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BEFORE THE

Oil Conservation Commission

SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO. 330-330A Special Hearing

VOLUME III

239 through 375

June 23, 1954

TRANSCRIPT OF PROCEEDINGS

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I N D E X

VOLUME NO. III

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Case 330-330-A
Morning Session, June 23, 1954

MR. SPURRIER: Mr. Foster.

By: MR. FOSTER: (Continued)

Q Mr. Cullender, when we recessed last night, you were explaining Exhibit 7. Will you proceed with your explanation of that Exhibit?

A Well, Exhibit 7 is a series of curves showing the effect of the different formulas on wells of different deliverabilities. It was prepared in order to compare the allowable of various size deliverabilities under the various formulas.

Q You say showing the different effect on wells of different deliverabilities, what do you mean by that?

A Well, a well having a one-million deliverability will have more allowable under certain formulas than others.

Q Or conversely have less?

A Yes, sir. Wells, say of two million deliverability, the same would hold except it would be a different formula on which they would have more allowable or less allowable.

Q Go ahead.

A I think a few points of intersection on these curves will be of interest and benefit in examining these different size wells.

Q If you are going to spot points of intersection on the curves, I will ask you to go to the board there and use a colored pencil to indicate the point of intersection that you are speaking of so that it will graphically appear in the record.

A The first point of intersection of interest is along the one hundred percent deliverability line. The 25 percent acreage formula,

if it is all right with everybody, I will just talk about these formulas with respect to the amount of acreage.

MR. SPURRIER: Just call them by their first--

A (Interrupting) I would like to refer to them all on the basis of acreage.

MR. SPURRIER: Yes.

A The 25 percent acreage formula intersects the one hundred percent deliverability line and delivera bility of 315.

Q What does that mean, 315?

A Deliverability of 315,000, the well would be assigned an allowable of 315,000 under the 25 percent acreage formula.

Q Okay.

A Under the fifty percent acreage, the figure is 557,000. Under the 75 percent acreage formula, the limiting deliverability is 733. Under the 100 percent acreage formula, the deliverability is 864,000, Taking the 100 percent acreage times deliverability line the 25 percent acreage formula intersects that line at deliverability of 1165. That means that under a well with a deliverability of 1165 will have the same allowable under the two formulas of 25 percent acreage and zero percent acreage. The 50 percent acreage formula will intersect that line at a deliverability of 1322.

Q That means what;I want it for the record.

A At that point, a well will have deliverability of 1,322,000 will have the same allowable under the 50 percent acreage formula as under the zero percentage formula.

Q When you say zero percent, you mean hundred percent deliverability?

A Hundred percent acreage times deliverability formula. The

75 percent acreage formula will intersect the 100 percent acres times deliverability at a deliverability of 1,435,000.

Q That means what?

A That means that at that point a well of that size will have the same allowable under the two formulas. At 1,518,000 the formula, a well of that size would be the same allowable under the same, under the 100 percent times deliverability acreage and zero acreage formula.

MR. GRENIER: What was the last figure?

A 1,518,000.

MR. GRENIER: Thank you.

A Now, taking the 25 percent acreage formula as the reference line, we already have its point of intersect of 100 percent acreage times deliverability; the 50 percent acreage formula, the allowable will be the same and deliverability of 1,486,000.

Q That means a well with a deliverability of 1,486,000?

A Will have the same allowable under the 50 percent as under the 25 percent acreage formula.

Q Yes.

A Then, taking the 75 percent acreage formula, deliverability of 1,584,000, the two wells will have the same or a well of that size will have the same allowable under both formulas.

Q When you say both formulas, which--

A (Interrupting) Under the 75 percent acreage and the 25 percent acreage formula.

Q All right.

A At a deliverability of 1,656 MCF, a well will have the same allowable under the 100 percent acreage formula as under the 25 percent

acreage formula. Taking the 50 percent acreage line as the reference line, the 75 percent acreage formula will intersect that line at a deliverability of 1,695,000. At that point a well having a deliverability of 1,695,000 will have the same allowable under the 75 percent acreage as the 50 percent acreage formula. At 100 percent acreage--and the 50 percent acreage formula there intersects at a deliverability of 1,759,000. Then, the last point will be the intersection between the 100 percent acreage formula and the 75 percent which is a deliverability of 1,831,000. The thing--

Q (Interrupting) Just a minute. What you have given us there is just mathematics, is it not?

A Yes, sir, that is just where the formulas work out to the same allowable for the same size wells.

Q That is the mathematical significance of that Exhibit?

A Yes, sir. Well, it is just worked out by mathematics. The significance of it is to me that you are not shifting too much allowables from small wells to large wells when you go to 100 percent acreage times deliverability formula as opposed to 100 percent acreage formulas as much as we are shifting allowables from medium sized wells to large wells as you go towards the 100 percent acreage times deliverability.

Q The mathematical significance of it is then that it shows what formulas will shift allowables from wells, is that correct?

A With respect to different sizes of wells.

Q With respect to different size wells, okay. Now, Mr. Cullender, will you explain to us first what Exhibit 8 is?

A That is a comparison of the percent of the total allowables assigned versus the percent of total wells to which that percentage

of total field allowable is assigned under the different formulas, and presents another comparison as to where the shifting of allowable occurs as between different size wells under the different formulas.

Q Is there any relationship between Exhibit 7 and 8?

A Not particularly, no, because this is on the percentage of the total wells as against percent of total allowable where Exhibit 7 has reference to individual well deliverabilities versus the individual wells allowable. I don't think that we need to go into the tables attached to Exhibit 8 other than to explain that each one of those pages is a tabulation of the data points that went into the curves shown on the curve sheet.

Q Yes. Would you tell us how you determined those data points?

A Yes, sir, just for explanation, the one hundred percent of the total allocation on the basis of acreage times deliverability. The allowable was calculated for each of the individual wells using the factors shown on Exhibit 6 and the wells were then arranged in the order of their allowables. In other words, the well with the smallest allowable was placed first, the well with the next allowable was placed second and they were arranged in that order through the 572 wells.

Q You mean by grouping them?

A First they were arranged in order of deliverability beginning with the allowable, excuse me.

Q Allowable, not deliverability?

A The well with the lowest allowable was the first. The well with the highest was the 572nd well. After the cards were arranged they were totaled for each 29 wells. The first line there shows the total for the 29 wells having the smallest allowable in the field

which is 5.07 percent of the total wells. The total deliverability is 941 and the total percent of allowable is 0.17. In this case deliverability was directly related to allowable whereas in the other tables we, the value of cumulative allowable was tabulated and then the percent of allowable arrived at. This curve reflects some information that has been on previous Exhibits. The first point is that 31.64 percent of the wells and that is the percent of limited wells under the 25 percent acreage formula.

Q Let's explain again at this point, what we mean by limited wells?

A A limited well is one in which the allowable is equal to the deliverability.

Q All right.

A When you go from the 25 percent acreage formula to the 50 percent acreage formula, the limited wells will have the same allowable and those wells above that deliverability will be given increased allowables as you put more weight on acreage. The point where the 75 percent acreage formula deviates from the 50 percent acreage is at 46.68 percent of the wells. Where the 100 percent acreage formula deviates from the 75 percent acreage formula is at 64.55 percent of the wells.

Q You are writing those percentage points on the chart, are you?

A Yes, sir, I am.

Q Is that 54 or 64?

A 64.55. Now, curve E is a straight line from about 60 percent of the total wells out to 100 percent of the total wells. The point that is to be made here is to compare what happens over in this end of the curve. Under the 100 percent acreage times deliverability

formula, ten percent of the wells in the field will have 40 percent of the total allowable of the field.

Q Will you repeat that?

A Ten percent of the total wells in the field will have 40 percent of the total allowable for the field.

Q Under what formula?

A The 100 percent acreage times deliverability.

Q All right. Now, relating that to the number of wells in the field, the 572, that means what? That is just interpretive, put it in the record.

A I am not sure--

Q (Interrupting) There are how many wells in the field?

A 572.

Q Ten percent is what? A 57.

Q 57 wells in the field would get 40 percent of--

A (Interrupting) The total allowable.

Q (Continuing)--of the total allowable of what?

A Of 320,000,000 cubic feet per day or any other.--

Q Or any other amount, but you are using the 320?

A Yes, sir, but the percentage would stay the same under the acreage times the deliverability formula.

Q All right.

A Curve B which is the 25 percent acreage formula, that same ten percent of the wells would then have 32 percent of the total allowable for the field. Curve C shows that that ten percent of the wells would have 25 and a half percent of the total allowable of the field. Curve D shows that the largest ten percent of the wells or the ten percent of the wells having the largest deliverability would

have 20 percent of the total allowable in the field.

Q That is the 50 percent formula?

A That is 75 percent acreage.

Q 75 percent acreage?

A Of the 100 percent acreage formula, ten percent of the wells would have 15 percent of the allowable. That is because if all the wells could make their allowable, the ten percent of the wells would have had ten percent of the total allowable. But the reallocation of this volume of gas that could not be produced by the lower capacity wells raised that to the 15 percent.

Q What is the mathematical significance of that Exhibit, Mr. Cullender?

A Well, I don't know whether there is any mathematical significance, it just is a comparison of the distribution of the allowable, and shows the amount of allowable, the percent of the total allowable that is assigned to the larger percent of the wells. Unless there is considerable variation in reserves, it shows that there is not, too much weight, should not be put on acres times deliverability.

Q But assuming that there is considerable variation in reserves, where would the weight be?

A Well, the more variation, possibly you might be entitled to more weight to acres times deliverability.

Q I wish you would just state for the record how you proposed to use these Exhibits that you have identified and explained in arriving at what, in your opinion, you consider a proper allocation formula for this field?

A Well, the Exhibits were designed to show the effect of the different allocation formulas with respect to different size wells

so that--

Q (Interrupting) When you say different size wells, what do you mean by that?

A Wells of different deliverability, different size deliverability.

Q All right.

A It was all done to get a distribution pattern of allowable under these formulas to be compared with the distribution pattern of reserves. Now, obviously, if the variations in reserves can only be three and a half to one, any allocation formula that would allow a variation greatly in excess of that ratio would not be a proper allocation formula.

Q Why?

A Because it would be impossible for that formula to assign allowable in relation to the reserves under the wells.

Q Stated another way, it would permit one well to produce more of its reserves than another?

A More than its share.

Q More than its share of the reserve.

A Now, the opposite of that is not necessarily true. Just because the ratio of variation among or as between allowables is the same as the variation as between reserves does not state that that is a good allocation formula.

Q That depends on what you mean by good?

A Yes, sir.

Q What do you mean by good?

A I wish I hadn't used the word, good.

Q I just want to get it in the record. I understand it.

A An ideal allocation formula is one,as we said, would permit each well in the field to produce its share of the reserves. A good allocation formula, I think would be one that would minimize any preventable drainage as between property. Now, I say that, because I don't think there is any allocation formula that we would arrive at that would actually assign allowables to wells in respect to the reserves under each of those wells. But if we--

Q (Interrupting) Right there, there are some that would more nearly do it than others, are there not?

A There are some that have the possibility of doing it while others don't even have the possibility of assigning those reserves.

Q Yes.

A Now, if we agree that we just actually can't accomplish the ideal situation then, the next best thing is to get as close to it as possible. If you prevent or minimize any preventable drainage then, at least the gas will stay under the acreage assigned to the individual wells and will be available to be produced at sometime. It may not be produced at the time and in the proportion on a current basis, that the reserves under that tract are related to total reserves in the field.

Q That would be due to factors other than the operation of the formula, wouldn't it?

A Yes, sir.

Q Such as the market outlet, the well had and things of that sort?

A Well, part of it could be layed on the formula if you didn't, unless you had an accurate formula.

Q I am assuming that you have an accurate formula.

A Well, I don't have an accurate formula though.

Q I know it isn't accurate. I mean it is as near as you can get under all the facts and circumstances?

A With the factors that I considered in the allocation formula?

Q Yes. So, what you have attempted to do here is to find a formula that would permit the wells to be allocated an allowable somewhat in relationship to reserves?

A Yes, sir.

Q And after considering this matter, what type of formula would you represent to the Commission that the Commission should adopt in prorating gas in the San Juan Basin?

A I would recommend the adoption of the allocation formula 75 percent to acreage and 25 percent to acreage times deliverability.

Q In your opinion, is that the allocation formula of all of those that you have considered that will most nearly, in your opinion, allocate the gas to the wells in relationship to the well reserves?

A Yes, sir, out of the five formulas considered, I think that formula will come nearest to allocating the allowable in relation to reserves.

Q Are there any other formulas that you could have considered that you didn't consider that would more nearly do it than the one you recommended?

A I don't know.

Q That you know of?

A Well, I didn't consider any other formulas in the study and there might be another type of a formula or another combination of formulas that would do a better job.

Q But if there is, you don't know about it?

A Well, I just am not able to judge them because I didn't make any study with respect to any other formulas.

Q You did study these and you have determined that the one you recommended would most nearly allocate the allowables to the well, somewhat in relationship to the reserves beneath the land?

A Well, it has the possibility of doing that.

Q Yes? A Yes, sir.

Q Now, I have one or two more questions here that I want to ask you. You have detailed to us here the factors,which you say, must be considered in weighting that deliverability, is that not true?

A Yes, sir.

Q It is also in this record that the factor of deliverability is not related to reserves, that is true, is it not?

A Yes, sir.

Q Now, I want you to explain to this Commission, if your effort is to find a formula that will most nearly as possible, allocate gas to wells in relation to their reserves, you have selected a factor in your formula to accomplish that purpose, that is not related to reserves?

A I tried to explain that to you last night and I never did get it done.

Q You mean I didn't understand it or you didn't explain it?

A I think you didn't have me under oath. When we started out to arrive at an allocation formula, the purpose was to, as nearly as possible, allocate or arrive at a formula that would distribute the allowable in relation to reserves. Now, the factors that effect reserves, at least the relative factors that we have to be concerned

with were area, pressure, thickness and porosity.

Q The term, area, you use there, you mean acreage?

A Yes, sir. By pressure, I mean stabilized reservoir pressure and by thickness, I mean effective thickness and by porosity I mean that, porosity.

Q Yes, sir.

A Now, unless we assume in the beginning that all the reserves be exactly equal under each tract, we have to consider something besides acreage.

Q Well, now, we know that doesn't exist, do we not?

A Yes, sir.

Q All right. So, you have to eliminate the factor of acreage?

A We have to use something other than acreage in our allocation.

Q Along with it?

A Along with it, yes, sir. We are not going to eliminate it. We come to the terms of pressure, thickness and porosity. Pressure of a sort can be obtained so that you can have an acreage and a pressure formula but that assumes that the thickness and the porosity are constant under each one of the tracts and that the only variation in reserve is pressure, obviously that is not the case.

Q We know that, do we not?

A Yes, sir. So, we come to the terms of thickness and porosity. The only factor that we have in respect to these wells that is in any way affected by thickness is the deliverability. If we say we are going to put acreage and pressure and deliverability in the formula, we still haven't taken care of porosity and I don't think that we really can take care of it. Now, if deliverability is affected

by pressure to some extent or to a rather marked extent, in fact, so, that the deliverability term could be taken as a variation in deliverability could be taken as representing a variation in pressure and thickness. On that basis, I think you can justify the use of the two terms, acreage and the acreage times deliverability and attempt to weight those terms in such a manner that they have the possibility of matching or of assigning allowables in relation to reserves.

Q You could do the same thing with pressure, could you not?

A Yes, sir, except you would immediately say that there was no variation in thickness or porosity in the field.

Q Yes, but pressure is a function of reserves?

A Yes, sir, or reserves are a function of pressure.

Q And you could have used the term, pressure, in arriving at an allocation formula to be applied in this field, could you not?

A Yes, sir.

Q What objections did you find to the use of pressure?

A The only objections that I had to pressure was that it was not a stabilized pressure. In many cases, wells of high deliverability pressure will retain to a stabilized pressure in a much shorter time than wells of low deliverability capacity. Now, the deliverability is dependent on the pressure. So, if the pressure is no good, the deliverability is no good.

Q I believe it is in this record that, if I am in error in this statement, I can be corrected. I believe it is in the record that it would take 180 days to stabilize some of those wells?

A I believe that was stated, yes.

Q Of course, --

A (Interrupting) You are talking about degree of stabilization?

Q Yes, the present pressures in the field, I believe are taken under time limit of seven days, is that right?

A Yes, sir.

Q And it is in this record that pressures in this field just won't stabilize over that period of time?

A Yes, sir.

Q And if it ain't in the record, what is your judgment about it?

A Well, from some of the pressure build-up data that I have seen, it definitely indicates that there is a long time stabilization period required to arrive at a stabilized pressure.

Q To stabilize these pressures, you have to shut in the wells, do you?

A Yes, sir.

Q Returning to your pressures and the comparisons of pressures and your comparison of deliverabilities, you are saying that if you can't get good pressures, why then, you can't get good deliverabilities?

A The deliverabilities can't be any better than the pressures.

Q So, you are faced with the situation, are you not, of just, well, if I can put it in the vernacular more or less of just spitting at a crack to determine whether you are going to take pressures or deliverability. Isn't that what you are getting down to?

A There is only three times you have acreage pressure and deliverability that you know about these wells. If you want to assume that reserves under each tract is exactly the same, then you don't need to consider anything but acreage. If you assume there is a variation then, you have to take into account something else and the

only thing left is pressure and deliverability.

Q You have chosen deliverability over pressure, why?

A Well, I would just have to be trying to justify what I did, to say why. Pressure could have been concerned. If I had considered pressure, I would try to arrive at the proper distribution between an acreage times pressure formula and an acreage times deliverability formula. Now, I didn't make that study and I don't know what the proper weight would be between acreage times pressure and acreage times deliverability. All I can say is that I didn't consider pressure, I considered only acreage and deliverability.

Q I am not asking to state what your results would have been or how you would have weighted pressure as compared to deliverability. All I am saying is that you just took the choice of deliverability rather than pressure?

A Yes, sir.

MR. FOSTER: I believe that is all.

GOVERNOR MECHEM: Any cross examination?

MR. GRENIER: I have a few questions.

By: MR. GRENIER:

Q Mr. Cullander, I believe that you and Mr. Barry testified that the factors to be taken into account in figuring reserves are acres, porosities, pressures, connate water content, and thickness of sand, is that correct?

A Yes, essentially, yes.

Q And that deliverabilities on the other hand are affected by pressure thickness, sand and permeability, is that correct?

A Yes, sir.

Q That would mean then that the factors of acres, porosity,

connate water content would have an effect upon reserves but not an effect on deliverability, am I correct in that?

A Did you say acreage porosity and connate water?

Q Yes, sir, they would be affecting only the reserve side of the picture as opposed to the deliverability side?

A That is correct except, well I think that is correct, yes.

Q And that the permeability factor would affect only the deliverability side as opposed to the reserve side?

A That is right.

Q And the pressure and thickness components would affect both, that is to say, would have an effect both on reserves and deliverability?

A Yes, sir.

Q Now, then in effect, what you are doing then, in computing reserves based in a formula containing in part at least a deliverability component, you must be assuming that the water, I mean that the water and porosity factors are fairly constant throughout the field, is that correct?

A Well, that would be an assumption, if you were wholly justified in using deliverability in your allocation formula. As I tried to explain awhile ago, the deliverability, some other term just has to be in the allocation formula.

Q Well, in the formula which you have suggested, acreage is a factor, so apparently you were weighting it by acreage. You were given some, there is nothing in there to reflect porosity and connate water content. So, apparently they have just been dropped out as not being of material significance in the case of this particular field?

A No, they have been dropped out because as far as I know there

is no way that I can evaluate them and take them into account.

Q The data is not available and therefore has not been put into the formula?

A As from well to well, that is correct.

Q Thank you. The same thing then would be true of permeability. We do not have detailed data from well to well which is why you left that out, is that correct?

A Permeability, as far as I know, doesn't have any effect on reserves.

Q That is right, we understand that and it effects only the deliverability?

A I didn't intend to consider permeability, as one of the factors that needed to be considered in arriving at an equitable formula.

Q All right. That, then is why you have come down to a formula which in effect, considers the three factors of acreage, pressure and thickness is the net effect of what you have done?

A Well, it considers only the factors of acreage and deliverability and deliverability is affected to some extent by pressure and thickness.

MR. GRENIER: That is all.

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

Q Referring to your Exhibit 6, Mr. Cullender, which is a tabulation of the studies which you made?

A Yes, sir.

Q I will ask you as to the method you used in computing the volumes of gas that wells with low deliverability would produce during the month?

A I assigned, I did not assign any well allowable in excess of its deliverability.

Q Well, in other words, on these low deliverability wells you took the deliverability and multiplied that deliverability by 30 and said that was the amount of gas that well would produce during the month?

A No, sir. The figures are on a daily basis. I just used the actual deliverability, assumed that it would--

Q (Interrupting) And your figures--

A (Continuing)--assumed--

Q (Interrupting) Excuse me, and you have taken,all these figures that you have computed here are based on the assumption that each day that we will be able to deliver its deliverability?

A Yes, sir.

Q Now, then, whenever these low deliverability wells are unable to deliver the deliverability that you have assigned them, there is a quantity of gas that has to be made up by wells with higher deliverability or the market wouldn't be served, isn't there?

A Yes, sir.

Q So, that the effect of giving acreage more consideration means that you bring more and more wells into the category of limited wells which can't produce in excess of the figures you have assigned them here?

A Yes, sir, the more weight to acreage, the larger number of limited wells that you have.

Q And there is the larger volume of gas that must be reassigned to wells with higher deliverability whenever one of these limited wells is shut in or for any reason can't make its allowable on that

day? A Yes, sir.

Q Now, then when you get to your factor of 75 percent acreage you then come up with 312 wells that have a deliverability of less than the allowable which is given to the field?

A That is less than the allowable would be, that would be assigned by the factors.

Q So, that more than 50 percent of the wells that you are considering in that column must produce their deliverability every day in order for these figures that you have here to be valid?

A No, sir.

Q Well, suppose that 50 of these 312 wells are off the line for ten days? A All right.

Q You have assigned the limit of their deliverability to those wells? A Yes, sir.

Q Where is the gas that those 50 wells are scheduled to produce going to come from?

A It is going to come from other wells that are capable of producing that gas.

Q That doesn't show in the computation that you have made here, does it?

A No, sir, but that does not make these figures invalid.

Q Well, to the extent that you haven't allowed or made any computation for the inability of 312 wells to produce every day this computation isn't accurate, is it?

A Well, you, I believe, are talking about the mechanics of day to day allocation. You are talking about 54 and a half percent of the wells are not going to be able to deliver all of their assigned allowable. Now, that 54 and a half percent of the wells has 30 per-

cent of the total allowable in the field. If you assume that 15 or 20 percent of that 30 percent is loss, you have six percent of your total allocation that has been lost to these limited wells. There, as far as I know, no allocation formula in effect anywhere that doesn't allow over and under production provisions by which the 69.84 percent of the market could be increased by the six percent from the 260 high capacity wells. There would be very little variation, I think, in the final answer even after the reallocation of the gas that you are talking about being lost.

Q Well, now, in practical operation, if you use the 75 percent acreage formula, you have got 54 percent of your wells that you would normally expect under production on?

A Yes, sir, which represents 30 percent of the total allocation.

Q So, to the extent that that under production from these wells has got to be assigned to the wells that have high deliverability, the very nature of production is going to force an allocation of more allowables to the high deliverability wells that you have shown here, wouldn't it?

A To a limited degree, yes, sir.

MR. HOWELL: That is all.

MR. SPURRIER: Anyone else?

MR. SMITH: Representing Stanolind.

MR. SPURRIER: Let's take a short recess.

(RECESS)

MR. SPURRIER: Mr. Foster.

MR. FOSTER: I would like to offer Exhibits 2, 3, 4, 5, and 6, 7, and 8.

MR. SPURRIER: Is there objection? Without objection, they will be admitted.

A On Exhibit 8, I made a misstatement. Mr. Foster asked me if I said it right and I said yes, but I didn't. Where Curve E deviates from Curve D is at 54.55 percent of the well and I said before it was 64.55 percent of the wells.

By: MR. SMITH:

Q I believe you referred to your Exhibit 8, that approximately 40 percent of the wells, you have, the lines B, C, D and E coinciding so that with respect to all the formulae except the one that is 100 percent deliverability, 40 percent of the wells in the field would not be affected by the adoption of either or any of the three other formulas?

A That is not quite correct. At 31.64 percent of the wells will not be affected to any greater extent by the 25 percent, by the 50 percent acreage formula than they would by the 25 percent acreage formula. The next point is at 46.68 and beyond that point the 50 percent or the 75 percent acreage formula would not affect the well below that point any more than would the 50 percent formula. Up at 54 and a half percent, the 100 percent acreage formula will not affect any more wells and by affect, I mean will not change the allowable of these smaller wells any more than the 75 percent of the acreage formula.

Q Now, Mr. Cullender, referring to Phillips' Exhibit 3, I will ask you to look at it and at the 4,000,000 deliverability group, where is the breaking point on that?

A There was one well had deliverability between 3,600,369. The next well in that order was somewhere between 5,400,000 and

5,499,000, so, the breaking point would come there at between the 3600 and the 5400 group.

Q You consider that the 342 wells that you had deliverability tests on are representatives of the wells in the field?

A That is the only assumption, I think that I could make that they were fairly representative, that probably the distribution wouldn't be changed too much more by the additional wells.

Q Referring again to the breaking point, which is indicated by the pencil mark on Exhibit 3. How many wells are listed there as having a deliverability higher than 4,000,000?

A Ten, I believe.

Q Ten. What percent of the total of 342, is that?

A It is about three percent.

Q So, that you find 97 percent of the wells in a catagory of having deliverability less than 4,000,000 per day?

A With respect to the actual test that was right. Now, I think including the deliverability tests the estimated deliverability test, I should be able to find what percent of the wells were above 4,000,000 as actually used in the study.

Q I am asking you with respect to this particular Exhibit up here.

A Yes, sir, that is right.

Q Let's refer to Phillip's Exhibit No. 7.

A Yes.

Q We find that on your recommended formula which is 75 percent acreage and 25 percent deliverability that the point 59 which all wells receive an allowable. In other words, the excess production is to be allocated to other wells is at what point?

A 557,000.

MR. FOSTER: No, no.

MR. GRENIER: 733.

A Oh, at the 75-25 formula, it is 733,000.

Q 733,000 cubic feet per day?

A Yes, sir.

Q At 4,000,000, how much of an allowable do you have on that formula?

A You mean what is the allowable of a well with 4,000,000?

Q What do you get with the 4,000,000 deliverability?

A You would get 1,120,000 cubic feet of gas per day.

Q I wonder if you could calculate for me the ratio of the additional allowable to be received by the 4,000,000 well over the ratio using the bottom point, the breaking point where it leaves the curve there?

A It would be 1120 divided by 733. Can I accept his figures or do you have a figure?

Q If you want to look at them.

A 112.

Q That is right. 112, is the ratio 1.55 to 1?

A You mean is 733 divided into 1120 1.55 to 1?

Q Is the ratio of 1.55 to 1, the ratio of increased allowables?

A I believe that is right.

Q I believe you adopted Mr. Barry's testimony.

MR. FOSTER: We didn't adopt it. The record speaks for itself. If you want to testify that he adopted it but I object to your doing it.

MR. SMITH: Well, let the record speak for itself.

MR. FOSTER: I believe that is fair.

Q You did use Mr. Barry's studies as your basic assumption for your calculations, didn't you?

A Yes, sir, not for the calculations with respect to the allowables under the different formulas but in comparing the allowables into the different formulas, I compared them to his reserves.

Q Do you consider that his estimate of disparity and reserves could be on the order of three and a half to one to be correct?

A Yes.

Q Then, your formula that you are recommending only gives weight, one and a half to one whereas by your own witness's testimony there is a disparity of three and a half to one in so far as the assignment of allowables to 97 percent of the wells in the field is concerned?

A In so far as the ratio of allowables of 4,000,000 at the point of 4,000,000, the ratio is 1.55 to 1.

Q I will ask you, if you can make the similar calculation for the formula 50 percent acreage and 25 percent acreage and 75 percent deliverability and see how those ratios work out?

A Well, I read this allowable at 4,000,000 from, at 1,430,000 cubic feet of gas a day. I come out with the figure of 196, does that check with you?

Q I believe our figure is a little higher. 2231, it is 199.

A I got 196.

Q 196 to 1?

A I divided by the 733 again. I will divide by the 557 which is, I presume the figure you wanted me to divide by and I get 257.

Q In other words, roughly on the order of two and a half to one?

A That is right.

Q With respect to the 75 percent deliverability and 25 percent acreage, can you calculate that for me?

A I read that to be 1820 which would be divided by 315, that comes out to be 578.

Q 578 to 1? A Yes, sir.

Q In view of the testimony of Mr. Barry, did the reserves on the order of three and a half to one just based on sand thickness alone and without giving consideration to variances in connate water and porosity, do you not consider that the assignment to 97 percent of the wells in the field of an additional allowable on the order of 1 and a half to 1 does not do equity to the people who have the higher deliverability wells?

A No, sir. I believe that that is it because there are larger wells in thefield than the 3,000,000 feet, those are only three percent of them.

Q Wouldn't the ratio remain more constant even if you estrapolated your curve?

A I beg your pardon. Do you mean if we go on out here?

Q That is right.

A No, sir.

Q But with respect to 97 percent of the wells in the field, however, the statement would still hold true?

A Well--

MR. FOSTER: (Interrupting) Let him answer the question.

MR. SMITH: I hadn't answered it.

MR. FOSTER: You said, wouldn't it hold true? You asked him the question.

MR. SMITH: Shall I start over?

Q With respect to 97 percent of the wells in the field, we have these various differentials that we have just been discussing. Now, referring to Phillips's Exhibit 8, I will ask you to locate on this chart the point at which 97 percent of the wells falls on line D?

A That falls at, that shows that three percent of the wells received 8 percent of the allowable.

Q So, that the amount of allowable assigned to the wells in excess of 4,000,000, would only amount to 8 percent of the total allowable nominated or permitted by the Commission, is that correct?

A Yes, sir. That three percent of the wells would get 8 percent of the total allowable under 75.25.

Q I believe you testified yesterday that you are familiar with the proration formula in the Hugoton field of both Kansas, Texas and Oklahoma?

A Yes, sir.

Q What is the proration formula in each of the three states?

A In each of the three states. The allocation formula in Guymon Hugoton Field in Oklahoma is 100 percent acreage times deliverability. With the deliverability being defined under the pressure conditions equal to 80 percent of the average pressure of Oklahoma and Kansas Hugoton Field.

Q Is that the same formula adopted in all three states?

A No, sir. Kansas Hugoton and Oklahoma Hugoton are the same deviation. They run the test in a different manner in that they take the shut-in pressure after the test in Oklahoma and before, the test in Kansas afterwards and in Oklahoma before.

Q What about Texas?

A Texas Hugoton Field is on 100 percent acreage times deliverability with the deliverability being defined at 80 percent of the individual wells shut-in pressure by the application of a correlation slope depending upon the rate of flow and the pressure pull off.

Q So, in all three states, one of the basis propositions is deliverability times acreage as the concept on which they prorate gas?

A That is right.

Q Now, in calculating your formula or in devising your formula, there is only one variable as I understand it, that is the deliverability?

A That is right. There is small variation in acreage, there will be as between wells but I think it is insignificant in arriving at the total.

Q For all practical purposes, the only variable factor that you suggest is deliverability?

A Yes, sir.

Q Would you say that using that calculation means that deliverability has some relationship to the reserve?

A I think that I explained why I used deliverability before, I don't believe that deliverability is related to reserves.

Q It is your opinion that the proration formula should be based on reserves?

A Yes, sir.

Q Then, as I understand it, you are recommending arbitrary action to the Commission?

A Mr. Foster accused me of the same thing earlier today. I

29 tried to explain at that time why I used deliverability and there is nothing I can do about it, that is the reason.

Q One other question. Mr. Barry testified yesterday that he selected core samples from 8 wells, I believe?

A Yes, sir.

Q Do you think that sampling of 8 wells with reference to 704, would afford an adequate sample for accuracy?

A I think Mr. Barry did the best job he could do under the circumstances.

Q Do you still think you could rely completely and accurately on such a small sample?

A In the absence of anything else, I don't know what you could rely on.

Q That was the best he could do under the circumstances?

A Yes.

MR. SPURRIER: Anyone else? Mr. Reeves.

By: MR. REEVES:

Q In the interest of saving time, I am going to try to confine this to questions on the basic underlying factors in determining the formula. I believe you testified that the formula is one that should allocate in proportion to the reserves under the well?

A Yes, sir.

Q I believe you also testified that you were dependent upon the estimate of reserves based on only sand thickness, three to 1, later corrected three and a half to one?

A I testified that in evaluating the different formulas that I relied on that, I relied on Mr. Barry's estimate of the variations in reserves.

Q I believe it is also clear that the estimate of reserves was based on a blanket sand with a ten percent porosity through the entire field?

A I believe that was the testimony, yes, sir.

Q As a matter of your opinion, do you consider it likely that in that whole area inside that dark line that porosities are uniformly ten percent?

MR. FOSTER: If the Commission please, the witness didn't qualify as a reserve engineer. He took the figures that were supplied by the reserve engineer and made his computation on that basis. I don't believe that is quite in order to interrogate him on that matter. If he wants to interrogate Mr. Barry, we will return him to the stand. I think it will save time and get the job done a lot better.

MR. REEVES: Well, I will rephrase my question.

Q Your basis was based upon an assumption that had uniform ten percent porosity throughout the entire pool area?

MR. FOSTER: Based on Mr. Barry's testimony, what ever that was. That is what he said. I don't recall what the record was on that.

A The study that I made was based on the deliverability test of the wells in effect of the allocation formula in evaluating the formulas relied on the information that Mr. Barry testified to.

Q Well, I believe in the testimony--

A (Interrupting) Sir--

Q (Interrupting) I believe in the testimony yesterday the record will speak for itself but there was a blanket sand with ten percent porosity and 30 percent connate water?

A I believe that is right but--

Q (Interrupting) If you take porosity into account and there has been testimony introduced to show it varies, connate water varies the testimony indicates 435 to 1; on porosity, four and a half to one which Mr. Barry didn't agree with his testimony, two to one on connate and 1.18 would come to 46. It is quite obvious that there is some variation. Let's cut it in half, if those factors which it has been admitted, determined reserves then a formula based on three and a half to one isn't accurate, is it? It doesn't result in a basic formula?

A Are you asking me to assume that the variation is on the order of 20 to 1, when I answer that question, or do you want me to say that I think it is 20 to 1?

Q No, I wouldn't expect you to say you thought it was 20 to 1. If it was 20 to 1, your formula would not be applicable and would not give equitable results?

MR. FOSTER: We admit that.

A I wasn't going to admit that.

MR. REEVES: Who am I questioning, you or the witness?

MR. FOSTER: It is obvious here that if the ratio of our reserves is too far out of line, then our formula is wrong. There isn't any argument about that.

A Well, I--

MR. FOSTER: (Interrupting) It is too far out of line. 20 or 30 or 40 or 50 based on three and a half to one obviously there is something wrong with the formula.

MR. SPURRIER: Let's see what the witness has to say.

A The only time that you know an allocation formula that

obviously will not work is when the possible variation in the assignment of allowable under that formula is in excess of the possible variation in reserves. Now, the very fact that you get the same answer, you get the same variation in both of them doesn't make a good formula. Now, then the fact that the variation that can be assigned by allowable is less than the variation that could exist in reserves does not make that within itself a bad allocation formula. It would certainly make you investigate some other formulas but it doesn't make it a bad formula.

Q But if we are wrong on the reserves under the leases, why I don't believe that you would recommend the formula that you recommended, would you?

A If Mr. Barry had come up with the figure of ten to one, I probably would have given a little more weight to deliverability.

Q That is the point I wanted to make.

A That is the point you want?

Q I don't want to take up too much time. I would like to make this point. In other words, this formula, there is 312 wells that to all intents and purposes are exempted from proration?

A Under the 75 - 25 formula there are 312 wells that have limited allowables, by that their allowable is limited to their deliverability. I wouldn't say they were exempt from proration. They don't have the physical capacity to get their share of gas.

Q Well, dry hole doesn't have its share--

A (Interrupting) It will not be in the allocation formula either.

Q In other words, there are 312 wells that are not going to be curtailed below their deliverability to all intents and purposes, no prorationing?

A I don't call that no prorationing, I call it allowable, that is limited to the physical ability of the well to produce below that wells share of the gas.

Q Those wells are not prohibited from selling to the market all of the gas they can produce?

A That is right, yes, sir.

Q 260 wells, only 45 percent are the ones that are taking the entire curtailment under what they can deliver, aren't they?

A Yes, sir, that 45 percent of the wells would take, would be unlimited as to deliverability which represents 70 percent of the total production but if a cut back came and the allowable was decreased then, some of these 312 wells would drop down into your limited category and the limiting deliverability would be smaller.

Q Well, I have one other point here that I think is rather important. Your figures are based on deliverability of 562,000,000 against a market of 320,000,000, I believe?

A Yes, sir, I think that is right.

Q I, also, believe it is testified there are now 704 wells or 23 percent more than your figures were based on?

A That is right.

Q The market still remains the same, does it not?

A I presume that it will for awhile.

Q Let's assume those wells were the same average as the others you have 692,000 cubic feet of deliverability?

A Yes, sir, roughly.

Q The market is 57 percent of your 592 or 46 percent of the deliverability of 692,000,000, isn't that correct?

A Well, I don't know whether it is correct or not. It seems

in the proper order.

Q The point that I am leading up to is this question, with that decrease in the market as compared to deliverability, wouldn't that tend to throw a considerable number of wells, higher percentage of wells into those that to all intents and purposes are not prorated under your formula?

A No, sir.

Q Well, there seems to be a difference of opinion there?

A Yes, sir, if I understood--

Q It is a matter of mathematics. We haven't time, unless you care to.

MR. SPURRIER: I would like to.

A As I understood the question, you said that would not the addition of these additional wells add to the market and/increase the proportion of the wells in the limited category?

Q That is right.

A I said no. Now, then, what will happen is that this straight line that you see on Exhibit 7, 75 percent acreage and 25 percent acreage times deliverability will slide down to this point, to some point lower than it is which will then make the limited wells, say for instance be 557, now, if the limit were 4 and 733 and it is now 557 and we assume that the new wells are going to have the same percentage of distribution as the old wells, it would be a smaller percent of wells in the limited category.

Q Let's see, you divide up 25 percent of the gas on the total number of wells, don't you?

A Yes, sir.

Q Then, you take 75 percent of whatever is left of 25 percent

deliverability, don't you?

A Yes, sir.

Q I think you will find that the tendency is contrary, however, I could be mistaken, Mr. Cullender.

A If you assume that the new wells, let's look at it this way, let's assume that we decrease the market on the present wells I have in my study to about 275,000.--

Q Yes

A We will say.

Q Yes.

A That will then slide this curve down, which throws some limited wells over into the non-limited category. Now, if this market increases, it will go up.

Q In other words, if the market goes up, you throw more and more wells into the non-prorated situation?

A That is right.

MR. FOSTER: No.

A Non-prorated, all right then. They are in a limited category.

Q The limited wells then?

A Yes.

Q Those in which proration causes them no distress?

A No, because they have their ability to deliver their share of the gas, that is right.

Q I think in the interest of time I have established the primary things. I have several others here. Thank you, Mr. Cullender.

MR. SPURRIER: Anyone else?

MR. SELINGER: Selinger for Skelly.

By: MR. SELINGER:

Q I would like to ask the witness a few questions. Mr. Cullender, you said I believe/on direct examination that you have studied only these five plans of formulas, is that correct?

A Yes, sir.

Q And that you had not considered any other formula?

A I made no study on any other formula.

Q Did you consider any other formula with out studying it?

A Well, I kind of thought about all the formulas that I ever heard about, but I didn't seriously consider it.

Q You limited your study from the data you have to these five plans?

A Yes.

Q I believe when you made your remarks about an allocation formula of acreage times pressure, you had one objection to the pressure part of the formula and that you followed that up by saying the same objection to the pressure part, was also the same objection to the deliverability part of the formula, is that correct?

A Yes, sir.

Q By that you mean that in order to get your deliverability you must get your pressures?

A Yes.

Q You also said in commenting on the/allocation formula of acreage times pressure that such a formula assumed that the porosity and thicknesses were equal, is that correct?

A Well, they don't take into account any variation in thickness or porosity.

Q Which is another way of saying that it is based on the assumption of the porosity and thicknesses being equal throughout the

field, isn't that the same thing?

A Well, not quite, I don't think but--

Q But, at any rate, it doesn't consider those two factors. Let me ask you this, Mr. Cullender, doesn't your pressure decline with production reflect your porosity and thickness?

A It reflects the rate of decline of the reserves, which are in turn affected by porosity.

Q Would your answer then be to say yes or maybe or no?

A No, they don't represent the porosity and thickness, they represent the decline in pressure, represents the decline in reserves.

Q Which, in turn, is a reflection of porosity and thickness?

A Porosity and thickness are two factors that enter into the reserves.

Q I gather then, that the decline in pressure indirectly reflects your porosity and thickness then by the connection with the decline in reserves?

A Through that kind of a connection, I would go along with that.

Q Under your allocation formula of 75 - 25, will you tell the Commission what is the spread of allowable between the lowest proratable well and the highest proratable well?

MR. FOSTER: Using the 320 market demand?

MR. SELINGER: He can use under his plan. He assumed 320, I assumed that is what he is going to base his answer on. Let him make his explanation as to what market demand he used?

A I think probably we are going to have to look at Exhibit 6 to go along with this.

Q Doesn't that Exhibit just give averages? You explained to Judge Foster and the Commission that you took the lowest deliverability

starting with Well No. 1, clear on down to 572, so you necessarily must have indicated the deliverability, the initial potentials and the allowables of all the wells?

A That is correct. I just wanted to get oriented here on Exhibit 6. I mean, give you your answer.

Q Yes.

A But if you take the limited well under the 100 percent allocation to acreage that is the only deliverability that is prorated under all of the formulas that were considered. Now, I have the ratios worked out with respect to that 864 and a well with a deliverability of 15,909,000 and that is the figures that I have here.

Q All right. Your deliverability did go up to 17,000,000 but you are going to use your 15.9?

A Yes, sir.

Q All right, go ahead.

A On the basis of 100 percent acreage ratio is 1 to one. Ratio of 75 percent acreage 25 percent deliverability, the ratio is 3.4 to 1. Ratio of 50 percent acreage to 50 percent deliverability, the ratio was 7.0 to 1. Under the 25 percent acreage, 75 acreage times deliverability the ratio was 12.4 to 1. Under the 100 percent acreage times deliverability, the ratio was 18.4 to 1.

Q Would you garner out of that varied answer the particular answer that I wish with respect to what is the spread of the proratable minimum and proratable maximum under your recommended plan?

A I will have to do some figuring. The minimum is 733. I calculate the allowable under 75 percent acreage times 25 for a well having deliverability of 15,909,000 cubic feet of gas a day

which we referred to the 733 is on the ratio of 3.22 to 1.

Q Your ratio then of the proratable wells is in the neighborhood of 3.22, is that correct?

A Yes, sir.

Q Now, I believe you stated that you were considering an allocation formula that you felt it should approach the reserves and also in the previous answer you gave that the allocation should also attempt to minimize drainage across property lines, is that right?

A Yes, sir.

Q When you say drainage in the reservoir, what do you mean, what causes that drainage?

A Some wells being produced at a faster rate and causing the pressure to decline around some wells more than around a surrounding well.

Q Am I correct in saying that the pressure gradient causes the drainage across property lines?

A Yes, sir.

Q Would it be correct to say that the more you minimize drainage the more ideally you approach the recoverable reserves of each operator's property?

A Yes, sir.

Q Then, an allocation formula should attempt to equalize pressures in the reservoir as nearly as practicable?

A It should attempt, it should attempt to prevent any large differences in pressures.

Q But it is, the objective of that pressure gradient is to become overcome as nearly as possible by attempts to equalize it as nearly as possible?

A I think so, yes, basically.

Q How does deliverability in itself prevent or minimize such drainage?

A I don't believe it does.

Q What factors in deliverability do minimize drainage?

A Well, there aren't any factors in deliverability that have any effect on pressure.

Q Will your decrease in deliverability result from the decreased pressure resulting from production?

A Deliverability will decline, yes, with the decline in pressure.

Q Therefore the only factor which prevents or minimizes drainage is the pressure decline or pressure equalization?

A Yes, sir.

MR. SELINGER: I believe that is all.

MR. SPURRIER: Anyone else?

MR. JONES: Trevor Rees-Jones representing Delhi.

By: MR. REES-JONES:

Q Mr. Cullender, the very first part of your testimony you referred to this isopachus map, I believe you pointed out some examples of wide variations within a section in deliverabilities, I believe you had a ratio of 4.5 or 6 to 1, is that right?

A I think so.

Q What was the reason for pointing those out?

A Mr. Foster asked me to point out some differences that were shown on the map and I got up here and I looked for some purple colors next to some red colors and I saw those two sections and I pointed them out.

Q Well, perhaps, I needn't go any further. I wonder, did that have any bearing on your going from there on into a proration formula?

A Not those two particular wells.

Q But I mean the fact of variances, where did that fit into your testimony which led up to your proration formula?

A The fact that there is not appreciable variation in thickness and you have large variations in deliverability entered into the amount of weight that I put on acres times deliverability or that I considered to be appropriate to put on acres times deliverability?

Q Yes, sir. Directing your attention to Section 21 of Township 30, North, Range 9 West.

A 30 North?

Q Yes, Range 9, West, Section 21. We have a well on the west half there, is that correct, which shows a low deliverability?

A Yes, sir.

Q You have one in the east half which shows a high deliverability?

A Yes, sir.

Q Are you aware of the fact that the well in the west half being the Delhi Florence Federal Number 1 well is completed only in the Cliffhouse formation? A No, sir.

Q If that statement is true, wouldn't you normally expect that the deliverability of that well would be much lower than the well in the east half, if the east half well is completed in the entire Mesaverde?

A I assume that the well in the west half was completed to the best of the ability of the operator to complete it and that is his highest deliverability.

Q Are you aware of the fact there are a number of wells in Township 30 North, Range 9 West which is in the best area of the Mesaverde that are completed only in the Cliffhouse formation?

A I was not aware of that situation, no.

Q Would you like for me to read the five names and locations so that you can check them?

A If you want to.

Q Florence Federal 3-8 well located in south west quarter of Section 13.

A Yes, are we only in 30 and 9?

Q Yes, sir, only 30 and 9. South west quarter of section 14, Florence Federal 3-8 well. Is there a variance between that well and the one on some tract adjacent to it?

A Yes, sir.

Q The next well is Florence Federal 1-13 north east quarter of Section 18.

A North east quarter of 18, okay.

Q The next well is Florence Federal 1-6 south west quarter of 23.

A South west of 23?

Q Yes, sir. The next well is Florence Federal 2-10 in the north east quarter of Section 30?

A Okay.

Q If it is true, Mr. Cullender, that the wells I have given you along with the one in Section 21 are Cliffhouse completions only then, couldn't you assume that the deliverability would be greater had they gone straight though to Point Lookout?

A I assume not because if the operator had thought they would have been better wells, I see no reason for--

Q (Interrupting) You are relying strictly on what the operator did at the time that the well happened to be drilled?

A I am relying strictly on the variation in deliverability, as from well to well.

Q It is your testimony to compare a well completed on the Cliffhouse formation to one completed in the entire Mesaverde formation?

A If we are discussing deliverability as a criteria we have no alternative but to do that.

Q Mr. Barry and you like to average connate water and porosity but you don't like to average out of sand thickness, if one well is completed only in the Cliffhouse and the rest are completed in the entire Mesaverde, is that correct?

A I don't think that there is any relation between the first part of the question and the last. If you repeat, maybe I can.

Q Well, forget it. The only point--Mr. Cullender, do you know of your own information that generally these wells completed only in the Cliffhouse have about one fourth of the initial potential of wells in the same area completed in the entire Mesaverde?

A No, sir.

Q You do not know that? A No, sir.

MR. REES-JONES: Thank you, sir.

MR. SPURRIER: Anyone else have a question of Mr. Cullender?

MR. UTZ: Yes, I have a question or two.

By: MR. UTZ:

Q Mr. Cullender, in relation to what Mr. Jones was just asking you, do you believe that a well completed in Cliffhouse could also drain the point, Lookout?

A Let's see, the Cliffhouse is, it would be very minor if at all. It might through the fractures in the Menefee, might

get some of the gas, yes, sir. It would be more likely to go to an adjacent well completed in the Point, Lookout.

Q In other words, it is possible for the Cliffhouse completions to drain the whole Mesaverde section, is that right?

A Given time, yes.

Q And if you wanted to increase the deliverability, you can do so by recompleting, can't you?

A I assume that if there is a bunch of wells that are just drilled half way through the formation with the deliverability allocation lower than the offset wells drilled through the formation, somebody would be on to those pretty quick.

Q In other words, he has the opportunity to recover his reserves?

A Without knowing the conditions of the well, I would say that probably that he did. I don't have any idea as to the condition that the wells are in.

Q I believe that you stated,Mr. Cullender, that there were no, as far as you were concerned, there was no relationship between deliverability and reserves?

A Yes, sir.

Q Even if a well had ten times the deliverability, you would assume that it had no more reserves?

A Well, it would depend entirely on what the factor was that contributed to the increase in deliverability. If it was permeability that did it, there would be no increase in reserves, if it was thickness, that did it, there would possible be an indication that that well in fact, if thickness was the cause, it would certainly follow that the reserves were higher in the other well. But since

I don't know how much of that increased deliverability is due to permeability and how much is due to thickness, I hesitate to say that the deliverability, increases in deliverability indicates an increase in reserve.

Q Would it, the higher deliverability well could have more reserves?

A Could have.

Q It could also have less? A Yes.

Q If you can, Mr. Cullender, I would like to know what your recommendation for formula would be if the reserves ratio was, say, 1 to 5 instead of 1 to 3½?

A Based on the study I made, I think that I would give more weight to the deliverability, possibly in the neighborhood of two-thirds of the allocation to acreage and one-third of it to acres times deliverability.

Q By the same token now, had the ratio been 1 to 10, would you have an opinion on that?

A Yes, sir. I stated when Mr. Foster asked me what allocation formula that I would recommend, I stated that the fact that the variations in allowable, the possible variation in allowable exceeded the possible variation in reserves indicated a bad formula. But that the fact that the variation in allowable, the ratio of the variation in allowable was in line with the variation in reserves did not within itself, make that a good formula. It only indicated that it had the possibility of being a good formula. I think in any allocation formula you need some kind of a stabilizing influence that will remain fairly constant, year after year, because assuming that you can accomplish the purpose you set out to accomplish, you

produce the wells in exact proportion to their reserves. Then, each year, their reserves will be in the same proportion that they were initially and their allowable should be in the same proportion year after year. If you put too much weight on a factor subject to the error that deliverability is subject to well conditions, the effect of stabilized pressure, and so forth you are going to have a large variation in allowables as between wells from year to year as you conduct your annual tests. Therefore, when I started getting up very high on the weight of acreage times deliverability, I would start considering putting the brakes on.

Q If the formula that you recommended, 75 acreage to 25 acres times deliverability is equitable for a reserve ratio of 1 to 3½ but that it made the problem of the pipeline company, if you put an additional weight and made it impractical/ we will, say for the pipeline company to gather that gas under that type of formula, how much consideration or weight would you give to the pipeline problem?

A In recommending the formula to the Commission, I would give no weight to it, the weight would have to be put on the allocation formula by the Commission if they have a right to do. I wouldn't include it in my recommendation as to the proper formula to allocate the gas.

Q In other words, you, in other words, to make the pipeline get the reserves out of the field, you would leave that up to the Commission?

A Yes, sir.

MR. UTZ: I believe that is all I have.

MR. SPURRIER: Mr. Macey.

By: MR. MACEY:

Q Under your proposed formula assuming that you have a six months proration period, do you know of any reason why the pipeline couldn't gather the gas as it would be allocated under your formula?

A Not with proper controls in your rules with respect to over and under production and proper balancing rules to provide a total allowable at all times, equal to the market demand.

Q One other point on your, do you think that this Commission should consider economics in so far as economics pertain to the pay out of a well in allocating the gas in the Blanco-Mesaverde Pool?

A To the extent that such considerations constitute a waste prevention method due to the abandon of wells. I think they are well within their right.

Q Do you think economics, an economic factor should be considered?

A With respect to the prevention of waste to not causing the premature abandonment of gas wells to that extent, I think it is a proper matter.

Q Do you think there might possibly ought to be a minimum allowable instituted?

A I don't think it is necessary.

Q Your formula--

A Under the 75 - 25 formula.

Q Have you made any calculations as to what the rate of time of pay out would be on a well drilled on the average well drilled in the Blanco-Mesaverde Pool with an allowable of 2,500,000 per day?

A No, sir.

Q If that pay out were within approximately one year, do you think that is a reasonable pay out as far as the quickest pay out would be in the field?

A I think that we put a lot of our money into projection that don't pay out that fast.

MR. MACEY: I think that is all.

MR. UTZ: I have one more question if I might.

By: MR. UTZ:

Q From what I have heard so far, I think every one is agreed that we can't use straight acreage, which leadsto the proposition that we are going to have to use deliverability or pressure or something else. Between the two other factors that have been recommended so far which is pressure and deliverability, pressure or deliverability from the practical standpoint of taking the bottom hole pressure once a year to apply it to the acreage as compared to taking the deliverability test once a year, which is applied to the acreage, in your opinion, which do you think is the most reasonable test?

A Well, now, when you say bottom hole pressure, do you mean actually run a bomb or to take a well at pressure and calculate it?

Q I mean, doing whatever is necessary to get an accurate bottom hole pressure, whether it is a bomb or sonic method or other methods.

A Well, the length of time involved is in favor of the pressure I believe. You have to determine your pressure when you take your deliverability test. From a practical standpoint, if you had to chose from the simplest test to obtain, there would be no doubt, it would be pressure.

Q You think pressure would be simpler to take than deliverability

A Yes, sir.

Q Do you see anything particularly wrong with the present deliverability test?

A Yes, sir.

Q Would you care to state that?

A The present deliverability test calculations is based on the static flowing pressure in the annulus while the flow is being taken through the tubing. If there is communication between the tubing and the pressure such a procedure, between the casing and the tubing, such a procedure is accurate in calculating the proper flowing pressure. If that pressure, if there is a bridge of any kind between the tubing and the casing, that pressure is not an indication of the draw down in the formation and the use of it would be highly in error.

Q The calculation of friction through the tubing as applied to all wells, is subject to considerable error at high flow rates?

A There is some question as to whether the taking of a pressure after the deliverability test is proper as compared to taking it before the deliverability test. I think that covers the objections to the test, as I see them.

Q Do you think that if it, we went to friction calculations on each well in the Basin that it would be an equitable test?

A I think if a suitable set of friction factors could be developed for the actual conditions existing in the Basin that you could probably get an equitable test through the use of friction factor. That is some work that would have to be done and without knowing whether you could accomplish that end or not, you couldn't say.

Q That is, in your opinion, the only objections to the test as it is now?

A I believe so, yes, sir.

MR. UTZ: That is all I have.

MR. SPURRIER: Anyone else have a question of Mr. Cullender?

MR. MACEY: I have one more.

By: MR. MACEY:

Q Mr. Cullender, in connection with that deliverability test, if after the test is run and the factor, P sub C is as determined, as the formula stands right now, if that factor P sub C is low from what it ought to be, in other words, the determination of that pressure is low, due to anyfactor either human or mechanical, does it not tend to give the well a higher computed deliverability?

A Yes, sir.

Q In other words, unless the well reaches a maximum P sub C the test is in favor of the operator, is that correct?

A Well, I know that to be correct within certain ranges. I think that probably under the deliverability formula by deliverability calculation which is based on a certain percent of the individual well shut-in pressure that such a situation would hold over the full range of the deliverability. I think that if you got your pressures too far off, probably you might, I hesitate to say that if you missed it 200 pounds or 400 or on down, it would hold all the way. If you miss it 25, 50 or 75 pounds, it will give you a calculated deliverability for the lower shut-in pressure.

MR. MACEY; That is all.

MR. SPURRIER: Anyone else? Mr. Foster.

MR. FOSTER: I have one on redirect.

MR. SPURRIER: Is there anyone else before Mr. Foster closes the record. Go ahead.

RE-DIRECT EXAMINATION

By: MR. FOSTER:

Q Mr. Cullender, in your opinion, should the Commission adopt some allocation formula to the San Juan Basin for the prorating gas?

A Yes, sir.

Q What do you base that on?

A On two situations, the present production in the Basin is being taken approximately or very close to 100 percent acres times deliverability and I don't feel that is a proper relationship of production to reserves, that it should be more in the nature of 75 percent acreage and 25 percent acres times deliverability, therefore, I do not feel that correlative rights are being protected. Also, the capacity of the wells to produce appears to be in excess of the market demand inasmuch as the wells produced some 350,000,000 feet of gas in March a day and only produced around 260,000,000 feet of gas per day in April as reported by the New Mexico Engineer Committee at Hobbs, so that there was a cut back in April and I think when a cut back is required, the Commission should designate where that cut back should come.

MR. FOSTER: That is all.

MR. SPURRIER: We will recess until 1:15. El Paso will be on immediately after lunch, If no further questions of the witness.

MR. FOSTER: One other question.

By: MR. FOSTER:

Q What do you consider to be the efficient drain and economic drainage of gas in the San Juan Basin?

A At the present time?

MR. SPURRIER: In the Mesaverde?

MR. FOSTER: Yes, in the pool we are talking about here.

A At the present time, I have no, nothing to base a conclusion that that 320 acres is not an efficient drainage area. Future production may show that it is not or that it is. In my opinion, it is, 320 acres is a reasonable drainage area for a well in the San Juan Basin.

MR. FOSTER: That is all. Thank you.

MR. SPURRIER: Recess until 1:15.

(RECESS)

AFTERNOON SESSION

MR. SPURRIER: Mr. Howell.

MR. HOWELL: May we proceed?

MR. SPURRIER: Yes, sir.

MR. HOWELL: We would like to have Mr. Woodruff sworn.

F. N O R M A N W O O D R U F F

the witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By: MR. HOWELL:

Q Will you please state your name for the record?

A I am F. Norman Woodruff.

MR. HOWELL: Are Mr. Woodruff's professional qualifications as an engineer acceptable to the Commission? I believe he has testified before?

MR. SPURRIER: They are and he has.

Q Will you please state the experience which you have had in connection with gas proration?

A Yes, sir. Prior to my employ[illegible] with El Paso Natural Gas Company, I was employed by the Railroad Commission of Texas for a three

year period. The major portion of that period was spent in the capacity of supervisor of the gas department. Under my supervision came the holding of hearings on gas pools, the evaluation of data, the preparation of rules for recommendations to the Commission, the administration of such rules after promulgating them, the preparation of proration and allocation formulas and the proration schedules.

Q How long have you been employed by El Paso Natural Gas Company?

A Three and a half years.

Q During that period of time, what work or study have you done in connection with the San Juan Basin and the question of gas prorationing?

A Since I went to work for El Paso Natural Gas Company, a portion of my duties has been to make studies of the San Juan Basin, since it is one of our major sources of supply supplying our markets. I aid in the preparation of reserve studies and under my supervision come the determination of the deliverability estimates and availability estimates during future years of the pools in the San Juan Basin.

Q Have you prepared a map of the Basin and put on that map, all of the wells completed in Mesaverde that you had any information on?

A Such a map has been prepared under my supervision with my aid, yes, sir.

Q Is that map the one that is on the wall which is marked El Paso Natural Gas Company's Exhibit No. 1-A?

A It is.

Q How many wells are shown on that map?

A 701 wells.

Q Does that represent all of the completed wells that have been

tested that you had information on up to a certain date?

A Yes, sir, as of June 7th, this year.

Q As of June 7, 1954?

A Yes, sir.

Q I note that Exhibit 1-A has some various color bands and is called, I believe an isopotential map. The colors are placed on there with reference to what factor concerning the wells?

A The potential of the well.

Q The initial potential?

A The initial potential of the well.

Q Why, in these studies, have you used the initial potential of the wells?

A I have used the initial potentials because we do have that value available on every well.

Q Is the deliverability available for all of the wells which have been completed?

A No, sir, it is not.

Q And will not be available for some wells until there is a pipeline connection, is that correct?

A That is correct.

Q Now--

A (Interrupting) I might add one other reason for using initial potentials. I am going to compare this map here with another Exhibit which is a factor entering into reserve calculations and I wanted both maps to be on the same age basis and initial potentials are as of a common age initial condition.

Q That is the initial potential represents the capacity of that well to produce under the same conditions at the same time with

relation to the age of each well?

A That is correct.

Q And if you were to take deliverability some wells have been delivering three years and others have not made any delivery?

A That is correct.

Q Now, then, what color did you use to show the bracket below a million and a quarter feet on an initial potential tests?

A Yellow.

Q What is the next bracket and which color is used?

A The next bracket is a million and a quarter to two million and a half and is shown by the blue.

Q Then, what is the next bracket?

A Two million and a half to five million shown in the rose.

Q What is the next bracket?

A The next bracket is five million to ten million shown in the green. The next bracket is from ten million to 20 million as shown in the tan. The next bracket is over 20 million as shown in the dark blue.

Q Has that map been colored with reference to your best estimate as to the area surrounding each well?

A That is correct.

Q You have left no blanks in there but you have estimated the initial potential in places where wells have not presently been completed?

A That is correct.

Q Now, have you conducted a study of the area shown on Exhibit 1-A in an effort to determine the thickness of the net pay sands?

A Yes, I have.

Q What, in general, did you do;substantially, the same things that Mr. Barry did in correlating gamma ray logs and logs of various types with such cores as you had available?

A That is correct.

Q Did you, for this entire area, in connection with your studies over three and a half year period, estimate thicknesses of net pay sand in various portions of the Basin?

A We have.

Q What is the greatest thickness that you have estimated for net pay in any part of the Basin?

A 180 feet.

Q What is the minimum net pay that you have estimated?

A Minimum net pay shown on any well which is presently completed and shown as a Mesaverde well is 6 feet.

Q Then, from the studies which you have made, would you say that there is a ratio in thickness of net pay sand in some places of as much as 30 to 1 between the thickest portions and the thinnest portions of the sand?

A That has been shown to be true by our evaluation of net effective sand thickness.

Q Have you prepared an isopach map with contours showing the thickness of the sands according to your estimate?

A We have.

Q Would you mark the map which has just been put up as an El Paso Natural Gas Company Exhibit 1-B?

A (Witness complies.)

Q Was El Paso Exhibit 1-B prepared under your direction and supervision?

A It was.

Q Will you tell the Commission what Exhibit 1-B reflects?

A Exhibit 1-B is an isopachus map of the Mesaverda formation, San Juan Basin. It is contoured on intervals of 20 feet isopachus being lines of equal thickness.

Q When you say 20 feet, what are you referring to, the net pay?

A Yes, sir, net pay, effective pay. Just briefly showing and explaining what the map reflects, I have used light and heavy lines to make it more apparent to continuity of sand thickness throughout the Basin. Also to show that from the edges of production sand thickness increases towards the center of the Basin or the center of the producing formation of the Mesaverde formation, producing portions of the Mesaverde formations.

So, just running through the contour intervals here, 0, 20, 40, 60, 80, 100, 120, 140, this instance we got from 120, 140, 160 to 180 feet. The sand pay was picked on a consistent manner on all wells in the Basin.

Q Did you consider the logs of 701 wells in making that isopachus map?

A Every log that was available to the wells completed in the Basin was utilized.

Q Was that essentially all of them?

A Yes, sir.

Q Now, in general, where do you find the thinnest sands?

A On the edge of the producing formation.

Q Where do you find the thickest?

A Towards the center of the producing formation.

Q Did you find in the center of the producing formations, some small portions of relatively thinner sands?

A Yes, sir.

Q What do you find in the way of a relationship between the initial potentials as shown on the Exhibit 1-A and the sand thicknesses as shown on Exhibit 1-B?

A We find a very close correlation in these and these Exhibits were prepared to aid you in visualizing the relationship between sand thickness and the initial potentials of the wells. Showing that generally throughout the field as a whole, that the initial potential increases with increase in net effective pay.

Q What conclusion, with reference to the existence of recoverable reserves,do you draw from this correlation?

A I believe that by presenting to the Commission this next Exhibit that I have and explaining to them what it reflects will aid me in advising them of my consideration of relationship.

Q All right now, the Exhibit which you have, will you mark it El Paso Natural Gas Company's Exhibit No. 2?

A (Witness complies.)

(Marked El Paso Natural Gas Company's Exhibits 1-A,1-B, 2, for identification)

Q Will you state to the Commission what El Paso Natural Gas Company's Exhibit No. 2 represents?

A El Paso Natural Gas Company's Exhibit No. 2 is a plot of average original six hour potential within 20 foot isopachus intervals versus the coring isopachus interval and the average thickness of the interval.

Q Starting down at the left hand corner there, do you have a band that represents wells completed within a thickness of zero to 20 feet and have you put those wells in one band?

A I have.

Q How many wells were there completed in sand thickness of zero to 20 feet?

A Six wells.

Q And have you plotted then the average of the initial potential of those six wells?

A I have plotted the average original six hour potentials in the six wells against the average thickness of the isopachus interval.

Q Those six wells that are completed in that section of zero to 20 feet thickness have had an average initial potential of what?

A 400 MCF per day.

Q Have you taken the 20 foot intervals and in a similar manner plotted the average initial potentials of all wells completed in that sand thickness?

A I have.

Q Would you just read briefly the number and the approximate initial potential average of each group?

A Group 2 in the interval 20 feet to 40 feet had 66 wells, an average initial potential of 1,200,000. Group 3, in the interval of 40 feet to 60 feet had 112 wells with average initial potential of 1,850,000. Group 4 being the interval from 60 to 80 feet, 115 wells with an average initial potential of 2,800,000. The next group was in the interval of 80 feet to 100 feet consisted of 152 wells with an average initial potential of 3,900,000. The next group was 100 to 120 feet consisted of 160 wells with an average initial potential of 4,500,000.

The next group, 120 to 140, 71 wells average inital potential of 5,100,000. The next group in the 140 to 160 foot interval consisted

of 9 wells and average initial potential of 5,700,000. We had two other isopachus intervals, a 160 to 180 which had 1 well with an average initial potential of 5,400,000. We had the interval of 180 to 200 feet consisting of 1 well which had an average initial potential of 14,500,000.

Q What do you conclude from that study of the averages of all the wells in the Basin?

A I concluded from this study that the relationship of initial potential net effective sand thickness is essentially a straight line relationship.

Q That, is there is a direct relationship between net sand thickness and the initial potential of the well completed in that thickness?

A That is right.

Q There maybe individual variances between wells which in part could be caused by mechanical troubles or methods of completion or one factor or another, is that correct?

A That is correct, that exists.

Q This represents the average of all wells in each sand thickness?

A That is correct.

Q In seeking a formula for proration of gas, what should be factors that should be considered. What is it you want to accomplish by proration of gas?

A Ideal proration is based on reserves underlying the tracts assigned to each individual well, recoverable reserves.

Q What relationship, in your opinion, does deliverability have with the recoverable reserves under any tract?

A I consider that deliverability has a very close relationship to recoverable reserves underlying a tract, as of the time of the taking of the deliverability test.

Q In your opinion, is there a close relationship between the initial potential and the deliverability of wells?

A We have found it to be.

Q Upon what do you base that production experience, production records?

A Yes, sir, and the correlation between potential tests, initial potential tests and the deliverability tests taken on wells.

Q Have you come to the conclusion that the deliverability of a well bears a direct relationship to the recoverable reserves?

A I have come to the conclusion, it bears essentially a direct relationship.

Q From your studies, do you believe that the deliverability of the well is directly related to the sand thickness in which it is completed?

A I do.

Q What wells and leases, acreage, does El Paso Natural Gas Company have in the Mesaverde Field?

A As an operator, El Paso has a whole or partial interest in 390 of the 701 wells which I considered. As a purchasing company, they gather gas from additional 100 wells of the 701, making a total of 490 of the 701 wells.

Q Of the wells which El Paso Natural Gas Company owns in whole or in part and operate, do you find both weak wells and strong wells?

A Yes, sir.

Q Are the wells of all the various characteristics that we have

heard about during this hearing?

A Yes, sir.

Q Does the company have predominantly one type of well or another or do we have all classes of them?

A We have all classes of wells.

Q Incidentally, was it El Paso Natural Gas Company that first developed the technique of drilling in with gas?

A Yes, sir.

Q In the Basin? A Yes, sir.

Q And first took a gas core?

A That is my understanding.

Q First took a core in a well drilled in with gas. Have you spent any time working on the committee that was appointed to study the question of proration in the San Juan Basin?

A Yes, sir, I served on that committee and attended all of their meetings.

Q Have you come to a conclusion as to the type of formula that should be used in the San Juan Basin, in order to most equitably and effectively give each person the recoverable reserves under his land?

A Yes, I have.

Q What, in your opinion, is the best formula for that purpose?

A 75 percent acreage times deliverability plus 25 percent acreage.

Q Why, Mr. Woodruff, do you include any acreage factor at all there, the 25 percent straight acreage?

A I consider that it is important that the Commission give consideration to the economic aspects apparent in this field.

Particularly I refer to the low capacity wells which have been defined hereby previous testimony as possible non-commercial wells. I think that the opportunity should be given to the operator of each well to get the maximum production from that well, essentially to permit it to produce at its producing capacity so long as in so doing, we do not have a number of wells in such marginal capacity that makes the ability to supply the market demand out of the field that takes away the ability of supplying market demand in the field.

Q Are you familiar with the proration rules that are in effect in Lea County now?

A Yes, I am.

Q As I understand the rules, if a well is under produced during the initial six months proration period, it may make up that under production during the next six months according to those rules?

A That is correct.

Q But if it fails to make up the under production, then, at the end of the second six months period, the under production for the first six months period is cancelled?

A That is correct.

Q On the other hand, over production must be made up by cutting back the allowable during the second six months or failing to balance the over production the well is shut in at the beginning of the third six months period, is that correct?

A That is correct.

Q If you have a substantial number of wells that are governed by an allocation that, I believe in this hearing has been called that of a limited well, what do you mean by limited well?

A That as defined in previous testimony and in my interpretation

it is a well which under the application of the allocation formula would receive an allowable in excess of its producing ability, therefore it is limited to its producing ability.

Q In other words, the allowable that it gets is its ability to produce?

A That is correct.

Q Now, then, in the event that well is shut in for any reason then, during that period of time, it fails to make its allowable?

A That is correct.

Q And if its allowable over a period of time is the same as its ability to produce its ability to produce isn't going to increase over that time, is it?

A That is correct.

Q So, that any deficiencies in the under production from a well which is in a limited category and is producing all it can produce can never be made up, is that correct?

A That is correct.

Q Now, if that were to amount to as much as 6 percent in the Blanco Field, I believe the testimony in this case shows that there has been an estimate of 320,000,000 cubic feet a day as the market demand, how many million cubic feet would 6 percent be?

A 19,200,000.

Q Per day? A Yes, sir.

Q Now, then, if over a period of a year, an under production from wells of as much as 6 percent were built up, approximately, how much under production would there be during that year from those wells?

A 700,000,000. No, that is 7,000,000,000, I believe. Just

one second. 7,000,000,000.

Q Unless that under production is reallocated to the wells that will make it,the market for that gas would just not be made?

A That is correct.

Q If you are going to meet the market demand then, as I understand your testimony, it becomes necessary constantly to take gas which has been allocated to the weaker wells and reallocate it to the stronger wells in order that the gas can be produced and the market demand met?

A That is correct.

Q And what type of formula is that, in the first instance rather than by a constant series of readjustments and reallocations?

A 100 percent acres times deliverabilities.

Q And would the formula which you have recommended of 25 percent acreage and 75 percent deliverability be better as a practical matter, a better formula to make an allocation that would more nearly approach the actual production that would be expected over the field?

A It would not be as good as 100 percent acres times deliverability.

Q Would it be better than 75 percent acreage and 25 percent deliverability?

A Much better.

Q If the factor of initial pressure times acreage be used, what would be the allocation formula that would go into effect immediately in this Mesa-verde?

A 100 percent acreage.

Q Why is that?

A Because under initial conditions, most wells have the same

pressure. That statement is not exactly true because there are some variations in pressure throughout the Basin because of variations in depth. Right at this moment, there would be some variations because of some wells having been produced but essentially it would be on the basis of acreage alone.

Q Then, before the formula of pressure times acreage becomes effective, there has to be a partial depletion of the reservoir so that the pressures have gone down substantially?

A That is right, for such a formula to reflect reserves underlying each individual tract, you have to have production, enough production to indicate the reflection of pressure in relationship to reserve. Initially it would not.

Q In your opinion, to apply a formula of pressure times acreage, would start out with a formula that did not bear a reasonable relationship to recoverable reserves?

A That is right.

Q It is only in the future that that formula would gradually be corrected to approach that relationship?

A That is correct.

Q In general, do you have any estimates as to the producing capacity of all the wells in the San Juan Basin Mesaverde, Pictured Cliffs, all the wells?

A The estimated producing capacity is about 500,000,000 per day.

Q And about what is the existing market demand for all markets that take gas from the San Juan Basin?

A Going back to your previous question, my answer was directed to those wells available to El Paso Natural Gas Company.

Q I see.

A I am not acquainted with the delivered capacity of Southern Union's wells.

Q What would be the demand that El Paso Natural Gas Company has for its market at the present time?

A Approximately, 400,000,000 per day average.

Q Does that represent about the maximum capacity of the facilities that El Paso has for transportation?

A That is correct. Actually the 400,000,000 that I mentioned wouldn't be average, it is not the average, it would be more of a maximum because we do not utilize the full facilities each and every day.

Q In your opinion, is there production available from wells completed in the Mesaverda Blanco Field in excess of El Paso's ability to market with relation to the wells connected to its system?

A Did you ask me if there was producing capacity?

Q In excess of El Paso's ability to market from those same wells?

A There is.

Q In your opinion, is it desirable to impose an allocation formula at this time?

A It is necessary to prorate the demand among the wells in the pool in some method.

Q There are a few points that may come up in connection with the rules that might be imposed. What, in your opinion, should be the maximum acreage alloted to any one well?

A It is my belief that the present spacing rule of 320 acres is appropriate.

Q Or with irregular sections, the nearest substantial spacing

unit to that? A Yes, sir.

Q With reference to the balancing periods, I believe that the Lea County balancing periods are January 1, and July 1, is that correct?

A That is correct.

Q Would you think it advisable to stagger the balancing periods as between the Lea County and the San Juan Field?

A It would certainly facilitate the operations of El Paso Natural Gas Company and should facilitate the problems of the Commission in figuring out the balancing at times necessary on the balancing dates.

Q What dates would you recommend?

A March 1st and September 1st of each year.

Q If that were not acceptable, would February 1st and August 1st be better than having it on July 1st and January 1st?

A It would.

Q Would the adoption of those balancing dates give both the companies accountants and the Commission's staff more time to work between peak intervals?

A It would.

Q It would make it easier to operate?

A It would.

MR. HOWELL: That is all.

MR. SPURRIER: Anyone have a question of Mr. Woodruff?

MR. SELINGER: Yes.

By: MR. SELINGER:

Q Mr. Woodruff, in your qualifications you advised the Commission here that you had previously worked for the Texas Railroad Commission,

is that correct?

A That is correct.

Q Were you connected with the Railroad Commission at the time that the allocation formula of the Carthage Field was changed from acreage times deliverability to acreage times pressure?

A I was not connected with the gas department at that time, if I was with the Commission. I do not recall the time of the change.

Q I was just asking if you were familiar with the fact that it had changed it, if you were connected with the Commission?

A No, sir. I do not know whether I was or not. I do not know the dates.

Q Are you familiar with the fact that the allocation formula was changed?

A Yes, I am.

Q Do you know why the allocation formula was changed from acreage times deliverability to acreage times pressure?

A I do not.

Q You are familiar with the fact that it was changed by the Railroad Commission?

A I understand that it was.

Q Making some comments with respect to the acreage times pressure formula, you said that if it was instituted immediately that it would be in effect a 100 percent acreage because you do not have enough production history to have the pressure factor be a dominant one in correcting allowables, is that correct?

A That is correct.

Q When would you have your formula go into effect, immediately also?

A Yes, sir.

Q Of the 701 wells in the field, how many wells have had deliverability tests at this time?

A I am not sure of the exact number that have had deliverability tests.

Q Do you have any idea how many?

A Only roughly.

Q You heard previous testimony to the effect that as, at least of May 16th, there were only 355 wells whose deliverability had been tested?

A I recall testimony to that effect.

Q Are you, also, familiar with the fact that the New Mexico Commission has requested operators to decease reporting such deliverability tests to them because of certain inaccuracies with respect to friction?

A Yes, I am.

Q With all that, then how do you propose the Commission institute gas proration under your formula immediately?

A I do not think it is absolutely necessary that they initiate it right immediately. However, there is a procedure whereby a relationship can be established between initial potential and deliverability which maybe utilized for those wells that do not have deliverability tests until such time as such deliverability can be taken and any adjustment made, that may be necessary because of any inaccuracy in estimate.

Q Then, you propose to calculate the deliverabilities of all those wells that have not, up to this time, had their deliverability test taken?

A I would say that such a method is reasonable and could be

done if the Commission desires to initiate proration at this time.

Q In making your deliverability test, do you not utilize pressure?

A Yes, sir.

Q Can you calculate pressures for those wells who have not heretofore had their pressures taken?

A The initial pressures are known in all wells.

Q The initial deliverables are not?

A Initial potential only.

Q How would you calculate the deliverability of the well that hasn't had the deliverability taken?

A By a percentage relationship.

Q That wouldn't apply to the pressure factor, it would only apply to the deliverability calculations?

A That is correct.

Q What is your opinion, Mr. Woodruff, as to the time that the Commission can institute proration of gas in the Mesaverde formation?

A Excuse me, would you repeat that?

Q Yes. What is your opinion, as to the time?Can they institute it as July 1st, August 1st or September 1st?

MR. HOWELL: It seems to me that is a matter that the Commission is best able to pass on because I suggest this witness isn't familiar with the facilities that the Commission has.

MR. SELINGER: If he is an expert in gas, I think he can give his best opinion to the Commission. The Commission can take it for what it is worth.

MR. SPURRIER: We will be glad to have your opinion if you

want to express one.

MR. SELINGER: That is all I ask, if he doesn't have one, he can say so.

A I think the reasonable time for institute would be September 1st of this year.

MR. SPURRIER: It might give us something to shoot at.

Q How long has the Mesaverde formation in the Blanco Field been on production?

A I do not know. It was produced by other pipelines other than our own, prior to our going into the pool and I do not recall.

Q You don't know whether it is two years, three years or four years?

A I know it is more than that.

MR. SPURRIER: More than what?

Q The institution of proration as of September 1st in four years time of production, you believe, as an engineer, you believe you have insufficient production history upon which to calculate pressure and an allocation formula?

A I do not understand your question.

Q Well, I will repeat it. Do you believe that the production we have had so far to date and the production we will have as of September 1st of this year is insufficient production history?

A To establish an allocation formula?

Q Yes. A No.

Q You think it is sufficient time, sufficient production?

A Yes, sir, I think it is.

Q In calculating reserves, Mr. Woodruff, as an engineer, how do you best calculate reserves, what method?

A Pressure decline method.

Q That is where you plot pressure decline against production or cumulated production, is that correct?

A That is correct.

Q Now, I notice that you recommended the same balancing dates that Skelly Oil Company on the first day of this hearing recommended as the balancing dates, March 1st and September 1st. Have you had sufficient time to look over the recommendations that Skelly Oil Company made with respect to the over and under in this proposed rule which I believe I handed Mr. Howell a copy of the first day?

A Mr. Selinger, I have looked at them, I am not entirely familiar with them or I have forgotten quite a bit that is in them as to the exact nature of them.

Q What is the purpose of establishing an over and under and adding it into your operational field rules?

A Well, it is to give flexibility of operation.

Q And it is also to assure the market demand be produced from a field in order to satisfy that market demand, is it not?

A It is to ease the satisfaction of market demand.

Q Then, you are not prepared at this time to say whether or not Skelly's Oil Company's recommendations on this proposed rule for over and under accomplishes that purpose as it is written and proposed by Skelly?

A Was your question, am I prepared to say whether your rule accomplishes that purpose?

Q Yes.

A No, I am not.

MR. SELINGER: That is all.

MR. SPURRIER: Anyone else have a question of Mr. Woodruff? Mr. Foster.

By: MR. FOSTER:

Q Mr. Woodruff, in order to establish friendly relations with you, I want to say that I have known you a long time, and I have a very high regard for your ability.

A Thank you, I never realized our friendly relations had ceased.

Q Well, I am just warning you that they might. Do you have some apprehensions that under the formula proposed this morning by Phillips Petroleum Company, that the market demand of the field wouldn't be met?

A I do.

Q Will you just tell us wherein that would occur?

A It is my opinion that the large number of marginal limited restricted wells, those wells with allowables equal to their maximum producing ability--

Q (Interrupting) Or greater?

A With allowables limited to that would result in such inflexibility that market demand could not be met. Now, we know that the demands of El Paso Natural Gas Company, speaking only for them is a very fluctuating demand. That means that every day during the month you can not take a constant volume from all wells. During the times when our system has to be cut back, that means that such a well with its maximum producing ability as its allowable would produce something less than the allowable. Such a well would not be capable of producing over its producing ability and therefore can not make up that portion of the allowable which was under produced.

Adding up that fact, or multiplying that fact by the number of wells in the pool could represent a sizeable portion of the total market demand which would be unproducable from those wells.

Such market demand could be produced from wells that were not restricted, that were not marginal as such over production which would be accrued by those wells, would have to be made up by subsequent under production so that at the time that could be compensated for but would have to be accounted for sometime in the future.

Q Now, I thought you said that this formula would accomplish at the out set what these other formulas would accomplish at some other time in their production history of the field. If that is true, I don't understand how you share any apprehension about market demand not being met under the formula that was proposed by Phillips Petroleum Company.

A I do not recall having discussed or testified to Phillips Petroleum Company's formula.

Q Well, that is the only other one that is before the Commission--

A (Interrupting) Judge Foster, I assume that I have heard it mentioned, see, if I can answer your question.

Q I understand you want to answer the question. I am just trying to get at the facts now.

A Yes.

Q If you find something in that inherently wrong, in the type of formula that was suggested that would prevent the market demand from being met?

A I think that any formula--I need a word.

Q Tell me what it is, I will give it to you.

A Any formula that goes away from 100 percent acreage times deliverability would cause increasing difficulty, going away from deliverability to acreage would cause increasing difficulty in meeting market demand.

Q Well, now, let's take the formula that is in use in the West Panhandle Fields in Texas, you are very familiar with that field. That is what we call one third to two thirds formula. It is one third potential plus two thirds acreage times rock pressure. Now, that field has about 2100 wells in it. It is presently operating with some 600 so-called limited wells in it and you know that the market demand is being met daily in that field, do you not?

A I do not know.

Q Well, I will tell you that it is.

MR. TURNER: Take the stand.

MR. FOSTER: I will be glad to.

MR. SPURRIER: Your comments will be directed to the Commission, Mr. Turner.

Q Now, you know of other fields where a similar formula that I have mentioned here are in operation and where the market demand in those fields is being met, do you not?

A I do know that there are fields with such formulas, I do not know whether the market demand is being met in them.

Q Do you assume that other Commissions would permit formulas to be adopted that would result in the field not being able to meet its market demand?

A It is entirely possible.

Q Do you know of any such instances?

A I said I did not know of any field where the market demand

was not being met.

Q Do you know of any field in Texas where you operated for a number of years in a very high and responsible position with the Commission of that state, where there was a formula ever adopted by the Commission that did not permit the meeting of the market demand in that field?

A Judge Foster, I do not recall any specific field. I do know of numerous instances where it was very difficult to meet market demand and actually think the market demand was not met. I can not mention a specific instance.

Q Are you talking about the difficulties of meeting the market demand or are you talking about a formula having been proposed here that wouldn't permit the market demand to be met?

A Difficulties.

Q All right now, then. That shades it a little bit. Now, I realize, of course, that there are difficulties in operating but also you, as an engineer of ability, must realize that there are other considerations that must be taken into consideration and such as the protection of correlative rights?

A Absolutely.

Q Now, we have got to find a ground somewhere on which we can operate so as to bring about both of these things?

A Correct.

Q Now, I don't take it, in your judgment, that you would advocate the adoption of a formula that would make it more pleasant or easier for pipeline companies to operate, which at the same time does not protect correlative rights in the field? You wouldn't do that, would you?

A I think both problems are important for the Commission to consider. I would not recommend that one be considered without the other.

Q You wouldn't recommend either the adoption of a formula by this Commission that would bring about the unratable takes of gas as between wells, would you?

A Not unless in so doing it was necessary to do so to be able to prorate the gas.

Q Well, are you saying--

A (Interrupting) Let me restate that.

Q I understand what you are trying to say.

A Does the Commission understand what I tried to say?

MR. SPURRIER: No. Let him ellaborate, Judge.

A I think--

Q (Interrupting) Are you saying--

MR. HOWELL: (Interrupting) Judge, the Commission asked to have him ellaborate.

MR. FOSTER: I thought he was directing his remarks to me. I beg your pardon. I thought he wanted me to question him further on that. If Mr. Spurrier has a question, all right.

MR. SPURRIER: Can you ellaborate on that last statement?

A I will try. I think that it is very important to protect correlative rights. Correlative rights, if I can express myself, can be protected only so far as I see it, you must be able to prorate gas in such a manner as to fulfil the market demand otherwise you don't have the market demand because you only maintain it by fulfilling it. So, you can not restrict a pool because you have a well or a few wells in there that can't produce their reserve in the period

of time that the demand would have to be taken out. You must prorate the field as a whole and prorate in such a manner that market demand is met.

Q You are saying that if in order to meet the market demand, you got to violate correlative rights, you advocate the violating of correlative rights?

MR. HOWELL: That isn't what he said.

MR. FOSTER: I am asking him if that is what he said.

A I consider, as I said, that if you want to maintain the market demand, you must allocate the gas in such a manner that market demand is allocated to the wells.

Q Very well.

A If in so doing, you result in assigning, say, restricting some wells, it could be that their ability to produce is caused by some peculiar coordination in the well bore. You can't restrict the field because that condition exists. By going on and prorating the field, you might permit some off setting well to take more gas than that well would take in relationship to their reserves but the Commission could not restrict the field because of that condition.

Q If you were faced with the alternative of either meeting the market demand or hurting correlative rights, what would be your recommendation?

A I think my answer to that, would be that if you do not have producing ability in excess of market demand, the Commission is not designated to prorate gas.

Q That is not the question. If you were faced with operating conditions in the field where you would take your choice between meeting market demand or violating correlative rights, what would be

your recommendation?

A Well, I would say that if--I hardly know how to answer your question. I don't believe you could meet market demand, that doesn't work out to my thoughts, either. I think that if you protect correlative rights by an allocation formula and can meet market demand, that that is the appropriate way.

Q I agree with that, but I am giving you a case here where you can't do that. Where you are faced with the alternative of either meeting market demand or violating correlative rights which horn of the dilemma would you take, what would you recommend that this Commission do?

A I don't think that we are confronted with that, Judge Foster.

Q Well, you have an apprehension that we are going to get in that situation.

A I believe then, I should answer, fulfil the market demand for this reason; if you can't protect correlative rights--

Q (Interrupting) That answers my question.

A It must mean that that well is incapable of producing its allowable and necessarily would be restricted to its producing ability, in other words, would get its proper share of--

Q (Interrupting) If you were faced with that alternative, your answer is that you would recommend the violation of correlative rights?

A I prefer to answer it in the manner in which I answered it.

Q Now--

A (Interrupting) Still friends?

Q Oh, yes, very much so. Now, the adoption of over and underage rules, it is common in all prorated fields, isn't it true?

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A I believe that is correct, all of them I am acquainted with.

Q Any area that you know anything about?

A Yes, sir.

Q Do you know of any field in any State where the Commission does not reallocate the cancelled underage so as to maintain the field in balance with market demand regardless of the formula that is used?

A I do not know of any.

Q In fact, you know of a good many areas where there is proration under a type of formula such as has been suggested here by the Phillips and by Skelly where the Commission does reallocate the cancelled underage so as to maintain the field balance?

A That is correct.

Q That is true in the Texas Panhandle Field. That is true in the Texas Hugoton Field. That is true in the Kansas Hugoton Field. That is true in the Oklahoma Field, is it not?

A I believe that to be correct.

Q So, that there really is no need, I will ask you if you sincerely feel that there is any need to adopt a particular type of formula in order to keep the field in balance?

A Yes, I do.

Q You feel that the type of formula itself is the thing that keeps the field in balance?

A I think it adds to the ease of keeping the field in balance.

Q Oh, I am not trying--

A (Interrupting) Or the possibility of it.

Q I understand that, but I am not trying to feel easy right now.

A I see.

Q I am simply trying to find out whether or not within your

conscience, thinking as an engineer of great ability, you feel that it is necessary to adopt a particular type of formula in order to maintain field balance?

A I do and particularly so in the fields in the San Juan Basin.

Q Well, now then are you saying to me that unless your formula that you have suggested is adopted that the San Juan Field cannot be maintained in balance?

A I believe that condition will exist.

Q Are you saying to me that if you adopt the formula suggested by Skelly or if you adopt the formula suggested by Phillips, that inherent in those formulas is something that wouldprevent this Commission from keeping that field in balance?

A I don't think there is in theory, there is anything that prevents it but I think in actual operations there certainly is. You allocate the market demand in any type formula but the ability to produce it becomes increasingly difficult..

Q I appreciate your apprehensions about it. I understand. Do your wells have an ability to meet your market demand?

A Yes, sir.

Q How can proration cut the ability of your wells to meet the market demand?

A By allocating excessive amounts of the market demand under an allocation formula of the type you suggested.

Q That doesn't affect their ability, does it?

A Under the type formula that you advocate or your company advocates, we have this large number of marginal wells with an allowable equal to the producing ability of those wells, market demand could not be met during the periods of severe fluctuation without over producing other wells. The wells which were prorated. Such over production would have to be made up by subsequent under production so this volume of under production of these wells would have

to be made up, could not be made up from the wells which accrued them.

Q Is there any proration formula that operates on the ability of the well to produce?

A You mean say like deliverability alone?

Q Well, is there any proration formula that you know of that changes the ability of a gas well to produce gas?

A No, sir.

Q All right. All the proration formula does is to allocate to each well its proportionate part of the gas on whatever basis you want to allocate it?

A That is correct.

Q So, it does not operate on the ability of that well to produce?

A If such an allocation formula results in marginal or limited wells as they have been defined here, it does.

Q Well, most assuredly, any proration formula may result in these marginal or limited wells.

A Not to such an excess nature as the one that Phillips has advocated here.

Q We are now talking about a matter of degree?

A That is right.

Q That is all we are talking about. I can't understand how, and I would like for you to explain to me, if you can, for the record, how any proration formula, the one suggested by Skelly, the one suggested by Phillips, the one suggested by you, could operate to restrict the ability of your wells to produce gas?

A They could not restrict the ability of our wells to produce

gas.

Q All right. Now, if an allocation formula in allocating among gas wells in the field allocates more gas to a well than that well has ability to produce, you agree with me do you not, that the well at least has the right to produce up to its ability?

A That is correct.

Q All right. Then, the amount which a formula, any formula, yours or the others that have been suggested, allocated to that well should then be redistributed to the other wells in the field so that the market demand may be met, isn't that true?

A I believe that your statement is true.

Q All, right, that procedure can be accomplished --

A (Interrupting) May I qualify--

Q (Interrupting) Okay--

A (Interrupting) I would like to complete my statement. The market demand will be allocated to the wells in the pool.

Q If that procedure is followed?

A That is right.

Q That is true, regardless of what the formula is, is it not?

A That is right.

Q Okay.

A If there is producing ability in excess of market demand.

Q If there is producing ability there. That is why I say the formula doesn't operate on the ability of the well to produce?

A No, sir.

Q All it does, is tell the well how much gas it is permitted to produce under the applicable formula and that is all that happens?

A That is right.

Q So, that are you saying now, that under any type of formula, that is adopted in this or any other field, that if you take the gas that is allocated to those wells which can not make their allowable as distributed to them by the formula and reallocated that gas among the other wells in the field, the field will be kept in balance so that the market demand can be met?

A Under your example, absolutely, but you can not produce the allowable of those marginal wells every day.

Q Now, that is not the fault of the formula, is it?

A No. That is a fault of the nature of the animal that we are faced with here.

Q Where is the fault, why is it those wells can't do it?

A Because of the fluctuating market demand.

Q Well now, you have a fluctuating market demand under any type of formula, would you not?

A Not so severe as we are experiencing and will experience in the future.

Q The formula doesn't fix the market demand?

A But the volume must be one that will enable market demand to be distributed to it, can be produced.

Q Any formula that you use in the field in allocating gas between the wells where the Commission follows the practice of reallocating the production of the wells that cannot make their allowable allocated to the formula, the market demand can be met?

A My same answer goes with that question.

Q That is true.

MR. SPURRIER: We will take a short recess.

(RECESS)

MR. SPURRIER: The meeting will come to order. Judge Foster, were you finished?

MR. FOSTER: I believe that is all at this time.

MR. GRENIER: A. S. Grenier, Southern Union.

By: MR. GRENIER:

Q Mr. Woodruff, you recall that Judge Foster asked you one question regarding what you would do if you were faced with a situation where in order to meet market demand for your pipeline, you would necessarily have to violate correlative rights in order to meet that market demand. Do you remember that series of questions?

A Yes, sir.

Q Do you feel that the questions of that sort and in the actual living world are questions which are to be answered by the pipeline company as the final arbiter, or by somebody else?

A I believe it is actually up to the Commission to weigh and value the going either direction rather than for the pipeline company to decide.

Q In other words, some public body, whether the Commission, who has the authority to settle such matters or the Legislature, itself, to lay down standards to take care of such matters?

A That is right.

Q Rather than the pipeline assuming to decide the thing on the basis of its own judgment?

A That certainly is my opinion.

Q If you were on such a Commission or member of such legislative body, would it make any difference to you what the character of the load was in attempting to answer that problem?

A Certainly, I think that it would.

Q What factors would you consider in that regard?

A Well, I would consider the nature of the demand for the gas, whether it was for light and fuel to maintain the heat in the people's homes and generate the electricity, whether it might be for some plant for commercial use.

Q If there was some substitute fuel readily available such as coal or oil, you would think there was more reason to protect correlative rights as opposed to convenience of the power plant operator or industrial plant operator, is that correct?

A That is correct.

Q If the gas were being used to cook and heat the homes of people in the winter season and if there were no readily reasonable substitute, you think that should be taken into account?

A Certainly do.

Q What is the annual load factor of your pipeline, El Paso's Natural's pipeline, the one extending from the San Juan Basin to California?

A I don't know. I can, I am sure that I could find out that information. It may be that a subsequent witness will be able to give us that.

Q Oh, you have more witnesses, fine.

MR. GRENIER: Mr. Howell, if one of your witnesses could give us an approximate figure on that, we would appreciate it.

MR. HOWELL: If this witness can't, we have somebody who can and we will make it as a statement.

MR. GRENIER: Thank you.

Q In Lea County, I believe your pipeline is connected to a few wells down there, is it not?

A Yes, sir.

Q What is the formula being used down there?

A 100 percent acreage.

Q Are there any wells down there which would fall in the category of what we might call limited wells as that term has been used here? A Yes.

Q Has your pipeline as yet through operations of the proration in that area been unable to meet its market demands?

A No.

Q In a 100 percent acreage formula, does that have more or less limited wells than one that proposes 75 percent acreage and 25 percent deliverability?

A I would believe that it would have more.

Q And it would have yet more than one proposing 50-50 relationship or one such as Phillips proposed of 25-

A (Interrupting) That is right.

Q (Continuing)--of 25, 75-25 percent deliverability times acreage and--

A (Interrupting) Are you asking me what a 50-50 would have?

Q (Continuing)--less, would 50-50 have less limited wells than a 100 percent acreage?

A Yes, I believe.

Q Would the Phillips formula also have less limited wells than 100 percent acreage?

A I consider that it would.

Q As yet, even though in Lea County, you are not on a 100 percent acreage times deliverability, no particular operating problem has arisen as respects inability of the field to meet the

the market demand under that proration formula?

A Actually, proration has been in for a very short period of time and during a period of minimum demand. I do not know what complications may arise.

Q So, you are not in a position based on Lea County experience, to say just how much harder it will be to operate under one of the formulas than the other?

A That is correct.

Q Referring to your Exhibit, one A and one B, and I call your attention particularly, if you will join me at the map, to the area in 31, 10, there is a fairly large area in here, is there not, Mr. Woodruff, which appears to be between the 100 and 120 isopachus lines, is that right?

A That is correct.

Q Within that area, how much variance do you find just in this single township area as between the initial potential of the wells as shown on the underlying isopotential map?

A The maximum that I see is 26,800,000 for initial potential. 4,447,000.

Q So, there is a ratio of approximately four to one variance in an area of approximately identical sand thickness, is that correct?

A There is.

Q Well, the ratio, you are essentially correct from what this represents on my mention that no log was taken on this large well, so, we have no way of knowing what the sand thickness was in that large well?

A Unfortunately that is true in most of the large wells that

are in the San Juan Basin, the Mesaverde formation.

Q So, as to the large wells then, the map is somewhat less reliable as it is, as to the small wells?

A I believe that is correct. We do show an indication of greater thickness on the large wells that we have logged as I said a majority of large wells do not have logs.

Q According to your Exhibit 2, Mr. Woodruff, I observe that, that what you have done here is to take averages of wells in various sand thickness, grouping them together and then plotting them in terms of their potentials so as to arrive at this straight line relationship which you observe, is that correct?

A That is essentially correct.

Q Have you made any study to determine what the average deviations from that straight line is per well? That is to say, had every well been plotted, would you have any ideas as to what the pattern might look like?

A No, I would not have, my study was made on the pool width which is what we are prorating.

Q That, of course, might be made on a pool width also to see if there was a relatively close correlation to the line or merely a relatively balanced shaped spread here which you could draw a line through in almost any direction, isn't that true?

A I would not expect it to occur.

Q Well, I wouldn't expect it to occur in the shape of a complete circle either but I would expect and would you not, also, that there might be rather material variances on either side of that line?

A There may be.

Q You have not made studies to determine what the extent of that variance might be? A No.

Q You have not expressed any opinion as to how closely the various wells in the field do track this central line?

A I think, on an average that it would track that.

Q I see, you have one rather unusual well over here, did this well which is the one in the approximately, the 190 foot range, did that well have a log on it, Mr. Woodruff, so that you do have an accurate sand group or not?

A Yes, it does.

Q So, here is one fairly clear wide variance from the line at least?

A That is right.

MR. GRENIER: I believe that is all.

MR. SPURRIER: Anyone else?

MR. SMITH: Mr. Smith, Stanolind.

By: MR. SMITH:

Q How many core analysis did you have available for study?

A We studied 14.

Q Were any of those 14, the same as the ones that were used by Mr. Barry in his testimony?

A I am not sure.

Q What did you find in the way of average porosity from one well to the other? What is the range of variance there?

A My recollection is that it varied somewhere averaging the whole net effective pay, taking each well between 7 and a fraction to 13 and a fraction.

Q Individual samples in some of the cores, did they run even

higher than that?

A Yes, they did.

Q What was the highest individual sample that you observed?

A The highest that I recall was 21.3 percent porosity.

MR. SMITH: That is all.

MR. SPURRIER: Anyone else?

MR. TURNER: I have a question.

By: MR. TURNER:

Q Would you tell us for the record, Mr. Woodruff, about, approximately how many miles of natural gas pipeline that El Paso Natural Gas Company operates?

A I believe, Mr. Turner, that will have to be the subject of the subsequent witnesses testimony. I do not know.

MR. TURNER: All right.

MR. SPURRIER: Mr. Reeves.

MR. REEVES: I would like to ask one question.

By: MR. REEVES:

Q Your reason for recommending 25 percent acreage plus 75 percent deliverability times acreage, was it not that, your belief that represented a fair ratio of reserves under the individual wells?

A Yes, sir.

Q And you believe that would place the operator in the point of producing proportionately to the reserves under each well?

A I think it will reasonably do so.

Q One more question then. In your opinion, would the formula suggested by Phillips permit that sort of production? That is equitable production in proportion to reserves?

A In my opinion, it would not.

MR. REEVES: Thank you.

MR. SPURRIER: Mr. Arnold.

By: MR. ARNOLD:

Q Do you consider the Mesaverde pool to be one reservoir?

A Yes, sir.

Q As defined by the Commission?

A Yes, sir.

Q Approximately, what method did you use in determining the net pay from the logs, the gamma ray induction logs? What approximate values--

A (Interrupting) What approximate what?

Q Values?

A My work has been on a general overall nature. I aided in setting up the basis for this but I do not recall the particular limits on each type of logging method which was utilized in picking the net effective pay. This map was prepared with my aid and under my supervision and with my cooperation but I did not pick each individual well's net effective pay. It was done in our office.

Q You don't know what those values were that were used?

A No, I do not know. I do not recall.

Q Using average porosity and connate water values, what net pay thickness, I mean how far could you reduce the net pay thickness to reach what you would call a commercial well?

A The well that is completed as a Mesaverde well with the least pay is 6 feet.

Q But if you converted that to reserves under the tract, would you consider that a commercial well?

A No, I wouldn't, but I do not know at what point I would say a commercial well existed. It is very difficult to define a commercial well. What is commercial for one company, may not be commercial for another company.

Q I wanted to ask one question about the 21 percent porosity. Was that a maximum value for one foot, was it an average value?

A That was a maximum value for a single sample that I recall.

MR. ARNOLD: That is all.

MR. SPURRIER: Anyone else? Mr. Maxwell.

By: MR. MAXWELL:

Q I would like to ask if a 100 percent deliverability times acreage formula with a minimum allowable actually supports your reservoir calculations in direct testimony with respect to relationship between recoverable reserves and deliverability as well as your 75 percent deliverability times acreage plus 25 percent acreage formula?

A I would say essentially, yes.

Q Would you expect to be under any obligation with respect to a minimum, should this marketing condition get so severe that you couldn't sell even the minimum per well?

A I do not believe, Mr. Maxwell, that I understand what you are asking me.

Q Well, if you have 700 wells and a minimum allowable of 250, say that the daily allowable, what is the figure 700 times 250, if your allowable would get under that figure, would you have to take the gas and flare it or would you consider yourself under any obligation then?

A I do not believe that I would consider that we were under

obligation, however, a minimum which would result in an allocation greater than market demand, I believe, if I may interpret the Statute would be unlawful because it would permit non-ratable takes.

Q Would the 100 percent deliverability formula tend to equalize pressure and tend toward an allocation formula?

A I believe that it would.

Q Would a minimum thrown into 100 percent deliverability somewhat ease the economic strain for delinquent wells, limited capacity wells?

A Such was my previous testimony with respect to 25 percent acreage.

Q Would a 75 percent deliverability formula actually benefit the under average wells at the expense of the overage?

A It would in a comparison of the two formulas.

MR. MAXWELL: Thank you.

By: MR. SELINGER:

Q How about the acreage times pressure formula, you wouldn't have that minimum to interfere with a depressed market, would you?

A I think I can figure out what you are saying.

Q I will repeat the question for you. I said, under an acreage times pressure formula, under a depressing market, you wouldn't be embarrased by any sort of a minimum, would you?

A No.

MR. SELINGER: That is right. That is all.

MR. SPURRIER: Anyone else?

MR. UTZ: I have one question, please.

By: MR. UTZ:

Q Mr. Woodruff, on any contour, on your isopach map up there,

where you saw a constant thickness, do you have a variance along that line of initial potentials?

A I believe that the answer is yes to that, if I understand your question. Certainly, initial potential does not, the initial potential curve does not coincide with the--

Q (Interrupting) I just want to be general about the thing.

A Yes.

Q Where you do have a variance in initial potential along contour of equal thickness, you are not saying, are you, that the reserves under those two wells are in direct proportion?

A Now, do I understand your question, that if there was a well, say, in the light blue on one side of an isopotential line and on the other side, that I would necessarily say that the reserve was the same?

Q What I am asking you is, Norman, is that a contour of equal thickness, if you have two wells say, as an example, one well is a million, the other is five million, if you do have such a spread and I imagine you do have, you are not saying that the reserves under those two wells is a ratio of one to five?

A They may be.

Q They may not be, too?

A Yes, they may not be. I do not know. There maybe some peculiar circumstances such as has been pointed out here concerning the completion practice, the completing of wells that may have resulted in that condition.

Q In your completion practice, you do get a variance in the amount of increase you get by whatever completion method you use, don't you?

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A There are good methods and bad methods, yes, sir.

Q In other words, say, two million wells on the same contour if you treated both alike and you got three million on one after treatment and five million on the other, that wouldn't mean that you had increased the reserves on the big well, would it?

A It wouldn't mean that I had increased the reserve, may have increased the recoverable reserve for that well. You are comparing of course, only variations in thickness when you are asking me to correlate it with reserve and there are other variables which enter into the reserve calculations which could also have influenced the variance in initial potential.

Q Do you have an opinion as to how much the reserves might vary between the offset wells?

A No, I do not.

Q It wouldn't be anything like a method of 1 to 30 which you stated between your 6 and 100 feet?

A It is possible. I do not know.

MR. UTZ: That is all.

MR. SPURRIER: Anyone else?

MR. FOSTER: May I ask one more question, please?

By: MR. FOSTER:

Q You used there in answer to Mr. Utz's question, might increase the recoverable reserves? What do you mean by that?

A The reserves which are available to the well bore.

Q Well, you don't mean that that would put any more gas in the well bore or beneath the land?

A Certainly.

Q It would? A Yes, sir.

Q The method of completion, treating of the well would put more gas between the land?

MR. HOWELL: That isn't the question, you asked, you said in the well bore and he answered you, yes.

MR. FOSTER: I will strike that question and ask another.

Q What I am trying to find out is you used the term and you told Mr. Utz that treating the well, and I suppose he had in mind shooting it, may increase, the recoverable reserves. Now, what I want to know is, are you saying by recoverable reserves that this treatment of the well or the shooting of it will put more reserves beneath the land on which the well is located?

A It may do that, yes, sir.

Q How?

A By opening up and making available to the well bore, sand stringers which may not be connected into the well bore but ended somewhere near to it.

Q It is all one reservoir, is it not?

A It is considered all as one reservoir. It is not one homogenous formation.

Q Now, the method of completion that gas was already there, was it not?

A Yes, sir.

Q The shooting didn't put it there?

A No, the shooting made it available to the well bore to be produced.

Q It made it so that you could produce whatever reserves you had at a greater rate?

MR. HOWELL: He didn't say that, Judge. We object to the

99 question the Judge--

MR. FOSTER: (Interrupting) I will withdraw the question.

MR. HOWELL: I would like to make an objection if the Commission please. I think I was ultra-patient in allowing the question to be asked five or six times.

MR. SPURRIER: I think you were too.

MR. HOWELL: I now request if the Judge is going to continue to question the witness that he please quote the witness correctly when he asks the question the second time.

MR.FOSTER: I had no intention of misquoting. I think the record will speak for itself.

Q What I am trying to get at is this; I will ask you if this is a fact that when you shoot a well that all that does is if it does anything for it, is to increase the rate at which you may be able to produce the reserves under the land.

MR. HOWELL: We object to that question, it has been asked before and answered by the witness.

MR. FOSTER: If it has, I didn't get it. It wouldn't hurt anything for him to answer it again. I don't want him to be repetitious.

MR. SPURRIER: The Commission has heard it before, asked and answered.

MR. FOSTER: Would someone mind telling me what the answer was.

MR. HOWELL: You didn't like what you got, Judge. He answered you. He answered it, that it would open up some stringers that might not otherwise be connected to the well bore and would thereby make the gas available to the well bore which otherwise might not be produced.

MR. FOSTER: Thank you.

MR. SPURRIER: Anyone else? Is that all, Judge?

MR. FOSTER: I wanted to ask him one question as to what the relationship is between initial potential and deliverability?

MR. SPURRIER: Very well. Did you hear him?

A I heard him. Approximately 18 percent to 20 percent.

MR. FOSTER: That is all.

By: MR. GRENIER:

Q Does that relationship vary at all with the size of the well, Mr. Woodruff? Is it consistent all the way up and down the scale?

A I can't recall individual instances, Mr. Grenier. I do recall the overall average.

Q You didn't observe from a study of Phillips Exhibit No. 3, what the relationship, as indicated there was, between average deliverability and average initial potential and any variance that there might be between that relationship as to wells of different sizes?

A I do not recall what his exhibit showed.

MR. GRENIER: That is all.

MR. SPURRIER: Anyone else?

MR. JONES: A couple of questions, please.

MR. SPURRIER: Mr. Jones.

By: MR. JONES:

Q Mr. Woodruff, as I understand it, there are a number of ways of completing wells in the Mesaverde Pool. I think there is sand-frac shooting, maybe hydra-frac, is that correct?

A That is my understanding.

Q These various methods in effect convert more of the gas in place under a particular tract into recoverable reserves, is that correct?

A That is correct.

Q In other words, fissures are opened up out into the formations by these methods, is that correct?

A That is correct.

Q These methods are in effect conservation methods are they not?

A I consider them to be.

Q In other words, they permit the production of gas which without their use might remain down there and never be produced, is that correct?

A That is correct.

Q These methods cost money, do they not?

A Yes, sir.

Q And these methods result in higher deliverabilities, is that correct?

A That is correct.

Q Then, one question. By putting a high deliverability factor in an allocation formula, are we not giving the operators an incentive to better completions and better conservation practices?

A It certainly would. I think that such an incentive should be considered and should be given because it is only with the increasing and better techniques of completing wells and maintaining deliverability, can we first hope to maintain our present market outlets and second, to increase our market outlets in the future.

MR. JONES: Thank you, Mr. Woodruff.

MR. SPURRIER: Anyone else?

MR. UTZ: I would like to ask one more, please.

By: MR. UTZ:

Q Mr. Woodruff, in arriving at your 75 percent, 25 percent acreage, 75 percent deliverability formula, did you consider a ratio of reserves over the field?

A I believe my answer would be yes to that.

Q In other words, what is your ratio in reserves over the field?

A Well, I do not understand your question apparently.

MR. SPURRIER: You mean between drilling units? I don't, either.

Q Between drilling units?

A No, I have not compared one unit to the other unit. I have made my study on the pool as a whole which is what is being prorated.

Q Do you know what the maximum to minimum reserves are in the field? Do you have an opinion on that?

A Well, it would be closely related to the relationship of sand thickness as a maximum and minimum which I previously testified to.

Q That was 1 to 30?

A 30 to 1, that is right.

Q You say the reserves are 30 to 1 then?

A Yes, I would think that the reserves certainly could vary in that pool, 30 to 1.

Q That would depend on how far you went out in the field too, wouldn't it?

A In this instance, we have a well completed designated as a

Mesaverde well which has 6 foot net effective pay--

Q (Interrupting)a commercial well?

A I do not consider it to be but it has been completed and it is in that condition.

Q Don't you think that in arriving at a ratio of reserves we should consider a point somewhere in the neighborhood of what we might feel is the commercial well or commercial thickness?

A Well, our feelings don't govern the persons drilling the wells. It is up to them to do that if they desire to do so.

Q If you completed a well in one foot of pay, the ratio would be 1 to 180?

A That is correct.

MR. UTZ: That is all.

By: MR. FOSTER:

Q What would it be if you call it a dry hole?

A They call it infinity.

MR. SPURRIER: Anyone else?

By: MR. MACEY:

Q I am not going to ask you about correlative rights or reserves or anything. I am going to talk to you about mechanics.

A Mechanics?

Q Yes. I believe it has been testified that a great number of the wells in the Basin do not have deliverability tests reported on them, is that correct?

A Yes, sir.

Q How, would you propose that this Commission establish allowables as of September 1st in the absence of the deliverability tests on the wells?

A I would recommend that the Commission determine a reasonable relationship between the deliverability and the reserves of those wells which we do have tests on apply that relationship to the initial potential tests of those wells and at such time that deliverability tests are available to reallocate the gas to those wells based on the deliverability test and make such corrections as are necessary.

Q Would you recommend that 18 to 20 percent figure that you mentioned a few minutes ago as a starting point?

A Based on the wells that were available at the time that the study was made. I think it would be well to redetermine the relationship based on the additional information available.

Q Are you familiar with the testing procedure in the Basin?

A Generally so.

Q Are you aware of the fact that the testing procedure calls for a session of deliverability tests from October 31st to, I believe, April 1st?

A Yes.

Q If you had a well completed in the first week of November, you did not have a deliverability test taken on that well, you would come up to the end of the balancing period without any concrete allowable that you could assign that well?

A Well, that certainly could occur but I don't say that it couldn't be reconciled by the calculation of an actual allowable by using deliverability, once it was available.

Q How would you balance if you didn't have anything to balance with? If the figures that you used were fictitious figures or temporary figures?

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A I don't see that there is a problem in balancing. You would have your figure there of over or under production due to the relationship of what you had given as the estimated allowable and then what you would give as the final allowable after the deliverability test was available.

Q Well, I don't particularly agree with you but I am not going to go any further.

By: MR. UTZ:

Q How would you estimate the deliverability on that well?

A I would estimate the deliverability by applying the relationship which you would determine between the deliverability and the initial potential of those wells which you had tested by applying that relationship to the initial potential of the wells that had no deliverability test on it.

Q By the time the well was tested, the next testing system on the basis of that estimate would, you think it would be off enough to be brought in balance in six months?

A Well, I can not positively say, however, it would certainly be to the advantage of the operator to test his well to make a deliverability test on the well as soon as possible, otherwise he would be penalizing himself by not having done so; because with production goes decreased deliverability. Maybe the solution is to shorten your period of deliverability test or set up some procedure whereby a new well would have a deliverability test taken on it soon after it was completed or connected to the pipeline.

Q Do you recall us having discussed that at one of the committee meetings?

A I do not recall but it may well have been so.

Q We did. We estimated that the estimated deliverability would be fairly close deliverability. That was the answer I wanted.

MR. UTZ: That is all.

MR. SPURRIER: Mr. Woodruff, if you advocate the 20 percent figure of potential to substitute for deliverability, do you feel that it is wrong to use that figure beyond six months providing that you can't get a deliverability test in that six months?

A Yes.

MR. SPURRIER: Why?

A I think that the well should be shut-in and the pressure taken at that time which could be utilized in revising the initial potential, to core that pressure and then you could apply that percent if you wanted to, but it probably should be resorted to some individual consideration rather than an overall rule to do that.

MR. SPURRIER: Anyone else have a question?

MR. UTZ: Yes. In regard to that question you are just asking. You are asking for a change in the present deliverability procedure?

A I wasn't aware that I was doing so.

MR. UTZ: I think you were because if the well is not tested by October the 31st, then it shall not be tested until the following deliverability testing season, which is from April 1st to October 31st, the following year.

A I believe, Mr. Utz, the question was directed to wells that could not have their deliverability taken.

MR. SPURRIER: That is right.

A That was what my answer was made for.

MR. UTZ: I see. That is all.

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MR. SPURRIER: Anyone else? The witness may be excused.

(Witness excused.)

MR. SPURRIER: Mr. Howell, do you have another witness?

MR. HOWELL: We have another witness. Mr. Striklin..

J A C K M. S T R I K L I N

the witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

By: MR. HOWELL:

Q Will you state your name for the record?

A Jack M. Striklin.

Q What position do you hold with El Paso Natural Gas Company?

A Division superintendent, San Juan Division.

Q Is the dispatching of gas and the operation of the gathering system and getting the gas into the main line directly under your supervision?

A Yes, sir.

Q Now, in order the Commission may have some estimate of the market in the future, so far as El Paso's market is concerned, has the company prepared some charts there showing the estimated peak days and the capacity of the entire system projected over a period of a year or two?

A They have.

Q Do you have that chart? How is that labelled?

A El Paso Natural Gas Company Exhibit 3, estimated main line requirements versus main line design capacities, 1956, it says.

Q Would you have that put on the wall there?

A Yes, sir.

Q We will go right on talking while they are putting it up on

the wall. What other sources, does the company have other than the San Juan?

A Well, they have the Permian Basin.

Q They have dry gas in Lea County and other sources in the Permian Basin?

A That is right.

Q Residue gas in Lea County, also?

A Yes, sir.

Q Is there connections so that gas from the South east is mingled with gas from the San Juan before it gets to its ultimate market?

A There is.

Q Will you look at the Exhibit No. 3, and tell the Commission what the total volume of August, 1953 was for the entire system? I believe this is shown in billion cubic feet, is it not?

A Yes.

Q So, that in August, 1953, approximately what were the main line actual requirements, the total main line requirements?

A A billion three hundred million.

Q By December of 1953, what was the actual requirements of the system?

A Well, it would be about a billion five hundred fifty million, six hundred million.

Q So, that in that three months period, there is a fluctuation of about 350 million cubic feet per day?

A That is right.

Q I believe that the chart also shows a dotted line,vertical line that indicates at that time what the main line design capacity

was slightly in excess of the actual load in December, 1953, is that right?

A That is true.

Q Then, by additional construction, the line, I believe is moved over as of the present time to approximately two billion, is that correct?

A That is true.

Q What is the average daily line requirement for December of 1954?

A December, 1954, it is two billion, well it is between two billion nine and two billion, it will be a billion nine six.

Q For January, 1956, what would the figure be?

A It is about two billion one.

Q For August, 1956, what is the estimate?

A That is a billion nine.

Q By December, 1956, what figure does it reach?

A It would be two million two, that is right.

Q Now, with relation to the difference between the average daily load requirements and the peak day load requirements, what was your actual peak day requirements in December of 1953?

A Billion five, billion six.

Q What is your peak day estimate by December of 1956?

A Two billion one.

Q So, that does this chart show the fluctuation which exist in the overall market, which the company's system serves?

A Over a time, yes, sir.

Q Do you have another chart prepared here, will you have someone put that up? It is marked El Paso Natural Gas Company's Exhibit

110 No. 4. Will you state what that chart reflects?

A This covers a shorter period of time. It is total main line sales and fuel from March 20, to April 11, 1954.

Q Does that show the actual volumes from day to day during those periods?

A It does.

Q And without calling each one out, does it show a fluctuation over the week end of March 20, and 21, when approximately a billion point 6 was the volume up to a peak day of a billion 8 fluctuation of two hundred million in less than a week there in the daily requirements?

A Yes.

Q A drop down by the 11th of April to about a billion--what is it?

A A billion two.

Q A billion two hundred million. Is that fluctuation from day to day and from week to week and month to month constant in the marketing of gas by El Paso Natural Gas Company?

A Yes, it is.

Q Now, do you have another chart that reflects the California demand?

A Yes, sir, I do.

Q Is that chart marked El Paso Natural Gas Company's Exhibit No. 5?

A It is marked No. 5, it doesn't have the El Paso Natural Gas Company on it.

Q What does the upper portion, the upper half of the chart from this parallel line to the top of the chart show?

A It shows Southern California takes.

Q What does the black line show?

A That shows the 1953 takes, the red line shows the 1954 takes, , the rate changes.

Q By the rate changes, what do you mean by that?

A The orders that we get from time to time changing the rate of the gas we put through the pipeline.

Q In other words, in dispatching the gas, you get an order from the California Company saying they will want so much gas a certain time in advance. Each one of these figures represents a notice received from that company that the rate of delivery is to be changed?

A That is correct.

Q That shows the fluctuation in the deliveries to the Southern California market. Does the San Juan feed into the Southern California market?

A It does not.

Q Does the lower portion of that chart reflect the same data with reference to the Northern California market?

A It does.

Q Is the gas produced in the San Juan put into the line that serves Northern California and communities in between here and the California line?

A It does.

Q Now, does the black line show the 1953 actual takes?

A It does.

Q And does the red line show the 1954 actual takes?

A It does.

Q Are those abrupt drops, how much volume does that drop such as appears here in the map on the 10/-th or 11th day of the month?

A These are 25 million increments here. The 11th, that is 450 million and on the 10th, we worked, that was a total sales, not all out of the San Juan but total sales of 600, about 630 million.

Q Then, in one day it dropped to 450 million?

A That is correct.

Q Mr. Striklin, what happens when you get one of those drops in the way you have to operate up there in the San Juan?

A We take the swing and cut the gas back.

Q How do you actually do it? Do you go out and turn valves on any portion of the 700 wells?

A We sure do. However, it depends on the size of the order that we get. It is quite possible to, by cutting back compressor stations and raising the pressures on the plants to raise the pressure in the field there by cutting back the flow to some extent. However, on heavy cuts, we have to go to the field and cut them off.

Q What is the effect of cutting off compression and raising the pressures on the gathering lines?

A Well, it gives you a higher pressure at the well head and the gas won't flow into the gathering system.

Q Which wells are the ones that necessarily are affected when that happens?

A Well, they are all affected. However, the wells that produce the least gas would be affected the most, I suppose. They would have less flow into the pipeline. They are weaker.

Q Is it possible in marketing this gas out of the San Juan to operate a system in such a manner that a well can be allowed to pro-

duce the same amount of gas each day in the year?

A Oh, no, no, sir.

Q Do you have any charts which you have prepared with relations to the actual takes from the San Juan Field?

A Yes, sir, I do.

Q Is that both Mesaverde and Pictured Cliffs?

A Yes, sir, it is the total.

Q Is that marked Exhibit No. 6?

A Six, yes,sir.

Q Will you hold that up so we can see. I think there are several sheets.

A It runs by months from August, 1953 through May, 1954.

Q Let's start with August, 1953, just get Mr. Woodruff to hold it up. Let's use him for a board there. Just trace, if you will, thefluctuation in the actual takes of gas during that period?

A Well, all right now, this chart, the top is 330 million and it stops at 160 million on the base. You can probably get some idea as to the trend through here. You want me to name--

Q (Interrupting) Just pick out some of the figures there?

A All right, on the 1st day of August, we were handling 195 million;on the 14th day of August, we were handling 275 million. I am showing extremes here. On the 23rd, we were down to 180 million, consequently on the 24th, we came right back up to 200, about 240 million, so on.

Q Let's look at the next month. What is the next month?

A It is in sequence, it is September.

Q Just give the two extremes in the fluctuation, the lowest?

A It seems like the extreme high would be somewhere in the

neighborhood of 270 million, it is 295 million and the lowest was 90,million.

Q Now, for the next month, what is the fluctuation?

A Well, we get the extremes again, we go over to the latter part of the month of October. We are in October, that extreme there would be, oh, about the 24th or 25th. It was Sunday, about 200 million, on Monday, 310 million.

Q The next month?

A Well, there we get to the end of the month again, and that is November and that would be on the 29th, it is on Sunday and we are down to 100, about 175 million on Monday we are up to about 308 million.

Q What other months do you have?

A I have another month here in December and that is on the 19th, we went way down. That particular case, however, was due to some physical work that we were doing to the pipeline, normally in the winter months, it stays a little better than it does in the summer. January , 1954, we started out with 300 million and we ended up with 435 million, 400 and about 438 million maximum. This is February, on about the 12th of February, we were at 400 million a little under about 395 million, maximum 455 million.

Q Those that we have shown are they typical of the fluctuations that take place?

A They become more rapid in the summer time.

Q Let's go to the last one.

A It started out,oh, well, it goes all over the place, we are down here to 215 million and we are up to 415 million and it just jumped all over the place during that month. That was May, 1954.

You want me to post this up here?

Q Yes. I believe you have an average figure that represents on peak of the pipeline capacity the additional amount you have to have for fuel in the compressor stations and shrinkage, one thing and another. Do you have a figure on that?

A Yes, sir. You are talking about the field fuel now?

Q Yes.

A Yes, sir, we have a figure on it.

Q Is that for use in the drilling out there in the field?

A Well some, that figure isn't, there is some drilling in with gas out there and we do use it, the figure that I had there that isn't included in that 22 million.

Q That is fuel that goes into compression?

A It goes into compression absorption losses and that sort of thing.

Q What does that figure run? A 22 million.

Q A day? A Yes, sir.

Q What is the capacity of the El Paso system, present system in the San Juan Basin?

A Well, we have got a certificate for 387 million.

Q That is delivery at California or point of delivery?

A Delivered out of the Basin.

Q In order to do that, you figure you have to take from the wells, approximately, 22 million more?

A That is right

Q I believe the question was asked as to the load factor which the system is designed, do you know what that is?

A Yes, we are designed to operate 91 percent.

Q 91 percent load factor? A Yes.

Q In the operations in the field when the peak demand comes on, where do you have to get the gas?

A From the San Juan Basin?

Q Yes.

A From the wells.

Q From any wells in particular as the peak demands go up?

A No, we get that after you have gone so far, you get what we have been doing as has been pointed out here in previous testimony, we have been flowing most wells on the line with the exception of the severe cut backs when we get high demands, we go and turn the wells on that we have off and put our compressor stations up to the designed capacity pull, and pull the gas out of the line.

Q If you have a well on the line that is making its deliverability, can you get any more gas out of it when you get to the periods of high demand?

A No.

Q If you have got a well that will deliver a hundred thousand cubic feet a day, why can you get much more than a hundred thousand cubic feet of gas out of that well?

A No, that is all you can get.

Q So, that the question I am getting to, Mr. Striklin is this, is it possible not from the company's operations, but from the viewpoint of the operators, of the small well that he can make up when he loses out on the production by reason of having his well shut in or by reason of having the line pressure backed up to where he can't deliver against it?

A As I understand it, the well is on, it is on its maximum,

it delivers that.

Q Yes.

A Then, for some reason it is shut in.

Q That is right.

A No, sir. There is no way in the world.

MR. HOWELL: That is all.

MR. SPURRIER: We will take a short recess.

(RECESS)

MR. SPURRIER: Mr. Howell.

MR. HOWELL: We would like to offer the Exhibits 1 through 6 and with reference to copies 1-A and 1-B we would like permission to withdraw them after the conclusion of the hearing long enough to make copies and then replace the copies.

MR. SPURRIER: Are there objections? Without objection they will be admitted and you may withdraw them for making copies.

MR. SPURRIER: Does anyone have a question of Mr. Strickland?

MR. TURNER: Just one.

J. M. STRICKLIN

Cross Examination

Q Mr. Stricklin, would you state for the purpose of the record approximately how many miles of natural gas pipe lines are operated by El Paso Natural Gas Company?

A Well, it would be approximately in the neighborhood of eighty-five hundred miles.

Q Eighty-five hundred miles of pipe line?

A Yes, sir. (That is all.)

BY MR. GREINER:

Q I am not sure whether you covered this or not. Maybe I missed it. At what annual load factor did you say your system was operating, at the present time, or was designed to operate at?

A I said designed to operate at.

Q At which? A Ninety-one percent.

Q Designed to operate at ninety-one percent?

A Yes, sir.

Q Is that in fact what you are operating at at the present time?

A No, we are operating at about seventy-five percent.

Q Is that merely through the summer or taking the whole well, say the year starting from now, would that be your guess as to what it will be for the next year?

A No. I think that that load will pick up in the Fall.

Q So it will be somewhere between seventy-five and ninety-one in that range?

A Well, it would be possibly around ninety-one percent on the average. I couldn't say to that, of course.

MR. SPURRIER: Anyone else? If not, the witness may be excused. (Witness Excused)

MR. HOWELL: That is all we have.

MR. SPURRIER: The next company on the list is Southern Union, I believe.

A. M. WEIDERKEHR

Direct Examination

BY MR. GRENIER:

Q Will you state your name for the record?

A A. M. Weiderkehr.

Q You are employed by Southern Union Gas Company, Mr. Weiderkehr?

A That is correct.

Q In what capacity?

A Manager of the Exploration Department.

Q What is your professional background, if any?

A Well, I am a graduate of Texas A & I College. Graduated in Natural Gas Engineering. Also, with a B. S. in chemistry. After graduation I went to work for Magnolia Petroleum Company; worked two and half years in the field covering fields in Arkansas, Louisiana, East Texas, and South Texas; and two and half years in their Dallas office working as a reservoir engineer; and for the past two years I have been employed by Southern Union most of that time as Southern Union's reservoir engineer.

Q You have testified previously before this Commission?

A I have.

Q Have you ever turned any valves in the field, Mr. Weiderkehr?

A I have.

MR. GRENIER: Are his qualifications acceptable?

MR. SPURRIER: They are.

Q Mr. Weiderkehr, will you tell us, please, what Southern Union's interest at the present time is in the production of gas from the Blanco-Mesaverde Pool.

A Well, Southern Union is both a producer and a transporter of gas from the Blanco field.

Q Approximately how many net gas wells would the company's working interest in the pool amount to?

A Approximately fourty-three.

Q Are any of them subject to being bought away from the Company by anyone else?

A Half of them are subject to Aztec Oil and option by Aztec Oil and Gas Company.

Q Which would leave Southern Union with a working interest in twenty-one or twenty-two net wells?

A That is right.

Q Does the Company have any additional undeveloped lease holdings in the Mesaverde Pool as presently defined or in its immediate vicinity and believed capable of producing from the Mesaverde?

A Yes we do; in the vicinity of twenty-five thousand acres.

Q Is any of that under option to Aztec?

A Thirteen thousand acres of that is under option.

Q So about twelve thousand acres is left that we know we are going to have, in any event?

A Correct.

Q How many wells in Southern Union's pipeline system currently connected to in the Mesaverde Pool?

A I would say in the vicinity of one hundred thirty wells.

Q Is it purchasing directly from all of those wells?

A Southern Union or the Southern Union subsidiary connected to those wells.

Q And is it taking from all its own wells?

A Not necessarily, no.

Q The gas from some of the wells is being sold to El Paso, is that correct?

A That is correct.

Q As a producer, would Southern Union, in your opinion, be materially affected in relation to its total business by the imposition of any of the prorations formulas which have been described here during the past two or three days?

A Well, as a producer I think probably Southern Union has wells that are probably average in the field and I don't think it would make a whole lot of difference what type formula was set by the Commission. As a purchaser, of course, we realize that the more deliverability involved, the easier it is to operate. If proration is necessary, and we sort of think it is, it won't affect us a whole lot no matter which type formula that we have to go to since there is going to be work involved in any type of formula.

Q In other words, the opinions which you express as respects what would be a proper allowance formula between wells will not be materially influenced by the effect which they might have upon our company?

A I hope not.

Q Just why then is Southern Union interested in these proceedings, in taking a part in them, and proposing an allocation formula.

A As I stated, we are a producer, and the management of our company feels that we are connected to quite a number of wells from

independent producers who he thinks we need to protect. He is interested in protecting them as well as our own company. For that reason we are planning to take an active part in this hearning.

Q It is your idea then, that whatever formula is adopted in the field should be as fair as possible to every one?

A It is.

Q That is the primary basis upon which you are going to testify?

A Yes.

Q Have you made any studies of the Blanco-Mesaverde Pool to determine its characteristics in an effort to determine what might be a fair proration formula to apply there?

A I have.

Q Have you made any study in particular of deliverabilities as developed in the field by means of the recent or the last deliverability test?

A I have.

Q Have you any maps or anything of that sort to show for your efforts?

A Yes, I have one, the list of which the Commission has seen. I am going to put it on the board and discuss it very briefly, but it has a second purpose in that we have cross sections following. This map was prepared from information taken from the Commission's files, information supplied by El Paso Natural, and information collected by Southern Union in its own testing program, and we have shown, have a scale showing varing deliverabilities and a color scheme as the Commission has seen in other exhibits. I think it is

self-explanatory.

Q Do you observe from an examination of this map or from the other studies which you have made, any relationship between the deliverabilities there shown and the underlying reserves as indicated by the data which you have had available to you?

A I feel that in general, there is some trend between deliverabilities and reserve, but I do not feel that this trend is consistent throughout the field. I do not believe that variations in reserves vary with it directly, with the deliverability of the wells.

Q Have you, too, had an opportunity to examine any cores which have been taken from various wells in this field?

A A few.

Q What do those cores indicate to you respecting the consistency of porosity and permeability through the field?

A The few cores that I have seen have a general characteristic showing somewhat in the vicinity of nine to eleven percent average. There are varitions--

Q Average what?

A Nine to eleven percent variation in porosity. There are extreme cases, of course, where the porosity drops down to very small percentages and the porosity can increase in small intervals up to sixteen to twenty percent.

Q How about the permeability, have the cores that you have examined seemed fairly homogenous in their permeability?

A No.

Q Have you seen any evidences of fracturing in the cores that you have examined?

A I have.

Q Material or slight?

A Let me say that I am not a geologist, I do not intend to qualify to a geologist and I would prefer that you would leave that question alone.

Q Restate for us then if you will, to what you attribute the rather wide variation in deliverability as reflected in our color or code map and the two, three, previous similar maps which we have seen, the wide variation in off setting wells there.

A I believe, and again I say I have no conclusive proof, but I believe that this variation must be due to a system of fracturing.

Q Would completion methods have anything to do with it?

A They would but they would probably have little to do with wells which were completed, naturally, with high IP's.

Q But as between the wells which had been shot and had initially similar IP's variations after the shooting would probably be due to the shooting rather than to differences in reserves?

A Due to the results of the shooting, yes.

Q Or other stimulatory techniques?

A Right.

Q Have you worked up any additional exhibits in anticipation of this hearing, Mr. Weiderkehr?

A Yes, I have.

MR. GREINER: Mark this exhibit Number Two for Southern Union Gas Company. (Marked Southern Union's Gas Company Exhibit No. 2)

Q Will you generally describe this exhibit to us, please.

A Our Exhibit Number Two is a cross section starting in Section 2, 3, North and 12 West, and taking a general southeasterly trend across the heart of the field and down in the southern end of the field, and ends up here in Section 6, 26, 7. That is a cross section showing the electric and/or neutron logs on various wells in the field. I have shown at the top of this exhibit the company number, the well name, the location, and the deliverability which I obtained from sources heretofore mentioned for each of the individual wells. I have also, I believe on each well, shown the casing point on the individual wells.

Q Now I see a red line--excuse me.

A The scale on this, on the left hand side of the map is simply a sea level scale and shows the relationship of each individual well as far as sea level is concerned.

Q Now I see a red line on the map going up and down. What does that represent?

A The red line represents a graphical interpretation of the deliverabilities that are pointed up here and it is on there to show the fluctuation a little more easily.

Q Does there appear to be any consistent relationship there between sand thickness and deliverability?

A No. Apparently not. If I am permitted to look across the various sands that appear to be trending across the wells, I note that some wells of apparently the same general sand thickness have extremely wide variations. I also note that there are wells with thinner sand sections which do have lower deliverabilities and

which would seem to indicate that in some instances deliverability and reserve might tie together. I would aslo like to point out for the record at this time, that this particular well was completed only in the Point Lookout and had a deliverability of nine hundred twenty-nine thousand a day, against another well in the same general location completed somewhat higher with a deliverability of two hundred sixty-two MCF a day.

Q That is also higher on the ones on the right?

A To the extreme right showing, I believe, that reserve can not always be based on the deliverability of the wells.

Q Do you have an additional exhibit to show us at this time?

(Marked Southern Union Gas Company's Exhibit No. 3 Case No. 330, 330A, for identification)

A Yes.

Q Before we take up this exhibit, let's go back and clarify the record a little bit. You said that this well in referring to Exhibit Two had been completed in only a portion of the Mesaverde series. Which well was that that you were referring to?

A Southern Union Gas Company, No. 1, Patterson. Section 2, 31, North, and 12 West.

Q Which were the other wells that you referred to as being opened through the entire series and have a lower deliverability?

A The second well to which I referred was El Paso Natural Gas, No. 1, Heaton, located in 28, 31, 11, some five or six miles away; simply for explanatory purposes, but that they are closer together in 36, 28, 8, El Paso Natural, Blanco No. 1. Unit completed with the entire section open with the lower deliverability than the

Southern Union Gas Company, Patterson, No. 1.

Q Will you explain Exhibit Three to us, please?

A First let me refer to our Exhibit Number One which shows the location of the various wells shown on Exhibit Number Three. These wells are located in a nine section area, being sections 22 through 24, or 22 through 27, and 34 through 36, township 31 North and 9 West.

Q Why was that particular group of wells picked, Mr. Weiderkehr, for this exhibit?

A Because there is some variation in deliverability between wells and of such close proximity.

Q Tell us what Exhibit Three shows?

A Southern Union Exhibit Three shows the various wells pointed out, shows the neutron log of the individual wells which were considered from which I believe that we can pick generally the sand thicknesses showing that the sand across most of these wells are approximately equal. I have shown the deliverability where it was available or the IP's where it was available on each well, and the deliverability if it was available. Since I didn't have the information on all wells, I showed the maximum production for the year 1953 and the total production offset the number of wells that well has produced. This exhibit shows that offset, relatively offset wells produced monthly fourty-six million, seventy-three million, one hundred sixty-eight million, fifty million, sixteen million, thirty-two million, fourty-nine million, one hundred twenty-seven million, no production, these are thirty-four million, thirty-eight million,

and eight million.

Q What are the variances which you observed in deliverabilities on the wells which you have data in this group of wells?

A In this group of wells the lowest deliverability is four hundred twenty cubic feet, thousand cubic feet per day. The highest deliverability is nine million and fifteen thousand cubic feet per day.

Q In IP what variance do you find?

A IP's vary from 2240 MCF a day to 23,000 MCF a day or 23 million cubic feet.

Q Does this exhibit tend to confirm or weaken your previous statements as to the probably relationship between deliverabilities and reserves in this Pool?

A I think that this exhibit pretty definitely shows that there is in many instances, particularlly where a group of large wells exist, that there is no probable relationship between deliverability and reserve.

Q Do you have any other cross section of the field along similar lines?

A Not along similar lines.

Q Do you have any other cross sections of the field?

A I do.

(Marked Southern Union Gas Company's Exhibit No. 4.)

Q What does this exhibit, which has been marked as Southern Union Gas Company's No. 4 show Mr. Weiderkehr?

A Exhibit 4 is the line B prime originating in Section 5, 30

North and 10 West and going across 30 North ending up in Section 19, 30 North and 4 West. This is a cross section across the center of the basin, actually. On it I have shown the well name and the location, the operator, the IP if available, the deliverability and maximum months of production if available, and the 1953 production. I have also shown on all, with the exception of one well, the casing point. I have drawn a line across what I consider to be tje top of the first main sand below the Pictured Cliffs which may or may not be the Cliff House. I have also attempted to determine the bottom of the Mesaverde section. This line (indicating) I hope you will ignore it. The map was prepared for something else. It does show the structural relationship between the Pictured Cliff and Mesaverde series.

Q Does this Exhibit tend to show anything with respect to thickness of sand and relation to position and field?

A I think this map will pretty well prove that acreage as a location factor could not be fair.

Q That is acreage alone?

A Alone, since I would assume that each of these wells, all of them with the exception of these wells, which I believe are considered commercial wells and yet the pay section in these wells from which we determine reserves varies from approximately gross section approximately seven hundred fifty feet over to possibly one hundred fifty feet.

Q That is a gross sand section rather than a net pay?

A Gross sand section.

Q You have not attempted to evaluate on this exhibit net pay?

A I have not.

Q Have you made any studies, Mr. Weiderkehr, as to the length of time that it will take wells of average cost in the Mesaverde Pool to pay out at various rates of production?

A Yes, I have. Based on an 87½ percent value of gross production, assuming Mesaverde gas to be worth twelve cents, I have shown the pay-out time of wells which I assume cost eight thousand. This pay-out time is based on two hundred, fifty, three hundred, three hundred fifty, four hundred, four hundred fifty MCF per day.

Q What do those pay-out times indicate it to be?

A The pay-out time for a well producing two hundred thousand cubic feet of gas per day three hundred sixty five days out of the year is 10.43 years; the pay-out time decreases and at four hundred fifty thousand cubic feet per day the well would pay out in 4.64 years.

MR. GRENIER: A copy of this has been marked as "Southern Union Exhibit Five" for identification purposes.

Q Have you made any similar studies as to, or are you familiar with the length of pay out period which the commission used in its recent hearings and studies regarding a depth allowable factor for oil production in the state?

A Yes, I think that approximated one half years.

Q What would the rate of production have to be for a Mesaverde Pool well to pay out in one and half years?

A 087½ percent of gross production, that would be around four hundred feet, if I have it, of gas per day.

Q Four hundred seventy-five thousand feet of gas per day. Based upon your studies, have you attempted to draw any conclusions as to what might be a proper proration formula for the Mesaverde

Pool the Blanco-Mesaverde Pool?

A I have some ideas. It is my contention that none of us know what is true and fair in this particular field. I think that I have shown that deliverability alone is definitely not fair. Conversely, I think I have shown that acreage alone could not be fair.

Q Why do you express only those two factors, acreage and deliverability?

A Those are the two factors which most operators in this area have considered.

Q Do you feel that there should be any minimum allowable fixed for the field which a well would get in any event to the extent that it is able to make it?

A I think that in any allocation formula which the Commission might adopt, that we will need a minimum allowable. I would suggest to the Commission that a minimum allowable be set at approximately three hundred fifty thousand cubic feet of gas a day which would give a pay-out of approximately six years.

Q That compares with the eighteen months pay-out period which the Commission's staff used in considering the oil depth allowable factor, is that right?

A That is correct.

Q Would you classify that as a slow, swift, or medium pay-out?

A Extremely slow, but I think that is necessary due to the fact that we have large areas that are proven for gas production in the San Juan Basin. But, the deliverability of these wells is going to be such that unless they are given a chance to make at least that much gas, they, will never be drilled. I know the approximate cost of wells in the area and that varies from I would say fourty-five

to one hundred thirty thousand dollars per well and unless a company anticipated that they were going to be able to get that money back, I don't think that a large portion of the San Juan Basin would ever be drilled. Areas which we know from past history contains gas, it would not be commercial at some what lower rates.

Q So that by setting a minimum allowable, you feel that you will encourage a greater ultimate recover of reserves from the field?

A I feel that we will obtain a greater ultimate recovery, that we will drill and develop areas that might not other wise be developed and in such drilling will develop new methods of completion which will be beneficial to the area.

Q In your opinion, should there be any maximum allowable imposed upon wells which would be able to produce more than that if there is a delivery component in the formula?

A Yes, I think a maximum allowable would be necessary.

Q How much would you recommend that the maximum allowable be?

A At the present time and under present conditions with the market demand being considerably less than the availability of gas, I believe that a fair top allowable would be somewhere in the vicinity of two and half million cubic feet of gas per day.

Q Explain to us why you feel that that would be a fair maximum allowable.

A It is my contention that there is no well in this field that has in excess of twice the reserves of the average well.

Q That is not of the poorest well, that is of the average well?

A That is the average well. If deliverability enters into the formula, probably the average well will get an allowable of somewhere

near seven hundred or seven hundred fifty thousand cubic feet of gas per day. If we give an allowable, a maximum allowable of two and half million feet of gas per day, we have not only protected correlative rights, but we have given some justification for an operator to develop new techniques in order to complete larger wells. I think that if you put too low a maximum allowable that you would take away some of the initative to develop better techniques.

Q This then is about three times the anticipated average allowable for the field, based on our current knowledge of probable demand conditions there?

A That is correct.

Q As compared to the two to one ration, which you think is probably the broadest spread in actual reserves between best well average well?

A Correct.

Q Now then, between the range of our maximum allowable and your minimum allowable, what formula would you propose to have applied?

A I would recommend to the Commission that they use a formula of fifty percent acreage times deliverability plus fifty percent acreage.

Q What is the basis for that recommendation, Mr. Weiderkehr?

A Do I have to answer? I believe actually that from testimoney that has been presented here and from the studies that I have made that that type of formula will allow each tract, each well to produce its equitable share of the reserves underlying that individual tract.

Q You don't feel that that is an exact correlation between reserves and allowable?

A No, I do not.

Q But you do feel that it is a reasonable, fair approach in the light of all the circumstances of which you are aware?

A I feel that it is just about as good as we can do from the information we have now.

Q Mr. Weiderkehr, there was some reference in previous testimony to these six month balancing periods, and when they might commence and end. Do you have any ideas as to how these balancing periods should be arranged during the year from an operating standpoint?

A From Southern Union operating standpoint, it would be advisable if we were to be able to balance out our summer and winter load to have a portion of the winter fall in each of the two balancing periods. Southern Union supplies primarly a domestic market and our load factor varies from winter to summer extensively. If all the six month balancing period should happen to fall in the summer, one time in the winter for the other six months, we might have trouble balancing out so I would suggest that February 1st be the cut-off date.

Q In other words, the two balancing periods would begin on February 1 and August 1 of each year?

A That is correct.

Q What is the annual load factor of Southern Union, if you know?

A Approximately fifty-two percent.

Q That is materially lower than the ninety-one percent or seventy-five to ninety-one percent testified to by Mr. Stricklin a moment ago, is it not?

A Yes, it is.

Q So that this is a matter of considerably greater importance

in all likelihood to Southern Union than it would be to El Paso from an operating standpoint?

A I don't know that I would go so far. They have considerably greater volume, but we have a greater variation in load. I think that I would agree with El Paso that they do need a date different from the Lea County area, but I would request that it be set only a month or so different, rather than the time they requested since our two lines are not connected, and we are in dire need of a cut-off date in the San Juan Basin, that will allow us to split our summer and winter production.

Q I believe you stated earlier that Southern Union's operating problems, particularly as a pipe line purchaser would be considerably greater if the proration formula adopted were one other than one hundred percent deliverability, is that correct?

A That is correct. It's easier to operate on a flowing line.

Q Is Southern Union's management, to your knowledge, prepared to undergo these additional operating difficulties in the interest of fairness?

A Yes, they are.

Q In other words, your concern here has been to find and recommend to the Commission what you believe to be the fairest formula from the standpoint of all concerned rather than merely the one which would be the easiest to operate under from our company's standpoint?

A That is correct.

MR. GRENIER: That is all we have.

MR. SPURRIER: We will recess until 11 o'clock in the morning.

MR. GRENIER: I request that Southern Union Exhibits 1 through

through 5 be admitted.

MR. SPURRIER: Without objections they will be admitted.

MR. SELLINGER: I will be unable tomorrow to be present to make my concluding statement for the reason that I am a member of the eight-man coordinating committee to overhaul the October proration system which has to be presented to the Commission Monday and Tuesday of next week. I want to explain the reason why I will not be here tomorrow to make a concluding statement. It goes without saying that we recommend our acreage times pressure formula.

MR. SPURRIER: Can you submit a written statement or would you care to?

MR. SELLINGER: I will be glad to and I will be glad to furnish each of the proponents a copy of my written statement.

MR. SPURRIER: Are there others that would be willing to do the same in the interest of time?

MR. FOSTER: Yes.

MR. REEVES: I think the Pubco would like to take advantage of that offer. It os happens that I too have to leave town tomorrow.

MR. SPURRIER: Yes, and don't forget that the quick way to get, maybe you don't want a quick way, but the way to get an order in this particular case is to submit proposed rules along with your statement or at some time later.

MR. SELLINGER: We have already done so, but we will attach a copy of our proposed rule to our statement to each of the companies.

MR. SMITH: Will you set a time within which the written statement should be submitted?

MR. SPURRIER: I think we should. We will give you a time on that tomorrow. If there is nothing further, we will recess until

eleven tomorrow.

(Whereupon the hearing was recessed to 11:00 A. M. June 24, 1954.)