deliverability, or its deliverability as time goes along. I didn't mean to say present deliverability, and in a sense, then, you would be producing that field based on a hundred percent deliverability.

Q And this is what you propose the Commission should adopt as an order?

A I'm saying that if there is to be a change made, that it should be in the direction of 100 percent. I have also indicated that because of this minimum allowable situation, that has

brought up some question that the 25 percent acreage factor in the current formula provides a minimum allowable, and I don't know what the extent, but it's reasonable that it could eliminate some violation of correlative rights.

Q As I understand you, then, Mr. Cleveland, you say that eliminating all restrictions whatsoever would be the same as operating under a hundred percent deliverability formula, is that correct?

A Yes, that's right. It would be producing thirty days a month or 30.4 days a month instead of just a very limited number of days during the month as we had under the current market.

Q Then if I follow you, since you are recommending that a 100 percent deliverability formula be adopted --

MR. KELEHER: May it please the Commission, this witness has not recommended that to this Commission. I object to the form of the question.

MR. STOCKMAR: In the opening remarks of your company, was not that recommendation made by some spokesman?

A I believe, sir, we were saying that if there were a change to be made, it should be in the direction of 100 percent. Here I have never recommended straight-out 100 percent.

MR. PORTER: The recommendation was conditioned.

Q (By Mr. Stockmar) Let me pose the question this way. If I understand you, then, as we approach a formula which has 100 percent deliverability, we are, by your own statement, approaching

no restriction by this Commission, is that correct?

A That's not right, no, sir. I'm not saying that at all. If the market were provided --

Q Yes.

A -- and we could produce every well as much as it would go, we have no restriction; but at the same time, since each well is producing at its capable rate, now then, we may be producing thirty days a month here in this instance; then each one of these wells then will recover its fair share of or its proportion of the gas that's being produced in the entire field, and it will also be proportionate to the recoverable gas under that well.

Q In the absence, then, of any limit on the market, a 100 percent deliverability formula would be without restriction by this Commission, is that correct, if there were no limit to the market?

A I think obviously if there were no limit to the market and we could all sell our gas, the Commission wouldn't have a problem.

Q Is not the production of gas wells at their full capacity, at their highest deliverability, is this not what used to take place under the pre-conservation days under the rule of capture? Everybody produced his well for all it could make?

A I think you can say that that's true; however, the problem that we've had or the question that has arisen insofar as this old rule of capture that you are talking about are those

instances where a man has a well on a very small tract of land and obviously then he could be violating some of his neighbor's correlative rights over there, but now we don't have a situation like that here as severe as all that.

In April we had 572 wells, total. Now then, some of those wells were marginal wells and were classified so. I don't know exactly the number of 100 percent non-marginal wells, but on a participating basis there were 530.55, I think, which accounts for these smaller acreage tracts. Now in the pool you've only got one or two wells, I think you have got one well that has an acreage factor of .13. Well, in the present formula that's taken care of. He's knocked down proportionately because he has a small acreage factor there. Now most of the other wells, there are three other wells, as I recall, that have acreage factors of 50 percent, where all the rest of them are up in the neighborhood of around 90 percent to, oh, say 114 percent.

I'm shooting from the hip here on those values, and you can probably pick one out of there that's 120 or so, but roughly that's the range. We are looking, as far as proration on an acreage basis, when the majority of your wells or all your wells have the same common factor, then that factor really can't be entered into a proration formula, in my opinion, in order to be equitable.

Are you trying to tell the Commission that each of these 33 wells will produce these recoverable reserves from exactly

the same surface area?

A You are talking about areal extent now, out of 320 acres --

Q You have just testified at length that when all of the acreage is more or less identical for each well that it's not material to the rule of capture or something like that. I'm asking --

A No -- Excuse me.

Q I'm asking you if each of these 33 wells to which you have assigned different producible reserves each will produce those producible reserves from an identical 320-acre surface area?

A I'm not saying that. I'm --

Q I am asking you -- Go ahead.

A I am depicting here the amount of reserves that can be recovered from an assigned 320-acres to this well. Now then, out there on the boundary of this 320-acre circle, admittedly it's not a square which we are producing from, but whenever all your wells are a pattern, in essence you are producing from a circular 320 acres. In some of these wells there's going to be some gas out there away from that well that within an economic period of time -- now when I say that, it may be 20 years, it may be 30 years, it could depend on the individual -- there's going to be some of the gas out there that's not going to be recovered.

Now then, that unrecoverable gas, you may be able to

crowd it all into say fifteen percent of the 320 acres, or twenty percent, I don't know. But there's one thing for sure, that in the proration formula we're starting off to see that the recoverable reserves that are going to be coming from that well is going to be drained from all of that 320 acres.

I think the Basin-Dakota is so, as tight as it is, and looking at what little geology we have of it, I think basically the formation is just very tight. Consequently, there's going to be some of those reserves out there that cannot be recovered through a low deliverability, and if they can't be recovered through that well to which it's closest, it certainly can be recovered from some adjoining well over there.

MR. PORTER: At this point we will recess the hearing until 1:15.

(Whereupon, the hearing was recessed at 12:00 o'clock.)

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AFTERNOON SESSION
April 20, 1962

MR. PORTER: The hearing will come to order, please. Before we get back into the case, Mr. Stockmar, you may continue your cross examination after -- there have been a number of questions with regard to running the hearing and when we would recess. We are of the idea that we should run the hearing on if we could conclude the case by tomorrow noon. It seems pretty apparent right now that we would not be able to do it. If we should recess the hearing, we probably would recess it until Tuesday morning.

MR. KELLAHIN: You are asking for suggestions, if we do continue it, as to what date we should continue it?

MR. KELEHER: We are almost through as far as our presentation is concerned. It might be advisable to consult some of the other counsel who will have witnesses about the extent of their testimony, and also what the Applicant proposes to do in the way of rebuttal. That might give the Commission some idea of the time. Adjourning it until Tuesday would not be very convenient for us because that's the day for the Annual Meeting, and most of us have to be there.

MR. STOCKMAR: Even though the rate of progess up to this point has not been rapid, I would recommend that we try to finish up by noon tomorrow. I think from our side at least we'll be able to move much faster, and just as fast as the opposition will permit.

MR. PORTER: I have been advised by Mr. Howell that he doesn't think their direct testimony will take very long. What about Aztec?

MR. SWANSON: We have one witness. I anticipate our direct testimony will probably take something in the neighborhood of 45 minutes. However, observing what has happened so far, I think an estimate of that type could have been made for most of the direct testimony that has been put on. I think it's running considerably longer than most of us would guess. It is our opinion we would not complete by noon tomorrow, and we would like to have

a recess.

MR. PORTER: Mr. Howell, how long do you think it would take El Paso to put on their direct testimony?

MR. HOWELL: Thirty to forty minutes.

MR. PORTER: Would you like for us to go ahead until noon tomorrow before we make this decision?

MR. HOWELL: Speaking for El Paso, we would like to go on, keep plowing. It's been my experience in these hearings that when you recess and reconvene that you plow a lot of the same ground over again.

MR. WALKER: Some of it has been plowed.

MR. KELEHER: That would be our preference, Mr. Chairman, that we continue.

MR. PORTER: We'll keep going. Mr. Stockmar.

CROSS EXAMINATION (Continued)

BY MR. STOCKMAR:

Q I am not certain exactly where we were, Mr. Cleveland, when we recessed, but I think we had reached agreement that an allowable order based on 100 percent deliverability, assuming such an order, in the absence of any restriction on the market was in a sense the application of the ancient rule of capture. I think we had reached that agreement, had we not?

A Mr. Stockmar, basically I would say that we had; however, I had qualified that concerning the smaller acreage tracts and that this situation on a general overall basis did not exist

out here, with the exception of maybe two or three or four wells.

Q If we have again assumed 100 percent deliverability formula but a restricted market, is not the only difference -- since the permissible allowable of each well is proportional -- is not the only difference the time, the greatly extended time within which the rule of capture would apply?

A This rule of capture that you are mentioning here, as I'm taking it, is in the sense of capturing something which isn't yours.

Q No, under the rule of capture, whatever you could get was yours.

A I've already stipulated that in an instance such as this, your rule of capture where you are producing a well at its capability, then since it is in proportion to its capability, and I have said, I believe, that deliverability is proportional to remaining reserves, then the gas that this well recovers is the gas that's due that well to start with.

Q In other words, for this field you approve of the rule of capture, basically?

A Well, in the sense that the rule of capture here is not even.

Q Whatever the well will produce, it is entitled to?

A If I've understood your question correctly, we don't have that problem here. And I've said there may be two, three, or four wells where the tract acreage is small, or the fraction

is small, of the 320 acres, and in those instances the formula that we now have cuts that particular tract back and all the others are based on 320 acres or thereabouts, so any time you start trying to throw something into the formula that is common to all wells, then you really have no need for that factor in your formula.

Q Well, I think we do understand each other that you are satsfied with an order which permits each well to produce all or some prorata part of all that it can make, its deliverability?

A Mr. Stockmar, I can't answer that question yes or no. It's not the type of question you can, and I'm not trying to evade you, but at the same time that this well is producing all that it's capable of making in your hypothetical situation here, all of the other wells are doing the same thing.

Q Yes.

A Now if all of the others were shut in and this one well were producing, then you would have a problem.

Q Well, I think you had also testified, or we were very near it, I've forgotten, that the drainage area for each of the 33 wells on your Exhibit 7 was approximately 320 acres?

A This has been the acreage which has been assigned to that well. Now then, on a tract to tract basis, the acreage factor might vary to some extent.

Q You mean there will be some variation from 320 acres, is that in a sense the average drainage area that we're speaking of or that the Commission has found to be a fair average drainage

area; isn't that what a spacing order is?

A Well, yes, spacing has been assigned to this field, basically.

Q Will some of these wells over a given period of time, say ten years, drain less than 320 acres?

A I would say that in this Basin-Dakota that there is a larger probability of one of these wells draining less than 320 acres than more than 320 acres.

Q Well,how about a well in the low deliverability range, in ten years will it drain more than 320 acres?

A In ten years?

Q Yes.

A I couldn't answer that question, if I was going to be shot the next minute.

Q Will it drain less -- well, let's use a comparison.

A There again I couldn't --

Q Will a low deliverability well during a ten-year period drain a smaller radius of drainage than a high deliverability well?

A I think the fact that the better well, as indicated by its higher deliverability, is an indication that more of that 320 acres will be drained than a lower deliverability well will drain.

Q Is there any possibility that one of the lower deliverability wells will drain gas from someone else's 320-acre drainage area, if it can't drain its own?

A Yes, I think there is that possibility, particularly if withdrawals from that reservoir on an individual well basis is not proportional -- may I --

Q If a well cannot drain in a given period of time the 320-acre circle around it, how can it drain an area beyond that?

A Well, now, when we answer or when we consider these type of problems, we always have to also throw in an element of time. It just depends on -- This is why I couldn't answer your ten-year question a while ago.

Q You testified several times, Mr. Cleveland, that it is the low deliverability wells that are guilty of abusing correlative rights in this field. This must be because they are reaching out beyond their 320 acres. How else could they be abusing correlative rights?

A Well, here again we're having, we would have to determine how serious this is. We would have to consider an economic time. Now then, all I've said was that on the basis of this data right here, and I didn't say that it was a fact, I just said it looked like it might be this is what's happening, that there is more credit being given to the lower deliverability wells than they should get. Now then, I may be corrected on this, I don't think I have ever said that a low deliverability well could not extend out and drain more than its 320 acres.

Q No, you did not say that.

A I think that under a proration formula such as is being

proposed, this type of situation could become more serious and we would certainly be able to detect it in a shorter amount of time than we will be under the 75-25, because I think under the 75-25 some of that is going on right now; but because of the short amount of time, I can't really definitely prove it. I'm saying that it would not exist if we went further in the direction towards 100 percent deliverability factor.

Q Mr. Cleveland, on your chart you show two wells having gas reserves of approximately three and one-half million cubic feet. Have you found those --

A Having reserves of three and a half?

Q Yes, sir.

A All right.

Q One of which has a deliverability of, what is it, a million and a half? The other has a deliverability of 3.8 million.

A 3.9 million, I believe.

Q Approaching three times as large a deliverability, is that correct? Two and a half to three times, as the first well?

A Now which are you calling the first well, with the 3.15 million?

Q No, 3.5.

A 3.5, okay.

Q The other one also having 3.5 million reserves and a 3.8 or 3.9 million deliverability. Have you discovered those?

A Yes, I see the ones that you are talking about.

Q In a given period of time, with these wells producing at their full capacity, which well will produce the most gas, the largest part of its three and a half million reserves?

A Based strictly on the individual data point which in my correlation here I have not elected to do, I have used a trend through all of the points to represent an overall average, certainly within this data there can be points which can be picked out which if I'd so desired I could have left them out, that would not be consistent with the overall general trend of data. Now then, the top point up there, in fact, I've got two, those are individual cases and I think certainly over the field that you can pick out individual cases, individual problems that you have, for some reason or other. If one had the time to check back into each one of these wells and see if there had been a new set of perforations or if the well had been fracked additionally, in order to extend out and connect the well bore with additional reserves, then points like this I think could be better explained.

Q Mr. Cleveland, I'm not trying to place any weight on this line whatsoever. As I understand, what you have done, these points represent two individual wells, do they not?

A Yes, that's right.

Q And as to each one you have taken the calculated deliverability in accordance with the formula adopted by this Commission?

A Yes.

Q That gives you one of your axes, does it not, or altitude

on the axis here, deliverability?

A Okay.

Q Then as to each of those wells separately, you have, through a pressure decline method, computed the reserves that each of those wells is capable of producing, have you not?

A That's right.

Q Well, then, ignore the line in the middle, we have two wells with equal producible reserves at this point, one having almost three times the deliverability of the other. My question was, during any given period of time, if these wells operate at their capacity or at their deliverability or any prorata part of it, which well will produce its producible reserves first?

A If this well, the higher well, were to maintain the high deliverability that it has right now, which I'm fairly sure that it wouldn't, then in picking out those two data points, the top point may or it may not, or the top well may or it may not produce those reserves first.

Now, in saying this, one has to consider that in the decline of deliverability or in the decline of capability of a well, there are a lot of factors which have to be considered. I am analyzing from strictly what happens, and that is the pressure differential from the exterior radius of your drainage area to the well bore, the permeability that's involved, the viscosity of the gas, which I would presume to be about the same for both wells, and then --

Q Well, possibly my question --

A I think that pretty well covers it.

Q -- is too broad, Mr. Cleveland. I said in any given period of time, what would be the situation; which of these wells will produce the largest share of its producible gas in the period from now until the next deliverability test is taken under the existing allocation formula?

A If we say that this well maintains the same deliverability, then certainly this top well will produce its reserves first. However --

Q Well, this is the answer that I have been seeking. Were you here during Mr. Trueblood's testimony?

A Yes, I was.

Q Did you see -- it's buried in the exhibits up there -- but a cube that he used as an illustration?

A I saw it. I have my own opinions about it.

Q As I remember, there were two side-by-side tracts with equal reserves such as we have with these two wells with different deliverabilities, different orifices, more gas coming out of one than the other.

A I believe he testified that if one were to be voided earlier than the other, that since there was no guard-all shield between them, some kind of a redistribution of the gas in the reservoir would take place, and that the high deliverability well with equal reserves would produce substantially more of the total gas

than the other. I think he further stated that in his judgment this was an abuse of correlative rights.

Q Do you disagree with that?

A Yes, I certainly --

Q With those premises?

A I certainly do. Certainly you can get up here and make a very basic diagram and say real easily, "This is what happens." Now first of all, under the two tracts of land, I've already indicated the variation in reserves from tract to tract, or the possible variation. I think it's very unlikely that the two tracts would have the reserves to start with, much less of the same slope characteristic on a back pressure type plot.

Now then, I bring this into it because it's very important. The slope of your curve on your standard back pressure plot or in your back pressure equation is a function of permeability, thickness, pressure differential, radiuses of drainage, temperature, gas viscosity, so forth. Now then, this was not even brought into this exhibit; it was not explained at all. The problem out there is not as simple as this.

Q Well, are you saying in essence that if there is a void space in one part of the reservoir and gas in the other, that there will be no migration from one to the other; the gas will not move to fill up the void space?

A Well, first of all, if the two wells have the same reserves, if they have the same permeability, and by reason of having

the same reserves, they have the same combination of porosity, water saturation, thickness and so forth; then those two wells are going to have about the same deliverability.

Q Certainly.

A Okay. Consequently, you don't have this problem if the two tracts are the same identically all the way through.

Q Then I'm forced to conclude, since I would not criticize the method of determining deliverability, that there must be a substantial error in your method of calculating reserves. Is it possible that you have too limited a pressure history for the pressure decline method to be valid?

A Well, engineers in most cases, or a lot of cases, are in the unfortunate position of having to work with very limited data. We're unfortunate also that we have a limited amount of time that we have produced this Basin-Dakota, in order to have more wells, a larger number than I've shown here, to demonstrate the thing that I'm trying to demonstrate.

Q If you had substantially more decline information, production history, you feel that you could make a more accurate estimate of reserves?

A These things always have to be revised as time goes along. Now two years ago there was only one point on these wells. Some of them have more than three points, but say two years ago you would not have been able to make as good an estimate as I feel I have made on these.

Q I think you testified -- Well, excuse me, do you have any idea what percentage of the producible reserves under these 33 tracts has been produced today?

A Well, I haven't, from my graph, I haven't averaged the reserves up and, against the cumulative production or anything like that. I don't think I have. Wait a minute. I don't recall doing it, but I may have. I can't seem to find it, Mr. Stockmar. I may have played around with it a little bit, but I don't have it right here handy.

Q Are you in a position to make available to us for inspection your pressure decline curves on each of these wells that you created in connection with these exhibits?

A No, sir, I'm not prepared with the curves. I have located the wells on the map and the data is available.

Q You don't have pressure decline curves?

A Yes, I have pressure decline curves, but I'm not prepared to show them.

Q This is basic data to this exhibit. Are you saying that you are unwilling that we see these?

A No, I'm not unwilling at all; I'm just saying that with the rough copy that I have here with me, I have not prepared additional copies for distribution for the Commission so they can inspect them closely and so forth. Now that's the reason --

MR. STOCKMAR: I would like to request the Commission to direct the witness to make available to us even these rough copies

for inspection. There is no use to take an extended time at this moment for that inspection. We can be looking at them in the course of the next few hours and possibly recall this witness for a question or two, but if the witness has basic data in support of his work here, we should be entitled to see it.

MR. KELEHER: If the Commission please, we object to that procedure. The witness is on the stand. He states under oath what he has done. He has prepared this exhibit and we believe that counsel is limited to the scope of the exhibit as it's submitted here.

MR. KELLAHIN: We join in the motion made by Mr. Stockmar that these be made available for inspection, because they are basic to the Exhibit No. 7. We have no way of testing the accuracy of the witness' work or conducting an intelligent cross examination of that exhibit, absent taking well-by-well, having him identify it and give the production history and the pressure point and the other information used. To make these documents available, even though they are in rough form, would certainly be in the interest of saving time. We submit it is a proper request.

MR. HOWELL: If the Commission please, might I suggest that the basic data is data which is available in the files of the Commission; that this represents only the witness' work, and the basic data is a matter of public record; and I question whether this would come within the category of basic data.

MR. PORTER: The Commission rules that if the witness

has the testimony available but does not choose to enter it into the record or make it available, then the Commission will not force him to do so; therefore, we sustain the objection.

MR. STOCKMAR: I would like to note an exception.

MR. KELEHER: If the Commission please, it is not on the ground we are unwilling to do it. It is the materiality. What they want to do is to get his study papers. The witness has testified that the exhibit reflects 33 wells, that the data was obtained from the official Commission records. Those records are available to the Applicant here in this petition. Let them make their own study. Let them produce a witness who will testify directly opposite, if they wish, to what the witness Cleveland has testified to. But to ask us to make available all of our work papers is something I have never heard of before.

MR. KELLAHIN: If the Commission please, since we seem to still be arguing the same motion, I would like to point out that the material part of the information used in this exhibit is his interpretation of it, which is admittedly available. That is the information we want to obtain in order to test his determination from an engineering point of view.

MR. KELEHER: As him any questions you want on the record.

MR. STOCKMAR: Does the record show that the Applicant takes an exception?

MR. PORTER: Yes.

Q (By Mr. Stockmar) Did you exercise any individual

judgment in preparing these curves?

A Certainly. In a matter like this, there is always a matter of engineering judgment that is required.

Q Is there a full copy of that in the records of this Commission?

A A full copy of the data?

Q No, of your judgment.

MR. KELEHER: If the Commission please, I object to the form of that question. Judgment is something intangible. It can't be placed in the record. It's a matter of opinion.

MR. PORTER: You contend that judgment can't be copied?

MR. STOCKMAR: Well, the Applicant contends there is a picture that needs judgment up there on the board.

MR. PORTER: Objection sustained. Let the record show that the objection has been sustained.

Q (By Mr. Stockmar) One more question only on that vein, Mr. Cleveland. I think you testified that you took your pressure data from the deliverability reports of these 33 wells, is that correct?

A Yes, sir, that's right, from the Commission records.

Q That pressure data was taken at three different times on three different reports?

A Yes, sir. The data in 1961 was read directly from the Commission reports. The statistics for the other two years and beyond that, which were taken from the official records of the

Commission and published in the New Mexico Oil and Gas Engineering Committee Statistical Book, data which was compiled from the Commission records.

Q Was there individual pressure data for each of these 33 wells for each of those three periods?

A Yes.

Q And that is available in the records of the Commission?

A Yes, sir. Now there might be a few wells in there that would have three or four, maybe five points; but all of them would have at least three points.

Q What is the required time for shutting in a well prior to the taking of a deliverability pressure measurement?

A Seven days.

Q Is seven days ample time for all wells to --

MR. HOWELL: If the Commission please, that's a rule of the Commission, and I for one hope that we can get through with this. I ordinarily don't intervene in anybody, except my own witness, but that's the rule of the Commission. I assume by this that the Commission considers it adequate, and for this question, it seems to me it's utterly improper and extraneous to any issue in this case.

MR. KELLAHIN: It's a question of adequacy of the test, for one purpose as contrasted to another. This has been used for extrapolating a pressure decline curve, and that is one thing, in determining a deliverability of a well, and using a pressure in the

formula is something different. The Commission's order has nothing to do with the testimony of this witness.

MR. EVERETT: Could I suggest to counsel, ask him whether he used the Commission figure for that seven-day period, in the interest of saving time, which comes first.

MR. PORTER: Objection overruled.

Q (By Mr. Stockmar) Mr. Cleveland, if a low deliverability well is shut in for over seven days, will it reach its maximum shut-in pressure during that period?

A On some of the wells it will. Some of the wells it won't.

Q Is it more likely to reach its shut-in pressure if it is a high deliverability well?

A Yes, sir, that is correct.

Q Therefore --

A Now the pressure that you are speaking of -- excuse me, sir. The pressure that you are speaking of is that pressure which is closest to the static reservoir pressure.

Q But there may be a difference in the validity of the data as between low and high deliverability wells?

A As far as the accuracy of static shut-in pressures; however, in the interpretation of this data, in a low deliverability well from the initial pressure to, say the point at the time when the second, third, and fourth pressures are taken, this pressure that you see after the first point or that initial point, the slope in those later points is such, in my opinion, such that you can

extrapolate those three points and arrive at about the same point that you would at abandonment pressure, as you would by extrapolating those three points had it been allowed to shut in, or if the well had been shut in and allowed to build up completely to a static reservoir pressure.

Q This assumes that the well was shut in for seven days only during each period, is that correct, so that there is a comparison that can be made?

A In the previous sense or the later sense of static reservoir pressure, or the seven-day shut-in as it stands right now?

Q The seven-day shut-in.

A Yes, that's right.

Q If some low deliverability well happens to be shut in for some extended period of time just prior to deliverability test, then this would not be a fair comparison, is that correct?

A Well, sir, I believe as the rules are set up right now, before the deliverability test is taken the well is tested for about thirty days, is flowed for about thirty days. Now this has been established by the Commission as a conditioning period, and I would assume that their judgment is that it is adequate.

Q To change the scenery quite a bit, Mr. Cleveland, I think you've testified that one of the reasons that you favor the large weighting of deliverability in the allocation formula is because it is the one thing that's known about all of these wells

that's precise. Was that not your statement?

A Well, it's the one factor which is, that has been calculated or has been determined for each individual well, and I feel like that since this data is taken regularly on an annual basis, that from time to time you are checking and rechecking yourself as you go along on this factor.

Q That is what you did say?

A No, I didn't say it. I'm just saying it right now. I'm explaining it to you.

Q I submit, Mr. Cleveland, that under the Commission's spacing order that the acreage attributable to each producing well is also known with great precision, is that correct?

A That's right. And it's also about the same for every well in the field. This is why it's not particularly an important factor.

Q It's equally precise as far as deliverability is concerned?

A It's precise. If we have two apples and you have one and I have one, and we want to split the two apples up, the only logical approach is for you to take one apple and me take the other one.

Q As Mr. Trueblood tried to say on the witness stand, that's why we are here. I submit to you, Mr. Cleveland, that if those two factors and those two alone, both of which seem to have a direct relationship to reserves, are there, that we should have

at least reached the fifty-fifty weighting at this time, do you agree or disagree?

A No, sir, I certainly don't.

Q Do you agree that the surface acres does not bear a direct relationship to the reserves?

A The size of the surface acres, as I have already stated, is about 320 acres per well. Now then, the scenery that you have on the surface over that 320 acres doesn't really count.

Q Well, is it fair to say that if we have a chart like yours, with reserves here, acreage here, we start with zero -- our first point is 160 acres, our second point is 320, 480, and 640; and I say to you the reserves under a particular 320, according to your chart, average two billion cubic feet?

A Is that a weighted average or just an arithmetic average from one end of the scale to the other? Is that what you are --

Q Why don't you give me the average reserves of these 33 wells and we'll use that. Will that have to be computed, Mr. Cleveland?

A Yes, sir, I don't have it handy.

Q I thought you testified that the average deliverability was 1240.

A Well, that's right.

Q Well, I submit to you, Mr. Cleveland, that if this chart has any validity, that if you can find 1240 on the curve, the average reserves of an average well will be directly beneath it.

A Mr. Stockmar, the sense in which you asked the question was an average on an individual well basis. Now the average relationship that I have shown through here, I would say that it is reasonable to say then that the 1240 does compare with an average of about two million.

Q Let's get back to my hypothetical chart here of acreage versus reserves. Using your average two billion, I'll put that at the 320 point. What should be the average reserves under a 160 tract, half of that, I submit, one billion?

A Yes, on a proportional basis, yes.

Q So we'll put that point. What should be the reserves in a 640-acre tract?

A Twice that amount. Now this is the amount of gas.

Q Should I connect those lines, will I have a nice straight line?

A In that sense you will, but you are working with one individual well as an example. Now then, the reserves in proportion to my curve here, if all of the wells were producing in the field on a 160-acre basis, or if all the wells were producing on 640 acres, then the relationship that you are talking about would be true for the entire field. In other words, the --

Q Mr. Cleveland --

MR. KELEHER: Let him finish.

A -- the 320, for an average of 1240, the reserve is two billion. For 640, if it would drain 640, could be in proportion

to that number and be twice that amount. Now then, this is provided that the drainage characteristics to that well bore over 640 acres will be in proportion to the data that is represented here by this chart.

Q (By Mr. Stockmar) I admit, Mr. Cleveland, that I am engaging in some mathematical gymnastics, as I called it here. I think you said that this might be valid as to a given well, this kind of thinking.

A Well, I think it could be valid to the extent that you are not looking at a large amount of area there; of course, as you go from 160 and you have one well draining 160 acres, the chances are you are going to be able to recover a slightly smaller fraction of gas from that 160 acres, as compared to the fraction of gas that is recovered from 640 acres by that same well.

Now, from that standpoint, your curve wouldn't be exactly correct.

Q But fairly --

A I can't say what there would be.

Q -- fairly good relationship, general relationship, would you say?

A Well, it's just an arithmetic proportion.

Q For a given well only, or is it true of groups of wells? I may have misunderstood you.

A No, I didn't say it, you did. It could be proportional. I've already said it could be proportional. Now the area that is

involved, I couldn't say. I am saying a larger percentage of gas could be recovered from the 160 acres; as you go out to the ranges of 640, well, the overall fraction or percentage of the gas that was there to start with would decrease as you go out. I think --

Q Well, if we worked with all kinds of varying acreage sizes and varying reserves under them, we could make a scattering of points, could we not?

A Well, to me it wouldn't mean anything. What would it mean?

Q Well, it would show that there's a very definite relationship between acreage and deliverability or acreage and reserves. If we are able to determine, as you have many times here, that this particular well has these reserves and it drains this many acres, some more, some less than 320, we can get a scattering of points, can we not? Can we not draw just the kind of a line that you have drawn on Exhibit 7?

A Mr. Stockmar, we have, in approaching a problem like this, we have to stay in the realm of all reason. Now in my opinion, such a thing like that in a field here where I've already indicated to you that we've only got a few wells which are not exactly 320, and they fall some below that and some above that, so this is not the major problem that we're concerned with here.

Q Then you are assuming that each well will drain its 320 acres and no more and no less, is that correct?

A This drainage area I think is a pretty reasonable spacing

assignment, and apparently the Commission has assigned this acreage to the well or to the field, and I'm just saying that I don't have any reason to quarrel with it. In my opinion, I think that 320 acres will be or is the maximum unit that could be assigned.

Q Does a spacing order protect the operator's general drainage?

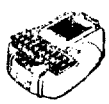
A Well, sir, as tied in with the present proration formula it certainly does.

Q Yes. Yes. Does a spacing order standing by itself, is that any measure of the amount of gas that might be produced through a particular well? Because the Commission says that 320 acres is the proper spacing unit, how does an individual well know that it must drain only that and no more?

A Well --

Q Is it not necessary to implement a spacing order with a proper allocation formula?

A Well, the spacing order itself, by the mere fact of having the spacing order, the Commission has from an acreage standpoint made that step which will prevent the violation of correlative rights.. Now then, if it were not, if it were, if they had a random spacing out there and you had one well assigned 320 acres, the other well assigned 160 acres, then there, that is an instance where the rule of capture point that you have made would certainly be applicable. Now then, this is not the case. The spacing is 320 acres and by far a large majority of the wells are on 320 acres.



Q If spacing orders alone will protect correlative rights, why do we need allocation formulas at all?

A Because under those, under that acreage which I'm saying for all practical purposes is constant here, under those 320-acre units you don't have the same reservoir characteristics, the same amount of gas in place, the same recoverable reserves. Now then, I mean that to me should be, should answer the question.

Q I think I will ask one more time, Mr. Cleveland, is it possible that a high deliverability well will drain gas from an area larger than 320 acres?

A Are you asking will it --

Q Yes. Will any high deliverability well drain gas from more than 320 acres?

A Well, sir, I've already stated that I think 320 acres is an appropriate spacing unit.

Q Yes, sir, you have.

A Now that in itself should answer the question that a large deliverability well is draining its 320 acres. Now, I have right here with me, I have no more definite proof that a large deliverability well will be draining more than 320 acres, than I have a low deliverability well would drain less than 320 acres; but I'm saying that the Commission has considered data and apparently testimony, and has assigned 320 acres to this field, and for me, I'm saying that it looks like a good assignment.

Q Mr. Cleveland, indulge in one hypothetical thing with

me. Suppose that one operator -- let's make it Consolidated, that would be more fun -- drilled one well right in the middle of this big red patch, and no other wells were drilled, would that well in the course of time drain more than 320 acres?

A Now the course of time that you are speaking of here, just any length of time; it would certainly take, I think, a relatively large period of time for it to do that.

Q Let's start with an infinite amount of time. Would it drain more than 320 acres then?

A For an infinite length of time?

Q Might drain the whole reservoir, in a sense?

A That's right. I think it would be a mighty long time.

MR. PORTER: I was hoping you would qualify that.

Q (By Mr. Stockmar) It is a high capacity well because it's right there in the high deliverability part of the field. Let's give it ten years. Will it drain more than 320 acres? Will gas from outside a 320-acre circle move across the edge of that circle?

A In ten years?

Q Yes, sir.

A Nobody can answer that question definitely.

Q Will there be --

A Unless you can consider all the factors and calculate through radial flow calculations or at least have a better estimate than just the facts that you have presented here, I can't

say yes or no.

Q You have a strong background in connection with this field and its information. Do you have any opinion without looking at specific factors for this well?

A I would say that within ten years -- Mr. Stockmar, rephrase your question and let me get my train of thought back here, if you would please?

Q Consolidated Oil and Gas drills a Basin-Dakota well right in the heart of the -- I've forgotten what it is called, but in the very high deliverability area; is the only operator to do so. It produces without restriction from that well for a period of ten years. Will it or will it not, will that production cause gas to flow from outside of a 320-acre circle around the well into that 320-acre circle?

A What size well is it? Would it be considered a very high deliverability?

MR. KELEHER: If the Commission please, I believe we're wandering far afield on this hypothetical question. There's no testimony before this Commission on such a well. We object to that line of questioning.

Q (By Mr. Stockmar) I gather that your answer is that you do not know?

A Yes, sir, it is impossible to know; I mean, to give you a specific answer.

MR. STOCKMAR: Gentlemen of the Commission, that termi-

nates my examination of this witness.

MR. PORTER: Does anyone else have a question?

MR. STOCKMAR: I would like the record to show whether or not the objection is sustained or overruled.

MR. PORTER: Have you changed your line of questioning, or did you just terminate your questioning? I didn't hear the last question that you asked after the objection was lodged. Did you ask another question after that time?

MR. STOCKMAR: No, sir.

MR. PORTER: The Commission will sustain the objection.

MR. KELLAHIN: If the Commission please, may I examine the witness?

MR. PORTER: Yes, sir.

BY MR. KELLAHIN:

Q Mr. Cleveland, to get back to the issue which was just dropped, earlier on cross examination by Mr. Stockmar, you very readily said that there was more chance that a well would drain less than 320 acres than more. Do you recall that testimony?

A Yes, sir, I think that's a fair statement.

Q And yet you say 320-acre spacing is good spacing.

A Well, your next proration unit would be logically 160 acres, and certainly I think 160 acres would be drained. Now then, I'm saying that 320 acres is the largest proration unit that I think is valid for this field. I think if it were on 640 acres, I think it would be a mistake.

Q You gave as your judgment that one well would have more chance of draining less than 320 than more. Will you give us your judgment as to whether a well in the Basin-Dakota Pool can drain in excess of 320 acres?

MR. KELEHER: May it please the Commission --

MR. PORTER: Just a minute, Mr. Keleher. I didn't hear that. I was in conference with Mr. Walker. What was that question?

MR. KELLAHIN: The question was that the witness testified that in his opinion there's more chance that one well will drain less than 320 acres. My question is, in his judgment, based on the same factor, is there a chance that one well will drain more than 320 acres in this Pool?

MR. KELEHER: We object to the question on the ground this is not a spacing hearing. It is incompetent, irrelevant, and immaterial.

MR. KELLAHIN: If the Commission please, the question pertains to the extrapolation of a production decline curve, which is a factor in this case.

MR. PORTER: The objection is overruled, and we would like the witness to answer the question if he can.

MR. KELEHER: An exception to it.

A If I understood your question correctly, you asked me if there is a chance, and there certainly is a chance. I have already stated before that there was more of a chance for less than

320 acres to be drained by one well. Now certainly there is a chance that a well can drain more than 320 acres.

Q Well, actually it would be your testimony, would it not, Mr. Cleveland, that you don't know in each instance whether a well is draining more or less than 320, do you?

A To actually pick out an individual well?

Q I'm asking you, isn't --

A Just to look at an individual well -- no, you can't say that.

Q You just don't know, do you, and nobody else knows, do they?

A That's right, but we all have opinions and I have already stated my opinion.

Q Now, again, just to be sure we're all talking about the same thing, Mr. Cleveland, what is your definition of reserves?

A My definition of reserve is a remaining reserve. When I refer to initial reserve, this means the amount of gas that was there to start with.

Q Now you say the amount of gas that was there, the amount of gas that was where?

A That was under the well, or that is applicable to the 320 acres.

Q In other words, you are saying the reserves you are talking about initially are the reserves under a 320-acre tract dedicated to a producing well?

A The initial reserves, that's what I'm referring to now. As far as any exhibit is concerned, I am talking about remaining reserves that are to be recovered from the date that the 1961 deliverability was measured.

Q Now we have two kinds of reserves, don't we? Let's get back, what are the initial reserves you are talking about?

A The initial reserve is the amount of gas that can be recovered from that well down to an economic limit, prior to the time that well has produced any gas.

Q That is without any regard to the area dedicated to the well, is that correct?

A Well, when I speak of initial reserves, I speak of the reserves or initial reserve or the remaining reserve that is applicable to that 320 acres. I have already stated it.

Q That's what I have been trying to get you to state. I didn't know you had stated it, I am sorry.

A I had said that these are the reserves applicable to 320 acres.

Q Applicable to the 320, does that mean they are underlying the 320 acres we are talking about, when you say applicable, are you talking about something else?

A No, I'm saying that to the best of our ability, best of our knowledge, these reserves are lying under that 320 acres. Those reserves -- the principle of drainage of that area to the well bore will be in a circular fashion. It certainly wouldn't be a square.

Q I understand that, Mr. Cleveland, but what you are talking about then is the reserves the Commission is empowered to allocate, which are the reserves underlying the tract dedicated to the well. Are we agreed on that?

A Yes, sir, that's right.

Q Now, you say that deliverability is directly proportional to these recoverable gas reserves, I believe you qualified it by saying that?

A Remaining recoverable.

Q But you are still talking about the remaining recoverable reserves under this single tract we are talking about?

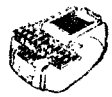
A That's right.

Q You said, I believe, and if I misunderstood you would you correct me, that deliverability gives weight to unknown reservoir factors which aren't available to you, such as the porosity, permeability, water saturation, and other factors. Did you say that?

A Yes, sir, that's right.

Q Would you tell me how deliverability is related to porosity?

A Well, the deliverability, as far as an actual mathematical relationship, I played around with it a little bit, enough in my own mind to feel confident, but the deliverability as correlated to the remaining reserves which I have shown here is the proof in my own mind that deliverability is a function of all these factors.



Now then, it may not be a single parameter porosity, but I feel like it's a combination of porosity, water saturation, thickness, all of these factors which have to be combined together which actually define the amount of gas that is there; and, of course, permeability gives you some indication of that amount which can be recoverable, or the percentage that could be recovered.

Q Are you familiar with the work of Morris Muscat?

A Yes, sir.

Q Is he a respected and well recognized engineer?

A Yes, sir.

Q Are you familiar with his work on the radial flow formula?

A Yes, sir.

Q Does he use anything other than permeability as a rock characteristic in that formula?

A He always uses thickness.

Q Is that a rock characteristic?

A That's, I think, ordinarily accepted as one of those characteristics which defines how much of a reservoir you've got there.

Q That contributes to the amount of permeability available, does it not?

A Yes, sir.

Q That's the reason it's included, is it not?

A Yes, sir.

Q It has nothing to do with porosity, does it?

A No, sir. There's no porosity function in that relation. However, I think that he has also done some work, maybe not, I can't recall exactly who has done this particular work, but they have done a considerable amount of research on correlation of porosity and permeability. Now then, I can't recall this equation just real readily.

Q Did you say who did the work?

A What?

Q Did you say who did this work?

A No, sir, I was trying to think. I can't recall exactly. It can be found in the text of Petroleum Reservoir Engineering by Amicks, Bass, and Whiting, which is a text which was published last year or the year before that. This work on the correlation of porosity and permeability has been a continuing thing for some time. They have tried to relate porosity and permeability through the porosity constant, which is, in simple words, just a manner in which the little capillary weaves in and out through the rock, if that is adequate enough.

Q Have you applied that information to your study of this reservoir?

A No, sir, but that type of thing has contributed, certainly not in this graph, but that type of thing has contributed to my analysis and my --

Q Actually, as of --

A -- It has contributed to my thoughts in my effort to

delve back into a mathematical reason for this thing.

Q Admitting that this work is under way, actually, today, it is rather generalized, is it not? You can't come up with a precise formula?

A No, sir, I haven't been able to develop a precise formula. I have been doing some work on it, and I may not ever be able to develop it, I don't know, but it is an interesting thing and it has been enough so far to at least lend a considerable amount of confidence to me in my feeling that deliverability is proportional to remaining reserves.

Q Now to get to these pressure production curves that you've used, was it my understanding that you had not less than three shut-in pressures on any one well, and some of them more?

A Some of them could be more, yes.

Q But you did have a minimum of three, did you not?

A I'm fairly certain in every case I did. In other words, I selected those wells for that very reason, so that they would have at least three.

Q I don't want to belabor the point, which is already covered somewhat by Mr. Stockmar, but is a single pressure point on a seven-day shut-in an accurate measure of the reservoir pressure? I assume you extrapolated that down to the reservoir pressure?

A Is it an accurate measure of the reservoir pressure?

Q Yes, sir, on a seven-day shut-in.

A Well, of course, this would depend upon how severe or

how low your permeability or your flow capacity to your well is. I'd say, as I answered before, that in some cases it would be adequate; other cases it wouldn't. However, the seven-day shut-in period has been established by the Commission, and the fact that it is consistent, it is a consistent measurement, it is a rule that's followed each time and they have a thirty-day flow period to condition a well, I feel that it allows the pressure points that are taken on that well to be extrapolated to an economic limit and determine the ultimate recoverable reserves.

Now then, the actual static reservoir pressure in a lot of cases, you are not looking at actual static reservoir pressure. First of all, you are taking the pressure from surface, which should be corrected down to reservoir pressure, but if each pressure from one time period to the next is taken under the same conditions, then an extrapolation of this data should be adequate.

Q Well, actually --

A And you should arrive at the same point as if you were to allow this well to be shut in from now until doom's day to make certain you have a real good static reservoir pressure. The slope of those pressure points would not be the same, but they would arrive at the same end point.

Q You couldn't actually make an extrapolation of that curve without knowing the characteristics of the pressure times buildup curve, could you?

A An extrapolation of the pressure cumulative data?

Q Yes, sir.

A I don't see why I couldn't. It has been pretty well established in the text and everything that the pressure volume relationship indeed, with a gas reservoir, will be essentially a straight line, except when you are dealing with pressures say over 2,000 pounds; and then you have a gas compressibility problem there which, in order to achieve a straight line through these points, you have to take into consideration gas compressibility.

Now then, in the lower ranges of pressure that we're dealing with here, it's ordinarily accepted, I think, that you do not have to correct this pressure for gas compressibility, and therefore you can consider a straight line extrapolation through these data points is a reasonable approach and is an acceptable method of determining gas reserves.

Q Well, that would be admitted, of course, if your pressure were right in the first instance, but without the buildup time on the pressure, how do you know your pressure is right?

A Well, you may find some relationship there to quarrel with, but I think generally it's accepted that you can extrapolate these pressure points.

Q On one pressure?

A No, no.

Q What pressures are you using to extrapolate then?

A On the two pressure points.

Q They are a year apart, aren't they?

A What?

Q Aren't they a year apart, or how long?

A They're a year apart.

Q That doesn't give you any buildup time, then, does it?

A Well, the buildup time that you have is a seven-day buildup in each case, each year.

Q Do you have any knowledge of any liquids in the hole in the Basin-Dakota reservoir which would affect those pressures?

A The liquid content of the gas vary over the field, it does vary; the extremes I don't think are too severe. You do have distillate production in, I would say, a majority of the wells. Now there are other wells where you do not have liquid production.

Q Did you take that factor into consideration on your pressure decline curves?

A No, sir, this would be another one of those factors which I think could be considered very similar or analogous to the time of buildup and conditioning before the well is shut in and everything.

Q It could have a very profound effect on your reserve calculation, couldn't it?

A No, sir, if the well is continuing to produce at the same liquid content ratio for these points, then you are extrapolating consistent data, you are not jumping from one point to the next.

Q Maybe you don't understand me. I'm talking about liquid in the hole at the time the test is made. I'm not talking about your production.

A Well, I think it would be possible to have liquid in your hole, but here again you are flowing this well and conditioning this well for thirty days prior to the time that well is shut in. Now then,if--this well is more than likely producing at the same liquid ratio; consequently, with the conditions existing prior to the test being the same, prior to each pressure measurement, then I'm saying that the liquid that you may have in the hole is consistent with all the other points and you are extrapolating on consistent points.

Q That's your interpretation of it?

A Well, that's my feeling. Now I don't have any definite proof to back it up, but it's my understanding that over the field in general that you don't have much of a problem in this regard. There's not a terrific amount of difference between the shut-in tubing pressure and the bottom hole pressure. Certainly you might have some liquid down there because I think the majority of the wells do produce liquid, and they might vary from well to well; but the conditions for this well, the conditions under which the pressure measurement is taken, they're the same each time.

Q Well, now, will the liquids vary in direct proportion to the reserves in place under the tract dedicated to the well; I'll say the gas reserves?

A Well, no, sir, I don't think you can say that entirely for one reason.

Q Well, would they vary in direct proportion to the deliverability of the well?

A No, I don't think you can say that, either, because you are dealing with a reservoir here that I don't really feel -- well, it's, you've got so many drastic changes across that field.

Q Yet, Mr. Cleveland, they will affect your reserve calculation, based on a pressure production decline curve, won't they?

A With the liquid in the hole you are always subject to a certain amount of air, but if your measurements, the conditions prior to each measurement are consistent each time, then your air is not cumulative.

Q Your air would not be cumulative to any single individual well, but putting wells on the comparative basis, from one well to the next, it would affect it, would it not?

A No, I don't think so, because if that liquid were not in the hole and you had exactly the static reservoir pressure that exists out there, and you let it shut in just a real long time and you got a pressure decline like that, now then, for some reason or other, because of liquids in the hole each time that you take this pressure measurement, or because of insufficient shut-in time, insufficient buildup time, the points after your initial measurement or after you initially complete the well and it has

flowed some, those points will drop down. If you will use your imagination here, that this is another statistic extrapolating up here, and it represents another static reservoir pressure, then this is the true curve. This is the one that you would really like to have.

We are not that fortunate. We don't have but this other curve up here; the lower one has been subject to perhaps an insufficient amount of shut-in time, if the seven days is not adequate. Also it might have certain liquid in the hole, but then I think it's logical to say that you can expect that this curve will decline in a straight line fashion to about the same point that you would have arrived at out here if you had been able to extrapolate a true static reservoir pressure and actually had a bottom hole pressure bomb in the hole and measured what the pressure was.

Q You didn't have any pressure bombs in any of these holes, did you?

A No, sir, I didn't.

Q Mr. Cleveland, what does a production pressure decline curve measure --

A Pressure production decline curve --

Q -- if extrapolated on the basis of your Exhibit No. 7?

A Yes.

Q What were you measuring there?

A Well, I was determining to the best of my ability, and

based on the engineering background that I have, I was measuring the recoverable reserves that could be expected from this well.

Q Now the recoverable reserves are the reserves that would reach that well bore, are they not?

A The reserves that would reach that well bore over an economic period of time, the end of which would be your economic rate of flow.

Q That has no regard to the area from which the gas came, does it?

A Well, sir, if there was just one well out there producing, I'd say it wouldn't have any. In other words, the entire reservoir would be in a direction, would be flowing in a direction of that one well bore. However, in our development pattern out there where every well is on 320-acre spacing, then the pressure wave as it reaches out there so far, and the fact that each of the wells has been given 320 acres, when the pressure wave reaches the mid-way point between that well and the next well, then you aren't looking at reserves in that particular well bore, that is coming from beyond this 320 acres.

Q Mr. Cleveland, assume we have a six million well directly offset by a hundred thousand well; isn't the chance that a six million well is going to reach that pressure point well inside the tract of the one hundred thousand well?

A Well, I rather doubt it because under this six thousand well you have a considerably larger amount of reserve.

Q I'm talking about the six million well, of which we have one up there.

A Yes, I am sure we can find one.

Q We have a thirty million well up there, don't we?

A Yes.

Q Do you think there's any tract in this pool that has 180 times the reserves of any other tract? Do you believe that?

A Mr. Kellahin, I think you can pick out in a field this large which encompasses 183,000 acres and some 572 wells, you can certainly pick out certain wells which they may seem to be freaks to you. This doesn't say that it's been disproven that those wells do not have a proportional amount of reserves.

Q You didn't answer my question. Would you please answer it? Do you believe that reserves are in proportion to deliverability on those two wells?

A Yes, I do. I have no reason to doubt it.

Q You do believe it?

A I have just stated to you that on the evidence I have right here, my opinion is certainly that the well is, or does have a large reserve.

MR. KELLAHIN: That's all the questions I have.

MR. PORTER: Does anyone else have a question of this witness?

MR. MORRIS: Yes, sir.

MR. PORTER: Mr. Morris.

MR. KELEHER: May the Commission at this time accept the qualifications of Mr. Cleveland? Nobody seems to have objected.

MR. PORTER: His qualifications were noted at the beginning and his qualifications will be accepted.

MR. KELEHER: At this time I would like to introduce Pubco's Exhibits 6 and 7 and offer them in evidence.

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

MR. KELLAHIN: I would like to make an objection, for the record, to the admission of Exhibit 7, for the reason that the basic underlying information from which the exhibit was made has been denied to us.

MR. KELEHER: To which Pubco states that the basic information from which the witness prepared that exhibit is the official records of this Commission and available to counsel and his assistants.

MR. PORTER: The exhibit will be admitted to the record.

MR. KELLAHIN: Exception.

MR. PORTER: You take exception to the Commission's action on that ruling?

MR. KELLAHIN: Yes, sir.

MR. STOCKMAR: I would like to ask three quick questions and then ask for a recess.

MR. MORRIS: I will defer to Mr. Stockmar.

BY MR. STOCKMAR:

Q I believe you stated that a great deal of your belief, or that your belief was greatly encouraged by the work that Bass and somebody had done, that you read recently?

A No, sir, I haven't read it recently.

Q Or that you have read?

A Yes, sir.

Q You did say that?

A Yes. Let me correct that. I said that the work of men who have worked on this porosity-permeability problem or correlation was published in this text by Amicks, Bass and Whiting last year, year before last. I think it was 1960. Those men did not do the work themselves, but it was reported in that text, and that's where I became acquainted with it.

Q Would their opinions be influential on your thinking, the opinions of somebody, Bass and somebody?

A No, they didn't say anything on the -- they certainly didn't say anything about deliverability as to whether it was related to reserves or not. Most of these things you have to consider --

Q Is the Bass --

A You have to consider the relationship that they demonstrate and determine what value they have to your particular work.

Q Is the Mr. Bass that we have been referring to Mr. Daniel Bass of Texas A & M Petroleum Production Department?

A Yes, sir, that's right.

MR. STOCKMAR: I defer to Mr. Morris.

MR. PORTER: Mr. Morris.

BY MR. MORRIS:

Q Mr. Cleveland, I believe you stated at the beginning of your direct testimony some time ago that the 25 percent acreage factor that's presently included in the allocation formula allows production well above an economic rate, and that in itself provides an adequate minimum allowable, is that correct?

A Yes, sir, that's the way I feel about it.

Q And according to your calculations, that 25 percent acreage factor at the present time provides in itself 2227 MCF per month of gas.

A Yes, sir. This is based on an overall monthly, or monthly average; in other words, based upon a prediction of annual nominations of 56,650,000 MCF, which was approximately the amount of nominations that we had for the year of 1961. Now it may, it may be more. I don't know.

Q I believe you further stated that that would be some 1462 MCF per month over what you would consider to be reasonable operating expenses, is that correct?

A Yes, sir, approximately.

Q By a process of simple subtraction, 1462 from 2227, you arrive at the figure of 765 MCF per month, which I assume by your statement you must consider to provide minimum, a suffi-

cient amount of revenue to cover minimum operating expenses?

A Yes, that's true. Yes, sir.

Q Looking at that 765 MCF per month, what sort of a calculation did you run through to see how much monthly income that would provide for a well for operating costs? How much was the value of the gas that you used in your computation? How much royalty did you take into consideration; how much in well costs did you consider, I mean in operating costs?

A All right, the operating costs that I used was based upon Pubco's experience. We have nine wells in the field, but we have only five there that had been produced for at least a year and which I felt like would give me a better idea of what our operating costs are. That average was $1,130.00 per year, or about $94.00 per month per well. The gas value which I have used is thirteen cents per MCF, and I have considered a value for distillate of about $2.50 per barrel after trucking.

Q How much of that would you attribute to each MCF of gas?

A Well, my actual calculations show here 1.65 cents, but I have just used two cents to round it off. The royalty that I have used is 12 1/2 percent, and production taxes of six percent, considered in the six percent production taxes is the State's two percent school tax, two and one-half percent severance tax, and fourteen-hundredths of one percent conservation tax, for a total of 4.64 percent, plus 1.36 percent for ad valorem tax on the production, which is the rate established for last year and changes

about every September 1st, I think somewhere along there, for a total of six percent production taxes.

There is another tax which I have not included in this six percent; however, I felt like that six percent would be applicable, and that would be a two percent tax on liquids which are sold outside the State of New Mexico, but I haven't included those.

Q Using those figures, then, you arrived at the basic figure of 765 MCF per month to just cover those expenses?

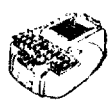
A Yes, sir, that's correct. That would be considered the normal operating expense. This expense also covers ad valorem tax which is paid on the equipment at the well.

Q Now, in order to keep a well on the line, certainly I think you would agree that an operator would have to have something in excess of that 765 MCF in order to get reasonable profit. In your duties, do you make recommendation to your company concerning the point where a well is no longer economical?

A Yes, sir.

Q What would that point be in terms of something above 765 MCF per month?

A We'd still be producing the well if it was producing anything over this 765 MCF per month. I mean, this is your economic limit. Anything above that is a profit, and since it is in excess of the economic limit -- by some standards it might not be considered reasonable enough, but I am saying that as far as we



are concerned we'd still be producing it and trying to get the last drop out of it if we could, down to the point where it was costing you money.

Q Does Pubco have any wells that are presently producing with an allowable of between 765 and, say, 2,000 or 2,500 MCF per month?

A No, sir, I believe that in every case of our wells we are above that. The average deliverability of our wells is about 1720 MCF per day. So I think you'd find that the monthly allowable there would fall considerably above this economic rate that I have shown you here. Now from a month to month basis and during the summer months, when you have a relatively small demand, admittedly our wells will come closer to this rate. However, in the real fat months of January, February, March, and December, I think those would be the heavier months, we have been able to stack up a considerable profit during those months because the rate has been higher. I've tried to apply this to overall annual basis.

Q I believe you testified that if drilling continues at the present rate, we will probably have something in the order of 700 wells in the pool by the end of 1962; and that absent any increase in the market the 25 percent acreage factor would provide an allowable of something in the neighborhood of 1585 MCF per month, on an average, is that correct?

A No, sir, not in its entirety. I said that a projection

of additional wells to about 745 participating wells, instead of 700.

Q 745?

A Yes, sir. In, oh, say the period 1963 to '64, extrapolation of the number of wells that we're going to have out there is, it's difficult to do. We just can't predict what the operators are going to do, but based upon the trend which has been established since the time of first drilling out there, I've estimated that we would have 745 participating wells by 1963 to 1964.

Q Mr. Cleveland, if wells continue to be drilled in the Basin-Dakota Pool, and if there is no increase in the market demand, both of which I believe are fairly logical assumptions for the next few years, we'll eventually arrive at some point where without a minimum allowable, wells will fall below your point of 765 MCF per month; would that be correct? Can you give me a yes or no answer?

A Well, certainly this is true.

Q And if a well falls below the point at which it is economic, it may still have recoverable reserves in the ground available to it, is that not correct?

A Yes, sir, at that time we would have to take steps in order to alleviate the problem, but this is some time in the future.

Q But that would cause what we might refer to as premature abandonment, if that point ever were reached?

A Yes, sir.

MR. MORRIS: Thank you.

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

MR. KELEHER: If there are no further questions of this witness, I wonder if he could be excused permanently. Mr. Cleveland has an important engagement in Texas. I would like to have him excused.

MR. PORTER: The witness may be excused.

(Witness excused.)

MR. PORTER: We will take a ten minute recess.

(Whereupon, a short recess was taken.)

MR. PORTER: The hearing will come to order.

(Whereupon, El Paso's Exhibit 1 marked for identification.)

MR. PORTER: The Commission will recognize Mr. Howell. Before we go ahead with this witness, I want to announce first, Mr. Howell, that there will be a night session. We will break this one off around 5:00 or 5:30, wherever we can reach a breaking point, and come back at 7:00 o'clock.

MR. HOWELL: We have one witness, Mr. Rainey, who has been sworn.

DAVID H. RAINEY

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

DIRECT EXAMINATION

BY MR. HOWELL:

Q Will you please state for the record your name, by whom

employed, and in what capacity?

A I am David H. Rainey. I am employed by El Paso Natural Gas Company as an administrative assistant in the Proration Department.

Q Is your professional education and your qualifications a matter of record with the New Mexico Commission?

A Yes, sir.

MR. HOWELL: I will ask if Mr. Rainey is acceptable to the Commission as an expert witness?

MR. PORTER: Yes, sir, he is.

Q (By Mr. Howell) In your position with El Paso Natural Gas Company, will you please tell the Commission what studies have been conducted under your general supervision relating to the Basin-Dakota Pool?

A Yes, sir. Our Reservoir Department, when this hearing was called, has made a detailed study of the reserves and deliverabilities, particularly reserves, of the wells in the Basin-Dakota Gas Pool on which we had both logs to determine net effective pay, and deliverability data.

I might add at this point that this was a part of a continuing and continuous study that our Reservoir Department makes, and was not done solely for the purpose of this hearing. In other words, the data has been gathered over a long period of time.

We determined that we had both log information and could

consequently calculate reserves, and had deliverability data on 457 wells in the Basin-Dakota Gas Pool; at the time we cut off there were approximately 550 wells in the pool. In making that determination we did exactly the same thing that was done at the October, 1960 hearing in which we presented an exhibit using the same data on 160 wells, which is what we had data on at that time. For the convenience of the Commission and other parties interested, we have duplicated that curve on El Paso's Exhibit 1. The only difference being that because the range of this study did not go as high in reserve data as the range on the study in 1960, we left off that one odd well over there on the end that so much was made of Wednesday, I think. Those are the studies that have been made, specifically. Now I can go into a discussion of that exhibit or we can take another point.

Q I wish you would go ahead and discuss the core data that was available, and the manner in which the core data was used.

A All right. Our reservoir people had approximately 65 to 68 core analyses from various Dakota wells scattered over the San Juan Basin area. Upon the basis of the comparison and correlation of that core analyses, those core analyses to well logs associated with them, they then made determination based on correlation then of other well logs with those upon which we had core data, to determine a net effective pay pick on every well in which, as I say, we had a log and corresponding deliverability information.

Then as a part of this continuing study of Dakota reserves,they had compiled and revised periodically parameters of porosity, interstitial water, pressure, temperature, gas gravity, and various other things that go into the makeup of calculation of reserves; and had compiled that on an average per township -- in other words, we did not calculate reserves in this study on the basis of any average factors for the Basin-Dakota Pool as a whole. It was done on an average for each township.

Those parameters, there has been much discussion about the variation there. Our figures indicate that the porosity varies from approximately six percent up to something slightly in excess of 15 percent. I might add at this point that our reservoir people arbitrarily use six percent porosity as a cutoff point, just as Pubco's people do, not because Pubco's people did but just coincidentally.

We found that the residual gas percentage -- and I'm using that term rather than interstitial water percentage, because in cases where we are attempting to determine gas reservoirs, there may have been some liquid hydrocarbons in the reservoir, and we lumped that percentage, that is,residual oil saturation, we lumped that with the interstitial water percentage; consequently, we came up with what we call a residual gas saturation which varied from about 77 percent down to 49 percent.

The pressures that we encountered, bottom hole pressures and as near as we could determine, initial bottom hole pressures,

in the various townships varied from 2200 pounds up to about 3400 pounds. The temperature varied from around 140 to 150 degrees up to over 200 degrees in some townships.

Q Did you discuss permeability?

A Permeability does not come into a calculation of reserves. Of course, it is a factor in a parameter in the determination of deliverability. Gas gravity varied from, oh, around six and a half percent up to around seven and a half percent. It was fairly constant -- I don't mean percent, I mean .65 to .75, excuse me.

I believe those are all the parameters that were used. In this study here, for purposes of this graph which is Exhibit 1, we arbitrarily assigned 320 acres to every well, recognizing that there are some wells that vary somewhat from that, but for purposes of this study, rather than attempting to delve into individual well acreage, we assigned 320 arbitrarily.

Q Mr. Rainey, did you establish, as I understand, for each township consisting of 36 sections an average, based upon the available core information in that area?

A Yes, sir. Now it will be recognized quite immediately that we did not necessarily have cores for every township. If we didn't, if we had cores surrounding a particular township, we probably took averages of the surrounding cores for that township. It's a much more accurate means of determining an average than attempting to take a field-wide average. The point I wanted to

make, that we varied the reservoir parameters in these calculations on a township basis.

Q For example, to illustrate the difference, let's look up here at the extreme northwest portion up in Township -- let's say 31 North, 13 West.

A Yes, sir.

Q Would you compare the factors here at this extreme edge of the pool with the factors which were used in an area such as has been described as the Angel Peak area, which I think has been testified as being the best area in the pool?

A All right. According to our reservoir parameters, although the Angel Peak area is the best area because it's one of the thickest areas, it does not necessarily conform in the calculations that we arrived at on the basis of MCF per acre foot, which is the factor that we used before determining net pay to calculate reserves. It is not the best reserve area. Nevertheless, as an example, the porosity that we used in the first township mentioned, 31, 13 --

Q That's the extreme northwest portion?

A Yes, sir. -- was 8.3 percent, which incidentally is approximately the field average. 51 percent interstitial water, and residual oil saturation, which means there was a 49 percent residual gas saturation; seven-tenths gas gravity; 152 degrees bottom hole temperature; original bottom hole pressure of 2457; and the factor of MCF per acre foot is 246.5.

Now in say 28 and 10, the Angel Peak area, the porosity was essentially the same 8.2 percent; however, the residual gas saturation was 65.3 percent; gas gravity was .76; bottom hole temperature, 142; bottom hole pressure, 2545; which gives us an average MCF per acre foot of 365.1, which is approximately 50 percent more in that area per MCF per acre foot than you find in this extreme northwest area.

The variation in the actual MCF per acre foot factor which we arrived at varies as low as 201 MCF per acre foot up in the Rosa Unit Area, which is up in about 32 and 5 --

Q Over in the extreme northeast portion?

A Yes. -- to a high which incidentally was based on a specific core in the 23, 5 area, which is the big red area to the east edge of the map, in which the high was 537.7 MCF per acre foot. Let me say at the outset, I did not specifically calculate these factors. They were done by our Reservoir Department and furnished to me for purposes of discussing at this hearing today, but they are continually being revised and are continually kept up to date as we obtain new information, new cores, and new logs and what have you in regard to the Dakota Pool.

Q Have you satisfied yourself as to the correctness of these studies?

A Yes, sir. I have checked some of the data that they have used in working out these factors, and see no reason to argue with them.

Q Then as I understand, having established this acre foot gas reserve, you then determined the area under a tract by multiplying by the net effective pay?

A Yes, sir. We determined, we assigned arbitrarily 320 acres to every well. We then multiplied that by the net effective pay picked on specific logs to arrive at an acre foot figure, and multiplied that by those factors that I have referred to previously.

Q Mr. Rainey, just to demonstrate the method that was used, would you look over here at Pubco's cross section on C-C^1 which has an O'Shea well, I believe it is, and point out on the map here where that is located and then comment on the method that we used in determining the net effective pay in that well?

A Yes, sir. I would like to state at the outset here, to relieve some argument later, I have not examined all the logs on all these wells. I have specifically looked at a couple of logs I have with me in this particular area. The determination of net pay thickness was made on exactly the same basis on every well throughout the Basin, recognizing the fact that on some wells we had logs that were more adequate to determine more effective net pay than other wells. But by attempting to correlate from one type of log to the other, we have arrived at what we think is a relatively good pick of net effective pay in the net affected wells. If we erred in picking that net effective pay, or differed from somebody else's pick, it should be a consistent basis because it was all done on exactly the same basis. This O'Shea well, as

you can see, picks a great number of sandstone lenses from induction electric log, and it's located in Section 3 of 31 and 13, I believe it's the Southwest -- yes, it's the Southwest Quarter of Section 3 of 31, 13.

Now one of the best tools that the logging industry has come up with for picking porosity is what we called, Welex calls it an acoustic velocity log, I think Schlumber-J calls it a sonic log. What I would like to illustrate is the difference in characteristics on some logs compared to other logs in picking pay, and the reason that there may be sometimes very wide discrepancy between the picks that one geologist will make and another will make.

It has been my experience, and I do not do the specific picking on these logs and it was done in the Reservoir Department, and it conforms to the way the others have been done, if you get four or five different geologists attempting to pick net pay, you are liable to get five different picks because of the different parameters one may use to the parameters the other one would use.

To illustrate what I'm talking about, this is a log of the Landour No. 1, which is the well in the Northeast Quarter of the same section. If you will notice, this is the Dakota interval here -- incidentally, I see Consolidated wells in those, these are a couple of Consolidated wells, but there is, apparently, these red marks at the perforated intervals which Consolidated

chose to perforate. Now you will notice that there is apparently good sand development, because you have got a wide separation on your -- this is gamma ray neutron log. You can see that there are good sand intervals, apparently, in this. If I were looking at this log, I think Consolidated perforated good intervals. I agree with them completely.

On the other side, as I mentioned, this sonic log or acoustic velocity log indicates specific porosity. There's a scale on the bottom of it on which, knowing the velocity at which the log was taken, you can specifically determine by running up from this scale what the porosity is. It's becoming a generally accepted tool in the industry for determining porosity.

Porosity increases to the left. You'll note that this red line is the six percent porosity interval at 17,000 feet per second velocity. Excuse me, that's micro-seconds per foot is the way they put the scale on the log. But anything to the left of that, a kick to the left of that indicates more than six percent porosity.

With the arbitrary cutoff of six percent porosity that our reservoir people used, they picked -- and I'll leave the logs up for examination -- intervals that corresponded to sandstone intervals on the gamma ray side of effective porosity. We get for this well, although there's 101 feet of gross sand in that well, we picked only 31 feet of net sand in that well -- excuse me, of net productive sand in that well. That's just an illustra-

tion of the manner in which this was done, taking into account all knowledge that we had of core data, log characteristics, and quality of sand.

Q How does the quality of sand that exists as shown in that log compare with other areas in what has been referred to as the better part of the field?

A In general, it's a much poorer quality sand. As I read the reservoir parameters, apparently there's a high water saturation in that general area, residual water and/or oil saturation in that area, in comparison to, say, the Angel Peak area.

Q Is there any evidence of shaly sand or sandy shales in there?

A Yes, sir. The log on the left indicates a considerable amount of shaliness where the log is particularly fuzzy in areas indicates a shaliness on that type of log.

Q Did you use, as I believe you have already testified, the same standards in screening the areas all over the Basin Pool?

A Yes, sir. That's the specific point that I wanted to make clear, that if we pick net pay different from the manner in which someone else may do it, or if we determine a net pay interval in a particular well different than what some other geologist may do, we have at least done it on a consistent basis on each one of the 457 wells that we have got on this Exhibit No. 1.

Q Now having determined and allocated to each of 457 wells an estimated recoverable gas reserve, what did you do then?

A We then tabulated that information by reserve groups, which is exactly the same thing that we did on the curve in 1960. We took all the reserves -- all the wells, excuse me, which fell between zero and one billion cubic feet of recoverable reserves, and tabulated them with their accompanying deliverability; and then, for the sake of simplicity, because I think we will all recognize that if you plotted each individual well in addition to getting sort of a shotgun pattern on your graph, you get something that's a little difficult to see and understand, so for simplicity's sake we averaged these by reserves groups, as I say, just exactly as we did in the 1960 hearing on which the Commission based their existing order. The purple curve on the graph, which is represented by the --

Q One thing, before we get to the curve, then did you --

A Yes, sir.

Q -- then did you determine an average of deliverability?

A Average reserve and average deliverability for each group of wells in a reserve grouping.

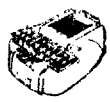
Q Before you discuss the curves, would you just state how many wells there are in each group from which you plotted points on this Exhibit No. 1?

A Yes, sir. The green curve, which is as I say, is the duplication of the 1960 curve, the figures are on the graph on the

board, but since it's covered up, the first point on the 1960 curve represented three wells; second point, 22 wells; the third point, 36 wells; the fourth point, 44 wells, that's in the range of reserves from three billion to four billion; the fifth point, 34 wells; the sixth point, 11 wells, that's the point that's down low in the range between five and six billion; the next point, five wells, which is the range between six billion and seven billion; and the last point, four wells. As I say, actually we only have, that only totaled to 159 wells because we left that last point off of this curve.

Now on the curves which we have drawn for this hearing, using 457 wells, and both the purple triangle and the orange square represent exactly the same number of wells; the purple triangle is on initial conditions of reserves and deliverabilities, and the orange or yellow squares are on current conditions of reserves and deliverabilities.

Now the deliverabilities used are the deliverabilities taken from the 1961 annual test. The reserves are calculated as of December 31, 1961 on the current ones, recognizing that there may be a number of wells -- and I don't specifically know offhand how many, but there may be a number of wells represented on those yellow squares which still have initial conditions. In other words, there were a great number of wells drilling and completed in the pool in '61, so the yellow squares may represent a great number of wells with still initial conditions on them.



The first point represents 12 wells; the next point 83 wells; the next point, between two billion and three billion, 150 wells; the next point, 100 wells; the next point, 65 wells; the next point, which is the range between five billion and six billion, 28 wells, and you will notice that the current point for that curve has fallen back to less than five billion reserves; the last point represents 19 wells.

Now I might add at this time that for purposes of that last point, there is a range of reserves up through nine or ten billion cubic feet, but they were individual isolated wells, so we took everything above six billion cubic feet and lumped them into a group and averaged them altogether to get that point. I believe that's the description of what the curves are.

Q That's the way in which the points are plotted on Exhibit 1?

A Yes, sir.

Q Now will you comment as to the conclusions which you draw from the facts which this Exhibit 1 reveals?

A Yes, sir. As can be seen, because we have got a great number more wells that we have data on than we had in 1960, the curves do not exactly coincide with the 1960 curve, which is the green curve. However, I think it is significant that in the ranges of deliverabilities, the ranges of reserves up through the three billion to four billion range, the curve falls in exactly the same place for both initial conditions and current conditions.

You see, they overlie one another, all we show actually is the purple curve. You can see the points on the yellow curve or the orange squares are very close to the purple triangles, and the same curve could very logically be drawn coinciding.

Now, after we get above the averages for three to four billion reserves, you notice that the curve begins to pretty abruptly flatten out, and that the curve for current conditions seems to fall somewhat below or does fall somewhat below the curve for initial conditions. First off, to me this indicates even more strongly than Mr. Cleveland's exhibit, which was much discussed, that the low reserve wells are receiving more allowable by virtue of a deliverability formula than the high reserve wells, because the curve flattens out; if it were, the relationship between the deliverability and reserves were a one to one relationship -- in other words, were reserves double, deliverability double, this would be a straight line off up the middle of the page at the slope that begins down in the lower ranges. It doesn't do that, it flattens out. Consequently, the higher reserve wells are not receiving allowables based on their deliverability commensurate with the allowables that are being assigned to the lower reserve wells.

Q What conclusion do you draw from the studies in this exhibit, with reference to the reasonable correlation, if any, between reserves and deliverability, between recoverable gas reserves and deliverability?

A I think this curve shows a very, very close correlation between deliverability and recoverable reserves, and I might add this, that the reserves shown at the bottom of the page is recoverable reserves calculated to an abandonment pressure in all cases of 500 pounds, just to get them on a comparable basis. I also think that even though it does not show a one to one, or what we call a one to one relationship as deliverability doubles reserves double, or vice versa, that it does show a very constant and consistent relationship, as evidenced by the close relationship of the points, particularly in the low deliverability and low reserve ranges on this, the first four points on this curve.

I think it's significant that the yellow curve in the higher ranges of reserves falls below the purple curve; in other words, the curve for current conditions falls pretty markedly below the curve for initial conditions, and the only explanation that I can think of for that, if you realize that it means that deliverability has decreased on those wells more rapidly than reserves has decreased; and with the close correlation of reserves and deliverabilities evidenced in the low ranges of the curve, I think I must draw the conclusion that there is that same relationship throughout.

It would appear that these wells had not received sufficient allowable, these high deliverability wells, high reserve wells had not received sufficient allowable so that they were depleting their reserves at the same rate at which the low

deliverability wells were.

Q Mr. Rainey, am I correct in assuming that the distance to the left, the horizontal distance in which we note that each yellow square is moved to the left from the purple triangle, represents the amount of reserves which have been produced from that group?

A That's correct. That's the total reserves -- excuse me, the average reserves that have been produced from the wells in that group; and the vertical distance is the average deliverability decrease in each group.

Q The drop in the orange line below the purple line at each of the points reflects the decrease in average deliverability which has taken place between the same identical wells?

A Yes, sir, that's exactly right.

Q Do you have any further comments you would like to make with reference to El Paso's Exhibit No. 1?

A I might point out one or two other things about that, Mr. Howell. For one thing, our average, the average for all the wells that we had data on, the whole 457 wells had initial conditions, the reserves were 3,140,000 cubic feet; in other words, 3.14 billion on this scale, with an average deliverability for the whole 457 wells of 1421 MCF. I meant to put those on the curve and I just neglected to do so.

If you will plot those points on the curve, you will find that they fall right on the line. The average reserves under

current conditions are 2,878,000, or 2.9 billion on this scale here, with an average deliverability of 1290 for the whole 457 wells that we had. Again, those points fall very closely on the curve, which leads me to believe even more emphatically that our curves are approximately correct; and I might add that we plotted the curves from the individual reserve range averages before we even calculated the averages on the whole pool, and the points fall so closely on the curve that I am more firmly convinced that our curve is approximately correct and that there is a very definite and close relationship between deliverability and recoverable reserves.

Q Does that conclude your comments with reference to Exhibit No. 1?

A Yes, sir.

(Whereupon, El Paso's Exhibit No. 2 marked for identification.)

Q Will you now refer to El Paso's Exhibit No. 2 and state the manner in which that was compiled and what this exhibit reflects, the studies that go into this?

A Yes, sir. In working with some other engineers, we came upon a possibility of showing even more clearly what the relationship is of reserve and deliverability breakdowns under the present 75 percent acreage times deliverability, 25 percent acreage formula, and the 40 percent acreage times deliverability, 60 percent acreage formula as proposed by this application.

It was determined on the basis of some figures that had been discussed prior to this hearing, those figures being that the estimated take in the next year or so from the Dakota Pool should be 60 billion cubic feet.

Q That compares with approximately 55 that Mr. Cleveland used, I believe?

A Yes, sir. I don't mean to commit the purchasing companies to taking any 60 billion out of there, but for the purposes of this study, we merely used that as a good round figure. Also used 600 wells as the average number of wells upon which to base this particular study. There are at the present time considerably more wells drilled in the Basin-Dakota Pool than that. For purposes of this study, the intent will be fulfilled by using 60 billion cubic feet annual production and 600 wells.

Now, extrapolating the data on the number of acreage factors and acreage times deliverability factors that appeared in the February, March, and April, 1962 schedules, we arrived at an acreage factor of 559.67 for those 600 wells; in other words, there are enough wells with short acreage that the acreage factors are less than 600.

Using the same type of extrapolation, in other words, what we did was we took the number of wells that were added to the pool between the February schedule and the March schedule and determined how many acreage factors were added, at the same

time determined how much deliverability factor was added, and then we took the same thing from the March to the April and determined how many acreage factors were added for the number of wells that were added to the pool and the same increase in deliverability, and just extrapolated that; on the April schedule there are 572 participating wells. We merely extrapolated those factors up to 600 on the basis on which they had come into the pool in the last couple or three months.

Any other figures of total estimated annual take or total number of wells or what have you will give the same answer in the calculations. It merely changes the numbers somewhat.

Now, taking the points from this curve of Exhibit No. 1 for original reserves, which is the second column, you'll note the number of wells shown there is the number of wells given on the exhibit. The column labeled "Reserves in MCF" is the original reserves for each of those seven points on that curve. The deliverability now is the current average deliverability for those same wells.

Q Comment on that third column, if you please; explain that.

A That's what I was going to get into, is how we arrived at that. Although El Paso does not have too many contracts in the San Juan Basin which provide for a one million for each ten billion cubic feet of reserves take, it is becoming much more common practice in the industry to make contracts of that type.

In determining approximately the reserves in the field on developed acreage, we arrived at about 1.9 trillion, and divided that by the daily take based on 60 billion cubic feet per year, which is 167 million cubic feet per day; that comes up with a factor of 11.46. That is a take for each 11.46 billion reserves, so it seemed that in this case a ratio of one million for each ten billion reserves was a reasonable figure to pick as a depletion rate if there was no proration in the pool and it was being completed under a contractual arrangement.

Q In other words, this column reflects the rate at which these wells would be produced if they were produced daily at the basis of one million cubic feet for each ten billion of reserves attributable to that well?

A Right, original recoverable reserves. You can see the numbers that we came up with there, the first,130 million cubic feet per year; 56 million cubic feet per year, the second figure, and on down the line. We then,based on these acreage factors and acreage times deliverability factors shown at the bottom of the sheet, in other words, the 559.67 for acreage factors and 790,487 for acreage times deliverability factors, we calculated the reserves under the current 75-25 formula and under the proposed 40-60 formula. You will notice that the low ranges of deliverabilities and reserves are receiving allowables even under --

Q Did you calculate the allowables, also, that would be

applied to that group?

A Yes, sir, that's what I mean, we calculated the allowables for each group.

Q You had said reserves, I wanted to correct you.

A Excuse me, calculated the allowables for each group that they would receive under these assumptions that we used, under the current formula and the proposed formula. You'll note that even the low deliverability, particularly the low deliverability wells received fairly substantial percentages under the existing formula in excess of what a one million per day for each ten billion cubic feet of reserve depletion rate would be.

You can compare, then, the percentages, which is what the column after the allowable column in each case is, the percentage increase that the low deliverability wells will receive under the proposed formula at the expense of the higher deliverability wells.

Granted the change in percentage is not too great on the high deliverability wells from the current formula to the proposed formula, but they're still penalized considerably below what they would receive under a one for ten fixed depletion rate. I believe that's all.

Q Now, Mr. Rainey, have you determined the number of wells which have been completed in the Basin-Dakota Pool in recent years?

A Yes, sir.

Q What is that number?

A There was some testimony that there was not going to be any continuation of drilling in the San Juan Basin-Dakota Pools because of the current formula. We checked statistically just to see what the drilling rate has been in the Basin. As of 1-1-58 -- now the first four figures that I have are taken from the New Mexico Oil Conservation Commission Gas Engineering Committee Annual Reports. The figure for the drilling during the year 1961, in other words, the figure as of 1-1-62, was obtained from our people in Farmington as to the number of wells that we actually connected to our system, the wells that were pending connection to our system, and we checked with Southern Union and obtained the same information from them, the number of wells they had actually connected to their system and those they estimated pending connection, to determine the number of Dakota wells in the Pool.

As of January 1st, 1958 there were 20 Dakota wells in the San Juan Basin. As of January 1st, 1959, there were 45 Dakota wells; in other words, there were 25 wells drilled during the year 1958. As of January 1st, 1960, there were 146 Dakota wells in the Basin, or there were 101 wells drilled during the year 1959. As of January 1st, 1961, there were 301 Dakota wells in the Basin, or in other words there were 155 Dakota wells drilled during 1960.

According to the best tabulation we can obtain, at the moment there are 673 Dakota wells in the Basin, which means that

there were 300 -- excuse me, that's as of January 1st, 1962, there may be more than that now; as of that time, which means that there were 372 wells drilled in the Dakota Pool during 1961, which is the year that proration has been in effect. There were more wells drilled during 1961 in the Dakota than had been drilled cumulatively to date prior to that time.

Q Do you recall the month in which the existing order was issued by the Commission?

A Mr. Howell, the hearing was held in October of 1960, and I believe the order came out sometime in November of 1960.

Q It was either November or December?

A Yes, sir.

Q So that with knowledge of this order, there have been more wells drilled to the Dakota in 1961 than in all the prior years of drilling?

A Yes, sir.

Q I wish you would refer, Mr. Rainey, to the April, 1962 proration schedule, this testimony is offered in rebuttal to some direct testimony, and observe the deliverability as shown on the Consolidated Oil and Gas Company wells in which they were operators; since the testimony shows, I believe, that in the wells in which they owned the larger interest they are the operator.

A Yes, sir.

Q See if you have tabulated and averaged the deliverabilities of the several groups of wells.

A Yes, sir.

Q With the system to which they are connected?

A Excuse me. According to the April, 1961 proration schedule, there are six Consolidated Oil and Gas Company wells connected to El Paso's pipeline system-- I don't know the reason why, but there are only three of those wells with deliverabilities shown on the schedule -- for an average of 157 MCF per well. the three wells have an average of 157 MCF.

Connected to Southern Union Gas Company, there are 28 wells and one well is connected to Southern Union Gathering Company. Of those 29 wells, I didn't take a specific average of those 29, but I averaged in the three El Paso connected wells and the 29 Southern Union connected wells which had deliverabilities on them for a total of 32 wells, and an average deliverability of 660 MCF per day, as reported on the schedule, which, as I say, was indicated by Consolidated to be the wells on which they had the greatest percentage of interest.

Q Now, in conclusion, will you please state to the Commission your opinion and recommendations with reference to the adoption of a minimum allowable, or the consideration that should be given to a minimum allowable for the Basin-Dakota Pool at this time?

A All right. In the first place, it was testified to as I recall by Mr. Utz yesterday that the average acreage allocation factor gave each Basin-Dakota well during, as I recall,

the ten-month period on which he had tabulated allowables, and I believe he extrapolated for two additional months to get a full year of allowables, had given those wells an average of 2800 MCF per month.

Based on just the thirteen cent per MCF figure, that's somewhere in the neighborhood of about $360.00 a month income to those wells. So it would appear that there's an adequate minimum solely on the basis of the acreage factor, recognizing that even a well with 100 MCF deliverability is going to get some additional allowable because of its deliverability and being in the Pool.

It has been testified to at some length that operating costs on wells range anywhere from 50 to 150 to 175 dollars. Even if the range is as high as $175.00, which from information that I have available, the tending of those wells and the production on those wells can be farmed out to consultants and engineers in the San Juan Basin area for $50.00 a month, so it seems like those people are spending a lot of money unnecessarily. That is the actual field operation. I realize that the figures that have been testified to include certain office expense and overhead and things of that kind. Nevertheless, the money that will be derived from the acreage factor alone in this Pool at the present time is considerably in excess of actual operating expenses on wells.

As Mr. Cleveland testified, I think nearly any operator, if he's making some profit, no matter how small, is going to

attempt to keep his well on the line and keep it producing. I can't say that I agree with Mr. Utz that he should have some incentive compensation to be sure he's going to work his well over or something like that.

So to my way of thinking, a minimum at this time is completely inappropriate in this Pool. The Pool is not sick, and I am a little bit dubious of writing a prescription until we get some ailments here.

Q Is it possible that the imposition of minimum allowables in this Pool at a rate of three million a month could result in diverting some of the market from some of the pools with lower deliverabilities?

A That's a possibility, Mr. Howell. I'm not sure exactly that I follow what your question is. In other pools which have a three million minimum, would have very drastic effects at the present time in the Basin-Dakota Pool -- it wouldn't have any drastic effect, if that's what you are getting at.

Q Well, I'll not testify, I'll let you do the testifying. Mr. Rainey, do you consider the present formula a fair one that prevents waste in the Basin-Dakota Pool and protects correlative rights, and one that will continue to do so for a reasonable period in the future without the necessity of any change whatsoever?

A Yes, sir. That's my firm opinion, and I think the curves on Exhibit 1 bear out the fact that the high deliverability

wells are being assigned allowables less than commensurate with their reserves in relation to the low deliverability, low reserve wells, and that any move to assign more allowable by virtue of increasing the acreage factor to low deliverability wells is a move 180 degrees in the wrong direction.

Q Were these exhibits, El Paso's Exhibits 1 and 2, prepared under your general supervision, and do they correctly reflect the matters to which they relate?

A Yes, sir, they do.

MR. HOWELL: We offer El Paso's Exhibits 1 and 2 in evidence.

MR. PORTER: Are there any objections to the admission of these? The exhibits will be admitted in evidence.

MR. HOWELL: That concludes our direct examination of this witness.

MR. PORTER: Mr. Rainey, you said that you wouldn't recommend, I believe you testified that you didn't think that a minimum allowable was needed for this pool because it wasn't a sick pool. Would you recommend a minimum allowable for sick pools?

A I think that situation should be taken into consideration in the case of each individual pool. There's a mechanism within the field rules, the prorated gas field rules at the present time for taking care of wells which are in danger of premature abandonment, and we certainly would not go on record as favoring premature abandonment of gas wells.

MR. PORTER: Any questions? Mr. Stockmar.

MR. STOCKMAR: If the Commission please, our cross examination of this witness will have to be based on some calculations that we will necessarily have to do. I could in a sense do this through the witness at great length. I think a fifteen minute recess will greatly shorten the total time that would be needed to interrogate the witness.

MR. PORTER: We will take a short recess.

(Whereupon, a short recess was taken.)

MR. PORTER: The meeting will come to order, please. We will recess the hearing at 5:30. Mr. Stockmar.

MR. STOCKMAR: Ted Stockmar for Consolidated.

CROSS EXAMINATION

BY MR. STOCKMAR:

Q Mr. Rainey, I believe that you testified that the fact or deduction, or whatever it is, that this purple line is curved, is because there has been an excessive allocation of allowable to the lower deliverability range?

A No, sir. I testified that by virtue of the allocation formula, that the lower deliverability wells received more allowable commensurate with their reserves, in relation to their reserves, than the high deliverability wells. I didn't say the curve was because of that. I said the curve indicates that's what has happened, that is what is happening. What I'm getting at, Mr. Stockmar, is that the magnitude of deliverability on low

reserve wells, relatively low reserve wells, is greater in relation to their reserves than the magnitude of the deliverability on the high reserves wells is, in relation to their reserves. Consequently, the lower reserve wells are receiving a greater percentage annually of their recoverable reserves than the high reserve wells are, and that will be shown by a subsequent exhibit.

Q Well, under some other allocation formula, then, I would understand that this purple line would have some other location on this chart?

A No, sir, I don't think necessarily. I don't know. I haven't plotted it under any other allocation and I couldn't state specifically; and we have not produced under another allocation, although there are a number of the wells that have been producing for some years prior to the allocation formula.

Q Is it the location of the line now, or the fact that it is curved, that has permitted you to conclude that the lower deliverability wells are getting more than their fair share of the allowable?

A I don't know that I follow you exactly, Mr. Stockmar. May I go from Exhibit 1 to Exhibit 2 and call your attention to the fact that on the basis of a reserve ratio one million for each ten billion cubic feet of reserves, under a 75-25 allocation formula the low deliverability wells do receive more allowable than the high deliverability wells do, commensurate with their reserves; and it's an even greater disparity under the formula

proposed by you, or by your company, excuse me.

Q I hate to be obtuse, Mr. Rainey, but there's something about this curve or line that is the basis of your testimony, or confirms your opinion from some other source, that the low deliverability wells are getting a break.

A Yes, sir.

Q This is what I would like to have you explain to me.

A I see what you are getting at. Let me put it this way then. If all of the wells were receiving or had deliverabilities in the same relationship to their allowables, this would be a straight line on the, approximately on the slope at the lower range because the points --

MR. HOWELL: May I interrupt just a minute? You said in relationship to their allowables. Did you mean in relationship to their reserves?

A I mean reserves; if I said allowables, I am sorry. Let me back up and start over.

Q (By Mr. Stockmar) I think if you will start the entire answer again.

A Let me back up and start over. If all of the wells in the various ranges of reserves had deliverabilities in relation to their reserves in the same fashion, in other words, if the deliverabilities of low reserve wells had the same relation to the reserves as the deliverabilities of high reserve wells do, this line would be a straight line and would be just extrapolating from

the first four or five points. When you get out in the range of the six to seven billion cubic foot reserve range, the deliverability of a well in that range, if it were in relation, the same relation to its reserves as the deliverability of the low deliverability and reserve wells are, the average would be approximately three million a day, whereas in fact it's 2200 MCF a day.

Q Would you mind, on my copy of your Exhibit 1, making the extrapolation that you just testified about? Please use a red pencil.

A Yes, sir, I'm using the pencil handed to me by you.

Q For the record, Mr. Rainey, --

A Yes, sir.

Q -- can you state that this straight line now runs from the common zero point to the intersection of the three million deliverability?

A Three million deliverability and the seven billion reserves.

Q The intersection of the three billion line, the horizontal line, and the seven billion reserve line, is that correct?

A Yes, sir, that's correct.

Q Did I understand you to say that the net change in the deliverabilities is a measure of the net change in the reserves, in the remaining producible reserves?

A I think it should be. It is not in the ranges of the high deliverability and high reserve wells. It is very closely

in the low deliverability wells, as can be evidenced by the fact that the curves in the lower ranges lie one on top of another.

Q Had we been operating, since the time of the preparation of the 160-well exhibit as represented by this green line, had we been operating under a 100 percent deliverability formula, would the curve or line be a straight line at this time?

A No, sir. I doubt it.

Q As I recall --

A If I may elaborate a moment, the point being that I don't think the high reserve wells have deliverabilities high enough in relation to their reserves, in comparison to the low reserve wells.

Q Under what conditions of production, Mr. Rainey, would your idea of the relationship between deliverability and reserves fall along a straight line?

A Mr. Stockmar, if the high reserve wells had high enough deliverabilities it's possible that there would be a straight line in this relationship. I think another thing that this curve evidences pretty clearly to me is that there is a possibility, because the deliverabilities of these high reserve wells had declined at a more rapid rate in relationship to their reserves than have the deliverabilities of the low reserves wells, there is a strong possibility that there is drainage at the present time from the high reserve area to the low reserve area.

Q Is it the fault of an owner of a low deliverability well

that your high reserve well does not have the high deliverability which you believe it should have?

A No, sir. I think he's just lucky, but at the same time I think it would be a step in the completely wrong direction to attempt to further penalize those high reserve wells because they don't have enough deliverability right now, and your proposal is to give more credit to acreage in the allocation formula.

Q Well, then, you are saying that in the high deliverability ranges, the comparison between deliverabilities and reserves does seem to fail for some cause, is that your statement?

A I think you've turned it around. In the high reserve ranges, the relationship is not as true as it is in the low reserve ranges because the high reserve wells do not have sufficient deliverability. They don't have sufficient producing capacity.

Q Why not?

A Any number of factors. There's a possibility that--the reserves calculated are based on various parameters, many of which have to be estimated; even though we have attempted to estimate them as accurately as we can on a township average basis, many of those parameters must be estimated. There is a possibility, and I'm a little disturbed about this myself, because of the very close correlation in the lower ranges, there is a possibility that we may have attributed a little bit too much reserve to some of the high reserve wells.

Q You are very candid to anticipate my next question. Is

there also the possibility, Mr. Rainey, that in conditions of high productive capacity, there might be a substantial change in the impact of some given factor that contributes to productivity?

A You are talking about fracking, yes, sir, that's quite possible.

Q No, I'm talking about -- well, let me, I have to be educated first and then we will go from there. What are the factors which enter into the productivity of a well?

A Pressure, porosity, permeability, temperature, net pay thickness, all the parameters that go into the determination of reserves, plus the parameter of permeability.

Q You mentioned that one of those factors that goes into determining the productive ability of the well is permeability?

A Yes, sir.

Q As I understand the definition of deliverability, it is a measure of the productive capacity of a well, is that correct?

A That's essentially correct, yes, sir, at a given set of conditions.

Q Well, then, permeability equating those, permeability seems to be some kind of a factor in deliverability?

A It is a factor, yes, sir. It's not the sole factor by any means.

Q Well, is acreage or area a factor in deliverability?

A No, sir.

Q Is porosity a factor in deliverability?

A There is no, to my knowledge, no direct mathematical relationship between porosity and deliverability. On the other hand, without porosity, you don't have any deliverability.

Q I understand you would have no gas?

A Right.

Q That is the reason?

A I don't know of any direct mathematical relationship between porosity and deliverability.

Q Have you made any studies to see if there is a relationship between porosities in the various wells in this field, and the deliverabilities of the wells?

A No, sir, not as such.

Q I believe you testified that the range of porosities was from something rather small to, or from zero to fifteen percent?

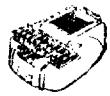
A Well, the range that we used in arriving at our reserve calculations for this study and for all of our purposes in the Dakota is from six percent to approximately fifteen, because we arbitrarily cut it off at six percent.

Q So actually the range of variation of porosity is rather small?

A Well, it's a hundred percent, 150 percent.

Q How does that compare with the range in the measured deliverabilities?

A Oh, the range in the measured deliverabilities, Mr.



Stockmar, range anywhere from something less than 100 MCF to, I think there's been considerable testimony and discussion today about a 30 million deliverability well.

Q You see no relationship between porosity and deliverability?

A Not directly, I don't. No, sir.

Q Excuse me, Mr. Rainey, but what were some of the other factors that you mentioned?

A Mr. Stockmar, to save a lot of time, if we are going to go one by one of the various parameters that are in reserves and discuss whether they are directly related to deliverability, I will say I don't think there's a specific direct relationship in any of them. Pressure bears a direct relationship to it. Your permeability admittedly bears a direct relationship, which is not in reserves. The point, if I may, just a moment and maybe save some more questions -- the point I would like to make is that deliverability, because it does have pressure, temperature, various other factors upon which it is dependent, maybe not directly, mathematically, but upon which it is dependent to be there, certainly bears a much greater relationship to recoverable reserves than straight acreage. Now has that saved us a lot of time?

Q Well, if I understood you, it was that of those parameters, permeability is the one, permeability and pressure do seem to bear together some direct relationship to reserves, is that correct?

A No, to deliverability. Permeability has no direct bearing on reserves.

Q Well, if deliverability -- Pardon?

A Permeability has no direct relationship on reserves other than the fact that if you don't have permeability you have no recoverable reserves; but pressures and permeability do reflect on deliverability.

Q I think that is what I said.

A You said reserves.

Q I'm sorry. I meant to ask, is there a direct relationship between pressure and deliverability?

A Yes.

Q And permeability and deliverability?

A Yes, sir.

Q If I may elaborate --

A Each of them.

Q -- is there a direct relationship between each of those items and deliverability?

A There is a mathematical relationship. I don't know exactly what you mean by "direct relationship".

Q You have testified that there is a direct relationship, or many of your people have, between permeability and reserves. Maybe we should clarify what is meant by a direct relationship.

A That's something at which I have been to some length to determine myself. Some people say that a direct relationship

is a straight line relationship. My feeling is that a direct relationship is any constant relationship which can be related to a mathematical formula. Now what that specific mathematical formula is in the relationship between deliverability and reserves in this specific pool and in this specific instance --

Q It is a direct relationship, but you would hate to be more specific?

A It's a relationship that can be determined mathematically.

Q It is? A Yes, sir.

Q It is either a straight line function or curve function?

A Yes, that's my interpretation or understanding of what a direct relationship is, yes, sir.

Q And this is true both as to pressure and permeability?

Q In relation to reserves?

Q In relation to deliverability.

A In relation to deliverability; yes, sir, that's my understanding of the situation.

Q What is the relationship between permeability and reserves?

Q You mean mathematically?

Q I mean -- yes, if you will.

Q Between permeability and reserves -- excuse me.

Q And reserves as you have used it.

Q There's no direct mathematical relationship that I know

of offhand, other than this fact that without permeability you don't have recoverable reserves.

Q It is your testimony that there is no direct, in the broad sense, no direct mathematical relationship between the two, is that it?

MR. HOWELL: That is the third time that the witness has answered the same question. I suggest that counsel adopt another line.

MR. STOCKMAR: Is it clear that his answer is no?

A It's no, that I don't know of any specific relationship between permeability and reserves.

MR. HOWELL: He has answered that three times.

Q (By Mr. Stockmar) The reason for my confusion is that you have just testified that there is a direct relationship between deliverability and reserves.

A Yes, sir.

Q And a direct relationship between the deliverability and permeability.

A That's correct.

Q The little arithmetic that I know, if there are two items that have a direct relationship to a third, then they have a direct relationship to each other. I am very anxious to determine what that relationship is.

A Mr. Stockmar, there may be a mathematical relationship that can be determined between permeability and reserves. I'm not

saying there is not such a mathematical relationship. I'm saying that I do not know what it is, if there is such a relationship. I merely say that there can be no recoverable reserves without permeability. Consequently, there is some relationship between permeability and reserves. Now again, I'm not trying to avoid the question. I flat don't know if there is a specific mathematical relationship between permeability and recoverable reserves.

Q Or you don't know what it is, that is a more accurate statement?

A Right. In the calculation of the deliverability formula -- in response to no question at all -- the slope of that curve,we were discussing the various parameters in reserve calculations that are not directly related to deliverability. The slope that is used in the calculation of deliverability to a specific set of conditions takes into account those other various parameters, and it's a characteristic of a particular well.

Q You mean the slope of this line?

A No, the slope of what the deliverability curve on an individual well.

Q Is there any significance in the slope of this line?

A No, sir, only the fact that it curves and the high reserve wells don't have enough deliverability.

Q Mr. Rainey, in your last group on Exhibit 1 of the 19 wells --

A Yes, sir.

Q --were there any low deliverability wells in that group?

A Just a minute, I'll check and see. I imagine there probably were. There were ranges of deliverability, high, low and in the middle throughout all of these. El Paso's position always has been that the pool must be prorated on the basis of averages and not on the basis of the few freaks, that they should be treated as special exceptions in special cases.

Q Is this an indication that you agree with Mr. Trueblood's testimony to the same effect?

A Yes, sir. I think those freaks ought to be treated as special exceptions, and I see no reason whatever for disturbing the whole pool allocation formula for the few freaks we are talking about. I think the overall pool allocation formula is applicable, and as I testified, I think it ought to be a little more toward deliverability. I think the high deliverability wells in the low ranges of reserves, or low deliverability wells in high ranges of reserves should be treated as special exceptions and special cases. The lowest deliverability well that is in that last group is 1,040 MCF, in the eight to nine billion range.

Q 1,040?

A Yes.

Q What was the highest deliverability well in that group?

A In that group?

Q Yes.

A Appears to be about -- well, there's one oddball in

there, there's 12 million deliverability, 12,063.

Q It's off the chart?

A Yes, well, it's averaged into that group is what I'm getting at. Yes, it would be off of this chart completely. I might point out that's the initial deliverability on that well. The current deliverability is only 4700, that same well.

Q One more question, how many of the wells in that group of 19 are above this average, and how many below?

A Let me get this stuff out, if we're going to go into that. That's from six billion up, isn't it? Do you want it on a current basis or on an initial basis?

Q Initial basis, please.

A All right. The average shown there is 2200. And I will stand corrected on that 1040 MCF I gave you a moment ago, because I hadn't gone far enough back. There's one 386 deliverability well in that group. There are,eleven of the wells are below the average, and eight of them are above the average.

Q This is initial?

A Yes, sir.

Q Now, of those eight wells in the below average --

A Above average on the eight.

Q Excuse me, in the eleven wells on the below average group --

A Yes, sir.

Q -- was there any noticeable drop in the deliverabilities

of those wells during the period reflected here, down to current deliverability?

A That twelve million one that I mentioned is down to 4700.

Q I'm asking about the wells in the below group.

A Excuse me, the below. I'm sorry. No, sir, they seem to be relatively in line. There is a small decline in all but one of them, and it went up from 814 to 900.

Q The higher deliverability wells, then, the eight wells up there, they do exhibit a sizeable percentage drop?

A Well, now, that twelve million well, as I mentioned, is a real oddball. The next one is only 4200 and other than the twelve million, the others exhibited a normal decline, some of them were initial, no decline whatever, it's the same figure. The twelve million dropped down to 4700.

Q Maybe we'll have to get -- did the wells in the higher deliverability group exhibit a larger percentage drop, percentage of their original deliverability than did the wells in the lower group?

A Without running any detailed calculations, Mr. Stockman, and just sort of eyeballing the figures, I would say probably a lesser percentage drop than the small ones.

Q Would it be possible, Mr. Rainey, over the dinner hour for you to actually calculate the percentage drop on each of those eight wells in the group above, and the percentage drop of each of

the eleven wells in the group below?

A You are going to be eating dinner.

Q I'll be glad to help you.

A No, I'll be happy to.

Q Can you also do that for us to calculate the average of the wells above, that is, the average percentage drop? This is the only way we can get at it, Mr. Rainey.

A I don't know how to figure an average percentage, unless you want me to take the total of the wells that were low and the total of their current deliverabilities, and then figure percentage there. You can't average percentages.

Q Here is what I would like to have you do, is to calculate the percentage drop of the average well.

A All right.

Q Weighted average.

A I'll tell you what I'll do. I'll be happy to give you the figures and let you do it, because I don't know what you want, frankly.

Q If you will produce for us --

A Here's the tabulation of the 19 wells in the high group.

Q Thank you, sir, we'll return it.

A If I knew what you wanted, I'd be happy to do it.

Q If, Mr. Rainey, we discover -- and apparently none of us will know until after dinner, that the percentage drop was

greater in the higher deliverability range than it was in the lower, can not we say that this is directly attributable to an overproduction by those wells? We're sort of gambling with each other.

A I couldn't say until I knew what their allowables were, based on their deliverabilities, and their production in relation thereto. It would appear to me it would indicate drainage more than anything else. If the high deliverability wells had declined more rapidly in this high reserve group, it would indicate to me a possible indication of drainage to some low reserve, low deliverability well that has a lower pressure.

Q If my recollection of the record is correct, you have just testified to the reverse by eyeballing, you said?

A I said it appears that --

MR. HOWELL: If the Commission please, this is entirely speculation. If the gentleman wishes to go ahead and compute his figures, Mr. Rainey will be glad to accept his computation, but we are in the realm of guesswork, and if we continue in this realm of guesswork, I don't know when we'll finish. We will be here on Easter morning. We object to that line of questioning.

Q (By Mr. Stockmar) We're getting very near the announced hour, Mr. Rainey --

MR. HOWELL: I might inquire of counsel if it's his determination to keep Mr. Rainey on until the recess, until he can do some more studying?

MR. STOCKMAR: It certainly is.

MR. PORTER: The hearing will recess until 7:00 o'clock.

(Whereupon, the hearing was recessed at 5:30 o'clock.)

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NIGHT SESSION
April 20, 1962

MR. PORTER: The hearing will come to order, please. Mr. Stockmar, will you continue with your cross examination?

MR. STOCKMAR: I would like the record to show that I'm returning to Mr. Rainey the data sheet which he loaned us.

MR. RAINEY: Thank you, sir.

CROSS EXAMINATION (Continued)

BY MR. STOCKMAR:

Q Mr. Rainey --

A Yes, sir.

Q On your calculations with respect to the well which dropped so drastically in deliverability, in the 19 well group on the right-hand side of your Exhibit 1, would that indicate that the drop in that single well's deliverability amounted to an average drop for all of those 19 wells of 386?

A MCF?

Q 386 MCF deliverability for each of those 19 wells, is that correct?

A I have not made the calculation, but I'll accept your figures. I'm sure it is.

Q In terms of the deviation that you testified as having

occurred between the purple line, the initial deliverability and reserves line, and the gold line, the current deliverability and reserves, we believe this amounts to at least one-third of that deviation?

A Yes, sir, that's correct.

Q Do you agree with this?

A That's probably correct, right.

Q This then substantially brings closer together the purple lines and the gold lines?

A Yes, sir, exactly.

Q Mr. Rainey, would you refer please to your Exhibit 2?

A Yes, sir.

Q As I understand the substance or the import of your testimony here, it was that the projected yearly allowable rates for wells under the existing formula is superior to the sort of national approach of allotting one million a day take to each ten million of reserves, and therefore that the existing formula is,in some of the, with respect to some of the wells in the top two brackets here doing better for those wells than the national average, you might say?

A Yes, sir, that's correct. The purpose and intent of any allocation formula is to, as nearly as possible, allocate the production between wells in the ratio that the reserves of those wells bear to the total reserves of the field. This formula, the present 75-25 formula, does not in perfection achieve that, but

it much more nearly achieves that than the proposal that we have before us of a 40 percent AD plus 60 percent acreage.

Q Do you feel that this does achieve it for these low deliverability wells?

A No, sir, it doesn't immediately, they are getting more. Since the fixed depletion rate is a direct ratio of reserves, it's obvious those lower deliverability wells are getting a little more than they should get in a direct ratio of reserves.

Q Your statement is the low deliverability wells in these fields are getting more under the present formula than they are under the fixed depletion rate?

A Yes, sir, that's obvious.

Q Well, Mr. Rainey, in looking at your data sheet, we find on that five well s at very low deliverabilities. Would you refer to it?

A In that high range of reserves, is that the sheet you are talking about?

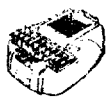
Q The data sheet we borrowed over the candy bar hour. We found there was one well that had a deliverability of 332 MCF per day.

A I fail to see that one. Excuse me, you are talking about current deliverability?

Q Yes.

A Right.

Q And an 8.1 billion reserve, is that correct?



A Well, a current reserve of 7.3 billion, based on our calculations.

Q I'll accept that. Another well with a deliverability of 147, a reserve of 6.6 billion --

A 6.4, yes, sir.

Q I'll accept that. A well with a deliverability of 337 --

A Yes, sir.

Q -- and what was the reserve for that?

A Reserve is 6.1 billion, 6.06.

Q Well with a deliverability of 402, a reserve of what?

A 6.2 billion.

Q A well with a deliverability of 386, and a reserve of what?

A 6.4 billion.

Q Now as I understood your testimony and the purport of this exhibit, if we have, say, 6 billion, then under the fixed depletion rate that well should be entitled to point six-tenths of a million cubic feet a day take, is that correct?

A Yes, sir, approximately; in round figures that's correct, yes, sir.

Q Under the existing allowable formula, what does a well in that low deliverability range, say 397, to be consistent with your top column --

A Yes, sir.

Q -- what is the comparison then between the fixed depletion rate and the allowable?

A The allowable is 164 percent of the rate, based on a fixed depletion. I don't know the exact figure per day. These are annual figures on this --

Q Yes, sir.

A -- this report.

Q We had selected one of these low deliverability wells and under the fixed depletion rate it should receive 600,000 cubic feet a day, is that correct?

A Yes, sir, if it's got six billion reserves -- is that correct?

Q Now this was --

A Wait a minute.

Q This was your tabulation.

A Right, right. That's right. That's a one for ten depletion rate.

Q Multiplying that times 365, or the number of days in a year, we find that that well should receive 200 million plus MCF on the projected -- excuse me, on the fixed depletion rate; this would seem to be seven times higher, it should be entitled to seven times more than you have shown for a more or less similar low deliverability well on the first line of your table.

A Mr. Stockmar, there's one apparent fallacy in that statement at the outset, in that that well is not capable of

producing but 386 a day, but whatever the deliverability a day you picked, I believe it was 86, obviously under any type of depletion rate it won't produce 600,000 a day.

MR. HOWELL: I would like to call Mr. Stockmar's attention to this fact, that he's mixing apples and oranges, because this exhibit will include the high deliverability well, the high reserve well, since the group that he has included is in the last line and not the first line of this exhibit. Therefore he's using a wrong assumption in his question, that the figures which were given him include the 19 wells that appear in this last line and he's questioning in regard to the group of low delivery wells that appear in the first line.

MR. STOCKMAR: I am trying to get some of the apples out of the orange barrel here and get them back into the apple barrel.

A May I make a statement at this point which may save some of this?

Q (By Mr. Stockmar) Yes, sir.

A Admittedly, these 19 wells in this last group are oddballs. We have all talked about these so-called freaks within this field. These are wells which, according to the best data available, and admittedly some of it is to some extent guesswork, but nevertheless, on the basis of the best data available indicate very high reserves, many of them, as you pointed out, have very low deliverabilities, some of these wells; and I cannot say which

ones, but you recall from some original tabulations, some of these wells have been in the field for quite some time and are old shot wells, have not been fracked and are, because of that fact have low deliverabilities. I know one well in particular is an El Paso well, one with eight billion cubic feet of reserves on it. It was completed some time ago and was shot, and I don't know why, we have never gone back in and re-opened and fracked it, but it has a million deliverability. I think in this group of wells you can pick out and prove most anything you want to by picking the isolated wells in this pool. Admittedly, they are freaks.

Q Well, let's pick one.

A Okay, sir.

Q You just stated before the conversation that one of these low deliverability wells of 397, something like that, wouldn't make its allowable anyway?

A That's right. If it's got six billion feet of reserves, it won't produce 600 MCF a day.

Q That is not what I asked you. Will a well with a deliverability of 397 make its allowable?

A Yes, sir. In the Dakota Pool it will make it. You were predicating it on the fact it was going to have six billion feet of reserves and get 600 MCF a day, in a fixed depletion ratio.

Q You testified because of its very large reserves, on the fixed depletion rate which we seem to be trying to achieve or beat here, that well should be entitled to 200 million MCF per

year?

A 200 cubic feet, wouldn't it be?

Q Excuse me, I'm sorry.

A Yes, sir, that's correct.

Q And yet its allowable would be what, Mr. Rainey?

A Approximately 49 million cubic feet a year.

Q Then its allowable is only one-fourth of what it should be if it were to reach the fixed depletion rate?

A That's right. But back to my original point, it cannot produce its fixed depletion rate at the outset; consequently, it's not entitled to that type of allowable.

Q Well, how much can it make?

A Well, it can make 397 MCF a day times 365, which is roughly 120 million, it seems like.

Q Would you accept 146 million?

A All right, sir, I guess we are doing that.

Q Which is three-fourths of the fixed depletion rate to which its entitled?

A Yes, sir.

Q And which is three times the allowable permitted to it at the present time?

A That's correct.

Q Is it still your contention this arises only because these wells are freaks?

A Yes, sir, because I seriously have doubts as to the

accuracy of either the reserves or the deliverability on that particular, on a particular well of that type, because of the very close proximation in averages throughout the range of the field.

Q Do you have the same doubt as to the relationship between the deliverability and reserves as to the next category of 28 wells in the five billion reserve range?

A Mr. Stockmar, I am sure that you will find wells within any range which has a deliverability that does not correspond to the reserves which we have determined for it. The averages correspond very closely. We can go through the whole 457 wells, and I'm sure you can find a number of them that will not correspond at all. But the great bulk of them and the overall averages correspond very closely.

Q I hand you Consolidated's Exhibit 3 --

A Yes, sir.

Q In the deliverability range -- excuse me -- do you recall Mr. Trueblood's testimony that these figures, that this data was derived from the February, 1962 proration schedule?

A Yes, sir.

Q In the zero to one thousand deliverability range we find 278 wells?

A Yes, sir.

Q Are all of these wells freaks?

A No, sir.

Q Are these wells generally scattered throughout the entire reserve range?

A There may be some that are scattered, Mr. Stockmar. If you'll notice the percentages through the first one, two, three, four categories of the wells on my graph, Exhibit 1, there are 75 percent of the wells in the pool in these first four categories, and the --

Q Let's look at these 278 wells on your Exhibit No. 1.

A Yes, sir.

Q Mr. Rainey, all of these 278 wells, if plotted individually --

A Yes, sir.

Q -- would be scattered throughout the entire reserve range shown on your exhibit, would it not?

A It's possible, yes, sir.

Q Is it possible, or is it absolutely true?

A I said at the outset, Mr. Stockmar, that there were ranges of deliverability from very low ones to very high ones in each reserve category.

Q Well, are all of these freaks, or just the ones in the end out here?

A I think basically nearly all of the ones on the end are probably freaks. There are individual cases because of specific reservoir characteristics that the deliverability is not, in a specific well, and I admitted it on several occasions, not

specifically related to the reserves; but in general, and on the broad average basis as shown very clearly by this curve, I think they are.

Q I submit to you, Mr. Rainey, that if we revised your Exhibit 2 so that this same tabulation was made, instead of taking the points as we have them --

A Yes, sir.

Q -- but if we refer back to Consolidated's Exhibit 3 --

A Yes, sir.

Q -- and work these up by the deliverability ranges of the wells --

A Yes, sir.

Q -- individually, each with respect to its individual reserves as determined by you, --

A Yes, sir.

Q -- that we would find that those 278 wells, each should receive a fixed depletion rate somewhere in the area of 100,000 MCF, as against a projected yearly allowable for wells in that -- take the two top categories so we'll be fair to you -- under 1,000, excuse me, under one million deliverability, you have a projected yearly allowable for those wells which would probably average 55 million, is that correct?

A I'm not sure that I follow you, Mr. Stockman. I lost you somewhere in the middle. Would you repeat that, please, sir?

Q I asked you, Mr. Rainey, that if we made a statistical

presentation similar to your Exhibit No. 2 --

A Yes, sir.

Q -- except that instead of using the categories represented by your seven average points,--

A Yes, sir.

Q -- that we used the deliverability ranges for our groupings that as to each well we found its reserves according to our own method of determining them,--

A Yes, sir.

Q -- I submit to you that the fixed depletion rate to which all wells, or let's say the average wells --

A Now let me interrupt just a moment to be sure I understand. You are talking about the first two groups on my Exhibit 2 or Consolidated's Exhibit 3?

Q I'm talking about setting up one group containing 278 wells.

A All right, sir. Which are the wells on Consolidated's Exhibit 3.

Q Which are all of the wells in the field in the zero to one billion deliverability range.

A Yes.

Q I suggest then that for column two we determine the reserves --

A For each of those wells?

Q -- for each of those wells, independently.

A Yes, sir.

Q I suggest then that we, if you wish, average all those reserves, average those 278 wells to give us a deliverability average of, what would it be, 500?

A Five, 600, I don't know, I would imagine.

Q More likely about 660?

A I imagine it would be on the high side, six or 700, I would guess, but it's just a pure guess.

Q But if it is as high as 700 then --

A Yes, sir.

Q -- by your own table here it should be entitled to a yearly allowable of 61 million, is that correct, or 70?

A I don't follow that at all, Mr. Stockmar. We don't know what it will be until we determine what reserve ranges they will fall into.

Q We have simply averaged the reserves of all --

A Average them and average the deliverability.

Q Pardon me?

A As I understood your problem, we were then going to average all those reserves and then average all the deliverabilities, then determine the ratio between the fixed depletion rate and the allocated allowable; and I have no concept of what that average reserve might be.

Q I was trying to simplify the matter, but instead we create a very long table. Treating each well independently, we

set forth its particular reserve, its particular deliverability. Then we compare, we take the appropriate fraction of its reserve for a fixed depletion rate --

A Daily depletion rate.

Q -- and compare that with the projected yearly allowable for that well.

A Yes, sir.

Q I submit to you, Mr. Rainey, that we will find on the average of those 278 wells, and they will vary, that the fixed depletion rate should be in the neighborhood of 75 to 80 percent higher than the allowable permitted under this formula.

A Mr. Stockmar, without making some detailed calculations I won't -- if you made the calculations and say that's right, okay, but I haven't, I don't know.

MR. HOWELL: You wish to be put under oath, Mr. Stockmar, and testify to that?

A I don't know, Mr. Stockmar.

MR. STOCKMAR: If we could have the data sheets for all of these categories that Mr. Rainey has, overnight, I'm quite certain we could find a witness that will testify to that, including myself.

MR. HOWELL: Well, I was just wondering if you are prepared to testify to it now, because the witness has stated several times he doesn't know the answer, and I submit it's argumentative and improper questioning to keep putting these

hypothetical questions about calculations which have not been made. Object to that line of questioning.

MR. PORTER: The Commission will sustain the objection, since the witness has not made the calculations.

Q (By Mr. Stockmar) Mr. Rainey, may we overnight have all those data sheets for these eight points?

A Yes, sir. I have no objection to your having them, borrowing them. These are grouped, for your information, these are grouped by reserve groups. You'll have to completely rearrange them by deliverability groups to achieve what you are after.

Q Mr. Rainey, returning to your Exhibit 1, please, --

A Yes, sir.

Q -- what is the average deliverability of all of these 473 wells?

A I have 457 on my exhibit. The average original --

Q Excuse me.

A -- deliverability was 1421 MCF per day. The average current deliverability, or 1961, based on 1961 deliverability tests, is 1290 MCF per day, bearing in mind that a number of the wells, the initial conditions are the current conditions.

Q Well, based on those initial deliverabilities, what would be the, you might say the reserve of the average well?

A 3,140,000,000 cubic feet, which as I -- I gave these on direct, Mr. Stockmar,and pointed out that those points fall

right on the curves.

Q Thank you, sir. Of these 457 wells, how many of them have a below the average deliverability?

A Below average deliverability?

Q Below the average of 1400 that you testified to.

A Mr. Stockmar, I haven't the slightest idea. I haven't made a deliverability grouping of these wells.

Q I submit to you, Mr. Rainey, that it will be in the neighborhood of --

MR. HOWELL: If the Commission please, we are getting back to Mr. Stockmar's testifying about some calculations that haven't been made. The witness has testified he doesn't know. I would like to get home sometime before Easter morning.

Q (By Mr. Stockmar) Mr. Rainey --

MR. PORTER: Mr. Stockmar, please refrain from having the witness testify to calculations which he hasn't had an opportunity to make.

A I might point out, Mr. Stockmar, the data sheets I gave you will enable you to make such calculations and you can present them tomorrow.

Q (By Mr. Stockmar) Mr. Rainey, did you hear Mr. Trueblood's testimony with respect to his Exhibit 4, maybe others?

A Is this Exhibit 4?

Q Yes, sir.

A Yes, sir, I heard it.

Q That of the 473 wells in the field subjected to his study, that 70 percent, or something near 70 percent of those wells were below average deliverability?

A Yes, sir.

Q Do you agree or disagree with his testimony.

A I haven't made those calculations. I would venture to say that he's probably right. I have no reason to dispute them. I haven't determined those on my own. I might point out that a great number of the wells in the field are below average reserves, too.

Q Mr. Rainey, can you tell us the average reserve -- well, assuming that 70 percent of these 457 wells are below the average deliverability --

A Yes, sir.

Q -- can you tell me the average reserve attributable to --

MR. HOWELL: If the Commission please, Mr. Rainey has answered that question that he has not computed on deliverability groups. Mr. Stockmar, may I inquire if it is your intention to continue questioning Mr. Rainey until midnight to make further attempts to impeach his testimony? Are you going to keep him on the stand with the same line of questioning until the Commission recesses for the night, because that's exactly the same question that he's told you he hasn't computed, and we object to that line of questioning.

MR. STOCKMAR: In answer to your question, I'm very

anxious to be done, Mr. Howell.

Q (By Mr. Stockmar) Mr. Rainey, if the average deliverability of the field wells is 1400 --

A Yes, sir.

Q -- and we have one well of a deliverability of 2,000, you will admit that there can be such a well?

A Yes, sir.

Q Can one single well of the below average deliverability group -- I'll withdraw the question.

MR. STOCKMAR: Thank you, Mr. Rainey, very much.

A Yes, sir.

MR. PORTER: Does that conclude your questions?

MR. STOCKMAR: Yes, sir.

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

BY MR. KELLAHIN:

Q Mr. Rainey, as I understand, in your reservoir study you did this on an average township basis, is that correct?

A Yes, sir.

Q Now in arriving at the calculations, what core information did you use on each township, was it the same or what?

A Mr. Kellahin, I testified at great length that I did not do it, our reservoir people did it in a continuous study of deliverabilities, of reserves, in the Dakota Pool. We used some 65 to 68 cores in arriving at those parameters, and as I mentioned,

if we did not have a core in a particular township and had cores in townships around it, we probably used the average of those four cores, the data on those four cores for the parameters to be used for the determination of reserves in that one township.

Q You say probably, you don't know?

A That's what was done. I'm just saying if we didn't have it in one township, we averaged what we had around it. What I'm saying, we did not necessarily have cores in every township.

Q But where you had cores in one township, you used those cores, is that correct?

A Yes.

Q Then you made the assumption that as far as the rock characteristics are concerned, they were uniform through the township?

A As near as we can determine. Of course, I made the further statement, which I hoped was clear, that we compared the logs on the wells on which we had core analyses. We then compared those logs with other logs of the same character in that township in an effort to determine an accurate count of net pay thickness.

Q That again assumes a degree of uniformity, doesn't it, Mr. Rainey?

A Uniformity or non-uniformity, there may have been great non-uniformity between logs; and if in correlating we couldn't find the same sands that had good core characteristics, and some logs in the township we probably didn't give any credit to that sand

as being net pay.

Q But on the average, for the whole township, you had to treat it as a fairly uniform --

A Basic as to your porosity and water and parameters, and things of that nature.

Q On your Exhibit No. 1 --

A Yes, sir.

Q -- it's my understanding that each one, while you did not group these by deliverability, your point there, for example, you have five wells between six and seven there; that is the average deliverability for those five wells, is that right?

A On that old original curve, yes, that 1960 curve.

Q Yes, sir.

A That's correct.

Q And on the 19 wells it would be the same, that's the average deliverability for those 19 wells?

A Well, except that on the curves for the new curves, those 19 wells on that last point, Mr. Kellahin, are a great number of these oddball wells we discussed at some length. They range in reserves up through nine billion.

Q I don't want to belabor that point, Mr. Rainey, but would you tell me what percentage, what number of the 19 wells had deliverabilities in excess of three million, do you know?

A Mr. Farmar has my data sheets. I don't know. Deliverabilities in excess of three million?

Q Yes, sir.

A You talking about current deliverabilities or initial deliverabilities?

Q Well, current deliverabilities, I would say.

A All right. Four of the 19, which is roughly 22 percent.

Q Would you accept the figure that the current April proration schedule showed some 61 wells with deliverabilities in excess of three million?

A If you say so, I'm sure there are, yes, sir.

Q Had you projected your curve on outward, then, you would have arrived at a reserve figure of some twelve billion, if you included those wells, would you not?

A Now wait a minute -- I fail to follow you there, Mr. Kellahin.

Q You are relating deliverabilities to reserves, aren't you? Projecting that curve, would you be able to come to a figure showing some reserve for those wells, if you included them on a deliverability basis?

A I see what you mean. Yes, sir.

Q It comes somewhere close to twelve million?

A That's right.

Q Twelve billion, I should say.

A Yes.

Q Have you made any calculation, Mr. Rainey, on your exhibit here as to the extent the reserves you show as the initial

reserves have been depleted, as shown by your current reserves?

A You mean percentage-wise?

Q Yes, sir.

A No, sir. I have the -- on the data sheets that Mr. Farmar has, I have the current, current reserves versus the initial reserves. It can be determined from those.

Q You also have them on your exhibit, don't you? Isn't that what your purple line and your --

A Oh, I see what you mean, the difference there. I have not calculated the specific percentage. I'll be happy to do so for you. As I recall, Mr. Kellahin, I believe we looked at them, I do not have the calculations with me; my recollection is that they are essentially the same. There may be a variation at one point from some other point, but --

Q Actually there's a substantial variation, is there not?

A Percentage decline in reserves?

Q Could you, for example, make the calculation for us on the depletion of the reserves between the five and six million figure?

A All right, sir.

Q That's 28 wells, is it not?

A Yes, sir. That's declined from 5474 to 4974, which is 500,000,000 over 5474, it's approximately 9.2 percent.

Q Now --

A I have got a small slide rule so I'm having to guess

pretty widely.

Q Now would you do the same, then, for the group just below that, the four and five billion group?

A All right, sir. That's from 4474 down to 4,009, which is 465 and 465 over 4474, that's 10.1 percent.

Q We don't quite agree on that. Would you please repeat the coordinates on the two points?

A I show 4474 on the initial conditions; that's 4,474,000,000, and 4,009,000,000 for the second point.

Q How does that then compare to the group between one and two?

A Between where? Excuse me.

Q One and two.

A Well, that's 825 and 768, that's 57 over 825. I get about seven percent.

Q What were your coordinates on that?

A 825 for initial and 768 for current.

Q Be closer to five percent, wouldn't it, Mr. Rainey?

A I get 57, didn't I subtract right? I get 57 over 825, which calculates to approximately seven percent. It's about 6.9 something. I can't read it on this slide rule.

Q Now under a proration formula such as you have shown on your Exhibit No. 2 -- I don't mean proration formula, I mean your depletion rate --

A Depletion.

Q Depletion rate.

A Yes, sir.

Q Your goal would actually be to deplete your reserves percentage-wise on an equal basis?

A Yes, sir, that's the hope of all proration formulae.

Q The other calculations here are solely hypothetical situations, aren't they?

A You mean the calculations as to the allowable under the -- yes, sir, with the assumptions as set out at the bottom of the page.

Q But this Exhibit No. 1 reflects actually what happened, doesn't it?

A That reflects what happened for one year of proration. There are a number of wells in this pool been here for some time.

Q This does reflect what happened in one year of proration?

A Yes.

Q And the withdrawals aren't equal?

A No, sir.

Q And the wells in the middle range are the ones who have received the greatest allowable, aren't they?

A They are the ones whose reserves have been depleted a slight percentage more than, than the averages in the lower range.

Q Those are actually the above average wells, aren't they,

Mr. Rainey?

A The ones in that middle range?

Q Yes, sir.

A I would say they are probably the above average wells in reserves. If you are going to talk about the averages that we have discussed previously, and being 1422 deliverability average, their average deliverability ranges are higher.

Q Well, the range of 10.2 as against seven, your calculation is about a 40 percent difference, isn't it?

A Well, I figure 30, but if you want to call it 40, okay. It would be 40 percent on seven -- excuse me, right.

Q Yes, sir. You gave us a figure of seven?

A Yes, right, if you are using seven as a basis.

Q You gave us 10.2 as the highest?

A That's correct.

Q We are still not talking about the wells with the greatest reserves or the highest deliverability, are we?

A We may be talking about some wells with high deliverabilities, not in these averages --

Q We are not talking about the wells with higher reserves?

A No, sir, however, the reserves are much higher than average.

Q It's your position that the wells with the highest deliverabilities are being penalized?

A On the basis of these curves, it would appear to be.

MR. HOWELL: That's a mis-statement of his testimony. His testimony was that the wells with the highest reserves were being penalized.

A That's correct.

Q (By Mr. Kellahin) Is that correct, Mr. Rainey?

A Yes, sir, that's what I testified. That's what this curve would seem to indicate.

Q The highest reserve wells are being penalized?

A Yes, sir. By the fact that this curve is, the slope of this curve changes relatively abruptly at about the three to four billion range.

Q Well, you group these wells on an average deliverability basis, have you not?

A No, sir. I have grouped them on an average reserve basis.

Q Well, what does this deliverability column on the left-hand side mean, then?

A That is the average deliverability of the wells within the reserve group shown on the bottom.

Q Well, I'd say then you have grouped them by deliverability.

A No, sir. I have averaged the deliverabilities in the reserve groups. I have not -- that's the whole point that Mr. Stockmar was taking these data sheets for.

Q In each instance you could have extremely wide variation

of deliverabilities?

A I testified to that, yes.

Q There's no relation between deliverability and reserves?

A No, sir, --

Q Thank you.

A Your statement is not correct. There is a very correlated relationship between the reserves and deliverabilities, as evidenced by this curve.

MR. KELLAHIN: That's all the questions I have. Thank you.

MR. PORTER: Does anyone else have a question?

MR. MORRIS: I have one or two questions, please.

MR. PORTER: Mr. Morris.

BY MR. MORRIS:

Q Mr. Rainey, I believe at the outset of your testimony you stated that as many wells have been drilled during the year 1961 as have been drilled in previous years in the Basin-Dakota Pool, isn't that right?

A Cumulated, there have been 301 wells drilled prior to 1961 -- excuse me, 372 drilled in '61.

Q Do you have any reason to believe that that rate of drilling will not continue over the next few years?

A I doubt seriously that it will, Mr. Morris, for several reasons. In the first place, a great number of the locations in what we call the good area of the field have now been drilled up.

Based on what we know of the market demand situation, what the Commission is very well aware of in regard to our problems and other companies' problems with the Federal Power Commission, there does not appear to be any immediate relief in the market demand situation, and I don't believe that operators are going to drill that many wells, I mean at that rate, until such time as the market demand picks up to justify it. Mr. Trueblood testified that he didn't intend to.

Q Would you say that a substantial number of wells would be drilled in the next few years, and probably at a greater rate than the 1960, 1959, or 1958 range?

A That's possible, Mr.Morris, that would just be pure guess on my part, though. I have no knowledge whatever of any company's drilling program, including El Paso's.

Q If 1962 and '3 prove to be heavy drilling years, the Basin-Dakota Pool would more rapidly approach the point, and if there were no increase in market demand --

A Yes, sir.

Q -- then the pool would reach the point where you would need to have minimum allowables assigned in order to prevent the premature abandonment of wells, would you not?

A No, sir. You could double the pool wells in the Basin-Dakota Pool and still have over a million and a half a month, based on the statistics from last year for an acreage allocation factor, which is in my opinion more than adequate to pay for

operating expenses and a reasonable profit.

Q Mr. Rainey, there's been a lot of discussion about freak wells on your exhibits.

A Yes, sir.

Q And in some categories you had very high deliverability wells, and I believe you have said that they might well have low reserves, and vice versa; you had low deliverability wells that might have high reserves available to them?

A Yes, sir.

Q Do you believe that a minimum or even a maximum allowable would be a reasonable way of handling those wells which you have described as freak wells?

A Mr. Morris, as to a maximum allowable, I made no specific calculations in that regard, and I don't know.

Q We are making no --

A As to minimum --

Q We are making no recommendation here in this hearing, either, for a maximum allowable. My question, you might consider it just with respect to the minimum.

A Yes, as to a minimum, I think any well in this pool is receiving an allowable if it is capable of producing it, and granting minimum allowables is not going to help a well that's not capable of producing that minimum anyway; that any well in this pool under present market demand conditions and situations, even if you doubled the number of wells in the pool and maintained

the same market demand, there would be enough allowable assigned on acreage only to take care of these small wells if they are capable of producing. If they are not capable of producing, the minimum won't help any.

Q You think the present formula even takes care of freak wells?

A Yes. We would recommend no change in the formula and no change in the pool rules.

MR. MORRIS: That's all.

MR. PORTER: Mr. Nutter.

BY MR. NUTTER:

Q Mr. Rainey, you gave the number of wells that have been completed in the pool at the first of the year for 1958, 1959, 1960, '61, and '62. Now what was the source of the information for the first year?

A The source of the information for all the years, other than those wells that were drilled in 1961, was the Report as to Dakota Pools, when they were still carried as individual Dakota Pools, in the New Mexico Oil and Gas Engineering Committee Annual Report.

Q Does that Annual Report list wells which do not as yet have pipeline connections?

A It's my understanding that that report lists all wells that have been completed, Mr. Nutter.

Q Does it list wells that haven't had production?

A Yes, sir, as to those pools. Now you recall that until the last year or so, when the Annual Report has been taking the statistical data solely from the Commission files, that prior to that they compiled by pools, the development in those pools each year; and that's the source of this earlier data.

Q Well, until what time was that type of information --

A It all came from the Annual Report, Mr. Nutter, and we took the figures that were shown in there. If there is any deviation, there may be a few more.

Q Well, I just wondered at what point during the development of the Basin-Dakota Pool that wells which were completed but did not have pipeline connections were included in the list of completions in the pool.

A I don't know, specifically, Mr. Nutter. I know that through the year 1959 that Annual Report carried wells by fields, and it was wells that had been drilled. Now as to the year 1960, which was the Annual Report for '61, I think there was the information in there as to completed wells. This information was gathered for me from our files, from files elsewhere, and I did not personally gather the information. I'm merely using the statistics furnished to me.

Q At any rate, the last figure you gave, the 673 --

A Does include wells that are not connected to a pipeline.

Q And some of the previous years may not?

A That's possible. As I say, I think for '57, '58, and

'59 it did. Now the year 1960 may not have.

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

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

MR. STOCKMAR: One more question, if I may.

BY MR. STOCKMAR:

Q Mr. Rainey,in the exchange between you and Mr. Howell just now, was the final result that you testified that under the existing formula wells with the higher reserves are being penalized?

A Yes, sir, in relation to --

Q But not --

A -- in relation to the wells with low reserves.

Q But not the wells with high deliverabilities? I think that was --

A Not necessarily; yes, sir, that's generally it.

Q By subtraction, then, does that mean that all of the penalties are being borne by the low deliverability wells with high reserves?

A That's a pretty broad generality, Mr. Stockmar. I don't believe I can answer that question without checking it out.

MR. PORTER: Does that conclude your questioning?

MR. STOCKMAR: I will have to calculate this, I'm afraid.

MR. PORTER: Any questions --

MR. HOWELL: I have a couple of questions on redirect.

REDIRECT EXAMINATION

BY MR. HOWELL:

Q Mr. Rainey, as I recall your testimony, you stated that in compiling Exhibit No. 1, you included in the initial reserves some wells which had been completed in 1958, some 1959, 1960, 1961, all different dates?

A Yes, sir.

Q And in the current reserves you took just the 1961 reserves?

A That's correct.

Q So that in any group there might be some wells which had produced for as much as three or four years, and some wells in which no production had taken place?

A That's correct. If I may correct one point on that, Mr. Howell, it's the reserves as of December 31, 1961.

Q As of December 31st?

A Yes, sir.

Q So it would not necessarily reflect an even rate of withdrawal of reserves on this graph, since you are using initial wells covering a period -- I mean initial reserves covering a period of three or four years and comparing with the current?

A Yes, sir, that's correct.

MR. HOWELL: That's all the questions I have.

MR. PORTER: Does anyone else have a question of Mr. Rainey? The witness may be excused.

(Witness excused.)

MR. HOWELL: That completes El Paso Natural Gas --

MR. PORTER: Does that conclude for El Paso Natural Gas?

MR. HOWELL: That concludes El Paso Natural's testimony.

MR. PORTER: Mr. Swanson, you indicated that Aztec had one witness?

MR. SWANSON: Yes, that's correct.

MR. PORTER: Has your witness been sworn?

MR. SWANSON: Yes, he has.

L. M. STEVENS

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

DIRECT EXAMINATION

BY MR. SWANSON:

Q Would you please state your name and the company by whom you are employed, and the position you hold with the company?

A I'm L. M. Stevens, employed by Aztec Oil and Gas Company in the capacity of Petroleum Engineer.

Q Has the work you have done with Aztec Oil and Gas familiarized you with the Basin-Dakota Pool?

A Yes.

Q Have you testified before this Commission previously?

A Yes, I have.

MR. SWANSON: Are the witness' qualifications acceptable?

MR. PORTER: Yes, they are.

Q (By Mr. Swanson) Mr. Stevens, you are familiar generally with the application in this case?

A Yes, sir, I'm familiar with it.

Q Have you made a study of the facts which you believe pertinent to the formation of an opinion --

A Yes.

Q -- as to whether the Basin-Dakota Pool allowable formula should be changed as Consolidated has requested?

A Yes, sir, I have.

Q Before going into the details of that study, will you tell the Commission your conclusion, if you have reached a conclusion from that study?

A My conclusions are that there is a general correlation between deliverability and reserves, and that an allowable formula with a larger weight given to deliverability would probably more nearly completely protect correlative rights; but the present formula affords a high degree of correlative rights protection, and in addition it also provides for a minimum allowable which is adequate at this time to prevent waste by premature abandonment.

My conclusion is that a 60-40 formula as proposed by Consolidated would seriously impair correlative rights.

Q Mr. Stevens, would you tell the Commission how your study was undertaken and what it developed?

A Well, the first step was the construction of gross pay,

isopach map. Gross pay was determined for every well west of the San Juan-Rio Arriba County line by counting every foot of Dakota pay which fell above base lines on available induction electric logs.

This map, which was prepared independently, was for all practical purposes identical to Pubco's Exhibit No. 1. This gross pay isopach map was constructed primarily to show the distribution and the magnitude of the reservoir's capacity to contain in-place gas reserves.

The second step involved the construction of an iso-deliverability map. It also was constructed independently, and I used current deliverabilities to construct that map, the same that Pubco uses, and our map is essentially identical to their iso-deliverability map.

Now we concur in Pubco's testimony that correlated areas of high deliverability with areas of thick gross pay. This relationship actually correlates high deliverability areas with areas of the reservoir which are capable of containing more in-place gas reserves than areas of thinner gross pay. Therefore it indicates to me that there is a general correlation between deliverability and recoverable reserves.

Q Are you familiar with any other parameter that approximates recoverable reserves as closely as deliverability does?

A One that is so easily figured that approximates it so closely, no, I am familiar with no other one.

Q Is it your opinion that recoverable reserves of the wells in the Basin-Dakota Pool can be estimated with reasonable accuracy from the information that is available?

A Yes, sir, with reasonable accuracy.

Q Is the reasonably accurate estimation of recoverable reserves important to any gas producing company?

A Yes, sir, it is. It lets you know how you stand, how much your company is worth, and other economic factors that would be important.

Q Has Aztec determined the recoverable reserves for each of its Dakota wells?

A Yes.

Q How many wells are operated by Aztec in the Basin-Dakota Pool?

A As of January this year, we were operating 61.

Q And how many wells does Aztec own an interest in in the Basin-Dakota Pool?

A As of January this year, we had an interest in 101 Dakota gas wells.

Q In the reserve study that Aztec undertook, what was the general range of reserves disclosed by Aztec's calculation of its own wells?

A The reserves ranged generally from a billion and a half up to about nine billion, or at a ratio of about eight to one.

MR. PORTER: Is that in this 101 wells?

A Yes, sir.

Q (By Mr. Swanson) Is the determination of recoverable reserves equally important to a gas purchasing or transmission company?

A Yes, sir, I believe it is. However, they usually figure reserves for a total pool or total area within a pool for their uses.

Q Did the computation of Aztec's reserves on an individual well basis compare favorably with the study of reserves made by El Paso as represented on El Paso's Exhibit No. 1?

A Yes, sir, they compared very favorably.

Q Do you have an opinion as to El Paso's reserves study and its value in showing the distribution of recoverable reserves in the Basin-Dakota Pool?

A I have a very firm conviction that they are very correct according to Mr. Rainey's testimony to the way that he supported them in his testimony, and also because our own reserve and deliverability calculations and investigation compared so favorably with them; and I think that I'm satisfied that our reserve calculations are correct.

Q What is your feeling as to the appropriateness of the El Paso study of 457 wells in this study?

A Well, I think it's the most appropriate thing that we have seen at this hearing, because it contains 457 wells, which was just about every existing Dakota well completion around

December of last year or January of this year.

Q Have you prepared any exhibits which are designed to show the effect on correlative rights in changing the present allocation formula to that proposed by Consolidated?

A Yes, sir.

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

Q Do you have a copy of Exhibit 1 which I have passed out to the Commission?

A Yes, sir.

Q Would you explain it to the Commission, please?

A Exhibit 1 is based on El Paso's purple curve of their Exhibit No. 1. This exhibit considers a complete Dakota Pool comprised of these 457 wells with allocation based on the present formula and allocation, being 40 billion cubic feet of gas a year, which was just about what was allocated in 1961.

This exhibit is a curve which is determined by a plot of the percent of the average well's recoverable reserves it would be allowed to produce in one year plotted against that average well's deliverability.

Q Mr. Stevens, this exhibit is based on the present proration formula, is it not?

A Yes, the present formula. Now if you'll notice the point down at the lower end of the curve, you'll notice that this average well with a deliverability of less than 500 would be allowed to produce about six percent of its recoverable gas

reserve in a year; and up at the top of the curve you'll notice that a well with a deliverability of over 2,000 would be allowed to produce in the same period just slightly less than two percent of its recoverable reserve. Now the distribution of the points between these two extremes indicates that the present formula favors the lower reserve wells with allowable at the expense of the high reserve wells.

Q Mr. Stevens, I note a pencilled circle above one that has a pencilled point next to it. Would you explain the significance of that, please?

A That pencilled point, I discovered the printed point is in error. The pencilled point is the correct one.

Q Have you any other comments to make in regard to this exhibit?

A No, sir, not at this time.

Q Have you another exhibit prepared that you would like to present to the Commission?

A Yes, sir.

(Whereupon, Aztec's Exhibit No. 2 marked for identification.)

Q Mr. Stevens, would you explain this exhibit to the Commission, please?

A Exhibit No. 2 has the same basis as Exhibit No. 1; in fact, it's practically identical, it is identical to Exhibit No. 1, with the exception that allocation is based on a 60-40 formula for this exhibit here instead of the present formula of 75-25.

You will note the performance of such a field under a 60-40 allocation formula. The average well with less than 500 deliverability would now have nine percent of its recoverable reserves allocated to it in a year. It would be allowed to produce nine percent of its recoverable reserve. During the same period of time, under this 60-40 formula, the average well with a deliverability in excess of 2,000 would be allowed to produce less than two percent of its recoverable reserves during the same period of time.

Now this average well with less than 500 deliverability would almost completely deplete its recoverable reserves in eleven years. During this same eleven-year period, the well with over 2,000 deliverability would deplete less than one-fourth of its recoverable reserves. This low deliverability, low reserve well probably would not cease to produce at the end of these eleven years, but it would probably impair correlative rights, drain the gas, the reserve from some other tract and produce it into the pipeline.

Q Mr. Stevens, you have demonstrated the relationship between the extremes on this curve and this group of wells. What is the relation between, what are the values between those two?

A The distribution of the points between the two extremes indicate that the higher a well's deliverability, the less percent of its recoverable reserve it would be allowed to produce each year under a 60-40 allocation formula.

Q Based on the results of your study, Mr. Stevens, have you a recommendation to make in summary to the Commission?

A Yes, sir. Aztec would recommend that the present formula be continued, that we see no need for a minimum allowable at this time. We think that the present formula is equitable in that it grants this minimum allowable, it protects correlative rights, and it prevents waste due to premature abandonment; and we seriously recommend that the 60-40 formula not be adopted, as it would seriously impair correlative rights.

Q Mr. Stevens, were Aztec's Exhibits 1 and 2 prepared by you or under your supervision?

A Yes, sir, they were.

MR. SWANSON: We wish to offer Exhibits 1 and 2 in evidence at this time.

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

MR. SWANSON: This concludes Aztec's direct examination.

MR. PORTER: Any questions? Mr. Kellahin.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q I don't quite understand the source of information on the two exhibits involved. It is taken from El Paso's Exhibit No. 1, is that correct?

A Yes, sir, that is correct.

Q Do these points on here represent the yellow points?

A No, sir.

Q What do they represent?

A The points on this curve represent a plot of the percent of an average well's recoverable reserves that it would be allowed to produce in one year under the present formula, on my Exhibit No. 1.

Q A plot of a percent of what?

A The percent of an average well's recoverable reserve that this average well would be allowed to produce in a year under the present formula.

Q Are these average wells for each point that you have here?

A Yes, sir.

Q How many wells are average?

A In the first point -- we'll start at the bottom and go towards the top.

Q This is on Exhibit No. 1?

A Yes, sir. In the first point there are 12 wells; the next one there are 83; the next one there are 150; and the next one there are 100; the next one there are 65; and the next one there are 28; and in the last one there are 19.

Q That is the same wells that were used by Mr. Rainey on his Exhibit No. 1?

A Yes, sir, exactly.

Q Are they the same wells?

A Yes, they are the same wells. This exhibit is based on the purple curve appearing on his exhibit. I asked him for the numerical values of these points and he supplied them to me.

Q But it is based on the same identical wells?

A Yes, sir.

Q You heard his testimony that he did not group those wells by deliverability?

A Yes, I did.

Q You have done so?

A No, I did not.

Q How did you get them on the deliverability scale on this exhibit?

A The deliverability is read from this scale here on this exhibit. I was supplied with the deliverability values for the particular reserve group of wells by Mr. Rainey.

Q Well, according to my understanding of Mr. Rainey's testimony, is it not correct that, for example on your 19 wells, your deliverability figure would be the average for just those 19 wells?

A Yes, sir, that is correct.

Q And they could range from an extremely low deliverability to an extremely high deliverability?

A That's right.

Q And yet you relate that then to the reserves in place

under that tract,--

A Yes, sir.

Q -- is that right?

A Yes.

Q On what basis do you justify that?

A Because I believe there's a general correlation between deliverability and reserves.

Q What do you mean by a "general correlation"?

A I believe that a well's deliverability indicates generally the amount of recoverable reserves that lie beneath the tract which it produces.

Q Can you say generally, can you say with what degree of accuracy it relates?

A No, I haven't made a detailed study concerning the accuracy.

Q Does it relate to it to ten percent?

A I wouldn't have the slightest idea.

Q You are talking about reserves, Mr. Stevens, what do you mean by reserves?

A Recoverable reserves.

Q Recoverable reserves from what place?

A Dakota,recoverable Dakota reserves.

Q Are you talking about recoverable reserves to an individual well bore?

A Yes, sir.

Q How do you define reserves as to an individual well?

A I would define it as reserves calculated or estimated for that well on the basis of 320-acre spacing.

Q Are we in agreement that what this Commission is concerned with allocating are those reserves beneath a given tract of land?

A Yes.

Q That is correct?

A Yes.

Q And that's what you mean by reserves?

A Yes.

Q And you say there's a general correlation between that figure and the deliverability of the well?

A Yes, sir.

Q But you don't know to what extent that general correlation is accurate?

A No, sir, I don't, and I have never seen it explained.

MR. KELLAHIN: That's all the questions.

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

MR. SWANSON: I have one more question on redirect.

MR. PORTER: Mr. Swanson.

REDIRECT EXAMINATION

BY MR. SWANSON:

Q With respect to comparison of individual wells throughout the Basin-Dakota Pool, there will be some situations where the

relationship between deliverability and recoverable reserves of the well are not identical?

A Yes.

Q When you take the values of recoverable reserves within given ranges and average the deliverabilities values within those ranges, the correlation is really quite close, is it not?

A Yes, sir, and I believe with Mr. Rainey and with Mr. Trueblood that this pool must be allocated on the basis of the average well.

MR. SWANSON: That's all.

MR. PORTER: Mr. Kellahin.

RECROSS EXAMINATION

BY MR. KELLAHIN:

Q On the basis of the answer just given, how close is this relation, on the average?

A Between --

Q Deliverability and reserves. I'm talking about reserves in place under the tract dedicated to the well. I'm not talking about the drainage area of the well.

A How close is this correlation?

Q Yes, sir. You said it was very close, in response to a question.

A It was a general correlation.

Q What is it?

A On the average, it's very close.

Q How close?

A How close -- close is all.

Q You don't know?

A I don't know how close.

Q There's no mathematical precision to it, is there?

A It's a general correlation.

Q It's a general correlation.

A I feel the same way about it, I'll go no further than the Oil Conservation Commission went when they wrote the order that instituted gas proration in the Basin-Dakota, and it is quoted in there, "There is a general correlation between reserves and deliverability," and that's as far as I want to go.

Q You don't want to define "general" either?

A No, sir.

MR. KELLAHIN: Thank you. That is all.

MR. PORTER: Does anyone else have a question of Mr. Stevens? He may be excused.

(Witness excused.)

MR. PORTER: My records are not complete. Who made the appearance for Sunset International, Mr. Seth? Mr. Seth, are you ready to go?

MR. SETH: Ready to go.

THOMAS F. POPP

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

DIRECT EXAMINATION

BY MR. SETH:

Q Will you state your name, please?

A Thomas F. Popp.

Q By whom are you employed, Mr. Popp?

A Sunset International Petroleum Corporation.

Q What are your duties, and your title?

A Chief Production and Drilling Engineer.

Q In that capacity have you had experience in the San Juan Basin?

A Yes, sir, I have been in, worked in the San Juan Basin and been familiar with it since November, 1958.

Q What particularly have been your duties in the Dakota Pool we're considering in this hearing?

A Drilling and developing Dakota well.

Q About how many wells does Sunset have in the Dakota Basin, Dakota Pool?

A We own and operate 13 wells and have an interest in two other wells.

Q What is your educational background, Mr. Popp?

A University of Wyoming, a Bachelor of Science in General Engineering in 1958.

Q And your experience when you left school?

A Drilling and pushing tools until I went to work for Sunset International in 1958.

MR. SETH: May he testify as an expert?

MR. PORTER: Yes, sir.

Q (By Mr. Seth) Have you prepared some data that pertains to the Dakota Pool which shows some relationship between recoverability to deliverability?

A Yes, sir, I have.

(Whereupon, Sunset's Exhibits Nos. 1 and 2 marked for identification.)

Q Now referring first to what you have indicated as your Curve No. 1, would you tell the Commission what that represents?

A Curve No. 1 is the initial or the first deliverability assigned to these wells, against the ultimate recoverable gas. These are ten wells that we have production history of one year or more,production history on.

Q Why did you select these particular wells?

A We don't like to run too many reservoir calculations on wells with less than a year's production.

Q These are all over one year?

A These are all over one year.

Q Tell us a little bit about the data that you used to prepare this curve?

A I used the reservoir reserve figures from the company files; the deliverability data is that deliverability as taken by the New Mexico Oil Conservation Commission, and is on record.

Q What about the shut-in pressure tests and other similar

data, is that taken in accordance with the rules and regulations?

A Yes, sir, in accordance with the rules and regulations of the deliverability requirements.

Q How are your curves calculated on your Exhibit No. 1?

A They're calculated on two or more pressure points versus production history with bottom hole pressure data, core analyses, and electric logs.

Q You used the pressure decline method rather than the volumetric method?

A The reservoir section of our company calculated them; it is my understanding that they used the pressure decline method.

Q Would you tell us, please, what this Curve No. 1 shows, what conclusions would you draw from this curve?

MR. KELLAHIN: If the Commission please, I would like to make an objection to this line of testimony on the grounds that the witness has testified that he took the reserve figures from the company files; someone other than himself made them and he apparently would not be available for cross examination on the validity of his calculations.

MR. SETH: If the Commission please, the witness has testified that he used company figures, as all the witness have testified during this hearing. I don't think we can expect any witness to have done all the work that goes into the preparation of any of these exhibits. It's bound to take a group of people who work up the exhibits. I think that's always been the practice

of the Commission.

MR. PORTER: Objection overruled.

MR. KELLAHIN: Exception.

MR. PORTER: The record will note that Mr. Kellahin has made an exception.

Q (By Mr. Seth) Would you tell us what conclusion you would draw from this Curve No. 1?

A I plotted the deliverabilities versus ultimate recoverable gas reserves, and because I couldn't draw or I couldn't determine what I could say was an accurate curve, I merely drew a straight line through what I considered a more or less average, what could be considered as a more or less average curve. With a couple of exceptions, I find that recoverable reserves versus deliverability more or less follow a straight line.

Q Do you believe that this line fairly represents this relationship between your deliverability and ultimate reserves the way you have prepared this exhibit?

A Yes, sir.

Q Have you prepared an exhibit which is entitled Curve No. 2? Would you tell us please what this curve shows?

A Yes, sir. It is a plot of the same ten wells plotted on the same scale, deliverability versus remaining recoverable reserves, as of December of 1961, using the 1961 deliverability.

Q Does this line on Curve No. 2, does that fairly represent the relationship between the two factors?

A Yes, sir.

Q What conclusions would you draw from this exhibit?

A That there is a relationship between deliverability and recoverable reserves.

Q Considering both of these exhibits and your study of the reservoir, in your opinion, under the present formula are these wells producing in proportion or at a rate that's in proportion to their recoverable reserves?

A Fairly much so. They seem to be declining about the same rate in proportion to their remaining reserves, except for the two lower-most wells which have recovered slightly more of their remaining reserves than the remainder of the wells.

Q You have heard the testimony during the course of this hearing relative to minimum allowables, have you not?

A Yes, sir.

Q What is your opinion or your conclusion relative to the present need for a minimum allowable?

A I believe right now it is unnecessary, as Mr. Utz pointed out.

Q Why do you say that? Why is it now unnecessary?

A Because of the built-in 25 percent acreage factor that gives every well a monthly allowable based on acreage alone, that is in excess of operating cost.

Q Could you give us some figures? On what do you base your opinion that it is above operating cost?

A Pardon me?

Q Upon what facts do you base your opinion that it is in excess of operating costs?

A Using approximately fifteen cents as a composite price for MCF, and using 1,000 MCF per month would be equivalent to approximately $150.00, which for future estimates we consider as the economic limit of a well. That is less than half of what the average figures would allow a well on 25 percent acreage factor alone.

Q Is it the experience of your company that the operating costs are in the area of $150.00 per well per month?

A That is an average cost that we use. It's not, well, it includes everything but the administrative overhead.

MR. PORTER: That figure you would estimate at $150.00?

A Yes, sir.

MR. PORTER: Per well?

A Per well, sir.

MR. PORTER: Thank you.

Q (By Mr. Seth) In your opinion or in your company's opinion, has the development of the field or pool ceased?

A Are you referring to the Basin-Dakota Pool?

Yes.

A No.

Q Does your company contemplate any further drilling during, say, the next two years?

A Yes, sir, we are constantly looking at submittals, and would very much like to do additional drilling in the San Juan Basin.

Q Do you have locations, do you own or lease locations now that you do not consider suitable for development?

A Yes, sir. I have one location in the Basin that we do not figure we can drill and recover our money on. In fact, we have set surface pipe on it but do not feel that we can recover our money on it.

Q Isn't this pretty much typical of any field; there are good parts and there are mediocre parts and poor parts of the field?

A Yes, sir, that's typical of my experience.

Q And it depends, how well, how successful the wells are?

A Yes, sir.

Q Do you have any further comments relative to the exhibit or to the application of Consolidated in this case?

A I might point out that there is a, on Curve No. 1, the initial deliverability of the well marked 1-C is actually 1857; and this well shows an abnormal behavior, as does the No. 1, the 1-F, and the 2-J.

Q Do you generally concur in the recommendation made by Pubco in this case, by El Paso?

A Yes, sir.

Q As to the continuation of the present formula?

A As to the continuation of the present formula, our company very much advocates that it continue as such.

MR. SETH: That's all we have. We would like to offer Curve No. 1 as Exhibit No. 1, and Curve No. 2 as Exhibit No. 2.

MR. KELLAHIN: Would the Commission defer admission until after cross examination?

MR. PORTER: What was your motion?

MR. KELLAHIN: We would like you to defer admission of the exhibits until after cross examination.

MR. PORTER: Mr. Seth, the Commission will rule on the motion at the close of the cross examination.

MR. PORTER: Mr. Kellahin, do you have a question?

MR. KELLAHIN: Yes, I do.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Right at the last of your examination, Mr. Popp, you said something about the 1-F, 2-J, and the No. 1 well. I didn't get what your statement was.

A The No. 1 well has been refracked; the 1-F well, I am experiencing some difficulty in producing it, paraffin problems, in fact, it has plugged off completely several times with paraffin. The 2-J I have experienced, I haven't been able to identify the water, it's carrying a black organic material and I believe that has caused that well to be erratic.

Q But you saw fit to use those three wells in your calcu-

lation here, is that right?

A I saw fit to put them in because I realized that everybody knew the wells were in there, and rather than explain them, without them in the curve, I thought it would be better to put them in the curve now.

Q Did the refrac job change the deliverability on your No. 1 well?

A Yes, sir, it did.

Q Did it change the reserves on that well?

A No, sir.

Q Now in making these calculations, Mr. Popp, do you know what pressure points were used?

A I'm assuming that our reservoir section --

Q Would you answer my question, do you know what pressure points were used, without any assumptions do you know?

A No.

Q Do you know whether they used more than one pressure point?

A Yes, sir.

Q Do you know if they used as many as five pressure points?

A On some wells, yes.

Q Which wells?

A I know on the No. 1 there was five points used.

Q How about on the 2-J?

A Without checking records or anything, I'm sure that

there was three points used on it.

Q On the 1-A?

A Three or more.

Q And yet you just testified you didn't know what points were used, Mr. Popp; do you know or don't you?

A I don't know what points were used. I have an idea how many points were used.

Q But you don't know what they were? Do you know where they derived their pressure information?

A Yes, sir.

Q From where did it come?

A From shut-in, seven day shut-in buildups, buildups over extended periods of time, bottom hole pressure surveys run in conjunction with dead weighted pressure buildup curves.

Q Does that apply to all of them?

A I believe most of them were calculated that way. In fact, I'm sure they were all calculated that way.

Q Well, all calculated -- you named about four different ways they were calculated. Were they all calculated four different ways, three different ways?

A I don't believe I said they were calculated different ways. I said they were calculated the same way, using --

Q What did they use for your pressure information; was it the seven day shut-in test on each well?

A They used all the available data they had, including

seven day shut-in, bottom hole pressure, pressure buildup tests, and production history.

Q You mentioned what, seven day shut-in, bottom hole tests, what was the other?

A Pressure buildup tests run in conjunction with the bottom hole tests.

Q Was that run on each of the wells, used on each of the wells?

A I believe that there was bottom hole tests run on all of the wells.

Q You mean they ran a pressure bomb on them?

A Yes, sir.

Q Is that the information that you are now testifying they used on this exhibit?

A They're using reservoir figures calculated from that information.

Q From the bottom hole pressure tests?

A From all of those tests.

Q On each well?

A Each well is calculated on itself.

Q Mr. Popp, the truth is you don't know what pressure tests were available --

MR. SETH: He's arguing with the witness. It's strictly argumentative. It's not eliciting any information, he's just arguing. We object.

Q (By Mr. Kellahin) Let's take the Well No. 2, and tell me what pressure information was available on that well for the purposes of this exhibit.

A For the purpose of this exhibit, there was pressure buildup tests taken.

Q When?

A Throughout the life of the well.

Q You have to shut a well in to get a pressure buildup test?

A Yes.

Q And you kept it shut in throughout its life?

A No. But it has had extended periods of being shut in.

Q You haven't had any pressure buildup tests throughout the life of the well --

MR. SETH: This is argumentative, also. I think it is obvious that the counsel is trying to testify himself.

MR. KELLAHIN: I'm not trying to testify. I am trying to find out what tests they did have. On the basis of the testimony given by this witness, he doesn't know.

MR. PORTER: Will you question the witness, but don't argue with him.

Q (By Mr. Kellahin) You say that you had pressure buildup tests throughout the life of the well, whatever that may mean. What other tests did you have, Mr. Popp?

A The seven day shut-in tests, bottom hole bombs.

Q How many seven day shut-in tests did you have?

A This particular well was drilled in 1958, and it would have to be at least three seven day shut-ins.

Q All right. How many bottom hole pressures did you make on it?

A I personally recall running two bottom hole pressure tests on that particular well.

Q Now, we have three seven day shut-in tests and two bottom hole pressure tests, plus a pressure buildup test over a period of time, is that right? Well, I think the question has been answered. Would the same situation then apply to your 1-E Well?

A Yes, sir.

Q Same number of tests?

A Maybe not the same number of tests. The No. 1-E is a newer well.

Q So you wouldn't have as many seven day shut-in tests, is that right?

A I'm sure that we have as much as a thirty day shut-in test on most of these wells.

Q I'm talking about your seven day shut-in test under the Commission's regulations.

A Under the Commission's regulations, I am positive we have at least three seven day shut-ins on the No. 1-E.

Q You are positive that those figures were used in these

instances in making your reserve calculation, is that right?

A As I stated, I got this data from the company files, substantially.

Q Mr. Popp, would you please answer my question?

MR. SETH: I don't think he finished his answer.

MR. KELLAHIN: He is not answering my question.

MR. SETH: I think he can answer, whether it's responsive or not. If it is not responsive, you can strike it.

A Would you repeat the question again?

Q (By Mr. Kellahin) My question is, are you positive that this information was used in compiling the reserve figures that show on your exhibit?

A It was used in compiling the reserve figures.

Q You are positive of that in your own mind, is that right?

A By stating that is part of the available data that our reservoir section had to calculate the reserve, I can do nothing but assume that they did use these seven day shut-in pressures.

Q That's based on assumption on your part, is that right? That's fair to say, is it not?

A I think that's fair to say.

Q You ran production decline curves on each of these wells, did you, or did your production department do that?

A Our reservoir section.

Q I mean your reservoir section, pardon me. They made

that calculation?

A Yes, sir.

Q Are you familiar with the calculations they made?

A I'm familiar with it, but I'm not a reservoir engineer.

Q But those are the figures which were used to show the reserves here, are they not, on this Exhibit No. 1?

A These figures shown on these curves?

Q Yes, as to the reserves.

A As to the reserves, yes, sir.

Q Based on a production decline curve --

A Yes.

Q -- which you did not make?

A No, sir.

Q And you are not a reservoir engineer and are not familiar with them?

A No, sir.

Q What does a pressure production decline curve show, if you know? You said you are not a reservoir engineer, so if you don't care to answer it, please so state.

A A pressure decline curve?

Q Yes.

A They're used in the evaluation of recoverable reserves.

Q Are they used as a tool to calculate recoverable reserves, is that what you mean?

A Yes, sir.

Q What reserves are you talking about when you say that?

A The recoverable reserves.

Q By recoverable reserves, do you mean reserves that will be recovered by an individual well?

A Yes, sir.

Q Without regard to the area that it may be draining?

A In regards to its dedicated acreage.

Q Well, does a pressure production decline curve show the gas to be coming from dedicated acreage, Mr. Popp, is that your testimony?

A I believe according to the spacing rules, the well is dedicated 320 acres, and the reserve calculations are made on that acreage.

Q By means of a pressure production decline curve, Mr. Popp?

A A pressure production decline curve is used in making the recoverable reserve calculations.

Q On the 320-acre unit?

A On that individual well.

Q Would you kindly tell me how you relate information gained from pressure production decline curves to 320-acre units?

A As I understand it, the 320 acres is used as the parameter, as one of the parameters.

Q One of the parameters of what?

A Of calculating the recoverable reserves.

Q On a decline curve, Mr. Popp?

MR. KELLAHIN: That's all the questions I have.

REDIRECT EXAMINATION

BY MR. SETH:

Q Do you have your well files available here?

A Yes, sir.

Q Do those show the pressure points on each well?

A Yes, sir.

Q Would you refer to those, please? Do these show the number of pressure points that are available in the company files, that are available to your reservoir section?

A Yes, sir.

Q Would you give us the number of points or types of pressures on a sampling of those wells?

A Such as the No. 1 Well, the original pressure point used was in February of 1958, some of this data was actually taken in 1957 when the well was first drilled; pressure data January 20, 1959; March, 1959; September, 1960; December, 1961.

Q Pick several other wells that are indicated on your two exhibits.

A The No. 2 Well, the original pressure points January, 1959; November, 1960; November, 1961.

MR. KELLAHIN: Which well was that, please?

A The No. 2.

MR. KELLAHIN: The No. 2. Thank you.

A The 1-E, the original pressure March, '59; November, '60; November, '61. The 1-F, the original, March, '59; December, '60; November of '61.

Q I believe that's sufficient. Are there a number of points, pressure points as to each of those wells, or there are a sufficient number from which pressure decline curves could be properly constructed?

A Yes, sir. There is the shut-in wellhead pressure, bottom hole pressures, bottom hole temperatures, gas gravities.

Q All this material is available or was available in the company file?

A Yes, sir.

MR. SETH: We move the introduction of the exhibits.

MR. KELLAHIN: At this time we object to the admission of the exhibits and move to strike the testimony pertaining to reserves as presented by this witness, for the reason that he did not make the calculations and is unable to answer the questions pertaining to the manner in which those calculations were actually made except based on an assumption the truth of which he cannot verify.

MR. SETH: If the Commission please, as I mentioned the first time, I think this is pretty typical of any calculation that is made for these purposes. As I mentioned before, one witness cannot do, ordinarily does not draw calculations. The reliance has to be on other persons to assist in the preparation of these

exhibits. I think if we start requiring that all the people who participate in these calculations appear and testify, I think we are going to unduly complicate these matters. The reliance is on the company figures. There's no indication there's any error in them whatever.

There's a sufficient number of pressure points. If the person who makes the objection can show that there is some error, some mistake, some doubt, perhaps there is some basis, but as far as the construction of the curves is concerned, there's no indication of that whatsoever.

MR. STOCKMAR: The Applicant joins in the motion of Mr. Kellahin.

MR. KELLAHIN: If the Commission please, I would like to make this observation, that the company witnesses have to use company figures. In the previous testimony of Mr. Rainey, he testified that he examined the work and he was able to testify on how it was prepared. That is not the situation here.

MR. SETH: I am sure that the pressure decline curves can be made available to them, if they wish to have them. They're part of the company records, just as in all these cases we have the same problem. I don't see why it's any different.

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

(Whereupon, a short recess was taken.)

MR. PORTER: The hearing will come to order, please. Mr. Kellahin, the Commission will overrule your objection and

admit the exhibits.

MR. KELLAHIN: It was also a motion to strike the testimony pertaining to the two exhibits. I assume that's overruled, Mr. Porter?

MR. PORTER: Yes, sir.

MR. KELLAHIN: We have an exception to the motion.

MR. PORTER: The record will so show.

MR. SETH: We have no redirect. That's all we have.

MR. PORTER: Anyone else have a question of this witness? He may be excused.

(Witness excused.)

MR. PORTER: Is Caulkins Oil Company read to come forward?

MR. SETH: Yes.

MR. PORTER: Has your witness been sworn?

MR. SETH: Yes, he was sworn the first day.

A. F. HOLLAND

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

DIRECT EXAMINATION

BY MR. SETH:

Q Would you state your name, please?

A A. F. Holland.

Q And by whom are you employed, Mr. Holland?

A I'm employed by Caulkins Oil Company.

Q And in what capacity?

A I am an engineer in charge of the Production Department.

Q Are you familiar with the engineering conditions existing in the Basin-Dakota Pool, San Juan County?

A I am; and I am better informed and will principally confine my testimony to the areas in which we operate.

Q And how long have you had this practical experience in the Pool, did you say?

A A little less than ten years.

Q And would you tell the Commission your professional qualifications, please?

A I'm a petroleum engineer by profession. I have a BS degree in Petroleum Engineering.

Q And what has been your practical experience since you left school?

A I spent some time in the Navy. After I finished that service, I was employed by Skelly Oil Company and later Caulkins Oil Company. Since 1946 I have been continuously engaged in petroleum production and petroleum production engineering.

MR. SETH: May he testify as an engineer?

MR. PORTER: The witness is qualified, yes, sir.

Q (By Mr. Seth) Have you made a study of the engineering conditions and factors existing in the area of the Basin-Dakota Pool in which you operate?

A That I have, and during the drilling of the lease block which comprises some 15,000 acres located principally in Township

26 North, 6 West, Rio Arriba County, New Mexico. We noticed or observed that mainly in the center of this block there were areas of better Dakota sand development. In this immediate area there are several sand lenses we treated principally as three different sand lenses. It's a little different, it's a different concept than the square boxed area that was presented here, we consider in simple terms, a rectangle, if you will, or more properly a lens arrangement that --

Q Would you show it to the Commission?

A -- that tapers on both ends.

Q And there's one or more of these, and one above the other, is that correct?

A Yes, that's right. And geometrically, if you would compare it with a square box, this would be a series of trapezoids.

Q How does that compare with this block theory of Mr. Trueblood?

A Well, the block theory is oversimplified. It's not true in this part of the Basin-Dakota.

Q Why is that, because you open up one or more of these zones in different wells, is that the reason?

A That's right. We have, our observation is that if you can make all three of these zones produce, you have a well with good reserves and good deliverability. For that reason, we consider deliverability to be a good barometer or a good, a proper factor in the proration formula.

Q Now if you did not complete -- if you had a well completed in each of these zones adjacent to a well completed in one, what would be the relationship of that with this block theory?

A If you had a well completed in three of these, as compared to one, if you were in comparable portions of the field I think you would expect probably three times the deliverability and in the magnitude of three times the reserves.

Q Does the Applicant in this case complete in the several zones, pretty much in accordance with your rectangular theory there?

A We have, and in some cases we haven't been able to make all three zones produce.

Q Does Consolidated follow a similar practice, as far as you know?

A We observed one of their wells, and they deviated from the block theory in that well.

Q Well, why don't you just tell us in general terms.

A Well, I have got a copy of this right here. I'll dig it up. Here are the three zones that --

Q Now tell us what you have placed on the board.

A Now I think this well demonstrates --

Q Tell us what it is, first.

A It's an electric log, or an electric induction log on Consolidated's Candido No. 1-15.

Q Where is this well located?

A This well is about five miles west of our lease area.

Q You located on Exhibit 1 there up in the, I believe one is up in the upper left-hand corner.

A That would be in Section 15, 26, 7, I believe. It would be right here (indicating).

Q All right. Referring to this reproduction of the log, what does that show?

A I think it shows the trapezoidal situation that I mentioned. Number 1, the three zones, one, two, three, they have actually worked for. We consider this a third zone, maybe they have four, I don't know. But it shot in these three zones.

From the center part of the field, gradually, a gradual shading of the zone so that by inspection of the log we have termed this non-commercial. This is probably the only zone that we would have thought had limited commercial possibilities. I don't bring this up as any criticism on the well, but that's what we think happened.

It grades from good sands to poor sands in several different zones, and what they did, and why, is they recognize that it is not the square box. They perforated two of the zones, completed the frac job, and then they came up and they perforated this zone and they found out that they had communication. Then they perforated here and they completed another frac. Well, I think it's very highly improbable that they made this zone produce.

The well has a deliverability of 183,000.

Q Now, Mr. Holland, have you prepared an exhibit that shows the application of the present formula to wells with different gas recovery?

A Yes. Continuing with the line of thought that we considered the center area of the field, grading both east and west and somewhat north and south into porous sands, we made an attempt to determine by bottom hole pressure means the reserve situation of two different wells. We operate some 12 Dakota wells in the area, and possibly have 20 additional locations in this area.

Now we chose these two wells because of the number of bottom hole pressure points available. There are two --

Q Excuse me for interrupting. Now you are referring to this sheet that's headed, "Caulkins Oil Company, Basin Dakota Pool, Rio Arriba County, New Mexico." Will you tell us first, before you get into the background, what it shows overall, what does this exhibit shows and then tell us how it was produced.

A This exhibit reflects the bottom hole pressure reserve estimate for two wells that we operate in this, in the area of Township 26 North, 6 West.

Q Now one column is labeled "Well A". Would you give us the name or location of that well?

A Well A is located in the Northwest Quarter of the Southeast Quarter of Section 5, Township 26 North, Range 6 West. Well B is located in the Southeast Quarter, Southeast Quarter of

Section 9, the same township and range.

Q All right. Now go ahead with your background for the preparation of this exhibit.

A These two wells are two of the earliest wells we drilled. Well A was drilled in 1953, Well B was drilled and completed early in 1956.

Q You feel you have enough experience and production history in these wells to make them suitable for this purpose?

A We have taken pressures since 1956. The two wells were reworked, and by that I mean speed sand water fracked, in 1958. Since 1958 I believe we have six pressure points on one well and seven pressure points on the other. These are bottom hole pressures, they are not surface pressures.

Q Now let's start at the top there, and tell us what these figures represent, Mr. Holland.

A At the top, the top figure is the estimated ultimate gas recovery for Well A and Well B, using this bottom hole pressure information. Well A, the ultimate recovery was estimated at 4,600,000 MCF; the other one, 12,000,000 MCF.

The second item is the deliverability of each of these two wells, and those are 1961 deliverability figures.

Q Taken in accordance with the Commission's rules, I assume?

A Those are the deliverabilities that are on the proration schedule.

Q And the third item?

A The third item shows the relationship between the ultimate gas recovery estimate for both wells. It's 2.6,. Well A, or Well B has an estimated recovery 2.6 times Well A.

Q Yes.

A The next item is the ratio of deliverabilities. Well B has 1.96 times the deliverability of Well A. The ratio of the assigned allowables from the April, 1962 schedule, Well B has 1.63 times the allowable of Well A.

What I would like to point out from this exhibit is that although the reserves of Well B are indicated at 2.6 times the reserves of Well A, the allowable as assigned by the Conservation Commission is only 1.6 times Well A.

Q Which shows what?

A It shows that Well B is receiving less proportionately of assigned allowable, commensurate with reserves, as compared to Well A.

Q Now do you have available the data that you used to compile this?

A I do. I don't have my work curves, but this bottom hole pressure information is not a matter of public record. Therefore I propose to --

Q Would you want to read it in the record?

A -- read it. I'll start with Well A. The first bottom hole pressure we have, July the 8th, 1956, 2242. The next, this

will be July 31, 1957, 2252; June the 2nd, 1958, 2196; January the 15th, 1959, 1943; May the 8th, 1959, 1645; March the 4th, 1960, 1438; July the 8th, 1960, 1495; July the 3rd, 1961, 1521; April the 1st, 1962, 1538.

For Well B, the first pressure, April the 17th, 1956, 2649; November the 15th, 1956; 2046; July the 31st, 1957, 1890; June the 2nd, 1958, 1761; February the 3rd, 1959, 2243; May the 24th, 1959, 2188; September the 1st, 1959, 2388; April the 18th, 1960, 2061.

MR. PORTER: What was that last figure?

A 2061. July the 8th, 1960, 2251; July the 3rd, 1961, 2392; April the 1st, 1962, 2441.

MR. KELLAHIN: Could I have the July, '61, again please?

A July, '61?

MR. KELLAHIN: Yes.

A 2392. The shut-in times on those wells varied from about seven to ten days. There was a slight variation. The shut-in time on Well B, about the same, seven to ten days.

Q (By Mr. Seth) Would you please mark your tabulation there as Caulkins Exhibit No. 1, Mr. Holland, and hand it to the reporter?

(Whereupon, Caulkins Exhibit No. 1 marked for identification.)

A I didn't make a tabulation. These are my --

Q I mean our exhibit here. Does the reporter have an exhibit?

A She has a copy of this.

Q Was this prepared by you, Mr. Holland?

A Yes, it was.

Q And the data calculations were made by you?

A That's correct.

Q Do you have any recommendation to make to the Commission as to whether or not the present formula should be changed or not changed?

A Our recommendation would be that the formula be left as it presently stands, that is, essentially 25 percent acreage and 75 percent deliverability.

MR. SETH: We would like to offer Caulkins Exhibit No. 1, if the Commission please.

MR. PORTER: Are there any objections to the admission of this exhibit? The exhibit will be entered in the record.

MR. SETH: That's all the direct we have, Mr. Porter.

MR. PORTER: Any questions of Mr. Holland?

MR. STOCKMAR: Ted Stockmar for the Applicant.

CROSS EXAMINATION

BY MR. STOCKMAR:

Q Mr. Holland, did you hear Mr. Rainey's testimony that there was a direct relationship between pressure and reserves, producible reserves?

A Well, I think he qualified by what he said, direct. If you are asking me if you can take the deliverability of this

well and plot it against reserves with another well on a straight 45-degree line, I don't think it will always work out that way.

Q Was the sense of his testimony that as the pressure goes down your remaining producible reserves also goes down?

A Well, I'll agree to that, yes, sir.

Q Is the reverse true, then, that if the pressure goes up your remaining producible reserves also go up?

A I think that's true.

Q You have just testified as to each of your wells that since this proration formula has been adopted, or at least the dates that you gave are consistent with that same time, the pressures in each of the wells has risen. Is it fair to assume from this that the proration formula is increasing your producible reserves even though you are producing great volumes of gas from your wells?

A Well, I don't necessarily attribute that to the proration formula.

Q To what do you attribute the increase in your producible reserves as time goes on?

A Well, there will be some scattering of data on a pressure production history, and some of the other formations, Pictured Cliff, for instance, I think as time continues that in your great number of cases there has been a gradual increase, perhaps. I don't mean that over a long period of time, but from year to year you may see a slight increase.

Q What do you mean, a long period of time?

A Oh, five, six, seven years, something like that.

Q Well, as an engineer can you tell me how the pressure in the reservoir can rise as you take gas out of it?

A I think one of the reasons here for an increase in pressure has been that the wells are gradually cleaning up after the large sand water fracture treatment. I think if you'll notice on Well B that for a time after the sand fracture treatment that the points were down quite a ways.

Q Has this caused you to revise your estimate of recoverable reserves?

A Not -- well, until a year or so ago, I didn't think we had enough points for this Well B. There has been some revision upward, and also Well A.

Q You say you have been carrying on studies of the reserves based on the pressure history?

A That's right.

Q Have you continued to plot the pressure points, is that it, and extrapolated them to economic abandonment?

A That's right.

Q In plotting these points you have found that they are going up, is that correct, over the last few years?

A They have been going up, and I don't doubt that maybe they will go up slightly some more, but I don't think it will materially change these reserve figures; and relatively, both wells

have had slight increases in pressures.

Q And as you extrapolate these points on up to higher and higher pressures, where do you reach the economic abandonment that you speak of?

A I think I testified that there will be a decrease. I don't expect them to continue to go up and up and up.

Q Do you guess at the amount of the decrease and add that as another pressure point?

A Well, I'll guess that these wells will decrease to 500 pounds at the time we abandon them. That's what these calculations assume.

Q You made some rather vague references to Consolidated's box theory and were pointing up to the board. Mr. Holland, to what were you pointing, if I may ask?

A Well, I guess it's under here, the box -- I think that's the box that you had the different values on.

MR. SETH: What exhibit number, do you have it?

Q (By Mr. Stockmar) Are you referring to the artistic cube Mr. Trueblood drew?

A That's it, yes, sir.

Q And you prefer some trapezoidal arrangement of your own, is that it?

A That's the way the reservoir appears to us in this particular area, right.

Q Just what is it that you understand to be Consolidated's

box theory? You seem to disagree with it. What is your understanding of it?

A Well, I understood their testimony that it evidently related to two wells, and they presented the reservoir sections in those two wells as this box, and I said that wasn't the condition in this area.

Q You do not have straight 320-acre tracts of land in your area?

A We don't have the box principle on those 320 acres. We have this (indicating).

Q Trapezoids?

A Right.

Q How do you know this?

A What?

Q How do you know this?

A Well, I pointed out the different sections on the log. I used the Consolidated log because that was the section I had available.

Q Well, from looking at a log, can you tell anything about what's out in the rest of the 320 acres in terms of the thickness of a particular lens?

A Well, I guess exactly, I know pretty well what the gross thickness is right at that point.

Q And that's all, is it not?

A That's all, yes. But if you can correlate between wells,

you have some idea of what's between.

Q You made some kind of an example of some Consolidated well. I'm sorry, but I did not hear the name of it. Would you mind repeating the name of the well that you have a little exhibit up on the board for?

A It's the Consolidated Oil and Gas Candido 1-15.

Q I think you stated that you would not have made an effort to complete the well in the top zone, is that correct?

A I think I said that the top zone looked non-productive to us.

Q I think you also stated that Consolidated did proceed to complete the well in that zone, none the less?

A Well, I am highly doubtful that they made the zone productive. I said that.

Q I thought you said that they had established communication between all those zones by fracking.

A Well, I did say that, but without a frack that zone would not produce.

Q And you would not have fracked that zone?

A I don't think so.

Q Is there gas in that zone?

A I'm not being critical of their doing it, but --

Q I see. Is there gas in that zone?

A I don't believe there's recoverable gas at that point. Is that what you are asking?

Q You just said there wasn't commercial gas, I thought.

A I said I thought that, I did not think there was recoverable gas, is what I said.

Q Well, then, if there is recoverable gas in the zone and if it is fracked, and if there is communication, then it will be produced, will it not?

A Well, are you saying that the frack entered the zone? Is that what you are saying?

Q I have no idea. I'm saying that if there was gas in that zone, and if the company fracked it, and if it established communication with the other zones open to the well bore, then gas will come from that zone; is that a poor assumption?

A I think the chances are that if they had communication that their frack probably went in one zone.

Q Is the substance of your testimony with respect to that well that you would not have fracked that zone, that if there had been gas there you would have left it there unrecovered?

A Well, I think my testimony was that I think there was recoverable gas in that. Mainly what I -- the purpose of that log was not to take, or oppose or condemn the idea of their trying to complete that zone.

Q Well, what was the purpose of the log?

A To show that the different zones in the field, that in the center of the field we had the three different zones, as I pointed out on that log; and out at that location, that that was

the trapezoidal part of the figure, that the zone had shaled out.

Q What are those little trapezoids supposed to represent, little lenses of gas sand or something?

A Well, they are good lenses of -- they are not little lenses, they are good lenses; and in certain parts of the area in which we operate, certain of these lenses, at times we have not been able to make them produce, and when we don't it shows up in our deliverability.

Q Mr. Holland, on the list which I think is your Exhibit 1, the descriptive matter with respect to Wells A and B?

A Yes, sir.

Q You are making some kind of a comparison or relationship between your ultimate gas recovery and your deliverability, is that the purpose of this?

A That's right.

Q Do you believe that there is a direct relationship between your ultimate gas recovery and your deliverability as of 1961?

A Well, you would have to qualify what you mean by direct. There's a relationship.

Q There is a relationship?

A Between reserves, right.

Q Is it a mathematical relationship?

A The relationship is essentially this, that in the areas where you have good reserves, you also have good deliverabilities.

Now that, I don't say that will be a 45-degree line. It doesn't work out that way.

Q Are there any areas in which you have very good reserves and very low deliverabilities?

A In this particular area I think that the deliverability is very representative of reserves, recoverable reserves.

Q How about other areas? Are there areas where the deliverabilities are not representative of the reserves?

A Well, there's a freak situation, I think that has been pointed out many, many times here, and I subscribe to the theory that it is a freak and would not be representative of reserves; and I'm sure there are some others.

Q In your judgment are there a substantial number of freak wells in the pool?

A What I will point out is that if you did not, if you prorated, you can call it an acreage basis, but essentially in this proration formula Consolidated's wells and our wells enter this on a per well basis. If you did not consider deliverability and considered principally just prorating on a well basis, you can see the injustice that this Well B would suffer; it's penalized, on this comparison on a per well basis that would be even a greater penalty.

Q It would be a penalty, you consider it would be an injustice to you to be permitted to produce less gas from that well, is that the sense of your testimony?

A Comparing, when you consider allowables based on reserves, yes, sir.

Q Would you have considered it an injustice to be permitted to produce less gas from the other well, from Well A?

A Well, I would like to stay where we are on Well A and get more from Well B is what I would like, would like to do.

Q You believe that your well should be permitted to produce all that you can cause to flow through that well bore?

A Well, we would like to sell those kind of volumes.

Q You believe you should be permitted to sell all that your well can produce?

A Well, I think that if the market demand would permit that, that it would be immaterial what our proration formula was, whether it was per well --

Q There would be no necessity to have a proration formula in that case, is that correct?

A That's right.

Q Do you know what is historically referred to as the rule of capture, Mr. Holland?

A I think generally I have an idea of what it is.

Q Is this what you want in this as a means of handling the production of gas from this field?

A What we have recommended is a continuation of the present allowable formula.

Q But you would like more, is that it? Did you not just

say that you would like more?

A You mean would we like to sell more gas? I think that's obvious.

MR. STOCKMAR: I think that's all, Mr. Holland.

MR. PORTER: Does anyone else have a question of this witness? Mr. Kellahin.

BY MR. KELLAHIN:

Q Mr. Holland, your ultimate gas recovery, how was that calculation made?

A It was made by an extrapolation of these pressure points to a 500 pound abandonment.

Q That's the production decline curve?

A That's correct.

Q What does a production decline curve measure?

A It measures the reserves of the particular well.

Q What do you define as the reserves of a particular well?

A Well, in this, in the South Blanco area, I would say that the gas reserves under the prescribed proration unit area.

Q Well, Mr. Holland, is it your testimony that a production decline curve reflects reserves under a given unit, in this instance, of a 320-acre unit?

A I think that's what these points represent, yes.

Q You think that is --

A Yes.

Q How do you relate that to 320 acres?

A I don't know exactly what the drainage area of these wells are. I do know that this formation is very tight.

Q Well, then, what you are saying is the reserves reflected here are the reserves that will reach the well bore, is that right?

A Well, no. I said that I thought this to the best of my knowledge represented the 320-acre unit.

Q But you said you don't know the drainage pattern. Is the figure related to the drainage pattern as well?

A Well, I don't know exactly what you mean. The only statement I can make is to assume, and I think it's a reasonable assumption, that this does represent the 320-acre drainage area.

Q Well, what is that assumption based on, Mr. Holland?

A Well, those are the units that have been established by the Commission. I think they are reasonable.

Q Are you through?

A And that's the basis of my statement.

Q Then you have assumed that the Commission, by entering its spacing order, has said this well will drain 320 acres, no more, no less, in order to say this reflects reserves under 320 acres?

A In establishing the 320-acre pattern, that was their conclusion.

Q And you accept that as being the true engineering conclusion?

A I do in this situation, yes, sir.

Q All right, now. When did this Well A go on the line?

A It commenced producing in 1953.

Q Did you make any reserve calculations at that time?

A We had no pressure record until 1956, and --

Q So you did not make one?

A No, I did not. I didn't make any reserve studies.

Q Did you make any estimate based on initial potential or any other information that might be available?

A I think I made a guess at it.

Q Do you know what the initial deliverability of the well was?

A We didn't, at completion we didn't measure deliverability.

Q Do you know what the cumulative production was to the date of the deliverability test in 1961?

A 1,078,700 MCF.

Q Now, would the fact that the deliverability on this particular well is somewhat lower than the deliverability on your Well B be attributed to the decline in reserves already produced?

A Decline in deliverability?

Q Yes, sir. You have a 900 deliverability as compared to a 1766 deliverability on Well B. A Yes.

Q You produced 1,078,700 MCF on the well; would the fact that the 900 well is lower than the other be a reflection of the

production which has already been made by this group?

A Well, the other well has produced more gas than that.

Q It has?

A The other well has produced 1,564,400 MCF.

Q Have you any estimate as to what percent either one of these wells have been depleted?

A Well, a billion, one, over forty-six, would be a little less than 30 percent.

Q A little less than what, sir?

A A little less than 30 percent. A billion, six, over twelve billion would be, that would be about 15 percent, wouldn't it? A little less than 15 percent.

Q Then the Well A has actually had on a percentage basis almost twice as much depletion as Well B?

A That's correct.

Q Yet your pressures in both wells are going up?

A Well, they are going up slightly.

Q Actually the last pressure taken on the Well B, April of 1961, is the highest pressure you recorded on that well since the original pressure in 1956 --

A It increased --

Q -- isn't it?

A -- 49 pounds.

Q And yet it reached a low in 1958 of 1661 pounds; you call that a slight increase?

A We, in reworking that well, we know that we opened up a new zone. That we know. And I think that will explain the pressure situation.

Q When did that occur?

A When did the --

Q Reworking.

A Right after the 1961 pressure you were looking at.

Q Well, then, it went up to 2243 and down to 2188?

A Right.

Q Now it's back up to 2441; did you rework it again?

A Well, I think I explained that we believe that the erratic pressure behavior on that well has been occasioned by the well cleaning up after the 100,000 pound frac treatment.

Q How long does it take a well to clean up after such a frac treatment, normally?

A I think from three to five years, something like that. I would like to point out that these increasing pressures favor Well B and further add impetus to the increase or the favoring of deliverability in a proration formula.

Q Well, now, were all these pressures taken in exactly the same manner?

A What do you mean by the same manner?

Q Well, were they all bottom hole pressures, pressure bombs used under identical circumstances?

A As far as I know.

Q They are all identical?

A As far as I know, I believe I'm correct. I don't know for sure. Most of them were taken with our own gauge. At different times we have had a service company, but they are taken at the same datum and the shut-in times, as I explained, varied from seven to ten days.

Q Mr. Holland, how can you calculate a pressure decline curve on the Well B on the information you have given us?

A On Well B?

Q It takes a great deal of interpolation to do that, doesn't it?

A I think we'll have a better curve in a period of several more years.

Q Well, actually, at the moment you have got a rising curve, haven't you?

A Can I finish?

Q Yes, pardon me.

A No matter how you analyze this curve, if you analyze it on any different basis, take in account the decreasing pressures, you will come out with a figure higher than the twelve billion.

Q That takes a sum of a great deal of experience, in order to calculate reserves on the basis of this, doesn't it?

A Any interpretation would increase that figure.

Q Any interpretation might show you have infinite reserves, if you carried it far enough.

A I don't think so. We are going to abandon that well some day.

Q I'm talking about the information here, though. You have a rising pressure; if you interpolated and continued that rise, you would have infinite reserves?

A I don't think I said that rise would continue.

Q No, I don't think you did, either.

A And I won't say it, either.

MR. KELLAHIN: That's all the questions I have.

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

BY MR. UTZ:

Q Mr. Holland, at any time on either Well A or Well B, have you made volumetric calculations of your reserves on these 320-acre tracts?

A I have made some guesses, Mr. Utz.

Q Do you have those guesses with you?

A No, I don't.

Q You have no idea what they were?

A The problem with electric logs, I think everybody agrees, these wells, the logs were taken years ago. No sonic logs are available on them. In determining net pay I could come up with all kinds of figures. I think this is representative data and would rather not get into a volumetric guess on these wells.

Q You don't use volumetric reserves at all on your prop-

erties?

A Yes, on an area-wide appraisal we have, but not particularly well to well, no.

Q Have you ever made any comparisons of the volumetric reserves versus the pressure decline reserves?

A On an area-wide basis I haven't, no.

Q Or on a per well basis?

A No.

Q You don't know whether the pressure decline reserves are more or less than the volumetric reserves?

A At this time I don't. We don't have enough area-wide pressure information. I have it on these two wells, as I have shown you.

Q Did you state the names of these two wells?

A I gave the locations, I don't think I gave the names.

Q I wonder if you would give me the names.

A Well A is our D-83 --

MR. KELLAHIN: What is that again? What is the number, please?

A D-83.

Q (By Mr. Utz) The location?

A Northwest Southeast, Section 5. Well B, D-204, Southeast Southeast of Section 9, all in 26, 6.

MR. UTZ: That's all the questions I have.

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

witness? You may be excused.

(Witness excused.)

MR. SETH: That's all we have, Mr. Commissioner.

MR. PORTER: Mr. Keleher.

MR. KELEHER: We have a short witness in Mr. Gorham.

MR. PORTER: Have Mr. Gorham come forward and be sworn.

(Witness sworn.)

FRANK D. GORHAM

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

DIRECT EXAMINATION

BY MR. KELEHER:

Q State your name.

A Frank D. Gorham, Junior.

Q What is your profession, Mr. Gorham?

A I am a Petroleum Geologist.

Q What is your official position with Pubco?

A Executive Vice-President.

Q How long have you been employed by Pubco?

A Since its inception in late 1950, actually incorporated in 1951.

Q How long have you been in the petroleum work, altogether?

A After graduating from the University of Missouri in 1942, I entered the Armed Forces. Upon return in 1946, I was with

Creole Petroleum Corporation in Venezuela for three years. After returning to the United States, I was with the Pure Oil Company for one and one-half years. At the end of that time I went with Pubco Petroleum Corporation in 1950.

Q And you have been with Pubco ever since?

A Yes, sir.

Q Are you familiar with the San Juan Dakota Basin?

A Yes, I am.

Q Testimony has been submitted here, Mr. Gorham, that Pubco operates a total of 81 wells in the San Juan Basin, is that about correct?

A Yes, sir.

Q How many wells do you have in the Dakota?

A Nine wells at this time.

Q The testimony here is to the effect that Pubco has 40,000 acres under lease. Is that approximately correct?

A That is approximately correct.

Q And Pubco for 1962 plans to drill how many wells?

A That, sir, will depend a lot on what our concept of future market is in the Basin. It will depend a lot on the development of wells being drilled by others in the neighborhood of some of our proposed locations, but at the present time it is my understanding that we tentatively plan approximately 22 wells.

Q And at what per well?

A Approximately $80,000 per well.

Q That would cause an expenditure of approximately how much?

A Approximately $1,500,000.

Q So would you say that Pubco is interested in this case?

A I certainly would.

Q In a very important way?

A Yes, sir.

Q Now Consolidated Oil and Gas, Inc., the Applicant here, has contended, as I understand it, that because the wells in the Basin-Dakota Pool have an abnormally high deliverability, and because the present Rule 9-C creates waste, does not properly recognize correlative rights and permits and will increasingly permit non-ratable taking of gas from the pool and drainage between producing tracts in the pool which is not equalized by counter-drainage, a special formula should be adopted pertaining to the Basin-Dakota Gas Pool. I'll ask you if you would care to comment on that.

A Yes, sir. In my opinion the proration formula should remain as is on a 75 percent deliverability times acreage plus 25 percent acreage basis. However, if the Commission should consider any change in the formula, that change should be in the direction of 100 percent deliverability, which we believe is directly proportional to the existing reserves under the individual wells.

Q Would you state that well deliverability more truly

reflects recoverable reserves?

A I certainly would, yes, sir.

Q What, if anything, would you care to say in regard to Pubco's position to the effect that an increase in the acreage factor at the expense of deliverability would in effect violate correlative rights?

A I believe that we have testified, as have most of the other companies present during the hearing, that reserves under individual wells vary considerably. Any time that an acreage factor is included as a norm throughout the field, it does not recognize the difference in reserves between existing wells and represents an invasion, in my opinion, or a violation of correlative rights.

Q Have you personally been active in the field in connection with the wells that have been drilled up there by Pubco?

A Yes, sir. I would like to say at this time that early in 1950 and 1951, I had the opportunity to examine the Dakota formation at the outcrop in various portions of the perimeter of the Basin. We found at that time, and geologists have found since that time that the Dakota formation is a very difficult formation to map, particularly on individual sand body bases. It's possible, for example, to be in a canyon and see the Dakota section on one side and be unable to trace the sandstone members from one side to the next. Within the San Juan Basin productive area, however, there does seem to be in certain areas a better consistency.

However, those areas are interrupted at various times by wells which have absolutely no reservoir rocks as such, silt in place of sandstone, and that in my opinion, the problem relative to sandstone thicknesses is an extreme one.

We notice, for example, on our cross section B-B^1, a very radical change in thickness from three wells located only one location apart, and in my opinion in those areas that show consistency, there's an excellent opportunity that between those wells there's liable to be silt stones actually interrupting what does apparently appear to be a consistent reservoir.

Q Can you state whether or not the reservoir changes rapidly occur on surface and sub-surface areas?

A Yes, I believe I have. I feel they do change very rapidly.

Q You have been personally identified on the ground, have you not, since 1951, with the wells that have been drilled by Pubco?

A That is correct.

Q And are familiar with the situation on the ground and very closely followed the drilling personally?

A That is correct.

Q Now what, if anything, can you say to the Commission in reference to the direct relationship between deliverability and recoverable reserves?

A We have found within the various departments of our

company through the years that there seems to be, or is, rather, a direct relationship between deliverability and recoverable reserves.

There's been mention throughout this hearing of so-called freak wells. I take exception to the term "freak wells" on the basis, in my opinion, the main reason that we cannot explain those particular wells is because in most cases they represent wells where only two, three wells at the most, for example, are in that particular category. Where we have an abundance of wells in a particular deliverability range, we seem to have sufficient information to establish a norm.

Insofar as various deliverability problems, it has been testified and it has been our experience that following the use of the sand-water fracture treatment, it is difficult to ascertain exactly when the well will clean up. Some wells will clean up in a relatively short period of time. Other wells will take extremely long periods; as a matter of fact, in my opinion wells sometimes will not clean up at all.

So that when we're talking in terms of deliverability, we do have occasional exceptions insofar as their behavior, relative to the mechanical conditions which they have been subjected to.

Insofar as reserves are concerned, we have been in most cases using an average insofar as electric log thicknesses are concerned. We have been using averages on a township-wide basis

on porosity. We have not had access to core analyses on every well in the field, and I believe that on the basis of the actual characteristics of the rock formation itself, that we can expect to see extreme variances. These variances will change from well to well, and I believe that the problem that we're seeing here today is not a problem of our formula, it's not a problem of anything other than a lack of experience insofar as being able to calculate reserves on a pressure decline method; and I feel that the erratics, if you wish, that we do see, are those which have either extenuating circumstances or we do not have sufficient information to actually evaluate them.

Q What, if anything, can you say, Mr. Gorham, as to major changes that have occurred and will continue to occur within the Basin, the Basin-Dakota Pool in porosity, permeability, water saturation, sand thickness, and those other factors?

A Insofar as, or in reference to Pubco Exhibit No. 1, we have shown those areas which have been developed to date, and in those areas we have shown that the one parameter, thickness, changes very rapidly in most cases to the exterior of that particular pod or area.

We have shown large areas in white. Now some of those areas in white obviously, on the basis of new drilling efforts, may become productive. There's a good question in my mind, of course, as to exactly where those areas are going to be. I have no idea whether they will inter-connect. They may or may not.

I believe our Exhibit No. 1 aptly demonstrates the fact that the Dakota Pool, as currently defined, has within it areas of extreme thickness, and in my opinion, based on examinations of electric logs, there are equally as extreme changes or variances in porosity and water saturation.

Q Assuming the Commission would grant the application of Consolidated, Mr. Gorham, what is your opinion as to whether or not such change would permit the weaker wells with less reserves to ultimately produce gas from the common source of supply in amounts in excess of their actual reserves?

A Well, I feel that the deliverability formula or the formula being currently used, using only 75 percent deliverability has already penalized operators who own wells with higher reserves and consequently higher deliverabilities at this time. I feel that if any change were made in the direction of an increase in acreage, that that inequity would be obviously increased.

Q What is your recommendation to the Commission at this time?

A It is my recommendation that the Commission continue to utilize the formula as currently used, and I believe that the 25 percent acreage factor adequately prevents premature abandonment and waste.

Q To that extent you join with El Paso Natural Gas, Aztec, Caulkins, and the other companies which have appeared here today and yesterday and the day before?

A That is correct. I would hinge that, however, on the basis that if any change were to be considered by the Commission, in my opinion it should be in the favor of 100 percent deliverability.

Q Do you desire to make any other comment to the Commission, Mr. Gorham?

A No, sir.

MR. KELEHER: We would like to express our regret at the long continued length of this hearing. You may have the witness.

MR. MORRIS: Mr. Keleher, did you qualify Mr. Gorham as an expert witness?

MR. KELEHER: I think he has been qualified as a witness before the Commission before this time, but I'll ask the Commission to accept him as a qualified witness.

MR. PORTER: The witness' qualifications will be accepted. Any questions?

MR. STOCKMAR: One question. Ted Stockmar for the Applicant.

CROSS EXAMINATION

BY MR. STOCKMAR:

Q I believe you stated that we do not have enough experience in this field to validly compute reserves by the pressure decline method. I believe you stated that the reservoir characteristics by which we might make volumetric estimates vary so rapidly

at such short distances that it would seem that we could not make volumetric estimates of reserves, so I submit that you are asking this Commission to compare deliverabilities with reserves that cannot be validated.

MR. KELEHER: Just a minute.

A I take exception --

MR. KELEHER: Just a minute. I don't think the witness has testified anything to that effect at all. He wasn't asked anything about it. Counsel is assuming that something is in the testimony from this witness that isn't before this Commission at all.

MR. STOCKMAR: I will let the record speak for itself, Gentlemen.

MR. PORTER: Did you have any more questions, Mr. Stockmar?

MR. STOCKMAR: No, sir.

MR. PORTER: Mr. Kellahin?

MR. KELLAHIN: I have no questions.

MR. PORTER: Anyone else have any questions of this witness? He may be excused.

(Witness excused.)

MR. PORTER: At this time we are going to recess the hearing until 9:00 o'clock tomorrow morning.

(Whereupon, the hearing was recessed.)

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MORNING SESSION
Saturday, April 21, 1962

MR. PORTER: The hearing will come to order, please. Does anyone desire to put on further testimony?

MR. STOCKMAR: If the Commission please, the Applicant would like to recall Mr. Trueblood as a rebuttal witness, if the opposition's cases have been concluded.

MR. PORTER: Will you call Mr. Trueblood, please, as a rebuttal witness called by Mr. Stockmar.

H. A. TRUEBLOOD

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

DIRECT EXAMINATION

BY MR. STOCKMAR:

Q Mr. Trueblood, are you the same Harry A. Trueblood who previously testified in direct testimony in this hearing?

A Yes, I am.

Q Mr. Trueblood, near the end of yesterday's session, we asked the witness for El Paso Natural Gas Company for certain basic data sheets which he graciously made available to us. Have you studied these and from these made certain calculations, and from those calculations drawn certain conclusions?

A Yes, I have.

Q Will you review the study which you have made, and state the conclusions therefrom?

A We took the El Paso basic data which actually we had utilized in our original testimony on 160 wells, although we didn't have all the data available to us from the 160-well study; and had we had that data available, we would have arrived at the same conclusion and would have had somewhat more beautiful exhibits to present than we are going to present to the Commission this morning.

However, El Paso's work, which was down by townships and ranges throughout the Basin, and calculating deliverabilities versus reserves, they testified, I believe, that they had studied 457 wells; somewhere in the mad scramble we've only come up with 451 of the wells, but it is possible that three or four of the wells or some number may have been overlooked by us, but may not have been on the data sheet with which we were working. We feel that is relatively immaterial with what we plan to present.

The one thing that must be kept in mind in a presentation of this type, it is our belief that, in order to avoid this argumentative problem of what reserves have been withdrawn or where it is today or what the deliverability is today, that when you are computing net pays and net recoverable reserves under a given 320-acre tract that are originally in place, and you are relating them to deliverability, then you must relate them to the original deliverability in order to have some semblance of continuity. Otherwise, you do lose your concept. However, this can be done in this way, if you can do it. In other words, we could start

all over again and also do it where we took the present deliverabilities and took the present reserves and replotted those. We don't believe that it would make a material change in the character of the curve, if you are working with the same approach.

Now if you will, Mr. Stockmar, so that the Commission can see and others can see, we have taken Consolidated's Exhibit No. 3 that was originally presented to this Commission, and we have regrouped the wells studied by El Paso in the same concept in which our original approach was made, in a study of the range of wells and the number of wells which are in the categories of deliverability range of zero to 1,000, 1,001 to 2,000, 2,001 to 3,000, 3,001 to 4,000, 4,001 to 4,000, 5,001 to 6,000, and over 6,000, which total 451 wells, and as I stated before, as compared to their testimony of 457, and it's quite possible that we either overlooked six or maybe it was not available, as compared with our 473 wells taken from the Basin-Dakota Gas Pool in February.

Now I believe that El Paso's testimony with respect to reserves and with wells that they cut off at December 31, 1961, so that there may in any individual category be a slight change in the position of the number of wells at that time, but in any event you can see at a glance that on the whole there is on the order of some very similar percentage of the wells in each group.

We then took all of the wells in the zero to 1,000 deliverability range that El Paso had studied, and took their reserves and grouped them as a whole. We took an average of all of

those groups lying within the category of zero to 1,000; and when we computed the reserves in that category, we found that the average reserve in that group was 3.02 billion cubic feet. We then found that in the 1,001 to 2,000, that the average reserve was 3.69 billion cubic feet.

We found in the category of 2,001 to 3,000 there were 3.52 billion cubic feet, which you might note is slightly lower than the 1,000 to 2,000. There must have been some thin sand on wells in those particular higher deliverability wells to explain that.

3,001 to 4,000, we found 4.19 as the average reserve. In the 4,001 to 5,000, we found 3.90 billion cubic feet. In the 5,001 to 6,000 we found 1.98 average reserve, and that can be readily explained by the fact there were only two wells in that group, or at least our computation showed that, and that these were probably, once again, probably thin sand section wells with high deliverabilities; and El Paso was unable to manufacture sand to give them enough additional reserves. This is a guess on my part. We don't consider it material.

Over 6,000 we found 4.20 bil. cubic feet in that particular category. Now in order that we can look at this interpretation in a more realistic light, first of all we took the weighted average reserves of the El Paso group as a whole and found that it was 3.34 billion as a weighted average group, and it falls very closely on the average concept that I believe Mr. Rainey testified

to, that the average of his curve was around the 3.1 to the 3.2 billion cubic feet. I don't remember exactly what he did testify to, but in any event, it gets back to their original work of 160 wells and this work, that the average well in the San Juan Basin, the Basin-Dakota Field has a reserve of something on the order of 3.34 billion cubic feet without regard to deliverability in any way, shape, or form; that it just happens to be that 451 wells, added up on a straight weighted average method, came out 3.34 billion cubic feet.

Now we have previously testified, or I have, and it is Consolidated's opinion that in a graphical construction of interpretive information, that it is well that, since the deliverability, as has been stated over and over and over again to this Commission, is the only precise measurement that can be measured, that these be grouped as a group and averaged. If they are grouped together as a group and averaged and then plotted against the more unknown quantity which has been computed for the deliverability wells without regard to deliverability as a function of reserves, but in fact using the average reserves in a deliverability category, that this really gives a more realistic picture and it's much easier for me to defend, in any event, as a petroleum engineer, this concept of producible reserves in place.

As was stated in someone's testimony, I believe it was Pubco's geologist, that there's one thing certain, and it's about the only thing certain in our account here, is that you can't have

more net pay than gross pay and with this point, no matter what your deliverability is, you can't manufacture new pay. Now you can manufacture the areal extent and the radius of drainage. You can enlarge your area, but you can't put more net sand there, so based on that concept, we have averaged the wells in each group and found that the 243 wells -- excuse me just one second -- If the Commission please, I would like to use El Paso's Exhibit 1 and unfortunately it's not big enough for the room to see, but I think some of you probably have them, and if I may, I'll put this up and apologize for the fact that it has a lot of my hen scratching on it from prior testimony, which is our Exhibit 6.

Now we have averaged, as I say, the precise number of wells of the only true thing we know for sure, and that's deliverability, and we are able to measure that. Now every single engineer in this room can sit and guess what reserves are. We can come up with, the same well, with 12 different opinions, that has been stated here, but the one precise thing that we know is the deliverability.

El Paso, in looking at the Basin as a whole, which is the problem of the Commission, and not looking at red spots and green spots and what have you, but looking at the Basin as a whole by townships, and taking 65 core analyses, I believe they testified, or 67, and all the logs in the township and coming up with these reserves without any other objective except for them to determine, I'm sure, for their own fact fight with the FPC to get

additional outlet for the San Juan Basin at some later time, that they're going to show them they have these reserves and that we will all benefit in the long run with greater gas sales.

In so doing, I have read you from our Exhibit No. 5, we found that the 243 wells, which is not on Exhibit 5, but this item, we found they had an average deliverability of 509 for this 3.02 reserve average that you find on your Exhibit No. 5 for Consolidated. We have plotted as best we could 3.02 versus 509, and have placed a point thereon.

In the next category of 121 wells, we found an average deliverability of 1358 for 121 wells, with an average reserve of 3.69. We have so plotted 1358 versus 3.69. We then found 46 wells in a category of 2392, that had an average reserve of 3.52, which fell to the left of the 121 wells, but we've tried to be as fair as possible in that we certainly can't subscribe, even though some of the points fall to the left, that the higher the deliverability, the lower the reserves. The only reason that it can be lower reserves is the net sand thickness I have spoken of in a few isolated ranges.

Then we took the average deliverability of the next group of 18 wells and found an average deliverability of 3397 with a 4.19 reserve, which we have plotted 18 wells. In order to stay on the chart or slightly off of that, we took the last category of 17 wells, which had an average deliverability of 4455, two wells with 5695, four wells with 7943. We weighted those averages

and found that the reserves --

MR. PORTER: Would you repeat the deliverability of the 17 wells?

A Yes, sir, the average deliverability for the 17 wells was 4455, the average for the two wells was 5695, and for the four wells, 7943. Now in order to put all these groups on this chart, and as they have done in the past, they brought a lot of these out in the outer ranges in; from the other standpoint, we took those 23 wells and weighted averaged those 23 wells and have a 5140, which is slightly off of this map, with a 3.78 reserve -- and I'll write that on here, but there are 23 wells with 5140 and 3.78, which it can be read from here, and we have attempted to draw the best line we have through those points.

Now I have testified earlier that I absolutely subscribe to, there's a relationship between deliverability and reserves in the range of 200,000 and below because it is my feeling that a 200,000 and below well will not probably drain 320 acres and that you are chopping down your effective acreage and, furthermore, you are using the old engineering system that all of us have employed since time immemorial, that every time we come up with a reserve we have what we call a peak factor and that peak factor is that we're looking at the deliverability or the producibility of the well before we put our final number down, and it gets very embarrassing sometime. It's happened to me, when you come up with an oil well that has a million barrels of oil but it won't produce

but ten barrels a day, it would take some ten years to produce it. I think we all have that tendency, and this I think is what enters into the deliverability, but we are looking at the reserves around the bore hole, we are looking at the log around the bore hole, the sand around the bore hole.

The one factor that we don't know in any given instance when we set pipe is, how far is that frac treatment that we are about to embark on going to travel horizontally? How far out is it going to reach? What fracture system is it going to touch? What is it going to drain? This is the factor that we don't know when we set pipe. We know how thick the sand is because we can count it. Net effective sand sometimes changes that deliverability but you can't put more there than was there to begin with. This is the one factor that has to stay there.

In subscribing to this obvious, zero permeability or deliverability has to have zero reserves, we have subscribed out here to 200,000 that there is some relationship at which point it starts to bend. What does that curve really tell you? What it tells me is that every well in excess of 500,000 deliverability in the San Juan Basin is certainly going to drain its reserves from its 320-acre tract, given the time, and deliverability is nothing more than a measure of time.

The allocation formula with a deliverability factor in it is nothing more than a measure of time. That's all in the world it is. If given time, even a 200,000 cubic foot well, unrestricted,

could eventually drain its reserves that's going to get to that well bore, and it's my estimation it isn't going to reach past 320 acres, it's going to do very well as a general rule to get out maybe to 160 acres; but in any event this, why the low reserves appear in this figure, because you do have this peak factor, as I call it, and that this radius of drainage is probably something less than 320, but this curve tells me that at 500,000 deliverability and above that, every well given its opportunity is going to drain its 320 acres.

Now the problem before this Commission is how do we theoretically wind up with all the wells exhausted of all their reserves at the same instantaneous time; and since time is in there, there must be some portion of deliverability in there, because deliverability does have a relation, to some small extent, to porosity and all the other factors that have been discussed, but as a true measurement deliverability really does nothing more than measure the permeability under the given set of pressures to that well bore. That's all in the world we're measuring.

Now with that concept of mine, and ignoring the fact that we have a point, even a weighted average point of 23 wells over here, where this curve could actually turn back the other way and start saying that the greater the deliverability the lesser the reserves. We will not make that argument from this witness stand. I'm afraid that I couldn't even stand up to that, but what it does tell me is that in El Paso's apparent fair work that they

have done throughout the Basin in an attempt to find out something about the San Juan Basin, they have recognized that you can get an occasional freak where you have a 15-foot sand well and some 500 millidarcys or 200 millidarcys or some large millidarcy permeability. That is nothing more than a pipeline into that well bore. You may only have two feet of it, you may have five feet of it, there may be twenty feet of thick sand, but all it really says is that occasionally you are going to get one of these pipelines and what does that pipeline do? You have got a great big sleeping giant out here of thick sand, thinning in places, but an overall great big thick reservoir, and when you get one of those pipelines -- and I'll call it pipeline deliverability in this instance, and it's only got a thin sand section, it's going to drain this 320 real fast. But then at some future date that deliverability is going to drop off, because it's starting to reach beyond its 320-acre tract.

Now I believe one of the witnesses for the opposition did testify that this pressure wave began to drop over and reach over and reach over and was beginning to finally cross the boundary line. These I think are some fairly practical engineering assumptions and fairly practical economical assumptions. However, this does tell me that at some point -- and that point is about two million cubic feet -- that no matter what you do deliverability-wise, there is no relation between deliverability and reserves.

If I can go on from there, if the Commission already

has El Paso's Exhibit No. 2, this will not be an exhibit of ours, but I would like for you to refer to it, if you will, for purposes of what I'm about to say; and that is that El Paso has brought out a usual industry-wide parameter that's used throughout the industry in different fields and different places, that one million cubic feet of gas should be taken for every ten billion cubic feet of reserves.

They have called it for this purpose a fixed depletion rate and have placed it on Exhibit 2 opposite the various deliverabilities and reserves, in order to show the Commission what these fixed depletion rates would be.

Now, we subscribe that what they've done is probably fully accurate in the manner in which they presented it, but if you put that in the category we have, which is our case in the San Juan Basin where we have a tremendous number of wells, not twelve wells or not 83 wells, not the total of 95 wells below a million cubic feet, but 243 wells on their study and 278 wells from what we got from the February proration formula. We averaged then those 243 wells and, as previously testified, we found an average deliverability factor of 509.

Now it just so happened that that almost approximated the first two categories of El Paso's Exhibit No. 2, and therefore we were at liberty to use their projection, since we aren't qualified to project what the gas sales will be in the future, and we were also qualified, however, to take this 509 and the 3.02 billion

cubic feet, which from our Exhibit 5 is the average reserve in that group, and under this one for ten concept, the wells in that group should be receiving an average of 302,000 cubic feet per day times 365 days per year, and they're able to make it because their average deliverability in that group is 509, which is considerably in excess of the 302, they would have a fixed depletion rate of 110,230,000 as opposed to, by averaging the 49402 and the 61698 and rounding it off, approximately 55,000,000 under the 75 percent - 25 percent formula; and as opposed to 9,000,000 by averaging the approximately 76 and 72, so what we're really saying is, to this Commission and to our opposition, is we would like as much as we could get, just as you would like to get as much as you could get. We'll be extremely honest in that. However, we would like for the Commission to be aware of the fact that the wells in that reserve group and in that deliverability range which can make their reserves are not getting, under the present formula, but half of what would be a normal industry parameter of one for ten.

As a matter of fact, what we have asked for is only 75 percent of that normal industry parameter ourselves. Now to go on from there, and since all of their deliverabilities on their Exhibit No. 2 range in the range of -- well, I can read them off to you, 1330 MCF per day, 1441, 1718, 1673, 1677, all of those are something below two million, so for the purposes here we, in order to stay in the same concept that we are talking about, we

averaged all of the wells in the San Juan Basin from El Paso's work, and have previously ascribed the average deliverability of above 1,000 MCFD, and we came up with all the wells in that category having an average deliverability of 4,206 MCF per day, and an average reserve of 3.58 billion.

Now under the one for ten concept, these wells should receive 358,000 a day times 365 days a year, or 131 million per year. Once again, since we're averaging again and this is, I think, the approach that we must all take, even though every once in a while every one of us gets in an extreme case one way or the other, average, again under El Paso's Exhibit No. 2 under the 75-25 formula, we have averaged all of their projected year's allowables and found the average would be in all the wells having in excess of 1,000 deliverability, would be 116 million. Now that is as opposed to 131 million that they should be receiving under the fixed depletion rate.

However, you should keep in mind that wells below 1,000 MCF are getting less than their fixed depletion rate they should have. However, this happens to represent a somewhat higher percentage of their fixed depletion rate than those in the category below 1,000 MCFD. Now under our proposed formula, the wells in that entire group would be penalized to the extent that they would average, under a 60-40 formula, 60 percent acreage and 40 percent deliverability, they would have an average allowable under our 60-40 formula of 111,924,000.

Now, they have been penalized an average of five million cubic feet per well per year. They are still more under our formula, percentage-wise. of their fixed depletion rate formula, than even the wells under 1,000 MCFD.

If the Commission please, we have another exhibit, and once again I must apologize for the appearance of these exhibits. They aren't quite as elaborate as we would like to have them.

This is Aztec's Exhibit, I believe Exhibit No. 1, which is an exhibit which purports to show from the El Paso work the percentage change or the percent of recoverable reserves of all those different categories of wells as what they're getting under the 75-25; and it shows under this work taken from specific points on El Paso Exhibit 1 that the wells in the lower category range are getting approximately 5.5 percent of their reserves under the present allocation formula; and the wells in the extremely high deliverability range, which is around two million, which if you'll recall was around the bending point of El Paso's chart, were receiving only 2.3 percent of their reserves.

Now for our Exhibit No. 7, we have taken these things by categories again, and once again using El Paso's reserves, but since we've once again run into this problem of the fact that their graph was constructed only up to three million and done from El Paso's work, that shows this at around two million cubic feet, which really tells me that around two million cubic feet deliverability that all the other factors come into play,

and that deliverability has nothing to do with reserves above that point and only has a slight amount to do with it at any point above about 500,000 cubic feet to a million cubic feet.

In any event, we took then all the wells from the El Paso data, averaged them up and averaged their reserves and arrived at a weighted average reserve picture; actually, we did it by groups and then averaged the groups together arithmetically, and we came up with the fact that the average deliverability well, of all of the wells in excess of the 243 wells, which were approximately a little more than half of the wells studied, all the wells averaged together, came up with a deliverability factor of 4206, which happens to be off of this chart, that under the 25-75 proposition without regard to deliverability in this other concept, but with regard to actual deliverability versus reserves in this category concept, that they were being allowed 3.6 percent of their reserves under the existing allocation formula per year; and that the wells in the 500,000 category, which is by far the most massive number of wells in the San Juan Basin today, and I would predict that it will continue to be that way in future years unless we happen to find some more soft spots out there -- those 500,000 cubic foot deliverability wells averaged, those 243 wells were only being allowed approximately 1.55 to 1.6 percent of their reserves per year under the present allocation formula.

Let's look at it under our proposed allocation formula.

Once again using the same category, using the same percentage of reserves, and using the 60-40 concept that we're asking for, we found that the wells in the 500,000 deliverability category were now being allowed to produce 2.55 to 2.6 percent of their reserves per year, which is fairly uneconomical within itself, but in any event, we won't get into that -- 4206 average deliverability, however, of the larger deliverability wells, were being allowed 3.4 percent of their reserves per year.

This further strengthened my conviction as to the propriety, and which I have stated earlier, that I had a lack of guts to ask for the 75-25 concept of 75 percent acreage and 25 percent deliverability, but it does tend to straighten this thing up considerably, and we admitted that all we were asking for in our Exhibit No. 4 was something that would still give these fellows an almost two to one advantage. Certainly it may not be two to one, but it certainly must be, even by rejuggling figures, may be a 50 percent advantage, and this tells me from Aztec's work reversed that we are still granting them approximately seven-tenths of a percent per year over 2.5, or be that as it may, approximately 30 percent advantage.

We are willing to live with this for a period of time. Take a look at this formula that we proposed; we get some more reliable reserve figures from the pressure decline method, which has been argued back and forth here for a considerable length of time, and our own interpretation of the pressure decline method of

computing reserves, if you can get true bottom hole pressures to work with and give them enough statistics from the reservoir, it is undoubtedly the most advantageous and certainly the most correct way of determining reserves, but it is determining reserves under a radius of drainage.

What is that well bore supposed to get? I believe we had a very hard fought case that we took no position in one way or another, but that Southern Union subscribed to 640-acre spacing in the San Juan Basin, and they took the so-called sweet area, if you'll recall, in that, and flowed, before the allocation formula went into effect, flowed very hard one well, taking periodic bottom hole pressures in the surrounding wells. They had some slight indication of interference, but once again, time being a factor, which is always a factor in a pressure decline interpretation method of reserves under a radius of drainage area. The Commission did not see fit to agree with the 640-acre spacing.

It is my firm conviction that, although we did not appear in any way at all, there are probably some areas in the San Juan Basin that should be on 640 acres, in order to make these wells commercial, commercial from the standpoint of ultimate return on your money, but to have a blanket field-wide Basin-Dakota spacing pattern of 640 acres would be disastrous from the standpoint of the lower deliverability wells.

It's been shown in a lot of different ways here that there are local variations throughout the San Juan Basin and there

are sweet areas. We agree with that whole-heartedly, we don't argue the point. We think the broad concept is that it is a fairly massive sandstone. The Commission will be interested to note that on this particular exhibit, which I don't recall the number of --

MR. KELEHER: Pubco No. 1.

A -- No. 1, Pubco has isolated these certain areas and granted some of the logs were not available, I must apologize, ours was not available, one of ours is not available this morning, but I'll reveal the general details and we will make it available after the hearing, release the log. We have drilled a well in the Southwest Quarter of Section 6 of Township 23 North, Range 3 West, which has encountered one of the most massive Dakota sandstone developments that I have had the pleasure of seeing, from a standpoint of continuity, thickness, and what have you, in the various wells that we have drilled.

We have a problem in this well in the fact that we don't know whether it's an oil well or a gas well. I'm quite certain that under the El Paso method of eliminating condensate and only using condensate and water saturation and only using net gas porosity, that we are going to have an extremely low gas in place number, because this well will hardly flow against 550 pound line pressure; and yet it was potentialed for approximately 100 barrels of oil a day, 750,000 cubic feet of gas per day.

We are testing this well at this time to find out if we

have an oil well or gas well. At this time it's an oil well. However, we have a feeling that perhaps the oil ratio will drop off sufficiently to be able to call it a gas well so we can sell our gas and get hooked up and get an allowable that we can operate under. But if we get an allowable for this well, which is going to be admittedly a low deliverability gas well under the present formula; but at any rate, under our formula, which would aid us some, we're going to have a hard time producing this well.

So in other words, if Pubco had had that one additional point, we could have had a big area.

In a moment I will introduce one other item which we attempted to do with respect to our acreage position in response to this massive sandstone. We subscribe to one theory in the San Juan, that you can't get gas where there is no sand. I think this is basically true, and we further subscribe to the fact that what is deliverability gas or what is producible gas, if you may, prior to a fracture treatment job in a massive sandstone, might change its characteristics if enough is exposed via the fracture treatment route.

Therefore it has been Consolidated's whole approach, time-worn, to stay in Pubco's red area, and we have been fairly successful in doing that. However, we have not been successful, admittedly, in getting the highest deliverability wells.

Fortunately, we happen to have been lucky enough or smart enough, I don't know what it is, that our net division order

interests happen to be the highest in our higher deliverability wells, and vice versa. This wasn't known in advance, it just worked out that way, but our whole concept is to follow this thick broad section policy, because if the reserves are there, I feel that technology, in the long range viewpoint, if we protect this reservoir from drainage between tracts, that we'll have the technology and we'll know how to get these massive thick, what are now to a certain extent non net pay reserves from these wells; and if we can prove that, El Paso will have no problems with the Federal Power Commission in proving to their satisfaction that probably the San Juan Basin-Dakota formation might have enough gas in it to take care of California by itself.

One other thing that I would like to add, if I may, I would like for the Commission to receive what was Pubco's Dakota isopach map of the gross producing sandstone in the Basin-Dakota Field, which we attempted to introduce through cross examination, which we would like to call our Exhibit No. 9. This merely shows Consolidated's general outline of acreage, its acreage position in the Kutz Canyon Field, its general acreage position in this area, and our acreage position in this area; and incidentally, this was commented on quite a bit in one of the testimonies, this particular area, and we have another problem with oil problems down there, and the zone that I think that was criticized on the logs so badly was the offset well that we tried to drill with gas, ran into oil, and we had a problem trying to drill the well and darned

near lost the north well and the south well. We made certain to get into that sand and as a consequence we have something approaching an oil well there. And then this new acreage position in the 23 North, 3 West, which is the new area that I just spoke of. That is the general outline, and if this in fact proves to everyone's satisfaction, and I hope that it will, that the interpretation of the gross section is something on the order of 140 feet or 150 feet, but certainly well over a hundred under almost anybody's pick, that once again we will be in the red area.

In conclusion, I would like to restate that we didn't do this reserve work, this is not our work. We think, however, that is representative work and it's work, we are already convinced of competent engineers who can predict two years ahead of time that this same general broad picture relationship of deliverability versus reserves is going to be approximately what it is today. If you'll recall, in my testimony, that we didn't have the numbers so we had to go at this category of five to three, this average category, because we didn't have the deliverabilities to go with the exact reserves. We stated in our testimony that this three to five relationship was about 60 percent variance, and I did make the statement that it was my opinion that it was something, probably not quite that bad, it was something in the order, or something less than 50 percent.

If you'll examine this interpretation approach where we did have the data available, you have something on the order of

four billion in the extremely high deliverability range, and the 500,000 deliverability which is the heavy massive portion of the wells, there's three billion, so there's 33-1/3 percent difference.

We subscribe that deliverability is necessary in the formula in some form, in some percentage to take care of that problem. We believe that a certain amount of it should remain in it. It's up to the Commission to decide what that right one is, and only God knows, but I hope that you all can come mighty close to it.

That, by and large, is our whole feeling in this respect. It's frankly why we're here. It's been a long and tiring fight amongst all of us, and I think that we're probably all a lot more knowledgeable about the Basin-Dakota Field, I know I certainly am, than I was when I arrived. It's our feeling, and now I'm speaking as management and not as an engineer, that even though we more strongly today feel that even a lower deliverability, higher acreage factor might be the proper one, we feel that a 60-40 trial balloon for a somewhat similar period of 16 to 18 months that we are under this type of thing, until we can get more data, will encourage additional development in these areas that are white on the map and will prove beneficial to Southern Union and El Paso in further convincing El Paso's case with the FPC of the tremendous amount of reserves that I have always believed are in the San Juan Basin.

I know our company, if we feel that we can at least

commercially operate and can foresee, if we happen to get a low deliverability well -- I say a low deliverability, I mean 500,000 cubic feet -- that our company, if we have a ten-year payout, will attempt to live with it, because we feel that we're technically able to stay somewhere above that 500 and maybe we can stay in the range of an eight-year payout or a nine-year payout on the overall average under the present market conditions.

We feel this formula will do this, as proposed. We would like to give it a trial balloon. It is not our plan to be immediately back petitioning for a 75-25, if we were so lucky as to be granted a 60-40. We believe everything needs a trial. We feel this is a move in the right direction. We believe it will continue to encourage development. We feel that the pressure on the Federal Power Commission of additional gas reserves will greatly aid El Paso in their attempts to extract additional gas from the San Juan Basin, which will materially improve the payout situation for all, and that we will all eventually, including the State of New Mexico, via the substition, benefit tremendously.

Q (By Mr. Stockmar) Are you through, Mr. Trueblood?

A Yes.

MR. STOCKMAR: If the Commission please, we would like to ask that the Applicant's Exhibits Nos. 5, 6, 7, 8, and 9 be marked as such and received in evidence.

(Whereupon, Consolidated's Exhibits Nos. 5, 6, 7, 8, & 9 marked for identification.)

MR. PORTER: Is there any objection?

MR. KELEHER: We object to the admission of so-called Exhibit 9 on the ground that no proper foundation has been laid.

MR. STOCKMAR: If the Commission please, I can lay --

MR. PORTER: Is this Exhibit 9?

MR. STOCKMAR: Yes.

MR. PORTER: The exhibits will be admitted to the record.

MR. KELEHER: Exception as to No. 9.

MR. PORTER: The record will show the exception. Any questions of Mr. Trueblood? Mr. Howell.

MR. HOWELL: If the Commission please, I have one question.

CROSS EXAMINATION

BY MR. HOWELL:

Q Mr. Trueblood, in that portion of your closing argument before you began the speech to the stockholders, you referred to the summation --

MR. STOCKMAR: I have been patient a number of times, as you have not with me. I do object to this line of conversation.

MR. HOWELL: Well, I will rephrase the question.

Q (By Mr. Howell) You referred, I believe, to the only factors that contribute to deliverability as being permeability, at certain pressures, do I recall your testimony correctly?

A I said those are the major factors, I believe.

Q Well, actually, is not the thickness of the pay sand also a major factor?

A Well, certainly, but I assumed that once the thickness of the pay sand was already there, that I do not know which number of feet are contributing, since through fracturing that we are making via artificial stimulation, I cannot tell you what the number of feet exposed to the well bore happens to be.

Q Mr. Trueblood, could you answer whether or not thickness is a contributing factor to deliverability?

A It absolutely is.

MR. HOWELL: Thank you.

MR. PORTER: Mr. Keleher.

BY MR. KELEHER:

Q Mr. Trueblood, you have testified or stated that the results of your work are based on averaging the averages both in deliverability and reserves, is that correct?

A That is correct.

Q Is it not true --

A Excuse me, under certain categories, in certain categories.

Q Is it not true that if you were to continue to average the averages ad infinitum that you would eventually have nothing but a fixed figure for average reserves and a fixed figure for deliverability?

A No, I couldn't say that would be exactly so, Mr.

Keleher. As a matter of fact, I don't believe I testified that that was so, other factors entering into it; and I believe it was my testimony that other factors do enter into it, one of which happens to be that, and it's been said here, that there is some relationship of deliverability to the available porosity of the well bore; of pressures, in a certain area we have bottom hole pressures, I believe it has been testified, ranging from 2400 to 2200; that we have certain thickness of sand, certain other factors where deliverability does enter into it enough; and that in fact on that curve which I have drawn through the points I have noted that there is a difference attributable somewhat to deliverability. As a matter of fact, I've stated that there is a 33-1/3, and I have also stated that I believe this to be a bad point at 5140 MCF per day deliverability with only a 3.7 reserve, because in that particular point, if I had taken into consideration completely, I would have had to have turned the curve around and from a strict standpoint of graphical, true graphical interpretation, we do not subscribe to that, we merely stated that because there were probably some thin sand zones somewhere that no matter what you do to them you couldn't increase the gross net pay, but you had twelve million deliverability or what have you; that this was happening, and that these so-called freaks that have been bandied around from time to time throughout the hearings are freaks, in some instances where you have extremely high deliverability, but no matter what you do, you can't get more than 20 feet of net pay.

I believe that's what I said. I do not believe by averaging the averages you could always come out with -- however, the construction of El Paso's Exhibit 1 is an average of the average. We have taken an average of the average in a different direction.

Q What you are attempting to do is to solve the solution, is it not?

MR. STOCKMAR: I would like to ask that that question be restated. I do not understand it.

MR. KELEHER: Well, I won't ask the witness any more.

MR. PORTER: Is that all you have, Mr. Keleher?

MR. KELEHER: That's all.

MR. PORTER: Anyone else have a question of Mr. Trueblood? He may be excused.

(Witness excused.)

MR. PORTER: Anyone else have testimony to present? Mr. Everett.

MR. EVERETT: I have a statement I would like to make in behalf of Ohio Oil Company whenever the time comes.

MR. HOWELL: I do have one item of testimony, if you will pardon me, Mr. Everett. El Paso will ask the Commission to take administrative knowledge of the Commission's files covering the two wells testified to by Mr. Trueblood in his direct testimony, being the Consolidated Government Leeds Well 1-8-L, and Consolidated Government Owens Well No. 1-7-D-N, with reference to the report filed by Consolidated on drilling and completion

history showing the treatment to the Owens Well to be sand-water fracked with 50,000 pounds of sand and 50,000 gallons of water, 750 gallons acid; the treatment to the Leeds Well being sand-water fracked with 100,000 pounds sand, 129,000 gallons water, 500 gallons acid.

MR. PORTER: Could you give me the Section, Township, and Range of those two wells?

MR. HOWELL: The Government Owens Well appears to be in Section 7, Township 31 North, Range 12 West; and the Government Leeds Well appears to be in Section 8, Township 31 North, Range 12 West; these being the two wells used for comparison by Mr. Trueblood in his direct examination.

MR. PORTER: The Commission will take administrative notice of the files.

MR. STOCKMAR: We certainly have no objection to this, except that my people advise me that the Owens Well happens to be a Mesaverde completion, thus not material to the Dakota presentation.

MR. HOWELL: I have misnamed that. The file jacket shows the Government Owens. The actual log from which I read is the Government Gross.

MR. PORTER: The Government Gross.

MR. HOWELL: The Government Gross, which was the well. It appears to be mislabeled on the file jacket from which I was reading.

MR. PORTER: Is that the same number?

MR. HOWELL: The number is the same.

MR. PORTER: The location is the same?

MR. HOWELL: The location is the same. The label of the file is apparently wrong as to the name.

MR. STOCKMAR: There's no objection on the part of the Applicant.

MR. PORTER: We are going to take a very short recess.

(Whereupon, a short recess was taken.)

MR. PORTER: The meeting will come to order, please. We are going to ask for statements in the case, and I would like for anyone who is going to give a statement to please come down to the front so that the reporter can hear what he's saying. Who wants to be first? Mr. Stockmar.

MR. STOCKMAR: I think in the normal course, the Applicant starts and then the others may have the last word.

I think Mr. Trueblood's testimony will serve as our major argument. I would like only to say that the company has given serious consideration, among other things, to the problem of a maximum and minimum allowable. It feels that no proper maximum and minimum approach can be achieved by that route alone. It has been testified, and it's the belief of the company that the adoption of its formula will in effect provide the minimum allowable, which will achieve the results desired by the Commission.

MR. PORTER: Mr. Kellahin.

MR. KELLAHIN: If the Commission please, Jason Kellahin for Southern Union Gas Company. Southern Union Gas Company is in great sympathy with the case which was presented by Mr. Utz for a minimum allowable. However, it is their view, on the basis of the evidence presented in this case, that if a proper allowable formula, such as has been advocated here, is adopted, there would be no need for a minimum allowable for a period of a number of years. If, however, there is to be no change in the proration formula, a minimum allowable should be adopted; and on the basis of the experience of Southern Union Gas Company as an operator in the Basin-Dakota Pool, we believe that the minimum suggested might be somewhat low and suggest that the Commission might want to consider something more on the order of five million.

In any event, if there is no change in the formula, it would certainly simplify the Commission's bookkeeping and that of the pipeline companies, too, if a minimum were adopted.

Now, turning to the case that has been presented here, I want to make just two very brief comments. The testimony offered by Mr. Haseltine is generally to the effect that there was a general continuity in this reservoir which gradually changed across the reservoir, with the exception, as we all know, of deliverabilities. We feel that that statement has been fully supported by the evidence presented by Pubco and by the El Paso Natural Gas Company. Now Pubco offered two cross sections -- well, they

offered three, but one of them is on an edge location, B-B^1, which I don't believe shows a reservoir condition except in a small isolated area.

There are other cross sections, that C-C^1, they utilized eight wells covering the distance of some 76 miles, and admittedly, by their own testimony, you would normally expect considerable variation over that distance. That does not in any way refute the testimony offered by Mr. Haseltine.

Now on the other exhibit, A-A^1, they offered that in an effort to show there was no continuity in this reservoir, there were radical changes from well location to well location. I think it's very apparent if you just glance at the exhibit that it shows a continuity across the reservoir, and significantly across the longitudinal axis of the sand beds in that reservoir. In other words, if you are going to expect any radical change, you would expect it if you cut across those beds rather than going down the length of them; and we see no way that that exhibit supports the contention that there are drastic changes in the sand body from well location to well location. Instead, it supports the view that there is a general continuity in this reservoir.

Now Mr. Rainey testified that every reserve point, or every reserve range that he used on his exhibit, there was a wide scattering of deliverabilities. That certainly doesn't support any conclusion that deliverability and reserves are in a direct

relationship.

Now El Paso in their presentation also used a township average for the reservoir conditions. The only change in the concept that they were able to note on the basis of their calculations was on the changes in deliverabilities again, which again does not support any conclusion that deliverabilities and reserves are related and does support Mr. Haseltine's contention that there is a general sand body showing gradual changes as you digress through the reservoir, the only differences being changes from well to well and the deliverabilities encountered in those wells.

Southern Union is in support of the application which has been presented here in this hearing.

MR. PORTER: Mr. Everett.

MR. EVERETT: I have a prepared statement, Mr. Porter. Before I get into that, I would like to answer or point out one matter to which Mr. Kellahin has just referred, and that is the Southern Union Exhibits. I call the Commission's attention to the fact that that was drawn on a scale of one inch to 400 feet, which would mean that looking at that exhibit, a tenth of an inch equals 40 feet. I would suggest, Mr. Haseltine had drawn it an inch to 4,000 feet, that the line of a pencil would show this point that he has been trying to make, he could have just drawn a pencil line right through all those well logs and they would have been uniform throughout. So when the Commission views that exhibit, please bear in mind the scale which is thereon.

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My name is W. Hume Everett. I am the Division Attorney of the Casper Division of The Ohio Oil Company. I represent my company herein in opposition to the application of Consolidated Oil and Gas Company, Inc.

In support of its opposition The Ohio Oil Company hereby adopts (as fully and completely as though presented by it) all of the exhibits, testimony, and opinion evidence offered herein by Pubco Petroleum Corporation, El Paso Natural Gas Company, Aztec Oil and Gas Company, Sunset International Petroleum Corporation, and Caulkins Oil Company, and states that under the facts in this case the allocation formula set forth in Commission Order No. R-1670-C should not be changed to increase the acreage factor or to decrease the deliverability factor as requested by Consolidated Oil and Gas, Inc., in that any such change would be highly inequitable and unreasonable and would result in a failure to recognize correlative rights.

The Commission after hearing on October 13, 1960, entered its Order No. R-1670-C, having found therein that the producing capacity of the wells in the Basin Dakota Pool is in excess of the market demand for gas from said common source of supply, "and that for the purpose of preventing waste and protecting correlative rights" adopted appropriate procedures "to provide a method of allocating gas among the proration units in the area encompassed by the Dakota Producing Interval, commencing February 1, 1961." Said interval and common source of supply was by such order

designated and "denominated the Basin-Dakota Gas Pool."

At the time of the entry of said Order No. R-1670-C, the Commission, as it is required to do under applicable New Mexico statutes, found and held: "That since the evidence presented, established that there is a general correlation between the deliverabilities of the gas wells in the Dakota Producing Interval and the recoverable gas in place under the tracts dedicated to the wells, the gas allocation formula for the pool should be based on seventy-five (75) per cent acreage times deliverability plus twenty-five (25) per cent acreage," and that, "Such a formula will protect correlative rights and will, insofar as is practicable, prevent drainage between producing tracts which is not equalized by counter-drainage."

The Commission thereby afforded each owner of each property in the pool with the opportunity to produce his or its just and equitable share of the gas in the pool in an amount so far as can be practically determined and so far as such can be practicably obtained without waste substantially in the proportion that the quantity of the recoverable gas under such property bears to the total recoverable gas in the pool, and has permitted each owner the right to use his just and equitable share of the reservoir energy.

In entering Order No. R-1670-C, and at all times since, the Commission has protected correlative rights by giving equitable consideration not only to acreage but to "pressure, open flow,

porosity, permeability, deliverability, and quality of gas," as well, so as to eliminate, upon a reasonable basis, the production of natural gas from any gas well or wells within or from said gas pool in excess of the reasonable market demand from such source of natural gas of the type produced, or in excess of the capacity of gas transportation facilities for such gas.

Wherefore, The Ohio Oil Company respectfully states that under the law as applied to the facts in this case the application of Consolidated Oil and Gas, Inc., should be in all things denied, and that the Commission Order No. R-1670-C be continued in full force and effect without change.

Respectfully submitted this 21st day of April, 1962.

I have given the reporter a copy of the statement. In addition to that, I would like to state that the position of The Ohio Oil Company is that there is no need for a minimum allowable as suggested; there is no need for such an allowable at this time.

It is our feeling that the acreage factor in the present formula is a sufficient and adequate minimum, and that the order in toto should remain unchanged.

MR. PORTER: Mr. Keleher, did you want to make a statement, too, sir?

MR. KELEHER: Mr. Chairman, and Gentlemen of the Commission, W. A. Keleher, for Pubco Petroleum.

Rule C, 9-C of the Commission's General Rules provides that the gas allocation formula for gas pools of Northwestern New

Mexico shall be based on 75 percent acreage times deliverability plus 25 percent acreage.

Consolidated Oil and Gas, the Applicant here, proposes to change the formula in the Basin-Dakota Field to 40 percent acreage times deliverability plus 60 percent acreage.

The pool as of April, 1962, according to the testimony presented to the Commission, had 572 wells developed with an areal extent of about 183,000 acres. In Consolidated's application, Consolidated proposes to change for these reasons: One, the pool has abnormally high deliverability; Two, the present rule, (a), creates waste, (b), permits and will increasingly permit non-ratable taking of gas from the pool and drainage between tracts which is not equalized by counter-drainage.

Consolidated maintains in its application that the change in formula will, One, prevent waste; Two, distribute the allowable production among the producers in the pool on a reasonable basis; Three, not violate or prejudice correlative rights; Four, prevent premature abandonment of wells which are uneconomic under the present formula established by Rule 9-C.

Consolidated further maintains in its application that under the present formula it is suffering and will increasingly suffer economic hardship as a result of continuation of the present formula.

Pubco's position here, as we have endeavored to express it in testimony, is that the formula should not be changed for a

higher acreage factor allowable; and if any change is to be made it should be made toward a higher deliverability factor allowable, since deliverability is proportional to recoverable reserves.

At the outset, may it please the Commission it is our contention that the burden is on the Applicant to sustain by a preponderance of evidence its contentions. It is our contention that the Applicant has utterly failed through the testimony it submitted, the testimony submitted on behalf of Southern Union, to sustain the contentions; and that the application must fail and that the application must be decided adversely.

As indicated in the testimony, this case is of great importance to our company. We have many wells in this area; we have nine wells in the Dakota. We are pioneers in this area. We have a schedule by which we propose to drill 18 wells in the San Juan Basin in 1962, costing not less than $1,500,000, not insignificant to a small company such as ours.

The contention suggested by Mr. Trueblood in his direct examination at the opening of this case, that Consolidated wants to get its piece of the pie, about sums up the situation. The testimony was to the effect that Consolidated can't do that under the existing formula, and Consolidated wants this Commission to assist them in that direction. This very morning Mr. Trueblood, in connection with his final statement, said, "We haven't been fortunate enough or successful enough to get high deliverability wells." That about sums up the situation.

Our witness, Dan Cleveland, who was on the stand for many hours and was submitted to severe cross examination on behalf of Consolidated, stated that his calculation was to the effect that on the basis of wells presently completed, about $520,000 annually would be taken from 17 different operators and distributed among 33 other operators in the Pool. Now I submit respectfully to the Commission that this Commission is not here for that purpose of equalizing distribution of money, but it's here to see that justice is done but not to reward those who are not fortunate enough, as has been expressed, in getting high deliverability wells, or spreading out, making the uneven, even.

The Commission has heard testimony submitted by an alinement of respectable companies which have great investment in this field, great interest. Pubco, El Paso Natural Gas, Ohio Oil, Aztec, Caulkins Oil, Pan American, Sunset International, very respectable array of companies which are sincerely interested in the progress and development of that field. It is inconceivable that these companies would go to the extent of drawing the graphs and preparing the exhibits that have been submitted to you here today unless those companies were sincerely of the opinion that this rule formula should not be changed.

The Applicant has entirely failed, in my humble opinion, in presenting or submitting any concrete evidence. I was astonished at the lack of exhibits, the failure of the Applicant to present testimony which would support, studies which would tend to demon-

strate the justice and the wisdom of their cause. Apparently their strategy was to submit one or two or three informal studies which could have been prepared by any ninth grade student in high school, demonstrating things that are ABC, and relying entirely on exhibits and testimony presented by those in opposition to the change in formula, relying on cross examination of the experts produced by those in opposition, rather than in presenting before the Commission experts who would testify to the contentions they were making; indicating to my mind that they were unable to produce experts who would testify favorably to their position.

Mr. Cleveland, one of our witnesses, in closing, in answer to a question said that, assuming a continuance of even a modest development program in the San Juan Basin-Dakota, any change in formula in favor of acreage as opposed to deliverability would be highly prejudicial to those operators having higher deliverability wells and higher reserves in favor of those with lower deliverability wells and lower reserves.

Pubco's position here is that such is not the mission or objective of this Commission, to attempt to award those who have not been successful in finding the wells they wished and hoped for, and penalizing those who have borne heat and labor of the day in the San Juan Basin, thus penalizing them.

We submit the matter to the Commission with every confidence that the Commission will reach a correct and proper decision in this matter.

I'll close with the statement of Mr. Utz of the Commission's staff, who testified to thirteen years or more background, experience. He said, and this is his testimony in the rough, at this point the acreage factor does provide a sufficient formula. I know the day will come when the formula should be changed. It's our contention, we respectfully submit to the Commission, that that day is not here.

MR. PORTER: Mr. Howell.

MR. HOWELL: I defer for the minute to Mr. Seth. He would like to make his statement first.

MR. SETH: If the Commission please, Tenneco left a short statement with me. Tenneco Oil Company opposes Consolidated Oil and Gas Company's application in this case, and believes that prudent operators have an interest in the present allocation formula of 75-25 percent. These operators have conducted all their activities in the Basin-Dakota Field, including the acquisition of acreage and the development drilling, based on the income developed from the present method of allocation. A change from the previously established precedent as to allowables in the field at this date would place an economic hardship on these operators.

Tenneco Oil Company also believes strongly that the economically recoverable gas reserves from Basin-Dakota wells is a function of the wells productivity. The present allocation formula adequately protects correlative rights and equitably

distributes the market demand or gas in the field among the presently completed and connected wells. That's the end of the Tenneco statement.

If the Commission please, while I'm up, I would also like to make just a few brief remarks about Sunset and Caulkins. I appeared for both of these companies.

Caulkins has been in the field, as the Commission knows, for a considerable length of time. They are a relatively small company compared to the other parties in this case. They have, however, a very real interest in the field. They have done a great deal of reservoir work through quite a broad distribution in the field. They conscientiously urge, seriously urge the Commission to continue the present formula. Caulkins is prepared to proceed with its development program as it has in the past under the present formula, and that I believe speaks as good an argument as can be made that the present formula is fair.

As far as Sunset is concerned, it has also been in the field a considerable period of time. They have done a great deal of the basic work on the development of frac plans for particular wells. They have done a lot of work on separation. They know the field very well, too. They are prepared to go ahead and continue their development on the present formula. Sunset is connected entirely to Southern Union, who has aligned itself with the Applicant here. Caulkins is primarily connected to Southern Union.

As has been mentioned any number of times in hearings before the Commission, its rules and regulations, its administration has to be geared to the particular field. It has to be on a field-wide basis. It has to cover the typical situation. Its general rules and regulations obviously can't cover all the possibilities. The erratic wells can be well covered and protected and handled through continuing proceedings before the Commission, and under its present rules the administration has to be on these general considerations; and I think the Commission has probably observed on this particular point of general considerations that by far the preponderance of the wells, that is, the operators of a preponderance of the wells, I should say, have indicated to the Commission that they believe that the present formula should be continued. This indicates to my mind that the rules generally apply, as they stand now, to these wells generally throughout the field.

I won't belabor the Commission with any unduly long comments on the case, but we were struck by the very persuasive development of the opinions and conclusions of the Applicants. I think their witnesses did an excellent job in that area, but we are also struck by the scarcity of particular and definite facts to put in the record to support these conclusions and opinions. I think we are all struck by that aspect of the case.

On behalf of these two companies, I would like to urge the Commission to continue the present rule. Thank you.

MR. PORTER: Mr. Howell.

MR. HOWELL: Ben Howell, representing El Paso Natural Gas Company. May it please the Commission, it seems to me that in facing the problem of any proration, the starting point is the recoverable reserves. Certainly El Paso in its studies began with that point, an effort to determine what are the recoverable reserves.

I feel I should call the Commission's attention that Mr. Kellahin in his argument overlooked the fact that the testimony shows that El Paso took account of the sharp variations which occur in net pay, and in giving reserves considered each well log separately and assigned a net pay to that well based upon the conditions which exist as to that well. Certainly every effort was made to determine the other factors from the best evidence available. Since there are only 65 or 68 cores available, that's all the core information that can be used. Everything has been done that can be done to get the most definite information.

Then if we start with reserves, what are we going to do with them? The gas is in the ground and it needs to be produced. It seems to me that the Commission's original order giving 75 percent deliverability times acreage plus 25 acreage has done a great deal to make possible the development and uncovering of these tremendous Dakota reserves, because the emphasis given to deliverability has induced operators to use methods of completion in the field, the opportunity certainly exists under the develop-

ment of a new field to use the best and most effective means of getting the greatest possible portion of the gas, and that that is true conservation; and that the emphasis given to deliverability by the formula has resulted in giving an incentive to operators to produce ultimately the greatest proportion of the gas in place and add that to the recoverable reserves.

I think that the cause of conservation and the prevention of waste is well served by that.

Now from that starting point, one next goes to the means of allocating or prorating these recoverable reserves that exist under each tract. I might pause, incidentally, to state that we had a great deal of cross examination of witnesses who testified concerning estimates made on the basis of pressure decline as to the area of drainage that any one well would drain. I submit that the answers which these witnesses gave, the testimony generally was that"I don't know and nobody knows," that the Commission by establishing a pattern of spacing has established counter-drainage which gives to each well the opportunity to expand its circle until it meets the circle of the surrounding wells drilled within the pattern established by the Commission; and thus following the statutory injunction to prevent drainage that is not balanced by counter-drainage, and that you have done so.

I would like then to say that starting with that point, El Paso then considers the deliverability in relation to the

reserves which it has determined to exist, and finds that the averages -- conceding that there will be individual variations in wells, those could result in some instances from mechanical problems in the well or matters within the sand, no two wells are going to be exactly alike -- and they come up with a reasonable relationship; and the Commission so found two years ago, and the testimony of the additional wells that have come in, the evidence from these wells indicates that that relationship still exists.

Now I think it's particularly significant that regardless of the method used in determining reserves, whether it be El Paso's volumetric method, whether it be Caulkins' or Sunset's pressure decline method, in each instance the correlation between the deliverability and the reserves attributable to the wells is the same; the general overall correlation and relationship is the same.

Now I'm not a mathematician, I can't get up and conclude what a curve would look like if you took and grouped by a different set of factors, you might come up with some kind of curve. I don't know. We do know that when we started with reserves and considered on the basis of wells with similar reserves, we found a consistent relationship.

Now the proponents do not take the wells and average within the same groups that we have averaged. They average averages in many instances. As a mathematician, I don't know

how much that varies your results. I do want to call your attention to the fact that El Paso's exhibits based upon averages, Sunset's and Caulkins' based upon individual wells, come out with about the same general relationship. I believe it's conceded by everybody that there is some relationship, I don't think anyone is willing to express it mathematically, between recoverable reserves and the deliverability.

So we submit that the proponents have not made any better case, the proponents of a change have not made any better case than they made in October of 1960. Their position is the same. Both Consolidated and Southern Union at that time desired a greater acreage factor. I have no criticism to offer of Consolidated. I think it's normal that a company will strive to get, as they put it, a larger piece of the pie, but I think that maybe a better analogy than what we have here is that everybody that came in and put the money in drilling in this Basin and came in after November, 1960, would know the rules of the game, and the cards had been dealt out and somebody got some deuces. Now you can reshuffle those cards and deal them again, but as long as there's only 52 cards in the deck, somebody's going to get some deuces. And I believe that the only thing that ultimately would help Consolidated's position is, as I think Mr. Trueblood frankly admitted, the opportunity for everybody to market more gas.

That doesn't seem to be likely in the near future. I believe he was quite frank when on cross examination he said he

probably wouldn't have drilled some wells that he did had he known that there were going to be as many other wells drilled and that the market would not be increased. So that unless we are going to increase the deck and change the game and put two decks in there, which we can't do because the size of the deck is limited by the size of the market, I think we ought to continue to play the game by the rules that we have.

Now El Paso's position as to minimums I think was stated by Mr. Rainey, and I would like to reiterate it. Certainly we have no desire, we are strongly opposed to anything that would cause premature abandonment of a well, and that's just not philanthropy. We have an investment of gathering facilities going to these wells, and we would like to get the benefit of those gathering facilities and we would like to have that gas available and not shut off from the market; but we don't think that the evidence in this case could justify the minimum at this time. We feel very strongly that an allowable to prevent premature abandonment should be considered in the places where it is needed.

I personally very seriously doubt if there is any legal justification for imposing a rule, in the light of the testimony, that isn't necessary at this time, and I think we shall endeavor with a great deal of interest and with an open mind and a desire to work with everyone to prevent premature abandonment, the hearing which I understand the Commission proposes to call with reference to the possibility of imposing minimum allowables

or allowables to prevent premature abandonment in other pools.

So if I haven't, or our witnesses haven't made our position clear, I can now state that El Paso opposes the application of Consolidated Oil and Gas.

MR. KELLAHIN: If the Commission please, at the outset I entered an appearance for R. & G. Drilling Company. I want to state their position is in support of the application.

MR. PORTER: Mr. Kelly.

MR. KELLY: Booker Kelly of Gilbert, White and Gilbert. I have two statements, one on behalf of Sunray Mid-Continent. Sunray Mid-Continent Oil Company believes that gas should be allocated on the basis of reserves. We do not believe that deliverability reflects reserves, at least on a direct relationship. We do not believe that the testimony has shown that. We believe that acreage and the thickness of production formula more nearly reflects reserves, more nearly reflects reserves than deliverability. Consolidated Oil and Gas Company's formula contains a heavier factor of acreage than the present formula, we would urge the Commission to adopt the Consolidated formula.

I also have a statement on behalf of Texaco. It is Texaco's opinion that deliverability does not have a direct correlation to the recoverable gas reserves in place under any particular tract, and therefore should not be considered as a factor in the prorating of gas production. It is believed that to include deliverability as a factor increases the tendency to

perforate longer intervals, which results not in an increase in reserves for any particular well but merely in an increase in the well's deliverability. We believe such practices in an effort to increase deliverability cause both physical and economic waste. Texaco believes that to protect the correlative rights of all parties concerned, the most equitable proration formula for the Basin-Dakota Pool would be a formula based on 100 percent acreage. Texaco urges that both oil and gas proration formulas be based on 100 percent acreage. However, we are in favor of any change in the Basin-Dakota allocation formula which tends to place more emphasis on acreage, and would therefore recognize this as a step in the right direction.

At the present time Texaco does not operate any producing wells in the Basin-Dakota Gas Pool. However, we are the operators of five wells completed in the Basin-Dakota reservoir that are currently shut in. We do own an interest in several wells that are currently in the Basin, and Texaco also owns considerable undeveloped acreage in the immediate area.

Therefore Texaco, Inc.,as a very interested party, recommends that the proration formula for the Basin-Dakota Pool be based upon 100 percent acreage. However, we recognize the application of Consolidated Oil and Gas as a step in the right direction, and therefore concur with their application.

MR. WYNN: My name is R. C. Wynn, with Delhi-Taylor Oil Corporation; and in the interest of orderly sequence of aline-

ment in this case, we would like to submit our statement at this time as nearly as possible to the alinement of the opponents of the application in this case; and Delhi-Taylor submits to the Commission that the present Dakota proration allocation formula is fair and equitable to all, and we recommend that no change in that allocation formula be made. In summary, Delhi-Taylor opposes the application in this case, 2504.

MR. PORTER: Mr. Eaton.

MR. EATON: For Pan American Petroleum Corporation, George W. Eaton, Jr. Pan American owns an interest in or operates 126 Basin-Dakota Pool gas wells. In addition, Pan American is also the owner of a large amount of presently undeveloped but possibly productive acreage in the Basin-Dakota Pool.

Now based on the Commission's experience, I am sure that it is aware that several companies generally support the use of a deliverability factor in a proration formula. There are also other companies who generally oppose the use of such a deliverability factor. Pan American does not fall into either category. As the Commission will recall, Pan American in the Jalmat case supported 100 percent acreage. We supported that allocation formula because all evidence indicated to us that 100 percent acreage in that pool was equitably distributing the allowable.

At the original hearing to adopt a proration formula for the Basin-Dakota Pool, Pan American supported the current

formula of 75 percent acreage times deliverability, plus 25 percent acreage. We supported that formula because we believed that such a formula would equitably distribute allowables in this pool. Based on our continuing study, we are firmly convinced that this formula is operating properly.

The primary purpose of any allocation formula is to give each operator an opportunity to produce his fair share of a pool's reserves. In this hearing we feel it's extremely revealing that not until this morning when in a rehash of El Paso's data -- none of the witnesses for those advocating a change in the current formula introduced any engineering exhibits to show that deliverability does not bear a direct relationship to reserves. Now several of these witnesses spoke generally of reserves, but only one single exhibit relating to this critical point was introduced by the advocates of a change. On the contrary, several witnesses for those operators who support the current allocation formula introduced many exhibits that dealt directly with this critical point; and they conclusively showed that in the Basin-Dakota Gas Pool there is a direct relationship between deliverability and reserves.

It is our firm conviction that the record made in this case conclusively shows that the application of Consolidated should be denied in its entirety.

Now with respect to the Commission's staff proposal relating to a minimum allowable for wells in this pool, it is

Pan American's recommendation that this be denied. The record is clear that such a minimum is not needed at this time and that the Commission cannot properly evaluate the effect of a minimum allowable until there is a need for such a minimum.

MR. MILLS: George Mills for the Atlantic Refining Company.

MR. PORTER: Mr. Mills.

MR. MILLS: The formula of 60 percent acreage plus 40 percent acreage times deliverability proposed by Consolidated Oil and Gas would be an improvement over the one presently in effect, but it's Atlantic's contention that deliverability should not be a factor in any field allocation formula.

Atlantic believes a proration formula should assure an operator the opportunity to recover an amount equal to the reserves underlying his tract. In our opinion, the present formula with its 75 percent acreage times deliverability factor does not assure this right. The deliverability of a well is dependent upon the manner the well is completed, stimulation treatments applied, and the effective permeability surrounding the well. Deliverability has no relation to reserves in place.

Therefore, when deliverability is a portion of a proration formula, a tract with a low deliverability and a large amount of gas in place will not be allowed to recover its fair share of the reserves.

It is for these reasons, or this reason, that Atlantic

believes that a proration formula should not include deliverability, and that a 60 percent acreage plus 40 percent acreage times deliverability would be less inequitable than the present formula of 25 percent acreage plus 75 percent acreage times deliverability.

MR. PORTER: Mr. McGrath.

MR. McGRATH: Phil McGrath with the United States Geological Survey. We would like to support the application of Consolidated Oil and Gas that the formula be changed.

MR. MORRIS: If the Commission please --

MR. PORTER: Does anyone else have a statement to make?

MR. MORRIS: I wish to make a brief comment.

MR. PORTER: Yes, sir.

MR. MORRIS: If the Commission please, I would like to make the position of the staff quite clear on the record. Mr. Utz in his testimony has gone on record as neither concurring with or opposing the application of Consolidated in this case. Where both sides of the controversy have been expressed with great ability on both sides, the Commission staff does not feel it advisable to take a position in the case.

Now I believe to clarify Mr. Keleher's last point in his argument, Mr. Utz in his testimony concerned himself only with the effectiveness of the 25 percent acreage factor in the present formula to provide a minimum allowable. He did not testify concerning the effectiveness or ineffectiveness of the present pro-

ration order to distribute the allowable on an equitable basis. That concludes my statement.

If the Commission please, the Commission has received statements of position from several interested parties in this case. In favor of the application, Tidewater Oil Company has submitted a statement favoring the application. Bruce Anderson Oil and Gas Properties supports the application. The Frontier Refining Company supports the application. Kay Kimbell, Oil Operator, supports the application. Amerada Petroleum Corporation supports the application. Humble Oil and Refining Company supports the application.

In opposition to the application in this case, statements have been entered by Pioneer Production Company, Western Natural Gas Company, Redfern and Herd, Inc., Southwest Production Company, and the British-American Oil Producing Company.

I offer these statements to the reporter and ask that they be included in the transcript of this case.

MR. PORTER: These letters of statement of position from these various interested parties will be made a part of the record. Mr. Stockmar.

MR. STOCKMAR: I sincerely appreciate having the last word as an opportunity for expressing to the Commission and to the staff our appreciation for their patience and serious attention to this long and hard hearing. I'm sure that all of us here would join me in expressing those thanks.

As to the legal point raised by others of the burden of proof, we submit that we have conclusively showed by a preponderance of the evidence that there is no general correlation between deliverabilities and reserves underlying the respective spacing units. Mr. Keleher, Mr. Seth, and Mr. Eaton all say that the Applicant has not submitted its own exhibits in evidence, but has used those of the opposition. This whole situation reminds me of the story of David and Goliath. These men are complaining that the stone that slew Goliath was Goliath's own data. We believe that the correct interpretation of that data, by using deliverability groups and not reserve groups, is conclusive.

I think we have shown that 100 percent deliverability is the equivalent of the rule of capture. The incentive provided by the rule of capture is not conservation. You heard a lot about a piece of the pie. Mr. Trueblood has testified that he wants his participants to get their fair share of the pie. As to the card game Mr. Howell wants to play, in the dealing of the cards, we do not want all aces. We just want to average seven.

I would like to make it clear, finally, that the position of the Applicant relates only to the Basin-Dakota reservoir, and not necessarily to any other reservoir in the State. We believe that each reservoir must stand upon the basis of the data available as to it.

As to the position of the staff, we sincerely hope that the staff will give deep and serious consideration to the testimony

and evidence developed this morning with an eye to reconsidering in favor of our application.

Again, thank you very much, gentlemen, for your patience and attention.

MR. PORTER: Anyone else have anything to offer in this case? The Commission will take the case under advisement and hope you get home in time for Easter, if you are going to go home; and if you don't, we hope you stay and enjoy it in Santa Fe.

(Whereupon, the hearing was adjourned.)

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STATEMENT OF HUMBLE OIL & REFINING
COMPANY TO BE ENTERED IN CASE # 2504

Humble Oil & Refining Company is not a producer in the Basin Dakota Pool but is the owner of oil and gas leases in the area and is concerned with the allocation formula adopted for the field.

There is no direct relationship between the reserves under a tract and the deliverability of a well or wells on the tract. Deliverability may be greatly affected by the method of completion and stimulation and by natural or artificial restrictions of the flow of the gas.

Acreage is a direct function of the reserves under a given tract and consequently is a more equitable and reliable parameter on which to base the allocation of the field production.

This case is an example of the fallacy of using deliverability in an allocation formula. Since there is no direct relationship between deliverability and gas in place under a proration unit, it would be surprising if the use of a deliverability factor did not contribute to migration between tracts and result in the violation of correlative rights.

We strongly urge that the Commission reconsider the advisability of using deliverability in an allocation formula.

HUMBLE OIL & REFINING COMPANY

/s/ Howard Bratton
HOWARD BRATTON

TIDEWATER OIL COMPANY

BOX 1404 HOUSTON, TEXAS

April 6, 1962

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Attention: Mr. A. L. Porter, Jr.
Secretary - Director

Gentlemen:

Re: Case 2504

This is regarding the subject application of Consolidated Oil & Gas, Inc. for an amendment to Rule 9 (C) of Order R-1670 for the Basin - Dakota Gas Pool, San Juan, Rio Arriba and Sandoval Counties, New Mexico.

Since I will be unable to attend this hearing on April 18, 1962, I wish to reiterate Tidewater's position as stated at the first hearing on this matter held March 14, 1962. Tidewater Oil Company concurs with Consolidated's application and hereby respectfully urges the Commission to revise the allocation formula applicable to this pool as requested by Consolidated.

Very truly yours,

TIDEWATER OIL COMPANY

/s/ John S. Cameron, Jr.

JOHN S. CAMERSON, JR.

JSC:mp
cc: Consolidated Oil & Gas, Inc.
1700 Broadway
Denver 2, Colorado
Attn: Mr. Robert B. Tension, Vice President

BRUCE ANDERSON
Suite 230
The Petroleum Club Building
Denver 2, Colorado

April 9, 1962

Oil Conservation Commission
Santa Fe, New Mexico

Dear Sirs:

As of this date, we are commencing the drilling of a well in the Basin gas pool of San Juan County, New Mexico, in Section 29-31N-13W.

We have locations for approximately five wells in this immediate area, but, under the present proration formula, we will only be able to drill one well which is drilled primarily to hold our lease. Both the Beard Oil Company, of Oklahoma City, who is joining with me in this well and myself feel that the present formula gives far too much credit to initial deliverability. In a fractured reservoir such as the Dakota, it allows certain wells and areas to unfairly drain the reserves of their neighbors.

While our wells are shut-in because of the formula, the gas from our lease migrates to other leases where they may have a better frac pattern but no better reserves to be giving them higher allowables.

Both the Beard Oil Company and myself join in earnestly requesting that you change the formula whereby it is based 75% on land and only 25% on deliverability. This would seem infinitely more fair to us. We make this statement before we have completed our first well, and, if we are one of the lucky ones who happen to get a frac pattern that would give us high deliverability, I would still stand by my statement that the present formula is definitely inequitable. Should you change the present formula, I am quite sure that we would go ahead with the drilling of our lease since the economics of our payout would then be present.

Sincerely yours,

/s/ Bruce Anderson

BRUCE ANDERSON

WESTERN UNION TELEGRAM

New Mexico Oil Conservation Commission 1962 March 13
Santa Fe, New Mexico

RE: Hearing of Case No. 2504 TN March 14: The Frontier Refining Company supports the application of Consolidated Oil & Gas, Inc. recommending an allocation formula for the Basin-Dakota Gas Pool based 60 0/0 on acreage and 40 0/0 on acreage times deliverability.

We believe the proposed formula will more equitably allocate allowable production from this reservoir, without continued discrimination against wells with equal original reserves but with lower deliverability.

The Fronter Refining Co.
By E. B. Granville
Superintendent of Drilling and Production

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WESTERN UNION TELEGRAM

New Mexico Oil Conservation Commission 1962 March 12
Box 871, Santa Fe, New Mexico

Pursuant to your March 14th meeting, Kay Kimbell should like to go on record as opposing the present allowable formula in the San Juan Basin. It is clear to see the fallacy in this formula when 10 0/0 of the wells get 40 0/0 of the total allowable. We feel the Commission should adopt a new formula which would permit the wells in the lower deliverability range to pay out. The majority of the operators are now harnessed with such wells. We recommend a new formula based on a higher acreage factor.

Kay Kimbell, Oil Operator
By: Sam W. Sims, Jr.

AMERADA PETROLEUM CORPORATION

P. O. Box 2040

Tulsa 2, Okla.

March 12, 1962

New Mexico Oil Conservation Commission
State Land Office Building
P. O. Box 871
Santa Fe, New Mexico

Re: Case No. 2504 - Application by Consolidated Oil & Gas, Inc., to amend the allocation formula in the Basin-Dakota Gas Pool

Gentlemen:

Amerada Petroleum Corporation, owner and operator of three wells and part owner of eleven wells in the area covered by caption cause, supports the applicant in Case No. 2504.

Although we oppose the inclusion of a deliverability factor in any allocation formula, we support the applicant's position here because he is asking for greater weight of the acreage factor in the amended order.

Very truly yours,

AMERADA PETROLEUM CORPORATION

/s/ H. D. Bushnell

By H. D. Bushnell, Attorney

HDB:1

cc: Consolidated Oil & Gas, Inc.

P. O. Box 2542
Amarillo, Texas

New Mexico Oil Conservation Commission
Santa Fe
New Mexico

Attention: Mr. A. L. Porter, Director

Gentlemen:

Pioneer Production Corporation presently operates twenty-two wells in the Basin Dakota pool and has varying interests in twelve other wells in the same pool that are operated by others.

We do not believe that on the basis of the testimony presented at this hearing there is any justification for a change in the allocation formula from that provided by Rule 9 (c) of Commission Order No. R-1670, dated May 20, 1960, as amended by order No. R-1670-c, dated November 4, 1960.

Accordingly, we recommend that the Commission deny the application of Consolidated Oil and Gas, Inc.

Yours very truly,

Pioneer Production Corporation

/s/ E. S. Morris

E. S. Morris,
Vice President

For Commission Records: Basin-Dakota Hearing

Case # 2504

Roy Jeter, Assistant Division Superintendent, on behalf of Western Natural Gas Company urges the Commission to retain the rules in the present form, believing that deliverability bears a reasonable relationship to recoverable gas reserves and that the present allocation formula furnishes a practical measuring device to permit each operator to produce his fair share of the reservoir.

WESTERN NATURAL GAS COMPANY

/s/ Roy C. Jeter

By: Roy C. Jeter

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3-14-62

New Mexico Oil Conservation Commission
Santa Fe, New Mexico

Re: Basin Dakota Hearing

Gentlemen:

As an operator in the Basin Dakota Pool we wish to be recorded as opposing a change in the proration formula at this time.

REDFERN & HERD, INC.

/s/ John J. Redfern, Jr.

April 20, 1962

Due to the length of this hearing, this is a statement from Carl W. Smith, General Superintendent, authorized to speak for Southwest Production Company. Southwest Production Company began its operations in what is now the Basin Dakota Gas Pool in the fall of 1959, and now operates some 70 Dakota wells, approximately 12 of which were drilled in 1962 and approximately 35 drilled in 1961. Southwest is the sole working interest owner in these wells, except where it was necessary to communitize or pool tracts owned by the leaseholders within the drilling unit.

Southwest did the major part of the development under the present proration rules, and has found them fair and workable, allowing us to produce our share of recoverable reserves.

If our sand development is so poor that we cannot drain the gas under our acreage, we do not feel that an offset operator with better sand can drain our gas from the same poor sand and that no violation of correlative rights occurs. Therefore we feel that the present formula giving much value to deliverability is equitable, and that no change in the formula should be made at this time.

/s/ Carl W. Smith

CARL W. SMITH.
General Superintendent
Southwest Production Co.

THE BRITISH-AMERICAN OIL PRODUCING COMPANY
Denver Club Building
Denver 1, Colorado

April 12, 1962

New Mexico Oil Conservation Commission
State Land Office Building
Santa Fe, New Mexico

Re: Case 2504 - Docket 12-62
Regular Hearing - April 18, 1962

Gentlemen:

The British-American Oil Producing Company will be unable to have a representative present during the hearing of Case 2504. Since our company operates wells in the Basin-Dakota Gas Pool, San Juan County, New Mexico, we wish to reiterate our position in this case. Our Company's position to all concerned is herewith quoted from our telegram of March 13, 1962, sent to the New Mexico Oil Conservation Commission on subject case which was to have been heard on March 14, 1962.

"As one of the many operators active in the Basin-Dakota Gas Pool, The British-American Oil Producing Company recognizes that under the present proration formula, the continuously decreasing well deliverability, coupled with the current limited gas market, results in well allowables that might be construed as inequitable. The fixing of a minimum and maximum allowable has some merit. British-American, however, does not feel that a change to a predominantly acreage proration formula or the instigation of a minimum or maximum allowable is justified for the following reasons:

1. Gas purchase contracts and pool development to date have been motivated by well deliverability, thus penalties should not now be inflicted by changing to a predominantly acreage proration formula.
2. Predominance of well deliverability in the proration formula is necessary to provide incentive and reward for employment of best well completion methods.
3. Any consideration in proration for minimum and maximum well allowables could conceivably encourage pool development on an unsound and an uneconomical basis, resulting in the drilling of unnecessary wells.

It is therefore urged that the Commission retain the current gas proration formula. In the alternative, should a change in the

proration formula be dictated, deliverability should continue to be the predominant factor. No maximum or minimum allowable limitation is recommended."

Respectively yours,

THE BRITISH-AMERICAN OIL PRODUCING COMPANY

/a/ Thomas M. Hogan
Thomas M. Hogan
District Superintendent

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

WE, ADA DEARNLEY and MARIANNA MEIER, Notaries Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings was reported by us in stenotype and that the same was reduced to typewritten transcript under our personal supervision and contains a true and correct record of said proceedings to the best of our knowledge, skill and ability.

DATED this 9th day of May, 1962, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My Commission Expires:

June 19, 1963

Marianna Meier
NOTARY PUBLIC

My Commission Expires:

April 8, 1964

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