BEFORE THE

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE 1641

TRANSCRIPT OF HEARING

May 7, 1959

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NEW MEXICO OIL CONSERVATION COMMISSION

Daniel S. Nutter (Examiner)

Santa Fe, NEW MEXICO

REGISTER

HEARING DATE May 7, 1959 TIME: 9 o'clock

NAME:	REPRESENTING:	LOCATION:
D. A. Mugan	W. R. Weaver	Farmington N.M.
E. C. Arnold	NMOCC	ofc Dr
A. J. Dudenhoeffer	El Paso	Farmington
L. D. Galloway	" "	"
G. W. King	Pan American Pet Corp	Ft. Worth
Gay Buell	" " " "	" "
A. Marshall	" " " "	Farmington
Kirk Newman	Atwood & Malone	Roswell
Fred Hannahs	El Paso Nat. Gas Co.	Santa Fe
Frank Andrews	" " "	Santa Fe
R. F. Lemon	EL PASO NAT. GAS CO.	EL PASO
Ben R. Howell	" " "	"
D. H. Rainey	" " "	"
A. N. Brown	Weaver & Brown	Farmington
Burnett Errebo	" "	Albuquerque
James E. Sperling		

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
MAY 7,1959

IN THE MATTER OF:

CASE 1641 Application of W. R. Weaver for the promulgation of special rules and regulations governing the Angels Peak-Gallup Oil Pool. Applicant, in the above-styled cause, seeks an order promulgating special rules and regulations governing the drilling, spacing, and production of oil and gas wells in the Angels Peak-Gallup Oil Pool in San Juan County, New Mexico.

BEFORE:

Daniel S. Nutter, Examiner.

T R A N S C R I P T O F P R O C E E D I N G S

MR. NUTTER: The hearing will come to order, please. The first case on the docket this morning will be Case 1641.

MR. PAYNE: Case 1641. Application of W. R. Weaver for the promulgation of special rules and regulations governing the Angels Peak-Gallup Oil Pool.

MR. SPERLING: Appearances for the applicant, W. R. Weaver, Burns Errebo and J. E. Sperling, Modrall, Seymour, Sperling, Roehl & Harris.

MR. NUTTER: Are there any other appearances to be

made in this case this morning?

MR. NEWMAN: Kirk Newman of Roswell, New Mexico and Guy Buell of Fort Worth, Texas, appearing on behalf of Pan American Oil Corporation.

MR. ANDREWS : Seth Montgomery, Federici & Andrews, by Frank Andrews, appearing with Mr. Ben R. Howell of El Paso for El Paso Natural Gas Company.

MR. NUTTER: Any further appearances?

Would you proceed, Mr. Sperling?

MR. SPERLING: Yes. Mr. Harris, stand and be sworn.

(Witness sworn)

J. J. HARRIS,

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

DIRECT EXAMINATION

BY MR. SPERLING:

Q Would you please state your name?

A J. J. Harris.

Q Where do you live, Mr. Harris?

A Albuquerque.

Q And what business or profession are you engaged in?

A Consulting geologist.

Q How long have you been practicing your profession in the San Juan Basin?

A Since, including my company experience, since January of 1947.

Q Give us a very brief resume of your education and experience background.

A Well, I went to school at the University of Texas. Did most of my geological work there, got my degree from Texas Christian University, and did some graduate work there, and was employed by Stanolin Oil & Gas Company at that time, from 1947 to -- I was employed by them earlier,before the war, but in the geological end of it, from 1947 to '53. The last year I was area geologist in Albuquerque for them. I have been consultant since then.

Q Have you appeared previously before this Commission?

A Yes.

MR. SPERLING: Are his qualifications acceptable, Mr. Examiner?

MR. NUTTER: Yes, sir, they are. Please proceed,

Mr. Sperling.

(Whereupon, Exhibit No. 1 was marked for identification.)

Q Mr. Harris, I will ask you to refer first to the Exhibit which has been marked Exhibit No. 1, which appears on the board there, and ask you to explain what that shows and the purpose of its preparation?

A Well, it is a structural map of the Angels Peak-Gallup field contoured on the lower Gallup member of the Gallup formation. The original Angels Peak outline went through here; the field has since then been extended to include this area as shown by this outside line here. And on this map, we will attempt to show.--

Q Mr. Harris, would you stand over on this side, if you please, so that the Commission staff can see the Exhibit.

A We will attempt to show the limits of the oil rim on the north and the gas on the south.

Q Will you explain what the red area represents?

A The red area represents the proved oil productive rim in this Angels Peak field, according to my figures and estimates on it, and actually it is probably a little bit wider than it is from later information.

Q What does the green area represent?

A It represents the proved gas area. I didn't take into consideration everything, but I limited it by the production

of the wells that are on there. It shows the proved productive gas area in that field.

Q Now, in the preparation of that Exhibit, and the indication of the red and green areas, what information did you consider as a basis for that estimate?

A Used the electric logs on all the wells considered, plus the gas-oil ratios in the wells, and the amount of productive sand looked like it would produce oil or gas in those wells.

Q And what about the structure contour information?

A It's contoured on the lower Gallup member of the formation which is, all of these wells in this area are producing from. I believe the 107 may be perforated other than the lower member, but some of the wells up here are perforated above the lower Gallup also, but --

Q Is there a substantial variation in gas-oil ratios between the wells which appear to be located in the red area and those wells located in the green area?

A There is a substantial difference in gas-oil ratios in those wells. However, the gas-oil ratios in these wells are going up since the original gas-oil ratios were taken.

MR. NUTTER: You mean in the red area?

A Yes. This one has increased to a certain extent. This one I don't know whether it has increased or not. The McAdams No. 3 has increased slightly; we don't have a gas-oil ratio on this Pan American Frost "B" 1, since that well is still recovering

load oil.

MR. NUTTER: Mr. Harris, you stated two wells and pointed them on the map had increased their ratios. Would you identify those wells for the record, please?

A The El Paso Natural Gas Company's Huerfano No. 105. I believe that was turned in originally at 6,000; I have forgotten. It is now 11,000 to 1. You have the original gas-oil ratios. The last report we had on this well was 9300 to 1. Pan American's McAdams "B" 1. The W. R. Weaver McAdams No. 3 has increased from 5200 to 5700 to 1. As I said, this well, we don't have any information, the Pan American's Frost "B" 1 because it is still recovering load oil.

Q (By Mr. Sterling) Now, you have indicated that the red and the green areas are the proved areas of gas or oil production?

A Yes.

Q Can you give us an opinion as to the possibility of the extension of either of those two areas?

A I believe, in my opinion, the oil area is limited by the Pan American McAdams "B", which was completed. The latest potential we had on it was 41 barrels per day. The Frost "B" 1 still had, at last report, which was two or three days ago, 1613 barrels of load oil still left in the hole, and was producing from 20 to 40 barrels a day on the pump, which looks like it is doubtful whether it is commercial or non-commercial -- doubtful

that it is commercial, I should say.

Q From your test, then, it's your opinion that the northern rim or edge of the oil producing area has been defined by the Frost Well and the McAdams "B" 1 Pan American, is that right?

A I believe it has been limited there, to the logs and those two wells.

Q How long has it been since the Frost Well was fraced?

A That's been about the time of the last hearing. I don't remember the date it was fraced. It has been just close to thirty days that they have been trying to recover load oil out of the hole.

Q What about the McAdams "B" 1?

A As I understand, they didn't recover all of their load oil until they opened both zones together in the Gallup, all of the different zones, and they finally recovered all their load oil and had to pull -- they have had trouble -- they had to pull their pump once.

Q Now, you have stated that the northernmost edge of the oil area has been defined, in your opinion. What about the southernmost area -- or the gas area, which you have shown as proven on that Exhibit?

A I called it proven due to the fact that this is one of the good gas wells which is the El Paso Huerfano No. 103, and

it is a high gas-oil ratio well, and I extended the limits to include the 160 acres on that well on the line very close to the contour. I didn't follow the strikes of the contour exactly because those sands don't always follow the strike of contours, and that's as far as proved gas production. And on the southeast end, I think this definitely limits there because it had a potential of about 352,000 cubic feet from the Gallup.

Q Is that the Huerfano No. 92?

A That is the Huerfano No. 92, which would limit it, I think, east and south, as far as proved production. Now, straight south of the Huerfano, El Paso's Huerfano 103, that is not limited as to possible production because -- as to the north edge of it -- because we still have a good well there, and the sand still looks good on the log. So it could possibly extend on one location or three or four locations. We do know in our own minds that we have a permeability barrier somewhere between the 103 and the El Paso Natural Gas Huerfano 104, because we are producing oil structurally higher from the 104, from the same zone that we are producing from the 103. So we almost have to have a permeability barrier somewhere between these two wells, otherwise, you would be producing oil higher than your gas, which would foul everybody's theory as far as the gas cap is concerned.

Q Now, Mr. Harris, in your opinion, with the drilling of the Pan American's Jack Frost No. 1, since this matter was last considered by the Commission, do you feel that the drilling of that

well has provided additional information with reference to the northern extent of the oil producing area?

A I certainly do, yes.

Q I take it, from your previous testimony, that you feel that there is an excellent possibility of the extension of the gas producing area a substantial distance from the south of what you show as the proven area?

A I feel sure it will extend to the south. Nobody can tell how fast it is going to pinch out. Apparently, the sands are thickening to the south a little bit, so there will be some extension to it because we still have a good well here where we are limited by a well of doubtful commercial value on the north.

Q Now, in connection with sand thickness, Mr. Harris, I will refer you now to Exhibit marked 2 and ask you to explain what that is, Mr. Harris.

A Exhibit 2 is a cross section from north to south made from electric logs showing the Gallup formation through the Angels Peak-Gallup Pool. I have an index map on the cross section showing from A which is this well here, which is the old, on the logs it is called the old Stanolin Oil Company's Angels Peak 1. I believe you now call it Pan American's J. C. Gordon No. 1, but I labeled them as they were labeled on the logs. And Angels Peak 2 is this, which is this well here, and on this map it goes straight down across here. This is the Pan American Jack Frost "B" 1, which is this well here, down to the McAdams W. R. Weaver,

Weaver McAdams No. 3, this well to the Weaver McAdams No. 4 to the El Paso Natural Gas Company's 103, which is the southernmost well in the cross section. As you can see, you can't see very much on the Angels Peak No. 1 to the north, but there is practically no sand development in the lower Gallup. There is no development as far as being a clean sand. You can see it plainer on this one, which is the Angels Peak unit No. 2 located here. There is no commercial Gallup production in the lower Gallup. You do have a little resistivity there which is common through all these sandy sections of the Mancos. Somewhere between the Angels Peak 2 and the Pan American Jack Frost 1, this sand pinches out entirely as far as the productive sand, which is indicated on here. This cross section shows a little more sand than is actually in the productive sand, just a gradual pinchout of the sand on this. It is a very shaley sand as indicated by your SP curve on the log there. This is your shale line. You draw a line straight across there, leaving you very little clean -- there is -- I doubt if there is over two feet of clean sand on this well. I don't have any core analysis on it. I've calculated the capacity from the sonic log that was run on the hole, and which was, porosity was very low on that well all the way through it. We come to the McAdams 3. Your sand is thickening considerably. It is, the Weaver McAdams No. 3 has cleaned up. You have a very clean sand there as indicated by the log. The McAdams No. 4, which is the next well on your cross section, also

has very clean sand, which is our best well on the lease as far as a gas well is concerned. And going on down through, you've got a further thickening of sand here. It is a little bit shalyer than either of these two, according to logs. However, this SP log has drifted. We don't know if that is caused by being sandy or mechanical on the log; they will do that sometimes. But it shows that the sand section is still good and increasing and getting better to the south, so we know that our gas production is not actually limited here, even though that is all I can prove. You might get a dry hole 330 feet from the line there, but it is not probable, let's put it that way, that we will probably have at least two more locations south we could extend this gas area.

Q Well now, that cross section that you have been referring to, taken as it has been, generally from north to south, does that substantiate the conclusions that you have drawn with reference to establishing the northernmost boundary of the oil producing area?

A Yes, it definitely establishes the northernmost boundary because, as I say, this well is of doubtful commercial value, and that's the only way we can determine the limits of the field. When you cease to be commercial, then you stop drilling there. If it has been a month recovering load oil and recovering at the rate of 20 to 40 barrels a day, when that load oil is entirely recovered, it will be pretty low, I imagine, the potential.

Q Now, as sand thickness does increase to the south

there, is it reasonable to conclude that your reserves increase substantially?

A Our reserves would increase substantially as your sand thickens and as your sand cleans up, which gives you higher porosity, more void space for oil or gas to be stored.

Q Now, Mr. Harris, if you will refer to Exhibit No. 3 and explain what that is?

A Exhibit No. 3 is an isopach map of the Angels Peak-Gallup field contoured also on the thickness of the lower Gallup. Shows a rapid thickening of the pay section to the north and the probable limits of the productive sand area in there, actually.

Q Was that Exhibit prepared from information obtained from logs?

A It was prepared from information obtained from logs, and I tried to pick out the net pay from the logs as well as I could to show the thickness. It is contoured on five-foot intervals from zero to twenty-five feet.

Q Now, what do you mean by net pay?

A The productive sand area, or the part of the sand. This area, we have shown about 35 feet of sand there. Actually, that is not all net pay, it is sand, but it is not productive sand.

Q Now, going back to Exhibit No. 2 again, what is your structural reference line?

A It's the top of the sandy zone in the Mancos, which is usually, most of us call it top of the Gallup, some call it top of the Gallup as far down as here, but it doesn't make too much difference. These zones correlate across, it is just a datum to hang the logs on and show this section.

This is all Gallup in here, this is lower Gallup here that we're concerned with in the hearing, I think mainly lower Gallup.

Q I see. And you do have excellent correlation reference points throughout the cross section?

A We have excellent, you can correlate on this, at this point to this point, and this one, this one, straight across you can pick any number of five section beds in there that will correlate exactly across there.

MR. SPERLING: I believe that's all right now. If you would like to take your seat, Mr. Harris.

One other question, Mr. Harris.

Q (By Mr. Sperling) From the study that you have made of this particular field, as indicated by these Exhibits that you have referred to, what conclusions have you reached, or what opinion have you formed with reference to the character of this field?

A My own opinion, I think it's a fairly small field, not a small field, it has an extremely large potential as a gas producing area with a very small oil rim on the north, as indicated on here, on Exhibit No. 1. I think our sand limits, thickness,

are definitely limited as far as -- I don't think it is a long drawn out trend like the Bisti field. I think we've got a small area in here of real good sand with the oil area, oil rim definitely going to the north to a very small area. We have zero sand in this Hancock Douthit well, which is now the British American Douthit. It is British American operating these properties. We are limited as far as--zero is the productive sand in those wells. The Frost "B" 1 has approximately 11 feet of sand, which has thinned there 22 feet. Here in one location it is half as thick, and this one down here, of course, limits the -- this one has 17 feet of sand, but it only potentials at 372 000, which is of doubtful commercial value at that depth. This well had zero sand, this Magnolia Crandell Well, also the old Huerfano No. 4, this Magnolia Crandell Well, if the production was following the strike of the contours, which it does in a lot of cases, it doesn't necessarily mean so in this case, because that well there is on,practically on strike with your McAdams Weaver, McAdams No. 3, which is a very good well, but this well had no productive sand apparently in the Gallup. So I think we are just limited on this end and on this end, but I feel that we have a large area which is gas productive and minor part oil productive.

Q Did you prepare these Exhibits?

A Prepard them myself.

MR. SPERLING: I think that's all at this time, Mr. Harris.

MR. NUTTER: Any questions of Mr. Harris?

MR. PAYNE: Yes, sir.

MR. NUTTER: Mr. Payne.

CROSS EXAMINATION

BY MR. PAYNE:

Q Mr. Harris, how many operators are there in the Angels Peak-Gallup Oil Pool?

A W. R. Weaver, El Paso Natural Gas Company and Pan American Oil Company, I believe, the operators that I am familiar with.

Q Has any attempt been made by W. R. Weaver to accomplish a pool-wide unitization with El Paso and Pan American?

A Not that I know of.

Q Don't you feel that this is one of the better ways, perhaps the best, to handle the situation where you have an oil pool with a gas cap?

A I'm not sure that that is an oil pool.

Q Well, even assuming that it's, just has an oil rim?

A With the lower permeability and porosity on the northern part of that unit, I don't think you could unitize and do any good. It would be, in my opinion, years getting your oil out at 20 to 40 barrels a day and even though you shut the gas well in to repressure them, just shut them in and forgot about them, which actually Weaver owns that gas under that section

that he is in, his correlative rights would be damaged, I think, by doing that.

Q If it were unitized, how would his correlative rights be --

A By taking so many years to get his investment back, probably about twenty-five years getting it back, by producing it that way, in my opinion.

MR. PAYNE: Thank you. That's all.

MR. NUTTER: Any other questions of Mr. Harris?

QUESTIONS BY MR. HOWELL:

Q Mr. Harris, Ben Howell, representing El Paso Natural Gas Company. From your Exhibit 3, it appears that you had not closed the pool to the northwest, you are not prepared to say that the area to the northwest will pinch out at any particular point, is that correct?

A That's correct. The zone in the El Paso Natural Gas Products Company's "B" 1 had 12 feet of sand that correlated with the lower Gallup here, but, in my opinion, this well is zero sand, which is more or less on strike with the contour on the structural map. However this may be another trend, I don't know. That's so far away that, it's about six, seven miles away. I wouldn't close these contours because we don't, I feel like we do have more gas production for sure in this area to the northwest, yes, sir. Somewhere between here and the Douthit Well, it stops, in my opinion.

Q As a matter of fact, the sand thickness, which the effective pay, which you give to the well, that is, the last one that has been drilled to the northwest is 22 feet, isn't it?

A That's right.

Q And you wouldn't purport to tell the Commission where the northwest limits of this particular pool would be or what would be found up there?

A No, sir, other than, I believe, in my opinion, it is somewhere between this Hancock Douthit Well and the Weaver area down across there.

Q But it is possible that it might run all the way up to the El Paso Natural Gas Products Company's Well, some seven or eight miles away?

A It is possible, I say not probable, but possible, in my opinion.

Q At the present time, however, we cannot define the northwestern limit?

A No, sir. I think we can, southeastern limits and the north limits; we cannot northwestern or the south limits, or the southeastern limits.

MR. HOWELL: Thank you, Mr. Harris.

MR. NUTTER: Any other questions of Mr. Harris?

RECROSS EXAMINATION

BY MR. PAYNE:

Mr. Harris, how long does it take to pay out a well on

this pool?

A Under present --

Q Well, let's take an oil well first, under present conditions?

A Now, you are speaking of one of your El Paso wells in the oil rim or --

Q Yes, we will take those first.

A Mr. Dugan will answer those questions on the engineering end. I haven't calculated; I could very easily.

Q Have you calculated them as to the gas wells?

A Roughly, but Mr. Dugan has calculated those out too. He is going to do the engineering testimony for us.

MR. PAYNE: All right, sir. Thank you.

QUESTIONS BY MR. NUTTER:

Q Mr. Harris, this connecting section of your Exhibit No. 2, all the wells are hung on a common datum, being the top of the Gallup zone, is that right?

A That's right.

Q You haven't attempted to show any structure or dips of structure on the north?

A No, sir. The structural contour map will show the dip of the formation, which is generally from southwest to northeast. It is almost north in this particular area of San Juan Basin, slightly northeast, which is very gentle.

Q What is the actual degree of dip in here?

A I didn't calculate by degree.

Q I mean in feet per mile.

A You've got from, say, from a 500 to 425 right here. That's about 75 feet to a hundred feet per mile, which would be approximately 1 degrees, about 90 feet per mile, I believe, which is just apparently regional dip. Thereis a little bit of nosing shown in here as some structure begins to pick up in the Angels Peak area where the Angels Peak Well was drilled -- and there is a little nosing over here on your Magnolia Well, which is very similar to the nosing here, but this well is non-productive in the Gallup zone.

Q Well now, if you had shown this Exhibit No. 2 hung from sea level rather than just hung on a common datum, the top of the Gallup, you would have a dip to the right, would you not?

A You would have a dip to the right, you would be coming up to the right.

Q I mean, you would be coming up to the right,--

A To the south.

Q -- and then would the green line be crossed by a line that would be a gas-oil contact?

A Possibly could be a very slight gas-oil contact. It is not going to be very long, as indicated by your McAdams, Weaver McAdams No. 3, which I have placed almost on the -- I have placed it in the oil area, but it is above 5,000 to 1, it is almost 6,000 to 1 gas-oil ratio, and this No. 2, I think, is 116,000 to 1, which

is -- we definitely have a much cleaner sand through this very small area. We didn't recover many cores on the McAdams wells, but part of the cores had permeability and porosity up to 200 milladarcies, above 200 milladarcies, which I don't think any of the wells in the oil rim will show much over 1 milladarcy.

Q Mr. Harris, when you were discussing that green band on Exhibit 2 and talking about it thickening as it goes to the right, I believe I heard the word "reserves" creep into your testimony. Did you make any actual reserves for this area?

A Very roughly.

Q Do you have an approximate of what the reserves of gas and reserves for oil --

A Mr. Dugan has calculated those figures.

Q I see. Now, do you feel, Mr. Harris, that there is a possibility that the strike of this structure may pass a little bit more northerly than you have shown and that the Hancock Douthit No. 1 may be south of the strike or south of the structure?

A It is possible, but not indicated by the datum, the correlation on it. El Paso Products Company drilled a well, I believe, the Frontier 1 "C", I believe, in Section 17. It is not shown on here. I didn't get the log until after I prepared these Exhibits. I do have the log in my brief case, and I believe it is in Section 17, 27, 11. And I think that that log will show they didn't even attempt a Gallup completion in it. They completed in the Dakota. I have the large scale logs, but I want to be sure

of the location of it before I -- this 1 "B," 1 "C", Section 16 -- I was off a Section -- it is in the northwest northwest of 16, and if my information is correct, they didn't even attempt completion in the Gallup.

Q Now, what -- would the top of the Gallup figure be the same figure you used for contouring your Exhibit No. 1? What would that figure be in Section 16?

A Let me correlate and see. I'll correlate it with this McAdams No. 3. There is your Tolcito zone there, it would be this zone at the top of it. I would pick at 58, about 5878.

Q Now, all these tops that you have given on Exhibit 1 are above sea level?

A Yes.

Q Do you have the elevation of that well?

A The elevation is on the log. Elevation derrick floor, which is all calculated 5226. Does that bear out the structural contous?

Q Yes, sir, that would help you to draw your contour line, just about fall right on it.

Q It is to the south, see, so that indicates that your strike of the formation, your field, is sometimes limited.

MR. UTZ: What was the elevation?

MR. NUTTER: 5226 elevation.

Q (By Mr. Nutter) What about the El Paso Natural Gas Huerfano 105, what is the potential on that well, Mr. Harris?

A The 105 in Section 29, the well was originally, I believe, potentialed at 571 barrels per day. I have it right here. The 105 was potentialed at 571 barrels per day. I think that the potential has been probably lower. I know at the end of six days' production it was down to 139 barrels per day, I understand, and the gas-oil ratio has increased considerably, from up to 11,000 to 1, and I believe when that 571 was taken, this -- I am not sure of the figure, that the gas-oil ratio was reported as 1538 to 1.

Q That's one of the two wells that at the beginning of your testimony you stated that the G O R 's were going up?

A Going up, that one and the Pan American McAdams "B" 1, and even the Weaver McAdams 3.

MR. NUTTER: Any further questions of Mr. Harris?

QUESTIONS BY MR. ARNOLD:

Q Mr. Harris, do you think that the present structure of the San Juan Basin, as such, was a controlling factor in the accumulation of oil in this reservoir?

A That the structure of the Basin was as the way the sands were laid down or what?

Q No, I mean the present structure, the present configuration of the Basin. Do you think that had anything to do with the accumulation of oil, do you think the oil accumulated before that time?

A Highly theoretically, the oil was accumulated, of

course, after the sand was deposited, and migrated, I think, to the up-dip with the gas migrating a little ahead of it, and there was a very small amount of oil trapped in this Angels Peak area, and a large amount of gas was trapped there, apparently, as indicated by your El Paso Huerfano 104, which is oil, and this might be a major oil field here whereas the deep waters were probably along in here, and your sand, you had a permeability barrier created somewhere in here.

Q Would you consider this a stratigraphic rather than a structural trap?

A I sure would.

Q That being the case, there isn't any particular reason why the good sand in the reservoir should necessarily follow structural contours?

A No. This has a slight nosing here on the formation. As seen on the structural contours, your sand sometimes is a little cleaner where you have some type of structure, and that might have been just a little nosing where your sand happened to clean out a little better on top of the structure, which is normally found -- I know the Mesaverde production, which is apparently stratigraphic and blanket we don't -- we do find some better wells where there is some structure indicating that the sand in the Mesaverde cleaned up, and the sands in the Gallup are comparable to Mesaverde in the type of deposition, permeability, and it is primarily a gas producing sand. We have a lot of Mesaverde

wells producing more oil. I know the Nordhaus Well on the Canyon several years ago was producing two million cubic feet of gas per day for three months, making 163 barrels of oil a day.

Q To go further on my question, if you should project this pool further northwest, then there is no particular reason why it shouldn't cut across structure?

A That's correct. It generally follows structural contours, but not, it doesn't have to follow the configuration exactly. You can see the field itself, that's a good well, and this is a good well; across that area right there are the better wells in the field, and they are not on the same structural contour, but they are within the general configuration of the structural contour. In fact, all of the oil production in the San Juan Basin and oil production, Pictured Cliffs and Mesaverde, is all northwest, southeast.

MR. ARNOLD: That's all, I believe.

MR. UTZ: Any other questions?

QUESTIONS BY MR. BUELL:

Q Mr. Harris, my name is Guy Buell, with Pan American Petroleum Corporation. Would it be a fair summary of your testimony to say that the purpose of your testimony was to show a small oil area and a large gas area?

A I think that's right.

Q All right, sir, I wonder what the change would be in the appearance of your Exhibit No. 1 if we transpose your zero

isopach from your Exhibit 1, would that not show a much larger red or oil area than you have reflected on Exhibit 1?

A I don't think it would show a great deal larger oil area but I limited, by these wells, I limited by what I thought was commercial wells, I didn't limit it by actual sand thickness.

Q Mr. Harris, let's get back to my question. Let's transpose your zero isopach contours to Exhibit No. 1.

A All right.

Q Would that not greatly increase the size of the red or the oil area?

A When you get down to zero, you don't have production.

Q Mr. Harris, you want to answer my question?

A If I can.

Q When we transpose your zero isopach contour to Exhibit No. 1, would that not greatly increase the red or oil area?

A You want to put your zero contour up here?

Q Where your contour would fall.

A Let's see, I would put it at the north part of this section; the zero contour would fall right here, but that is non-productive.

Q Yes, sir, we realize that. Would you have any objection, Mr. Harris, or would you ask counsel if they have any objection; they may say so, but would you have any personal objection

to transposing your zero isopach contour on your Exhibit No. 1?

A No, I wouldn't have any objection.

Q We certainly realize --

A It will be very rough.

Q It will be rough, yes.

A Section 27, put it right across there?

Q Let the record show that Mr. Harris has penciled in, roughly, approximating it, the zero isopach contours, as reflected on Exhibit No. 3 on Exhibit No. 1.

A You want it all around or just the north limits?

Q Let's go a little further to the west there, Mr. Harris. Let's go on out to where it is opened; you can't close your contour anyway.

A All right. I believe it is going to be through about there, I am not sure of that. I believe that's fairly close, I am not sure.

Q Now, when we look at that, if that were colored in red, gas-oil contact to your zero isopach line, we'd have a lot bigger oil area, wouldn't we?

A If that was all productive, yes, but I was trying to limit the limits of commercial production, not limits of --

Q Yes, sir, I realize what you are trying to do. I also ask you if we colored the area between your gas-oil contact and your zero isopach line, we'd have a much larger red area, would we not?

A It would indicate that, yes, it would be a much larger red area which, then it wouldn't be true as to commercial production.

Q Yes, sir, I know it wouldn't, but we would have a tremendous increase on the area?

A I could paint the red area here, but it wouldn't mean anything.

Q Doesn't your isopach mean anything?

A Yes, my isopach is sand thickness.

Q And that's what we are using on your Exhibit 1, isn't it?

A We are using these wells right here as limits on Exhibit 1, that are non-commercial producers, in my opinion, in the limits of the oil area.

Q Let's clear up the record. One thing, when you were discussing your Exhibit No. 3, and talking about Pan American's Frost "B" 1, --

A Yes.

Q -- you said, in your opinion, that well only had two feet of pay?

A No, two feet possibly above one milladarcy permeability and the porosity above ten percent.

Q Well, --

A Eleven feet of pay. Eleven feet of sand.

Q It has eleven feet of net pay?

A Of sand.

Q And not two feet of net pay?

A Oh, no, no. I didn't say two feet.

Q But if I understand you correctly and the record reflects that you said two feet of net pay when we were discussing Exhibit No. 3, you want to change the record?

A If I said two feet of net pay, I want to change the record on that because I have indicated here approximately, that's a little over the net pay thickness, but --

Q Mr. Harris, I notice on all of your Exhibits you show that the reservoir that we are discussing is in complete communication, one part with another part?

A I don't say that the complete reservoir is in communication. Certainly it is in communication over a period of many, many hundreds of years, yes.

Q Do your Exhibits show any faults, any structural impediments?

A No, other than permeability barriers, which I don't show structurally.

Q Let's look at Exhibit No. 3.

A It shows the sand is thickening, and this one here shows that these sands are not as clean as these sands, --

Q Yes, sir.

A -- which would indicate that you are not, your communication is much slower.

Q Yes, sir. Exhibit 3 is an isopach, is it not?

A Yes.

Q Does your Exhibit 3 show any kind or type of separation within what you consider the productive limits of the reservoir?

A It doesn't show any barriers at all.

Q So we have communication?

A You have communication on any field where the wells are offsetting each other, I am sure of that.

Q All right, let's go back to Exhibit 1. Mr. Harris, looking at your Exhibit 1, the green gas and the red oil, what would occur in this reservoir--according to your testimony we have communication; if you produced a well in the gas area or the green area at a rate disproportionately higher than a well in an oil area, what happens in this reservoir?

A You lower the pressure on the reservoir here.

Q What occurs in a reservoir when you lower pressure in one portion of it?

A You lower the pressure on any reservoir when you produce oil or gas, either one.

Q Under the assumption of this, we are producing the gas or green area at disproportionately higher rate than we are the oil or red area?

A You are going to lower this more.

Q The green area. What happens to the red area?

A If your communication is sufficient, you lower it here, but where you have a real low permeability, I don't believe that you've got permeability and porosity to lower the pressure drastically in this area by producing these wells.

Q In other words, is it your testimony, Mr. Harris, that you could produce a gas well in this reservoir --

A No.

Q -- and it would have no effect on the oil area, is that your testimony?

A No. If you produce them wide open any time, you produce any reservoir wide open, you are going to have some waste and lower the pressure, but we are asking for a limiting, a fair limiting oil ratio where we can produce these wells commercially.

Q What are you asking for? You have made no recommendation.

A We are asking for 6,000 to 1.

MR. SPERLING: I think we ought to be permitted to put a case on before we ask what you are asking for.

MR. NUTTER: Yes, sir. I don't think Mr. Harris has made any reference to what he is asking for in this case. He is giving geological testimony only.

Q All right, what would happen, Mr. Harris, -- let's go back to the question, assume that we produce the gas wells in the gas area at a disproportionately higher rate than we produce the oil rate?

A If you produce them at a disproportionately higher rate, I don't know what a disproportionately -- what the rate is. I know at the present rate of production, 2,000 to 1, it will take probably twenty years to pay out our well.

Q You don't understand the word "disproportionately higher?"

A I understand what disproportionately means, but I would have to have figures to know how much. In other words, you can produce these wells at a rate of ten million a day each, as against what up here?

Q All right, sir. Let's look at the actual facts in this reservoir. What occurred in this reservoir when the gas wells were producing as they were prior to the recent Commission Order?

A What happened to the gas wells?

Q Yes, sir. What happened in the reservoir, did we have oil migrating into the gas area?

A When the wells were producing before?

Q Yes, sir.

A That, I couldn't answer for sure, that we have oil migrating into it, because of these permeabilities, and that is something you would have to know,whether it was migrating in there or not but we drilled the first well in here, we had no knowledge of any oil in there. We produced them as gas wells, and what we want is a reasonable pay out of our wells. We don't want to produce gas that belongs to us under here to produce marginal

oil wells for somebody else.

Q Maybe we can get at it, Mr. Harris. Will you assume, for the purpose of this question, that due to the rates at which gas wells in this reservoir were produced, that we had oil migrating from the oil area into the gas cap area. For the purpose of this question, will you assume that in the event that occurred, did that result in physical waste?

A Well, you produce your oil through your gas wells if it does.

Q It is your testimony, then, that if oil from an oil area migrates into a difficult gas cap area, that you'll have no waste?

A That, I couldn't answer. If it migrates, I don't know how much it has migrated. We haven't had any evidence of any oil migrating into this well.

Q We are assuming,for the purpose of this question, that it does.

A If it does, --

Q Waste will result?

A I don't know if you will have waste or not. You might produce it with your gas.

MR. BUELL: That's all.

MR. NUTTER: Any further questions of Mr. Harris?

MR. SPERLING: I have a couple.

REDIRECT EXAMINATION

BY MR. SPERLING:

Q Mr. Harris, with reference to some of Mr. Buell's questions, has there been any evidence of any migration of oil, so far as production, from the No. 3 Weaver McAdams is concerned, in view of the fact that your oil and gas ratios are increasing?

A I wouldn't -- due to the fact that the oil and gas ratios are increasing, it looks like the oil hasn't migrated because we are producing less oil and more gas.

Q Now, with reference again to Exhibit No. 3, which is your isopach map, you stated in answer to Mr. Howell's question, it could not be closed on the northwestern end. Is there any indication from studies that you have made, that you might anticipate any thickening of the oil producing section in the northwest?

A I have no indication of it, no, from my studies.

Q Well then, is your conclusion that if --

A This well only made 30 barrels, I believe.

Q If it is extended to the northwest, would it, in your opinion, increase the gas producing area, or the oil producing area?

A I think your gas will go further northwest than the oil area due to one fact, that you can produce gas from a zone with lower permeabilities and porosities than you can an oil well. We could extend this gas area, I think, considerably out in here whereas your oil area, I believe; that's my opinion. I can't back it up with facts because I don't have the control --

Q Before you turn away from Exhibit 3 there would you indicate on there, on the isopach, what you consider to be the limits of commercial oil production?

A It will be the same limits that I had on the other map because I am going by --

Q Mr. Buell asked you to extend zero --

A He asked me to put my zero line there. Well, the oil limits, I think, come inside of the Pan American's Frost "B" 1, of the limits of commercial production, is that what you want?

Q That's right.

A It will follow right along with the red on this map, which would be inside the Frost Well, and just barely, this McAdams would be in the edge of it. That's it.

Q As I understand, on your Exhibit No. 1, you attempted to show in red only the commercial producing area?

A That's right.

MR. SPERLING: That's all.

QUESTIONS BY MR. NUTTER:

Q Mr. Harris, is there any reason to believe that there on Exhibit 1 the red could not be extended along the north side of the green, on the right side of the green?

A On this side, there is no reason to believe that it couldn't be extended, but I couldn't prove it. I extended it out to the edge of the 160-acre location, as proved. That's all I was attempting to show there, not, we might extend this gas area clear

down to within one contour here, but we can't prove it.

Q Would you expect that a well would be productive of oil if drilled within a half of a mile of the north side of the green line there?

A In here?

Q Yes, sir.

A It possibly would. It looks like there is a small oil rim on the north side of the gas, but very small. Actually, we have, under present producing methods, I don't think there is but one well in the whole oil area that will make its allowable under 2,000 to 1 ratio, and it is 2500, 2600 to 1; the 107, it wouldn't make its allowable, so that wouldn't leave any of the wells that would make their allowables under present conditions.

MR. PORTER: By that, do you mean top allowable for the pool?

A By that, I mean top allowable for the pool.

Q (By Mr. Nutter) Is that the lowest ratio in the pool?

A As far as I know, the lowest ratio. I don't have one on that, but I am sure it wouldn't because it is only making 40 barrels of oil while pumping load oil.

Q Do the Weaver McAdams 1, 2 3, and 4 Wells make any liquids?

A Yes, sir.

Q What is the ratio on those four wells, Mr. Harris?

A The oil and gas ratios on the McAdams No. 1 is, on the No. 1 is 88,550 to 1. The McAdams No. 2 is 120,930 to 1. The No. 3 is, this says 5221. We took a recent one just the other day, it was 57 -- wasn't it 5690? I will correct it here. The McAdams No. 4 is 116,636 to 1.

Q Do you know the ratios on the El Paso Huerfano 103 and 99?

A On the Huerfano 99, we have 55,000 to 1; 55,506; on the 103, 98,947.

Q 98,--

A thousand,947.

Q 947. How about the Huerfano 106?

A The Huerfano 106, 62,983.

Q While we are at it, we might as well have the ratio that you have for the rest of the wells.

A I have,Huerfano 107 is 2, 2573. The Huerfano 92, I don't have a gas-oil ratio in 92. Is there any others that you don't have?

Q Yes, sir, the Huerfano 105, I think you testified?

A The 105 is 11,210.

Q Pan American's McAdams "B" 1?

A Pan American's McAdams "B" 1 on here shows a 9235 estimate, that is what shows is estimated.

Q And we don't have any ratio yet on the Frost.

A On the Frost, that's right.

MR. NUTTER: Thank you. Any further questions of Mr. Harris?

QUESTIONS BY MR. ARNOLD:

Q Mr. Harris, if it were found from additional development that Section 19 were productive, that thissand was continuously present --

A 19? What Township and Range?

Q 27 North, 10 West --

A 19 --

Q --it would be just to the northwest end of the pool, one more over. No, to the west.

A Oh, in --

Q 27, 10.

A 27, 10, that would be right there.

Q Would you expect that that well would be a higher or lower gas-oil ratio well than the Huerfano unit 105?

A If it were a continuation of this field, I think you would have it lower, but you might have another trend coming through here, the same as we have down here on the Gallegos trend. I don't know for sure. We don't have control there, but I think we've limited the sand by this Angels Peak 2, through here. I wouldn't look for any production at all from the Gallup oil in there.

Q Actually, though, do you think that any sand to the northwest, which is continuous with the present producing

reservoir, would be oil productive because of the fact that it is lower structurally?

A An oil rim, you d find it lower structurally, yes. The gas area would be higher structurally, yes, that's right.

Q So that it wouldn't be possible that the oil area in relation to the gas area might, it might be that there is a lot larger oil area in relation to the gas area as you go northwest?

A I don t believe that there is; it is possible. I wouldn t recommend drilling a well out there, let s put it that way.

MR. ARNOLD: That s all.

QUESTIONS BY MR. UTZ:

Q Mr. Harris, you spoke of permeability and porosity in the oil zones. Do you have any figures on those?

A The only figures I have on the two wells to the north, is that what you are speaking of, in the oil zone?

Q Yes, sir.

A Our calculated porosity from the sonic logs, which were calculated by me and one of the schlumberger engineers, shows the McAdams "B" 1 in the lower Gallup, shows a -- I've got it if I can find it. Here it is. It was just a penciled notation from the schlumberger engineer; the McAdams "B" 1 shows a porosity range of five to ten percent with an average of eight per cent. The Pan American Jack Frost Well had an average of 9 percent with a range of 5 to 11 percent, which normally would be comparable to your Mesaverde

figures which are not gas productive, but normally you find, in oil fields you will find a little better porosity than that.

MR. NUTTER: Mr. Harris, you were testifying a while ago that you thought that the permeability was such as to impede the migration of oil from that area. Do you have anything on the permeability in there?

A I have nothing that -- you can't calculate permability from those logs, and core analyses on those wells were not available to us. I imagine Pan American will have that test.

Q (By Mr. Utz) You didn't core any wells?

A We attempted to core with gas two of the Weaver wells, and I think Dugan has the core analyses, two of them, and as I stated, part of one core that we recovered we had a very small interval in there that the permeability was up to 222 millacarcies, in the, one of the Weaver Wells, I believe it was the McAdams No. 2, I am not sure of that one.

Q Do you have a core of that, Mr. Harris?

A Mr. Dugan has the core analysis of the well from Core Laboratories, but as I say, we recovered about, what is it, 10 percent, 20 percent recovered on our cores? Our sands were, apparently the softer sands just blew away, and we cored the tighter sand.

Q Do you know whether or not Pan American cored their wells or not, Mr. Harris?

A I understand they did core their McAdams "N" 1, and

some cores were taken on the Frost 1. I am not -- that I couldn't -- that's hearsay.

MR. UTZ: That's all.

QUESTIONS BY MR. HOWELL:

Q Ben Howell, representing El Paso Natural Gas. Mr. Harris, has there been more than one gas-oil ratio test taken on the McAdams No. 3?

A Yes, sir. There was two taken, one was 50.

Q What was the initial gas-oil ratio on that one well?

A The first test that I have any record of was 5 -- I believe 5220. The second one that I have any record of, which was taken just a few days ago, was 5690.

MR. NUTTER: Any further questions of Mr. Harris? He may be excused.

(Witness excused)

MR. NUTTER: We will take a ten-minute recess.

MR. NUTTER: The hearing will come to order, please. Mr. Sperling, do you have any other witnesses?

MR. SPERLING: If the Commission please, Mr. Errebo will conduct the examination of Mr. Dugan.

MR. ERREBO: We would like to call as our next witness Mr. Dugan. Would you stand and be sworn, please?

(Witness sworn.)

THOMAS A. DUGAN

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

DIRECT EXAMINATION

BY MR. ERREBO:

Q Would you state your name, please?

A Thomas A. Dugan.

Q Where do you live, Mr. Dugan?

A Farmington, New Mexico.

Q What is your profession?

A Petroleum engineer.

Q How long have you been a petroleum engineer?

A I graduated from Oklahoma University in 1950.

Q How much experience or practice have you had, timewise, in the San Juan Basin?

A Six and a half years.

MR. ERREBO: Are his qualifications acceptable?

MR. NUTTER: Yes, sir. Please proceed.

Q Have you made a study of the Angel's Peak-Gallup Pool, Mr. Dugan?

A Yes.

Q Based on this Pool, have you prepared certain exhibits which you now have this morning to present to the Commission?

A Yes, I have.

(Applicant's Exhibit No. 4 marked for identification.)

Q I'll refer you to Applicant's Exhibit No. 4, Mr. Dugan, and ask you to identify it.

A It is a data sheet.

Q That data sheet shows the drilling and production data on the wells presently completed in this Pool?

A Yes, that's correct.

Q How many wells are there completed to date as producing wells, or wells capable of producing?

A There's twelve wells that have been drilled. One of the twelve is still recovering load oil.

Q That is the Pan American Well which was discussed by the last witness?

A Yes, the Jack Frost B-1.

Q That's the well he stated he didn't think would be a commercial well, is that correct?

A That's correct.

Q Now how many of these wells are now flowing?

A There's ten that's flowing.

Q Are those all gas wells?

A No, there's two of those wells, three of them are oil wells in the oil rim..

Q By that you mean they are wells having ~~more~~ lower gas-oil ratios than the wells in the gas area, is that correct?

A Yes, that's correct.

Q Are any of these wells now pumping?

A There's two wells pumping, the two Pan American wells.

Q Will you point out on Applicant's Exhibit No. 1 on the board those two wells?

A It's this Jack Frost B-1 and the Pan American McAdams B-1.

Q Now with regard to the gas-oil ratios -- you may take your seat again, Mr. Dugan -- on these wells, how many wells have gas-oil ratios,according to the latest tests which you have been furnished, less than 2,000 to 1?

A There aren't any wells with a GOR of less than 2,000 to 1.

Q Do you know what the Commission rules now in effect are with regard to GOR's?

A Yes.

Q What is that GOR?

A You are restricted on your oil production, if your gas-oil ratio is above 2,000 to 1.

Q With regard to the data shown on Exhibit 4, that shows all the wells in the field without regard as to whether they are owned by Weaver or somebody else?

A Yes.

Q Have you made inquiry of the other operators and asked them to furnish you all information that they might have so you might present a complete picture to the Commission?

A Yes.

Q And this is based on the information you were furnished?

A Which I obtained from the other operators or obtained from the Commission office in Aztec.

Q Now with regard to the Pan American McAdams B Well, Mr. Harris testified that that well is presently recovering the load oil, is that correct?

A No. The McAdams B has -- Pan American McAdams --

Q Excuse me, I refer to Frost B well.

A The Jack Frost is still recovering load oil Monday when I checked with the Pan American people in Farmington.

Q When was that well fracked, do you know?

A No, I'm not sure of the date.

Q Do you have any estimate of when it was fracked?

A Three or four weeks ago.

MR. ERREBO: Is that approximately correct, anybody with Pan American know?

MR. MARSHALL: Yes, it's approximately correct.

Q Do you know how many barrels of frack oil were put in that well, do you have that information?

A I think I do some place.

Q Do you have any estimate of it?

A Fifteen to eighteen hundred barrels.

Q Fifteen to eighteen hundred barrels?

A I would say.

Q Do you know how much, according to what has been reported to you, how much oil is still left to be recovered?

A Monday they said they had 614 barrels left to recover.

Q At what rate is that oil being recovered?

A Well, at that time they had just pulled the pump and I believe he gave me a figure that it had produced ten barrels, no, twelve barrels in ten hours.

Q On the pump?

A On the pump, yes.

Q Do you have any other information that you would like to give the Commission at this time with regard to that well--

A No.

Q -- that's significant to you?

A On the Jack Frost?

Q Yes.

A No, except that twenty barrels in ten hours was apparently right after the pump job. It was possible that there

might have been some accumulation of oil in the well bore that would make that gauge slightly high. I believe before the pump job it was down to twenty barrels, something like that.

Q Now based upon your knowledge of this Jack Frost well, would you say, Mr. Dugan, that this will be a commercial well for Pan American?

A Well, it doesn't look like it will be.

Q Would you say it is likely to fall short of ever paying out?

A I believe that there's very little prospect that it will pay out.

Q Now on that basis are you in agreement with Mr. Harris that the Frost B-1 is a well which may be regarded as defining the northern limits of the oil accumulation in this area in this field?

A Well, since it is undoubtedly a non-commercial well, it would define the commercial limits of the field, I'm sure.

Q When you referred to Pan American McAdams B well, will you state what the current gas-oil ratio is on that well?

A Well, this well, they've done an awful lot of testing on the McAdams B-1; they perforated and fracked the lower Gallup zone and recovered their load oil from that zone, and then set a bridge plug and perforated and fracked an upper zone, recovered their load oil and got tests on each zone separate. Then they killed the well and completed it, made, and they have just

recovered their load oil after this, after they had put the entire Gallup together, all zones, and this I. P. that is shown on the data sheet was the first day after they recovered the load oil with all zones together.

Q First day after recovery of all the load oil, then the I. P. was taken?

A With both zones together. The zones were tested separately, though.

Q Will you repeat again what was the test on the lower zone?

A Well, I haven't got that on the data sheet.

Q Do you have any knowledge of how that zone performed?

A Yes, it was reported, I believe, to the scouts at forty barrels per day with a gas-oil ratio of twenty-five to twenty-six hundred.

Q Now refer to the El Paso Natural Gas Company Huerfano No. 105, that is another oil rim well, is that correct?

A Yes, it's located in the oil rim, as Mr. Harris has it on his Exhibit 1.

Q What gas-oil ratio is shown for that well on your Exhibit No. 4?

A The most gas-oil ratio was 11,210 to 1.

Q Do you have any information as to what the initial test was on that well?

A Well, the I. P. which was a three-hour test calculated

571 barrels of oil per day with a gas-oil ratio of 3300 to 1.

Q So the initial test was 3300 to 1, and is currently 11,000 to 1, is that correct?

A Yes, sir, that's correct.

Q Is that startling to you, or do you feel it is unusual that a well should perform in that way, located as it is?

A Well, of course, that initial test was a test of short duration which possibly you could get an erroneous answer as to a gas-oil ratio.

Q You think it might have been a little higher than that?

A Yes, it's possible. In fact, on another exhibit I show some other gas-oil ratios after the well was producing.

Q Do you have any idea what the current potential of that well is, what the well is presently capable of making?

A I haven't any idea. I know it makes its allowable very easily.

Q It is producing, but you don't know what it will make?

A No, but it will make its allowable.

Q By that the well is penalized, isn't it?

A Oh, sure.

Q Then it really didn't make its allowable, you mean it makes its penalized allowable?

A Yes.

Q That would be considerably less than the 54 barrels per day?

A I haven't figured out what the exact allowable should be, although it would be relatively easy to do, if you would like to have it.

Q Do you know what the method of production of this well is?

A They have got it flowing to 500 pound line and they have a free piston in the well.

Q What is the purpose that you think the El Paso has that free piston in this well?

A They probably put it in there for a dual purpose; one, to try to eliminate a paraffine problem; and the other, to try to lower the gas-oil ratio.

Q You think that the use of the piston would be effective in keeping the gas-oil ratio under what it would be under different methods of operation, is that correct?

A Yes, I do.

Q Now with regard to the El Paso Huerfano No. 107, what information do you have on that well with regard to gas-oil ratio?

A The gas-oil ratio I have listed here was filed with the Commission and taken in, I believe March 29th, which was 2,573 to 1. They have taken a subsequent test that was slightly lower than this, but the second test was on a shorter duration.

This test was a twenty-four hour test, whereas the second test was a ten hour test, which could possibly make the difference, the small amount of difference in the calculated gas-oil ratio.

Q Actually, according to your tabulation this well is the lowest ratio well in the field, is it not?

A Yes, it is, that I have information on. Of course, the only one that we don't have information on is the Jack Frost B-1.

Q Is this well currently producing, to your knowledge?

A Yes, it's flowing to atmosphere.

MR. NUTTER: Just what do you mean by "flowing to atmosphere?"

A Well, the other wells, with the exception of the Weaver McAdams 3, are all producing into a line and selling the gas at 500 pounds system, whereas this well and the No. 3 are producing to a low pressure separator and venting, flaring the gas. In other words, they're holding a smaller back pressure on the well head.

MR. NUTTER: Now I note that your Weaver-Brown No. 3 is also flowing to atmosphere. Is this well incapable of flowing into a five hundred pound line?

A Yes, it's uncapable of producing, it's not capable of producing its allowable against five hundred pound system.

MR. NUTTER: Is that the same situation here with the Huerfano 107?

A I assume so.

MR. NUTTER: Excuse me, go ahead, Mr. Errebo.

Q (By Mr. Errebo) How long has the Huerfano No. 107 been producing, do you know?

A No, I'm not sure of that, although I believe, I had a hard time finding the date of first delivery, but I believe it was turned on about the last of March, on steady production.

Q Now how many of the wells as shown on this tabulation have ratios in excess of 6,000 to 1?

A Well, all of the wells have, with the exception of the Weaver McAdams 3 and the Huerfano Unit No. 107, have ratios in excess of 6,000 to 1.

Q Then based on the information which is shown here, would you say that this well, or that this Pool is primarily a gas pool?

A Well, it would be pretty hard to say that from the gas-oil ratios; however, from the cumulative production I would say that the majority of the wells produced are gas wells, yes.

Q Would you say that on the basis of the ratio of gas completions to oil completions?

A Yes.

Q Now I refer you, Mr. Dugan, to Applicant's Exhibit No. 5. Before we leave No. 4, however, is there anything further you care to point out before I move on to the next exhibit?

A No, not that I can think of right now.

(Applicant's Exhibit No. 5
marked for identification.)

Q Then referring to Applicant's Exhibit No. 5, state what that exhibit shows.

A Well, I've plotted the gas-oil ratio versus time on two wells that are in the oil rim.

Q Now would you say that, number one, that exhibit shows that the ratios are already high as compared to wells which you might find not only in this field but other fields?

A Yes.

Q In other words, they're well above 2,000 to 1?

A Yes.

Q What else does that exhibit show?

A Well, on these two particular wells that the gas-oil ratios are increasing, although the data here is limited because of the small amount of production from the wells.

Q On the basis of what you see here and what you have shown here, Mr. Dugan, would you state that these wells might give some indication as to what we might expect from the other wells in the field?

A Yes, I would.

Q Which of the two wells would you say, as shown o n No. 5, would be more likely to be more typical?

A Of the wells --

Q On the gas-oil ratio performance of the other wells

in the oil rim?

A Well, I would have to answer that by saying probably the Weaver McAdams No. 3, because it has had more production, more length of production than the information as shown here on the 105.

Q Now then the Weaver McAdams No. 3 is increasing, though, isn't it?

A Yes, it's pretty high but it continues to go up.

Q Do you expect that soon it will be above 6,000 to 1, based upon what you have shown here?

A Yes, it might level out close to 6,000 to 1.

Q But you really don't know, do you?

A No, I don't.

Q On the other hand, Mr. Dugan, Huerfano No. 105 has had a tremendous increase in a short time?

A Yes.

(Applicant's Exhibit No. 6 marked for identification.)

Q Refer to Exhibit No. 6, if you will, Mr. Dugan. Will you explain what that exhibit represents?

A It's a summary or it's the core analysis from Core Laboratories Incorporated on two wells that have been cored in this Angel Peak-Gallup Pool.

Q Are both of these wells located in the gas area of this pool?

A Yes, they are.

Q You have not shown the average permeability for those wells on this exhibit?

A No, I haven't.

Q Do you have that average which could be added to the exhibit?

A Yes. On the McAdams No. 2, twenty-one feet, the average permeability is 26.2 millidarcies. The average porosity is 11.7 percent; oil saturation is 19.9 percent; average water saturation, 18.1 percent.

On the El Paso Huerfano No. 106, the average permeability is 31.5 millidarcies. This is on an average of twenty-two feet section, and the average oil saturation is 21.4; average water saturation, 28.1, average porosity, 12.9.

Q With regard to the oil saturation, what do you mean by that?

A That's the residual oil saturation.

Q You mean then that on the core analysis which was made on these wells that they actually showed that there was oil saturation in the cores, is that correct?

A Yes.

Q So on that basis would you call this a dry gas cap?

A No, you sure couldn't.

Q It's saturated, is that correct?

A Yes.

Q Do you know whether that is a dark oil or light oil?

A No, I don't. The oil being produced from the wells that are in the gas cap is a light oil with a gravity of 58 to 60, and it's clear.

Q That is more of a distillate or a condensate, is it not?

A It appears to be.

Q It's clear, you say?

A Yes.

Q It's white?

A No, it's amber in color. It's translucent, you can see through it.

Q You say the gravity is what?

A 58 to 60.

Q With regard to the oil which is being produced in the oil rim, what color is that?

A Well, it's a dark green.

Q Dark green?

A Yes.

Q And what gravity is it?

A 42 to 44.

Q Some fifteen percent lower, then, in gravity?

A Degrees, yes.

Q Or degrees lower, than the distillate?

A Yes.

Q Before we go on, I would like to refer you back to

the gas-oil ratios again, the wells in the oil rim. You say that the ratio for the Huerfano No. 105 is 11,000 to 1, approximately, is that correct?

A Yes.

Q That the McAdams B is approximately 9700 to 1?

A That is, I stated that a gas-oil ratio, I don't have a gas-oil ratio that was taken after both zones in the Gallup were combined and the well finally completed. This I believe was taken before the final completion, this gas-oil ratio.

Q Then the Huerfano No. 107 is 2575?

A Yes.

Q And the McAdams No. 3 is some 5700 to 1?

A Yes.

Q You stated with regard to Exhibit No. 5 that you thought that the McAdams No. 3 might be more typical. I wonder if you would say that perhaps the ratio which might be expected of the other well, namely, the Huerfano No. 107, might be likely to be more in the range between the two curves shown on No. 5, as well as any other wells which might be drilled in the oil rim?

A Of course, that would be pure speculation. However, I feel if allowed to have a longer producing period, that gas-oil ratio would continue to increase.

Q Actually you do have two quite high ratio wells in the western part of this oil rim, don't you? That's the 9300 to 1 and the 11,000 to 1?

A Yes.

Q Based on your study of this reservoir and the drilling production data that you have offered here this morning, do you have any recommendations as to what oil unit this Commission should adopt?

A On wells drilled in the oil rim?

Q Yes.

A I tried to approach that from a reservoir standpoint and lacking any core analysis in the oil rim, I was pretty well at a loss to do so; if the field was developed on eighty acres, there would undoubtedly be sufficient reserves to justify this development.

Q In other words, do you feel that if we went to forty acres at this time, there might be grave danger of drilling unnecessary wells, and that danger would be fully reflected by additional information that you do not have at this time?

A Yes, particularly bearing in mind that the sands seem to be emptying out right in the oil rim and the fact that the permeability and porosities are decreasing in that direction, I would be inclined to be cautious as to the amount of drilling to be done.

Q Do you have any recommendation as to the amount of acreage which a gas well, we'll say a well in the gas area as shown on Exhibit 1 would efficiently and economically drain?

A I feel that there's no doubt that these wells are

very definitely gas wells, but what they could drain 160 acres.

Q What would be your recommendation as to the amount of acreage which the Commission should permit to be assigned to a gas well?

A Since in my opinion they can drain 160 acres, I would recommend that they assign 160 acres.

Q Actually, Mr. Dugan, have you had benefit of any interference test information?

A No. We attempted to get permission to test, to take an interference test; however, doing so would have exceeded our allowable and the test was not taken.

Q Do you think that it's likely, on the basis of additional testing information, that it's possible that 320 acre spacing might be more desirable for this area?

A Well, I haven't done any lengthy study as to the desirability of 320 acre spacing.

Q Actually you just don't have the information at hand at this time, is that correct?

A No, I don't. I would hate to recommend it without doing a lot of lengthy calculations and tests, studies.

(Applicant's Exhibit No. 7 marked for identification.)

Q Now then, referring to Applicant's Exhibit 7, in connection with this exhibit, Mr. Dugan, will you state again what the limiting gas-oil ratio now is as applicable to all wells

in the field?

A 2,000 to 1.

Q What is the allowable assigned to those wells?

A Well, I calculated and I added the forty-acre allowable over the past year and got an average allowable and came up with a gas allowable of 118 MCF a day.

Q That is based on the depth factor times the unit allowable times 2,000 to 1?

A Yes, times the average unit allowable over the past year.

Q Now then, on that basis have you drawn and compared information shown on Exhibit No. 7?

A Yes.

Q Will you proceed to explain what that shows?

A First of all, I made a cost estimate of what I estimated to be the minimum cost of a well drilled in that area. This would be an average minimum cost, as there is quite a difference in elevation, some of the wells are considerably deeper than others. I used an average depth figure and took and calculated or made a cost estimate trying to determine the amount, the original cost or the minimum original cost, and then plotted that against the revenue from allowable of a well producing in the gas cap area.

Q What was this minimum cost as shown on this exhibit?

A Well, I figured a Gallup single completion would be

about $78,000.00.

Q $78,000.00?

A Yes.

Q Then using that cost average factor, did you plot the uppermost curve as shown on this exhibit?

A That is the $78,000.00 plus five percent interest on the unpaid balance.

Q Then what does the curve immediately below that show, Mr. Dugan?

A Well, I made a similar cost estimate study of a Gallup Dakota, a dual, and for lack of any better basis, I divided the cost in half between the two zones.

Q You feel that's a reasonable basis?

A I feel it would be a conservative basis.

Q Conservative basis. What does the straight line represent, Mr. Dugan?

A That's the cumulative reserve from a typical well drilled in the gas cap area.

Q You mean accumulated revenue, do you not?

A Yes, revenue, excuse me.

Q Then what does this exhibit show, Mr. Dugan, with regard to payout?

A Well, the payout on a single Gallup well would be approximately thirteen years.

Q You feel that is a reasonable payout period?

A I feel it's pretty long.

Q You mean it's unreasonable?

A Sure do.

(Applicant's Exhibit No. 8 marked for identification.)

Q Now with regard to Exhibit No. 8, we'll next refer to it. Will you now proceed to describe to the Commission the manner in which you prepared this exhibit, Mr. Dugan, and also what it shows?

A This is the actual cost of the development of the Weaver McAdams Lease, plus five percent interest on the unpaid balance, is the upper line. The other lines are the cumulative revenue to date with the expected payout after the wells were completed and with the probable payout under the present conditions.

Q In other words, before the Commission reclassified this field, Mr. Weaver expected a payout of approximately three years and five months from his investment in developing the lease?

A That's from the date that he started the development work.

Q As a result of the reclassification and under the present restrictions, he can now look forward to payout of nine years and seven months, is that correct?

A Yes.

Q What do you think about that type of payout, is that

a reasonable payout?

A It's sure not reasonable when you consider the ability of the wells to produce.

Q In that regard will you give to the Commission the information that you have with regard to the present potential as you know it of the Weaver wells which are completed in the gas area?

A Well, the No. 1 will deliver about 1900 MCF a day to the line; No. 2 about 2500; the No. 4 about 6,000 MCF per day.

Q Six million cubic feet per day?

A Yes, six million cubic feet, and the No. 3 on the gas-oil ratio test that I took the day before yesterday was producing about 130 barrels of oil per day.

Q Would you say those are good gas wells?

A Sure would.

Q Excellent, aren't they?

A Yes.

Q Yet under the present rules they'll be required to take nine years and seven months to pay out, is that correct?

A That's an estimate, yes.

Q On that basis would you say that Mr. Weaver needed relief from the rules which are now in effect?

A I certainly would think I would need it if they were mine.

Q Now you have proposed some rules with regard to

spacing. Do you think that those rules would help to give relief to Mr. Weaver?

A Yes, they would.

Q Do you think that they would protect correlative rights and prevent waste while doing this?

A I feel that they would protect correlative rights and would not cause any waste, that will not probably occur unless the field is taken over and communitized.

Q Now, Mr. Dugan, we're not asking this morning for 160 acre gas units, insofar as the term is presently recognized by the rules and by the laws of the State of New Mexico. We're asking for eighty acre oil units with permission to assign up to 160 acres to gas wells, isn't that correct?

A That's the way I understand it.

Q Now if the wells in the oil rim are drilled on a density of eighty acres and the wells in the gas cap are drilled on a density of 160 acres and the rules are kept in effect as they are, do you know whether or not Mr. Weaver's correlative rights will be violated?

A If production continues with a restriction of 2,000 to 1 gas-oil ratio, I'm sure that his correlative rights will be violated.

Q On the basis of surface acres, would the gas wells in the gas cap have the same voidage as the eighty acre oil wells in the oil rim?

A Well, no, a well in the oil rim would be producing the same amount of gas plus whatever its oil allowable would be while the wells in the gas rim would be producing.

Q In the oil rim --

A The gas wells would be producing a given amount of gas while the oil wells would be producing the same amount of gas plus whatever oil their allowable is.

Q Would you say that there would be disproportionate withdrawals between the gas area and the oil area under the type of development which you could expect in the future under the present rules?

A Well, there will be more voidage in the oil rim, and therefore gas from the gas cap area will be moving into the oil rim.

Q Now then, do you think that if Mr. Weaver is allowed to assign up to 160 acres to his gas wells as given allowable, based on the assigned acreage, that this will help to retard the movement of the gas toward the oil rim?

A Yes, I do.

Q Actually, under the rules as they now exist, the only way that Mr. Weaver can prevent this is to drill additional wells?

A That's correct.

Q Do you think it's economical to drill additional wells in the gas area?

A I don't believe the reserves in the gas area would justify drilling additional wells.

Q So then it's your opinion that the gas is presently moving toward the oil rim, or would move under a full development of the field under the present rules?

A Yes.

Q And that his correlative rights are being and will be violated?

A Will be, yes.

Q Actually that movement would be more pronounced upon a full development of the oil rim under a close spacing?

A Yes, it would be.

Q And it might or might not be moving in that direction now?

A I would say it's pretty stable right now, there's not much being produced out of the field.

Q All right. Do you have any limiting gas-oil ratio which you would recommend that the Commission adopt for this field?

A Oh, I feel a 6,000 to 1 gas-oil ratio would be justified, bearing in mind the gas-oil ratios that have been taken on wells producing in the oil rim.

Q Do you know whether or not any waste would occur under a 6,000 to 1 ratio as compared to a 2,000 to 1 ratio as it now exists?

A Let me answer that question with a comparison. You

take, say, take a typical oil pool where the average gas-oil ratio is, say, in the neighborhood of 1200 to 1, and you had a well that had a gas-oil ratio of 6,000 to 1, and you restricted the production from that well because of its excessive gas-oil ratio, well, it's true that the reservoir energy that is contained in this gas would probably help produce oil from another well. However, take a field such as the Angel Peaks-Gallup Pool where all the gas-oil ratios are high, the energy is not being used to any better advantage in any particular well than it is in the other particular well, so about all that you are accomplishing is extending the payout period.

Q Extending the payout period increases the cost, doesn't it?

A It sure does.

Q And possibly can result in early abandonment, is that correct?

A Possibly, not necessarily.

Q Now, you are saying then that the effect of 6,000 to 1 ratio would simply enable the wells to produce the oil and gas that are in this reservoir faster than they would produce under a 2,000 to 1 limiting ratio?

A Yes.

Q Actually there would be no substantial savings or benefit insofar as use of reservoir energy is concerned, is that correct?

A I can't see how you could get better use of your reservoir energy, seeing as how the oil wells have high gas-oil ratios and restricting the gas-oil ratios to less than they actually are is just lengthening the payout period.

Q You feel that there are any rules now in effect by the Commission which would have to be modified by special order as a result of the rules which you now propose, insofar as the amount of production which may be taken from a well per day?

A Yes, I would like to recommend that the Commission waive the daily tolerance rule 502, paragraph 1, because of the ability of Mr. Weaver's wells to produce is quite high and restricting their daily production as they are right now to roughly 185 MCF a day, it causes considerably more expense, producing expense because you either have to switch the wells daily, or would have to install additional equipment to take a high pressure drop from, actually the wells would probably be producing close to a wellhead pressure of a thousand pounds, and you are cutting that pressure to, well, actually you are cutting it to 250 pounds.

Q In other words, when you have a six million well producing into a line, and it's permitted to produce only a fraction of what it is capable of producing, then it will cause freezing up of the regulator, is that right?

A You are taking an excessive pressure drop between your wellhead and your line pressure, and you either have to dehydrate your gas and install additional heating equipment to

take the pressure cut.

Q Or else go out and switch the well each day to make its allowable?

A Switch the well each day.

Q How about the location of the wells, Mr. Dugan, what is your recommendation to the Commission in that regard?

A Well, I can't see any reason for changing the location from the State-wide location of wells that is now in effect in that area.

Q In other words, you would recommend that the minimum distance from a lease line of 790 feet for gas wells and 330 feet for oil wells would be workable under these conditions?

A I can see no reason why it wouldn't be.

Q How about testing of these wells, what do you recommend insofar as that is concerned?

A The only, I can't recommend any change in taking an annual gas-oil ratio test or deliverability test in the case of a gas, however, it might be a good idea to allow the Commission or the offset operator to request a gas-oil ratio test or deliverability test at any time from any particular other operator.

Q Now as to the disposition of the gas produced from any of the wells in this field, you recommend that the Commission require that be sold and not flared to the air?

A If the Commission adopts a higher gas-oil ratio, I would recommend that there be a no flare order written.

MR. ERREBO: If it please the Commission, this concludes the Applicant's testimony in this hearing. We would like to offer our Exhibits Nos. 1 through 8 in evidence at this time.

MR. NUTTER: Exhibits 1 through 8 will be entered in evidence. Does anyone have any questions of Mr. Dugan?

MR. PORTER: I would like to ask him one.

MR. NUTTER: Mr. Porter.

CROSS EXAMINATION

BY MR. PORTER:

Q We talk about oil wells and we talk about gas wells here. Do you have a recommendation for a definition of a gas well?

A It's relatively easy to determine whether, on completion, whether your gas well is an oil well or gas well in that particular area, although I realize there has to be a dividing line. If a 30,000 to 1 gas-oil ratio was adopted, I believe it would not result in any problem.

Q You wouldn't give any consideration to the characteristics of the liquids produced?

A You certainly could do that and you certainly could determine whether your well was in a gas cap or oil rim, because of the characteristics of the liquids produced.

Q In other words, you might go to gravity factor, something like that.

A Yes, it would be very applicable.

Q You would recommend a 30,000 to 1 as the dividing line on gas-oil ratio?

A I think that would be a good point.

Q Now, another question here, as you know we don't have gas proration in this particular area at this time.

A Yes.

Q However, the oil wells would be prorated, even the gas which is produced from them. I was wondering that, if, in the event that the Commission followed your recommendations, would you recommend gas prorationing in this area, too?

A The proration of the gas could be calculated from the oil proration formula. In other words, with the limiting gas-oil ratio of 6,000 to 1.

Q Well, that would apply to oil wells.

A Well, you could convert that to a gas well, too, and prorate your gas wells in the same manner that you prorate your oil wells with a maximum gas allowable.

Q I have another question here, I believe you said you would recommend a no flare order in the event that the Commission adopted a 6,000 to 1 limiting ratio. You testified, I believe, on Exhibit No. 8, which concerns payout predictions, and that's on a lease basis showing cumulative revenue to date on the lease, among other things. Now, do you know whether any of the individual wells in this pool, Weaver 1, 2, 3, or 4, paid out up to now?

A No, I'm sure they aren't.

MR. PORTER: That's all I have, Mr. Examiner.

MR. NUTTER: Any further questions of Mr. Dugan?

MR. PAYNE: Yes.

MR. NUTTER: Mr. Payne.

BY MR. PAYNE:

Q Mr. Dugan, what's the difference in assigning 160 acres to a so-called gas well in this pool and establishing 160 acre proration units?

A The difference between assigning the allowable and establishing a proration unit?

Q Yes, I understood --

A The only difference I could see would be forced pooling.

Q I understood Mr. Errebo to say that the Applicants are not asking for 160 acre spacing or prorationing. What I'm getting at, if you assign 160 acres to a gas well, how does that differ from having 160 acre proration units?

A The only difference would be, that I can see, is forced pooling.

Q All right, do you agree with the testimony of Mr. Harris that Pool-wide unitization would impair correlative rights?

A That would entirely depend on the way it was handled, of course. I believe what he was referring to is that possibly lengthens the payout time.

Q How would it do that, Mr. Dugan, wouldn't all the operators be sharing in the oil production?

A Yes, theoretically.

Q So that being the case, I don't follow how it would lengthen the payout period.

A I'm sure that it would lengthen it to what they were expecting the payout to be. However, it might not lengthen it to what it's going to be under present conditions.

Q Do you consider that the most efficient way to produce a pool of this nature is when it's completely unitized, from the standpoint of waste, now, rather than correlative rights?

A From waste?

Q Yes.

A I sure do.

Q Now assuming that assigning 160 acres to a so-called gas well is the same thing as having 160 acre proration units, do you feel that having two different spacings in a pool, 80 acre for oil wells and 160 acre for gas wells, is contemplated under the rules and regulations and the statutes governing the Oil Conservation Commission? Perhaps I should address this to Mr. Errebo.

A I think it would be a good idea.

MR. ERREBO: Mr. Payne, it's hard to tell sometimes what the statutes contemplate in some instances, but I do know this, that it does seem to me under the rules as they're now written

and the statutes that are now written, any reasonable means -- let's put it this way, any reasonable yardstick for assigning allowables to wells is permitted under the rules and under the statutes; and to the extent that it will cause waste or not protect correlative rights, it's prohibited, and the converse is also true. As I see this, what we are proposing here today is a reasonable yardstick which will protect correlative rights and certainly will not cause waste.

MR. PAYNE: As a general rule, you are saying that the Commission can do anything reasonable to prevent waste and protect correlative rights?

MR. ERREBO: Well, generally speaking.

MR. PAYNE: What if that conflicts with an expressed statutory thing?

MR. ERREBO: Well, I would have to see it.

MR. PAYNE: Let me read a portion of the statute, 65-3-14 (b), which says: "The Commission may establish a proration unit for each pool, such being the area that can be efficiently and economically drained and developed by one well." Do you feel that that statute contemplates having two different spacings in the same pool?

MR. ERREBO: Well, it contemplates one, and as to two, I don't know, it quite possibly could. I don't think under what we've prepared here today we are faced with that problem. We asked only for the establishment of one proration unit; namely, the 80 acre unit, with the permission to assign to wells classified

as gas wells up to 160 acres for proration purposes, and I believe that is the difference.

MR. PAYNE: Since it's for pro --

MR. ERREBO: That would be permissible under the statute.

MR. PAYNE: This statute is dealing with proration units, you are going to assign this for proration purposes, so therefore is there any actual distinction or a distinction without a difference, this assigning 160 acres and yet saying it's not a 160 acre proration unit?

MR. ERREBO: I think there is very definitely a difference between a 160 acre proration unit and assigning 160 acres for proration purposes. I think that distinction is what clearly brings us within the statute. I'm not prepared to say that we couldn't even establish 160 acre proration units in the same pool with other units. We are actually, I think, avoiding that question by the proposal we are offering here this morning.

MR. PAYNE: Mr. Examiner, in view of the testimony brought out here today, I would like to move that the record in Case No. 1616 be incorporated into the record of this case.

MR. NUTTER: What is Case 1616?

MR. PAYNE: That was the case that dealt with the reclassification of this pool from a gas pool to oil pool.

MR. NUTTER: Is there objection to the consolidation of the record of Case 1616 in the record of this case here today,

1641? If not, the records will be consolidated.

MR. BUELL: Is it already consolidated?

MR. NUTTER: No, sir.

MR. BUELL: I just wondered, I haven't any objections, I'm worried, I'm not familiar with that case and I wonder about the pertinency of the consolidation.

MR. NUTTER: I believe, if you recall, that is the case that Pan American testified in as to advisability of the reclassification of the pool from an oil pool to a gas pool.

MR. PAYNE: That's correct. There has been a lot of testimony this is a gas pool.

MR. BUELL: I misunderstood the case. I was going to make that motion myself.

MR. NUTTER: Is there objection to the consolidation of the records in the two cases?

MR. PORTER: Mr. Nutter, I had another question.

MR. NUTTER: Yes, sir, we are not through with Mr. Dugan yet.

MR. SPERLING: Could I inquire from Mr. Payne as to his statement for the reason?

MR. PAYNE: The previous case, in the previous case, Mr. Sperling, the Commission witness, Mr. Arnold, testified in effect that he felt that this was an oil pool. Now the testimony here today has been generally that it's a gas pool, a large gas pool with a small oil rim. Therefore, to have the record complete

before the Commission, I think we ought to have the previous record incorporated into this one.

MR. ERREBO: Certainly the Applicant at this time is not requesting any reclassification, and to that extent we are not challenging the findings of the Commission in the case whose record you propose to incorporate.

MR. PAYNE: I understand, Mr. Errebo.

MR. NUTTER: If there is no objection, the record in Case 1616 will be incorporated in the case of 1641. Does anyone have any further questions of Mr. Dugan?

MR. PORTER: I have one that I want to clarify.

BY MR. PORTER:

Q I believe you recommended 6,000 to 1 gas-oil ratio, and you recommended the normal unit allowable plus the depth factor. Now you have also recommended eighty acre units, did you mean to include in there the eighty acre depth factor?

A Yes, that would be 2.77.

Q Yes.

A Yes.

MR. PORTER: That's all.

BY MR. NUTTER:

Q What is the top unit allowable in the San Juan Basin at the present time, the normal unit allowable?

A I think this month it is 54, average is about 51.

Q What is the depth factor for this top allowable?

A 1.77.

Q What is the top allowable for this pool for the month of May?

A It would be about 94, I believe, barrels a day.

Q The wells presently are receiving an allowable of 2,000 times this 94?

A Yes.

Q Or 188 MCF per day?

A Yes.

Q In effect, what have you requested here, that this gas allowable be tripled?

A By increasing the gas-oil ratio it would be tripled to 6,000.

Q Now this 94 barrels is the amount of allowable that's assigned to forty acres, correct?

A Yes.

Q You have requested the oil pools be assigned allowable on the basis of eighty acres?

A Eighty.

Q So we would take 94 barrels and add another 54, is that correct?

A That's correct.

Q Giving a total allowable of 148 to the oil wells. For proration purposes you would assign 160 to gas wells?

A Yes.

Q And increase the gas-oil ratio to 6,000?

A Yes.

Q So the oil wells would receive 6,000 times 148, is that correct?

A You lost me.

Q The oil wells --

A Would receive an allowable of 148 barrels a day.

Q Yes, sir, and the amount of gas that they would receive would be 6,000 times 148?

A Yes.

Q On 80 acres?

A Yes.

Q Now the gas well that's located on 160 acres would receive twice that?

A Yes.

Q What amount of gas would be available then to a well classified as a gas well and located on 160 acres?

A About 1.8 million.

Q How does this compare with the allowables that are assigned to gas wells in the San Juan Basin at the present time?

A Well, the allowable, since these wells haven't been prorated I don't know what the allowable would be, but the contractual obligation, minimum contractual obligation that El Paso has been taking from them would be about half of their deliverability. In other words, prior to the time that these wells were

reclassified they were, well, the No. 1 for instance was producing about a million a day.

Q These wells are roughly comparable to the Mesa Verde wells in depth, are they not?

A A little deeper.

Q How much deeper?

A The No. 1, which was the discovery well, was 6250, I believe.

Q What's the average depth of Mesa Verde wells in the Basin?

A Fifty-two, fifty-three hundred.

Q What's the average a Mesa Verde well in the Blanco-Mesa Verde Pool is receiving?

A Well, I believe this month it is relatively low, about thirty percent of its deliverability.

Q Would this allowable that would be assigned to these Gallup gas wells then be --

A Well --

Q How would it compare with the Mesa Verde wells?

A Well, on the No. 4, it would be just about the same on the others, since it has an ideal of approximately six million, thirty percent would be about -- on the others it would be considerably less -- of 30.1 million.

MR. NUTTER: I think we're going to recess the hearing at this time. The hearing will be recess until 1:30.

AFTERNOON SESSION
May 7, 1959

MR. NUTTER: The hearing will come to order, please. Does anyone have any questions of Mr. Dugan?

MR. HOWELL: Yes.

BY MR. HOWELL:

Q Mr. Dugan, you testified with reference to the McAdams No. 2 Well, the El Paso Natural Gas Huerfano 106, which formed a basis of your Exhibit No. 6, I believe the permeability of these wells is excellent, is it not, in comparison with other wells in the San Juan Basin?

A Yes.

Q Most of the wells that are completed in this Angel Peak-Gallup Pool are completed in formations that have very good permeability, are they not?

A It's pretty hard to say whether the most of the wells are or not, because we are limited in the core information we have got. However, from the log information, a portion of them are completed in relatively good permeability areas. However, the two Pan American wells are probably poor permeability areas.

Q They are wells that you would put up to the edge or just over the edge of the commercial production in the oil zone?

A Well, Mr. Harris spotted that McAdams B-1 right on the edge of what he considered the commercial limits of the field.

Q The wells which are completed down in the gas area

are generally completed in an area of good permeability, are they not?

A Yes, with the exception of the El Paso Huerfano 92.

Q And that is borne out by the performance of the wells in delivering gas into the pipe line?

A Yes.

Q They have good deliverability?

A Yes.

Q Now your testimony was, I believe that you recommended 80 acres for spacing for oil wells. It is your opinion, is it not, that one well will adequately drain the oil and the gas that would be associated with the oil in an area of 80 acres, is it not?

A I'm sure it will in these good permeability belts.

Q And in the gas zone one well would drain 160 acres or more, would it not?

A In these good permeability areas, I'm sure it will.

Q Would you think it would drain efficiently as much as 320 acres?

A It's possible, but as I stated this morning, I haven't made any calculations or taken any tests to try to establish 320 acre spacing; therefore I would hesitate to recommend it.

Q You wouldn't recommend against it, though, would you?

A Not if there was sufficient evidence for it.

Q Now, your Exhibits 7 and 8 refer to the payout period, and I believe the line that you have drawn there is based upon one well to forty acres in each instance, is it not?

A It was based upon the present allowable, which is forty acres, yes, sir.

Q That's right. That is allowing a well to have forty acres attributable to it?

A Yes.

Q If eighty acres is allowed, why then of course the payout would be quite a bit shorter, would it not?

A Yes.

Q And the economics would be better for the operator in that event?

A Yes.

Q Now actually the period of payout for most gas wells drilled in the San Juan Basin is relatively long, is it not?

A I presume if you took a weighted average of the entire Basin, you might make that statement, although I have not made a study to that effect.

Q You know that the middle wells were completed in the San Juan Basin with deliverabilities which were ridiculously low in comparison with other gas producers?

A Maybe not ridiculously low.

Q They are low with what you find around the Gulf Coast?

A I've never worked the Gulf Coast, but with my under-

standing, that is correct.

Q That's right. You recommended a waiver, I believe it was Rule 502 which requires --

A The daily tolerance.

Q -- the daily production of a well to be more or less on a level, is that not the purpose of the rule?

A Yes, it was. Yes, I'm sure it was.

Q As a matter of fact, practically, with gas wells it's almost impossible to produce exactly the same amount of gas each day because the well has to put gas into the line and then there's the demand for it, isn't that correct?

A That's correct.

Q Isn't that the practical way to produce a gas well?

A Yes, and the line pressure varies considerably, which varies your production rate.

Q Your recommendation would be that the pool rule permit the well to be produced when the market is there available for it, and then shut in until the market is again available?

A That is correct, although it would probably be preferable on the part of the operator if he could produce his monthly allowable in that given month, although that isn't always the case.

Q It isn't always the case in gas wells, and to attempt to take it to a daily, to attempt to produce the allowable for each day is practically impossible where you have gas wells,

isn't it?

A Yes.

MR. HOWELL: That's all.

MR. NUTTER: Any further questions?

MR. PAYNE: Yes.

MR. NUTTER: Mr. Payne.

BY MR. PAYNE:

Q You are not recommending that the monthly tolerance be waived for this pool, are you?

A I didn't recommend that, no.

MR. NUTTER: Mr. Buell.

BY MR. BUELL:

Q Mr. Dugan, let me ask you one preliminary question so that it will help me in my other questioning. Have you had a reservoir study of this pool, or have you simply made a statistical analysis of this pool?

A My main study has been statistical; however, I have done a little bit of reservoir work.

Q What have you done in the way of a reservoir study in this pool?

A Well, I have attempted to make a volumetric calculation of the gas reservoirs in the gas cap area, for one thing.

Q You say "attempted?"

A Yes, with the information I had at hand, I presume.

Q Would that indicate that you were not successful?

A No, I think I'm very successful, with the information that is available.

Q What else have you done?

A That's practically all.

Q How many gas wells does your client have in this pool?

A Three.

Q Three gas wells?

A Yes.

Q Are any of them dually completed gas wells?

A Well, of the two, of the three gas wells, two of those are duals and then there's one oil well which is a dual also.

Q I'm referring now to simply just gas wells.

A Yes.

Q Your client has three gas wells, two of which are dually completed?

A Yes.

Q As I recall your cost breakdown, a dually completed well in this pool, you said $65,000.00?

A That was one-half of the minimum cost of a dual, was my estimate.

Q But that figure is on one of your exhibits?

A Yes. For lack of a better reason, I took one-half of the cost, of the total cost of a dual assigned to one zone.

Q Yes, sir. I believe your exhibit also reflected that

a singly completed well in the Gallup cost $78,000.00?

A That was my estimate, that would be a minimum cost.

Q We have got a sixty-five, a sixty-five, and seventy-eight. What does that total?

A Well, now, as you realize --

Q Just what does that total?

A Well, sixty-five, sixty-five, seventy-eight -- two oh eight.

Q Two oh eight. I also recall one of your exhibits, I think it was Exhibit 8, showed to whatever period of time you ended that calculation, that you had cumulative revenue of $200,000.00, is that correct?

A Well, that was from all zones, Dakota and Gallup.

Q That's from both --

A The Dakota and Gallup. Total lease revenue versus total lease cost.

Q Would you give me the revenue on the Gallup, I believe it's going to be pretty close to the total. Do you have that available?

A No, I don't.

Q I believe you see the point I am driving at. Your client's gas wells are practically paid out, aren't they?

A No, that's not correct. You have to consider the entire lease costs, not the theoretical costs, as you well know.

Q Then why did you submit them?

A Because as you well know, initial wells drilled in an area, the costs run higher. This No. 1 was a discovery well, this is a minimum cost that a well could be drilled for at the present time. Not two years ago, or one year ago, or not in an unknown area.

Q All right, sir. Assuming that your client's three gas wells, we'll assume that they were drilled for the cost as you reflect on your exhibit.

A For the $616,000.00 initial lease cost?

Q No, sir, we are assuming --

A Development?

Q We are assuming that those wells cost exactly what you have shown on your Exhibit,sixty-five.

A What I have shown on my exhibit is $616,000.00 as the total cost of the lease development.

Q Would you assume for the purpose of this question, Mr. Dugan, that those wells were drilled and completed; that the cost reflected on your exhibit of sixty-five thousand for a dual Gallup and seventy-eight thousand for the one single Gallup; with that assumption, aren't these gas wells almost paid out, based on that assumption?

A Well, the wells weren't drilled for that originally and they would -- well, would be approaching maybe sixty percent of being paid out, if you assigned half of the cost of the well to the Gallup only. However, we're pretty fortunate, if you

wanted to prorate the original cost of this $130,000.00 that I estimated as the minimum cost of a well to its initial by prorating it by the initial deliverability or the initial I. P. of the two zones, why, the burden of payout would be upon the Gallup, correct. In other words, our Gallup zone is as much more prolific than the Dakota zones, there are several ways of looking at it, but taking an unknown location, it's pretty hard to say, well, we want to prorate sixty percent or seventy-five percent to the Gallup zone or vice-versa.

Q But the figures I have been using are your figures that were on your exhibit. I don't know how you arrived at them and I am not challenging them, I want to use them. They are on your exhibit, aren't they?

A They're the minimum cost of a potential well to be drilled tomorrow without any trouble.

Q Mr. Dugan, in making your reservoir analysis of this pool, did you see any indication of the occurrence of oil migrating into the gas cap area?

A There's no physical indication of that, and it would be assuming, you would have to assume a pressure gradient across the lease boundary to have a movement of the oil. There is no physical indication of the gas-oil contact moving that I know of.

Q Would you say that due to the way the field has been produced, conditions.are,would you say, excellent for such to occur? What I mean, maybe I had better explain that.

A It would depend on your permeability, and since the discovery well happened to be in the gas cap, why you are lowering the pressure in that immediate area; if the permeability towards the oil area was such that there would be theoretically a possibility of migration.

Q Substantially all the voidage has been out of the gas cap area?

A To date.

Q Yes.

A Yes.

Q You haven't had a log of your McAdams B No. 3 or is it on your cross section?

A Yes, this is it right here.

Q What were the original perforations in that well? What was the location, the footage of the original perforations?

A I think I have that some place, although right,not at my fingertips.

Q I'll wait.

A According to this information here, it was 2670 to 80.

Q 2670 to 80?

A To 80.

Q Is the log of that well on that cross section, is the McAdams B-3 on the cross section?

A Yes, that's it right there.

Q Would you approximate or locate the perforations on that log on the exhibit, so we will have it in the record?

MR. NUTTER: Would you label those the original perforations, Mr. Dugan?

A (Witness complies.)

Q (By Mr. Buell) What did that well potential for in that interval?

A Nine million.

Q Nine million what?

A Cubic feet of gas.

Q What was its gas-liquid ratio on that test?

A That was completed as a gas well.

Q Yes, sir.

A And there wasn't a gas-oil ratio taken to my knowledge. However, the well was subsequently produced with these perforations open.

Q You don't know what the gas-liquid ratio was on that initial potential?

A No, there wasn't any taken.

Q Did it produce nine million a day, or is that some kind of a theoretical calculation?

A That's a three hour --

MR. HARRIS: Peto tube calculation.

Q Where is that well located now?

A It looks like about 6257 to 67.

Q Would you mark that on your Exhibit 3?

A Yes.

MR. NUTTER: Mr. Dugan, your Exhibit No. 4 indicates the perforation at 6250 to 72.

A 50 to 72?

MR. NUTTER: Yes, sir.

A Well, that would be a little up. I was taking this log run when the second set of perforations were made. Just reading them off the log. If you are comparing these actual depths or the depths off this log would be 57 to 67.

MR. BUELL: For my purpose we don't need to resolve the small amount of difference in the two.

MR. NUTTER: I see.

Q (By Mr. Buell) That well is now completed higher in the section than the original completion?

A Yes.

Q What was the potential of the well at its present completion interval?

A The gas-oil ratio test filed shortly after recovering the load oil was 103.42 barrels of oil; 540 MCF of gas, with gas-oil ratio of 5221.

Q That well in the original interval was a nine million a day gas well?

A Yes.

Q You came up the hole higher in the section and

completed it as a fairly low ratio oil well, is that right?

A Yes.

Q Would that not indicate to you, Mr. Dugan, that oil has migrated into the gas cap area?

A Not necessarily. This other zone that we perforated is the zone of high permeability, and the original perforations were, as I understand it, were low because of a mechanical error. The ability of gas to be produced from a low permeability area is greater than the oil to be produced from the same area, and we have come up to more prolific area.

Q Are you telling me, Mr. Dugan, that in this common reservoir in this interval of this well bore that we have got a nine million a day gas reservoir below a low ratio oil well? Are you telling me that?

A The initial I.P. was nine million is what was reported. I don't know the amount of oil;they might have had a good gas-oil ratio at the time.

Q But you don't know that?

A No, I wasn't on the lease.

MR. BUELL: That's all.

MR. NUTTER: Any other questions of Mr. Dugan?

MR. PORTER: I have one question.

By MR. PORTER:

Q Mr. Dugan, would you consider three years a good payout, reasonable?

A It depends a lot on the initial investment, and the prospect in mind when the investment was made and the reserves behind that.

Q Let's say in this particular instance, would you consider three years reasonable payout?

A Yes, I think so.

MR. PORTER: That's all I have.

BY MR. NUTTER:

Q Mr. Dugan, Mr. Weaver has four Gallup wells here,, correct?

A Yes.

Q Does he also have four Dakota wells in this same section?

A Three.

Q He only has three Dakota wells?

A Yes.

Q You said you hadn't taken any test to establish that 320 acre spacing would be proper for this gas area?

A No.

Q Have you taken any tests to establish that 160 acres would be proper?

A As I mentioned before, we proposed an interference test; however, by taking it at any sensible rate of withdrawals from the wells, we would have exceeded our allowable, so it hasn't been done.

Q Have you taken any test to establish that eighty acre spacing is proper in the oil area?

A The only, as I stated this morning, that recommendation was made because of, on an economical point of view, the reserves in the oil rim is not -- to my knowledge are unknown, and there is no core analysis that I have available to try to determine the total reserves which would in turn determine whether you could justify the expense of drilling on forties.

Q So you really haven't determined whether a well could drain eighty acres or not?

A No, I haven't.

Q Do you have any idea of the value of the gas that's in place per acre foot in this gas area?

A Per acre foot?

Q Yes.

A Well, per acre, I figured it about 10,000 MCF per acre.

Q Well, now, is the thickness of the sand uniform enough that you could compare the various areas that way, or would it have to be on an acre foot basis, compare tracts?

A Well, yes, it would have to be.

Q How about the oil reserves, do you have any idea of the value of those?

A No, I don't. As I said, I haven't got any core analysis in the oil rim; therefore I didn't feel it was justified

projecting the core analysis that was available in the gas cap area to the oil rim.

Q This proposal of yours, Mr. Dugan, to dedicate twice as much acreage to a gas area well as is dedicated to an oil area well, and to raise the GOR limit for the pool, this isn't any attempt to establish ratable take among the gas wells and the oil wells, is it, or a volumetric withdrawal of the reserves?

A Assuming the wells producing in the oil rim were producing at the average gas-oil ratio, which is allowed, the ratable take would be very close to being equal.

Q What do you base that on?

A Voidage figures.

Q Do you have those voidage figures? I think those would be pertinent to this hearing if you could introduce those.

A I calculated that an oil well producing in the oil rim that was making 150 barrels of oil per day with a gas-oil ratio of 6,000 to 1 would be voiding approximately half of the area that a gas well would be that was producing 1.8 million per day and 24 barrels of oil, which was double, of course, there's twice the surface acreage assigned to the wells in the gas cap area, plus the fact that the pay thicknesses are greater, which would actually make your acreage draw down or your acreage voidage factor in favor, or the oil well voiding more of its total percentage of oil than a gas well would be.

Q If you could give us those actual figures, Mr. Dugan,

I would appreciate it.

A Well, I calculated, let's go back to the information that is available on these wells in the oil rim.

Q Yes.

A To my knowledge there's been no sample, reservoir sample taken to try to determine the solution gas or the shrinkage factor, so those factors have to be assumed or calculated, which I tried to calculate, so the accuracy of this type of calculation with the information at hand might be, leave something to be desired. However, I got on this potential, this oil well in the oil rim, voidage factor of 21 and a half thousand cubic feet versus 44 thousand cubic feet for the gas well producing 18 thousand or 1.8 million per day, plus 24 barrels of oil.

Q Now let me see if I have this correct. The oil well would void 21,000 cubic feet?

A Twenty-one and a half.

Q Twenty-one and a half?

A Yes.

Q The gas well would void 44,000 cubic feet?

A Yes.

Q That's considering 160 acres would be dedicated to the gas well?

A Assuming that twice the acreage was dedicated to the gas well; therefore, the gas well would have twice the surface acreage to void, plus the fact that it is relatively obvious that

the sand thickness is greater in the gas cap area, so the percent of total reserves that was being voided at any one time would be, it would appear to me, although I haven't made the calculations, because of the difference in the sand thickness you would be voiding a greater percentage of your reserves in the oil area.

Q Now, Mr. Dugan, in an ordinary oil pool where you don't have one of these gas cap situations, if one well is producing with a gas-oil ratio of 1,000 and the other well is producing with a gas-oil ratio of 2,000, does the one with the higher gas-oil ratio actually void a higher space in the reservoir?

A Yes.

Q Is any attempt made to equalize the takes and protect the correlative rights of one operator with the low gas-oil ratio against the operator with the high gas-oil ratio?

A There's no attempt made that I know of below 2,000 to 1. Actually, I assume that's what the gas-oil ratio limit was probably originally designed for, besides conserving the energy; the fact that the oil wells in the oil rim all have relatively high gas-oil ratios that seem to be increasing is the only fact, the only basis I have for trying to establish a gas-oil ratio, a limiting gas-oil ratio.

Q Is the Dakota in this area considered a commercial venture as a single completion?

A Probably not as a single completion.

Q What is the actual cost of dually completing a well

that has penetrated the Gallup formation?

A Do you mean --

Q Without apportioning the drilling costs to the Gallup, but just the actual cost of physically making a dual completion there.

A Just assuming that up to the point --

Q Assuming that you have got a well through the Gallup formation completed in the Dakota, and then you decide that you want to complete it?

A Up to that point, you had made no -- or we'll assume that you hadn't spent any money, that you got that hole in the ground for nothing.

Q The Dakota paid for?

A Cased, yes, I would estimate eighteen to twenty-two thousand, possibly more.

Q These four Weaver McAdams wells that we're considering here today have produced varying amounts of gas, have they not?

A Yes. Do you mean monthly?

Q No, I mean the total production from the four wells varies considerably, does it not? Is this the total number of gas that No. 4 has produced, 726,000 MCF?

A Yes.

Q What has been the cumulative production from the No. 3 well?

A On gas? Isn't it on there?

Q Well, it's 8620, but this well was originally completed as a nine million cubic foot gas well?

A Yes.

Q It only produced 8,000 MCF after that?

A Yes. 8620. That nine million gauge was never substantiated with the production. See, the well was completed in August, and November it only produced only four million, that was the first production from the well, November.

Q Oh, I see. Although it was completed May 23rd, it didn't deliver any gas until November?

A That's correct, November.

Q Now I note on your I.P. data for that well you give an I.P. of 5800 MCF, Mr. Dugan, yet you stated it was originally nine million?

A I made a mistake. I was thinking of the 2, this is correct, the 5800.

Q This is the initial completion data then, the 5800?

A Yes.

Q Then when it was recompleted, it was completed for 305 barrels and 340 MCF?

A That was the initial gas-oil ratio.

Q Was that a twenty-four hour test there?

A Yes, it was. I made an error, I glanced at the McAdams No. 2 instead of the 3 when I stated that initial I.P.

MR. NUTTER: Does anyone have any questions of Mr. Dugan? Mr. Porter.

MR. PORTER: I hate to keep beating a witness to death, but I would like to, just for my own information on this computation of the space voided, see if I understood it right.

BY MR. PORTER:

Q Did you have a figure there of 21.5 for an oil well on an eighty as compared with 44 for a gas well on 160?

A Yes, that's correct.

MR. PORTER: That's all I have.

MR. HOWELL: I would like to ask another question.

BY MR. HOWELL:

Q Mr. Dugan, as I understand your calculations as to the cubic footage that is voided, if there were two oil wells, each drilled on an eighty acres, the space which those two would void would be 43,000 feet or twice 21.5 thousand, would it not?

A Assuming that both wells were producing the same amount of oil with the same gas-oil ratio. Well, I am assuming, I figured 150 barrels per day and 6,000 gas-oil ratio.

Q Well, that would be true if a limiting gas-oil ratio be placed upon the weight?

A Of 6,000 to 1.

Q And that gas-oil ratio be below the actual gas-oil ratio of the well, so that it acts as a limiting factor?

A Well, it would have to be exactly 6,000 to 1,

assuming that the State-wide allowable is maintained, which would be roughly 150 barrels a day for the well.

Q That's right, but now then, if instead of having two gas wells on 320 acres, and assuming that one well has the capacity to drain 320 acres efficiently, one gas well on 320 would in the same manner void twice 44,000 or 88,000 cubic feet, would it not?

A Yes, if the well was producing 3.6 million, yes.

Q Under the same limiting ratio?

A Yes. If the well had the capacity to produce 3.6 million, why theoretically that's what you would be voiding.

Q That's right, and that one well then on 320, if it's a gas well, and is limited by that ratio, would produce at approximately the same rate as two wells would on 160?

A That's correct, yes, if it has the capacity to produce.

Q And that would be comparable to four oil wells each on eighty, insofar as the volumetric withdrawals are concerned?

A That's correct.

MR. NUTTER: Mr. Errebo.

REDIRECT EXAMINATION

BY MR. ERREBO:

Q In your voidage calculations, you stated that you calculated 44,000 for the gas well producing under the rules which you propose, 21,500 for an oil well on eighty or 43,000 for two oil wells on 160?

A Yes.

Q So that for all intents and purposes, then, the voidage per surface acre between the gas area and the oil area would be the same, would it not?

A Yes.

Q Except that it is true that there is a much thicker section in the gas area, isn't that correct?

A It was brought out this morning on his isopaque map and also on the cross section.

Q So then the voidage in the gas cap area would be less per acre foot than it would be in the oil area, isn't that correct?

A The percentage of the total reserves would be less depending on the thickness of the pay.

Q Then would this result in a tendency for the gas cap to expand under these original conditions?

A With all these theoretical limitations, it sure would.

Q After all, Mr. Dugan, you have made certain assumptions, haven't you?

A Yes.

Q And you have stated that here. You know of very many engineering calculations that are made without making some assumptions up and down the line?

A I'm sure that they can be made if you have the correct data.

Q That is not unusual in engineering calculations, is it?

A I don't think so.

Q All we are doing here is making a comparative analysis, isn't it?

A That's what I was trying to do, yes.

Q So then if the gas cap is expanding, can you see how anybody's correlative rights can be hurt insofar as the oil area is --

A Assume the gas cap is expanding, the people in the gas cap --

Q In the oil area, they are going to get help?

A It would appear that under these circumstances.

Q And under the rules that you have proposed?

A Yes.

Q Okay, thank you. Now with regard to the Dakota development, actually insofar as having dual completions is concerned under the present spacing there can only be one dual completion, can there not, under the 320 acres?

A That's correct.

Q Actually Mr. Weaver's lease has more than that, but those wells were drilled prior to the Dakota spacing?

A Yes.

Q So he didn't have the advantage of the wider spacing. Now in cross examination by Mr. Buell, he compared the minimum

well costs which were shown on your Exhibit No. 7 to the actual recovery dollar-wise from the Weaver lease.

A Yes.

Q Can you see that that comparison has any relevance, does it signify anything to you, or is that like trying to compare apples with doughnuts?

A No, I can't see that it has any point other than the fact --

Q They're just two separate figures?

A Yes.

Q And they are actually picked out of context from separate circumstances that you are trying to depict on two separate exhibits?

A Well, my figure on Exhibit 6, I believe, is purely theoretical.

Q Actually it has no foundation in basis, does it, no foundation in fact, I mean to say, that type of comparison?

A Well, the comparison, although the figures, if you went in to drill a well today and had no trouble, you could probably complete one for that amount of money.

Q But actually, Mr. Dugan, it cost Mr. Weaver more than that, didn't it?

A Yes, of course, he drilled the discovery well.

Q When an operator goes out and drills the discovery wells and takes the risk, sometimes it costs more money?

A Yes, my experience in drilling a well in a new area is generally two or three times as expensive.

Q Now with regard to perforations, or the perforations of the McAdams' No. 3, that was reperforated immediately after you found the perforations were too low initially?

A Well, it was apparently done right immediately after the well was put on production. I don't know the dates.

Q So far as you know, they attempted to correct that as soon as possible?

A I am sure they did.

Q That was because the perforations were too low?

A Yes, due to a mechanical error.

RECROSS EXAMINATION

BY MR. PAYNE:

Q Assuming a 6,000 to 1 gas-oil ratio limitation, and assuming an oil well on eighty, if the gas well produced approximately 900,000 cubic feet per day, it would void approximately the same space as the oil well, is that correct?

A The actual voidage is practically the same, that's correct.

MR. PAYNE: Thank you, that's all.

A No, that might be mistaken. The voidage of the gas well, well, you said 900,000, didn't you?

MR. PAYNE: Yes.

A Half that, that would be about right.

BY MR. NUTTER:

Q What is the payout that you expect under the 160 acre spacing for this gas area with a ratio of 6,000 to 1?

A This curve showing the actual cost would be very close to being correct.

Q You mean one of these lines depicts the 160 acres?

A No, the actual costs, the lease costs.

Q Yes. Well, now, this line that goes up here and intercepts the lease cost at three years and five months, that was under existing conditions prior to reclassification, wasn't it?

A Yes.

Q Then the line that intercepts the lease costs in 1966, nine years and seven months, that's a payout under the present condition with a 2,000 to 1?

A 2,000 to 1.

Q Where is the interception of the 6,000 to 1 and 160 acre line?

A Well, these wells were producing, with the restrictions placed on them by the transporter of the gas, were producing in the neighborhood of what we're asking for, I believe.

Q I see. In other words, with this reshuffling of acreage and gas-oil ratios you would get approximately the same payout that you had before the reclassification?

A Let me make it plain that I haven't figured that, tried to attempt to figure the payout with what we have proposed,

although that would be my estimate, yes.

Q In working out these payouts and so forth, have you given consideration to the liquids that are produced?

A Yes. Also this is considering,this actual curve is considering the gas produced from the Dakota.

Q Now, Mr. Dugan, you stated that some of these wells have increasing gas-oil ratios, as a matter of fact, Exhibit 5 shows that?

A Yes.

Q As those gas-oil ratios go up on the oil wells, the voidage of those wells is going to be less and less, is it not?

A As the gas-oil ratio increases, the more gas is produced the more the voidage will be, assuming --

Q But I mean the voidage on account of oil will become less, won't it?

A If the oil is restricted due to a gas-oil ratio; however, the space that barrel of oil takes up as compared to the space that a thousand cubic feet of gas is less, probably a third less, probably.

Q You were considering, in making your approximation of voidage, you were considering 150 barrels of oil?

A Yes.

Q And 888,000 cubic feet of gas per day, weren't you?

A No, it would be 6,000 to 1 gas-oil ratio, which would be six times the 150.

Q Yes, that is 888,000.

A Oh.

Q Actually that allowable is 148, approximately 900,000, but as time goes by, will those oil wells tend to void less or more space in the reservoir?

A As the gas-oil ratio goes up, they will void more space. In other words, you are taking out.

Q They are still going to be restricted, though, aren't they?

A Yes, but the percentage --

Q Right now aren't they taking,under your theoretical calculation, they are eligible to take out 888,000 cubic feet of gas plus 150 barrels of oil?

A Yes.

Q As times goes on, they will come down to the 188,000, won't they, as the ratios go higher as you have stated they are going, the amount of gas will increase?

A If you are restricting the amount of gas, yes, you are right, as the oil produces, the total oil produced comes down, the voidage space will be less.

Q So at a later date in the course of the depletion of this field, it will be less necessary to have this sort of formula that you have introduced here today than it is right now, the need for it won't exist as strongly later on as it does now, is that correct?

A Well, now, I don't agree with that.

Q Aren't you attempting to get ratable withdrawals between the oil zone and the gas zone right now? If the oil zone is producing less later on, you won't need to produce as much from the gas cap, will you, to have equal withdrawals from the two areas?

A Of course, that percentage is very small, you realize, the percent or the space that one barrel takes up in the reservoir, one hundred barrels isn't going to make very little effect on the total voidage space, I don't think, it would be rather negligible.

Q Why did you use the figure 6,000 to 1? Is that the figure you came up with when you had a certain amount of --

A No, the 6,000 to 1 was based on the production history to date of the wells in the oil rim.

Q What do you mean?

A Originally. Well, the gas-oil ratio averaged slightly more than 6,000 to 1 of the three wells that I have accurate gas-oil ratios on in the oil rim.

MR. NUTTER: Any further questions? Mr. Utz.

BY MR. UTZ:

Q Mr. Dugan, did I understand you to say that you are not taking or didn't know of any bottom oil samples being taken?

A I know of no bottom hole samples that have been taken.

Q The Huerfano 107, I believe you said, had a ratio of 2573?

A Yes, that's correct.

Q Would you say that any of that gas produced from that well would be part of gas cap gas, or would that all be gas in solution?

A I would assume that since this well is located in the oil rim that it would be probably solution gas.

Q And the Huerfano 105 I believe has a ratio of 11,210?

A Yes.

Q Would you say that part of that could possibly be gas cap gas?

A That would be pretty hard to determine.

Q Pretty close to the gas-oil contact?

A Although I'll admit it's getting close to the contact.

Q Can you tell me how much daily volume that you would need to produce from each of your wells in order to receive a three year payout?

A In gas?

Q Yes, sir.

A I could with a little work, I believe.

MR. HOWELL: Well, may I make a comment off the record?

MR. NUTTER: Yes.

(Discussion off the record.)

A We would need a revenue of roughly in the neighborhood of $600.00 per day which if you figure --

Q (By Mr. Utz) Revenue of thirteen cents, you are assuming?

A Well, after overhead and royalties, it would be in the neighborhood of 9.7.

Q $600.00 gross?

A That would be, we would have to recover $600.00 net.

Q Net?

A To pay out --

Q Three years?

A -- in three years, yes. So that's 6.2 million or so a day of gas.

MR. PORTER: I believe there's something wrong with your figure, but that would be over $600,000.00.

A Well, counting your interest at the end of three years, that would be about $680,000.00.

Q (By Mr. Utz) I'm not figuring on a lease basis, I am figuring on a per well basis.

A The only accurate costs I have are the total lease costs.

Q You gave a figure here of $78,000.00 for a well?

A Yes.

MR. HARRIS: That's an assumed cost.

Q (By Mr. Utz) You wouldn't expect us to give you an

allowable for a dry hole?

A In fact, we don't have a dry hole, they are all good wells.

Q But the one hasn't produced as much as the other three, though.

MR. PORTER: You are figuring on the basis of four wells?

A Yes, that's correct.

Q (By Mr. Utz) It would be for the four wells?

A Actually it's three duals and one single with the total lease cost.

Q The Dakota also?

A Yes, I include Dakota in there.

Q So the six million a day would be for Dakota and Gallup production?

A Yes.

BY MR. NUTTER:

Q This 616,000 is the cost of developing the lease in the Dakota and the Gallup?

A Yes, it is.

Q You have included the Dakota revenues in these lines?

A Yes, I have.

MR. NUTTER: Any further questions of Mr. Dugan? Mr. Fisher.

BY MR. FISHER:

Q Mr. Dugan, when you said what you did, when you figure payout, you took a half of the price of the well, is that right, and you charged off to the Gallup zone half the price?

A That was just on a theoretical basis. When you start to drill a well or a proposed well, you don't have too good of an idea on what kind of a well, the size of a well you are going to get in Gallup, or the size in the Dakota. If you are fortunate enough to get a darned good Dakota well, after the well is completed you may be able to prorate it on the size of the initial I.P. or some other method.

Q But I'm getting something else.

A I was thinking what, if I were going to drill a well now in that area how I would try to justify it.

Q Going on your net of half to the Dakota and half to the Gallup, or any percentage that we want to choose, then, you let each zone,by your method, do you let each zone pay itself out?

A No, you wouldn't, after the well is completed, you take the total revenue from both zones and try to make your payout on that basis, but before you started to drill a well, or on a theoretical basis, why you would have to approach it from that standpoint,or that's the way I would approach it, and there might be some other --

Q That's answered my question, thank you. This McAdams No. 3 of yours, is there other types of lines in that area besides

a five hundred pound line?

A I believe I'm correct in saying that the gathering system is a 250 pound system and they have installed back pressure regulators on all the wells and holding 500 pounds against them, against it.

Q Is there any line in there that the McAdams No. 3 could feed into, you say it's flowing out to the atmosphere because it can't buck the 500 pounds?

A I don't know unless I tried it, but it might flow against the 250 pounds.

Q What if the Commission put in the no flare order that you asked for, what would you do then?

A Well, we would have to change the method of producing it, probably.

Q To what?

A The well might possibly produce with a bottom hole choke and a free piston into that system, but it is only, it would have to be tried.

Q There's a possibility, however, that you might have--

A Install a gas lift.

Q Yes.

A Or other types.

Q You would go to the expense and work to try to buck that or increase the capacity of that well, the ability of that well to buck into that 500 pound line, is that right?

A I'm sure that they would.

MR. FISHER: Thank you, that's all.

BY MR. NUTTER:

Q Mr. Dugan, here on your Exhibit No. 7, I was just wondering, you talked in here about estimated oil production per day at the above rate, 2.42 barrels. What kind of well are you talking about there?

A That was made for a typical well in the gas cap area. That 2.4 was figured on a 75,000 to 1 gas-oil ratio.

Q 75,000 to 1?

A Yes.

MR. NUTTER: Any further questions of Mr. Dugan? If not, he may be excused.

(Witness excused.)

MR. NUTTER: Do you have anything further, Mr. Sperling?

MR. SPERLING: No, sir.

MR. NUTTER: Does anyone have anything further they wish to offer in this case? Mr. Buell.

MR. BUELL: If it please the Examiner, Pan American has one witness.

MR. HOWELL: El Paso has two witnesses.

MR. NUTTER: The hearing will come to order. Mr. Newman, did you want to make an appearance?

MR. NEWMAN: Oh, yes. I thought we had made an appearance. Kirk Newman of Roswell, New Mexico, and Guy Buell of the Texas Bar representing Pan American Petroleum Industries.

MR. BUELL: We have one witness, Mr. Examiner, Mr. Marshall.

(Witness sworn)

CHARLES R. MARSHALL,

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

DIRECT EXAMINATION

BY MR. BUELL:

Q Mr. Marshall, state your full name, by whom you are employed, in what capacity, and what location, please.

A My name is Charles R. Marshall. I am employed with Pan American Petroleum Corporation as a petroleum engineer in Farmington.

Q Now, you've testified at prior Commission hearings, have you not?

A Yes, sir.

Q And your qualifications as a petroleum engineer are a matter of public record?

A Yes, sir, they are.

Q Right at the outset, Mr. Marshall, would you briefly summarize the recommendations you will make today with respect to this pool?

A As a result of my study of this reservoir, the Angels Peak-Gallup reservoir, it's my recommendation that the oil wells in this field be spaced -- assigned an 80-acre allowable, spaced on 80 acres, and wells classified as gas wells be allowed to have acreage up to and including 320 acres dedicated to them. It is my further recommendation that the allowable set for oil wells be in accordance with the existing statewide Rule 505, and that the gas allowable -- allowable for wells classified as gas wells be set equal to four times the unit gas, the 80-acre gas limit. Also, it is my recommendation that we define a gas well as being any well producing with a gas-oil ratio in excess of 25,000 cubic feet per barrel, and an oil well producing less than 25,000 cubic feet per barrel.

Q What would be your recommendation with respect to a limiting gas-oil ratio?

A It is my recommendation that this reservoir would best perform under the ratio that exists at the present time, or 2,000 to 1. Consequently, it is my recommendation that the limiting ratio be set at 2,000 cubic feet per barrel.

(Whereupon, Pan American's Exhibits were marked for identification)

Q Mr. Marshall, I direct your attention now to what

has been marked as Pan American's Exhibit No. 1. What is that Exhibit?

A Exhibit 1 is a structure map contoured on top of the main Gallup pay sand, on a contour interval of 25 feet of the Angels Peak-Gallup field area.

Q Is that Exhibit similar to Pan American's Exhibit No. 1 in Case 1661?

A Yes, sir, this is the same Exhibit except that I have added gas-oil ratio information.

Q All right, so this record would be complete in itself, would you briefly, very briefly, review what is reflected by this Exhibit 1?

A Exhibit 1, as I said, is a structure map of the area contoured on the main Gallup sand based on log information available. I have indicated in green what I estimate to be the productive -- commercial productive limits in this reservoir, both on the northern side and the southern side also. As the reservoir has not been defined to either the southeast or the northwest, in order to have an area to consider, I had arbitrarily cut off the reservoir by these broken lines on the northwest edge and the southeast edge. Also, this orange band, as indicated on the Exhibit, reflects the area in which we have gas in immediate contact with oil. And I have indicated a solid orange line through the middle of this Exhibit, which would indicate the gas-oil contact at an elevation of 420 feet.

Q I direct your attention to what has been marked as Pan American's Exhibit No. 2. What is that Exhibit?

A Exhibit 2 is a cross section, I have shown a trace of it on Exhibit 1, AA prime, and it is taken through, starting with El Paso's Huerfano Unit No. 104 on the south, going through their 1, Huerfano No. 103, the Weaver McAdams No. 4, and No.3 and Pan American's McAdams "B" 1 and Pan American's J. C. Gordon No. 1.

Q In respect to the main Gallup sand, how have you shown that portion of the sand which would be oil productive and that portion of the sand which would be productive of gas?

A The portion of the sand that is oil productive, I have indicated in green, and the portion that is gas productive, I have indicated in pink.

Q All right, sir. Where on this cross section will we see the same section that is reflected by the orange shaded area on your Exhibit 1?

A The orange shaded area is the, what you would see in the horizontal plane of this distance of overlap of the gas over the oil, or from here to here. Of course, they are not on the same scale, but that is the area represented by this --

Q The cross section, is that the approximate location of the Weaver McAdams No. 3 Well?

A That is correct.

Q And that shows the overlap of the gas being above

the oil?

A Yes, sir.

Q All right, sir. Do you have any other comments to make on Exhibit 2?

A No, sir.

Q I direct your attention now to what has been marked as Pan American's Exhibit no. 4. What is that Exhibit? Exhibit No. 3, pardon me.

A Exhibit 3 is a plot of all available surface pressures taken on gas wells in this field. It is a plot of these pressures in PSI, pressures versus times and months.

Q Would you briefly state for the record the color code?

A The color code is listed on the attachment, each well appearing with a color corresponding to the ledger. It represents pressure taken on that well.

Q All right, sir. When you examine these data, Mr. Marshall, is this performance what you would normally expect in a reservoir of this type?

A Yes, sir, the pressure decline is what would be expected in a reservoir of this type.

Q All right, sir. Do you have any other comments to make on that Exhibit?

A No, sir.

Q I direct your attention now to what has been marked

as Pan American's Exhibit No. 4. What does that Exhibit reflect?

A Exhibit 4 is the same information that appears on Exhibit 3, entitled in addition to the dates of the tests that the various pressures were taken from, the type of tests that they were taken from, and cumulative production figures for the various wells, which pressures were available.

Q This is more or less self-explanatory. Do you have any further comment you would like to make on it?

A No, sir.

Q I direct your attention now to what has been marked as Pan American's Exhibit No. 5. What is that Exhibit?

A Exhibit 5, let me say this. On Exhibit 4 there were all the pressures available to me are listed. Exhibit 5, I took the pressures, the initial pressures for wells on which initial pressures were available. In other words, these are shut-in surface pressures taken prior to any production from the particular well and plotted these pressures versus times and months, as was in Exhibit 3. Also, the color code on this Exhibit is identical with Exhibit 3 except some of the wells, where initial pressures were not available, have been left off.

Q What do you observe when you plot these data, Mr. Marshall, with respect to the initial pressure of completed wells?

A The initial pressures of each subsequently completed well is less than what is my estimation to be at or near the original reservoir pressure. The pressure taken on the Weaver

McAdams No. 1, the first or yellow dot, is 1356 pounds. That pressure was taken when the well had produced only 1,486 MCF. I expect the initial surface shut-in pressure in this reservoir would be close to the 1356, possibly some less by virtue of this small amount of production.

Q All right, sir. What does this indicate to you from the standpoint of communication of wells in this pool, Mr. Marshall?

A It indicates that there is excellent communication between the various wells completed in this pool.

Q All right, sir. I direct your attention now to what has been marked as Pan American's Exhibit No. 6. What does Exhibit 6 reflect?

A Exhibit 6 again is a tabulation of the information contained on our Exhibit 5 with additional information: the date of the pressure measurement; shut-in time is given, the initial shut-in pressure; also, the radial distance to the nearest well producing at the time the pressure was taken is given.

Q All right. Would you use Exhibit 6, and in conjunction with Exhibit 1 discuss the varying distance that we have observed communication between these wells?

A The -- of course, the McAdams was the original pressure, 1356, the No. 1 Well, which is located on the NW/4 of Section 34, Township 27 North, 10 West; the Huerfano Unit 92, which is located some 15,500 feet away in the NW/4 of Section 7, Township

26 North, Range 9 West, on its initial pressure, which was a pressure taken on this well before it had produced any gas from the Gallup, was 1325 pounds, or 31 pounds less than what is estimated to be the original pressure. Now, the Huerfano Unit 99, which is located in the NW/4 of Section 2, Township 26 North, Range 10 West, had not produced when this pressure was taken on August the 19th, and it had a shut-in pressure of 1269 pounds. It is located 3350 feet from the nearest producing well, which would be the McAdams -- Weaver McAdams No. 2. This -- and it had a pressure drawdown of 87 pounds. This would indicate a minimum drainage area of 810 acres, and I didn't point out that the interference communication that was indicated between the 92 and the first well, the McAdams No. 1, 15,500 feet, would indicate a drainage area of 17,000 acres. The McAdams No. 4, which is located in the SE/4 of Section 34, Township 27 North, 10 West, had an initial pressure of 1,081 pounds, and it is located 2550 feet from the nearest producing well, which was, I believe, the No. 1 or 2. They are quite close, whichever one you consider. The radius is very close. It had a pressure drawdown of 275 pounds. That radius would indicate an effective drainage of 480 acres. Now, the El Paso 103, located in the NW/4 of 3, 26, 10 had an initial pressure of 1,088 pounds, and it was 1900 feet from the nearest producer, which was the No. 4, Weaver McAdams No. 4, or indicating a minimum drainage area of 260 acres. Now, I might point out that in the case of Huerfano Unit No. 92, we have com-

munication indicated over a rather large area, 15500 feet. However, this is also supported by most of the other pressures on here in that the -- for instance, the No. 4 Well had a pressure drawdown of 275 pounds by virtue of production from a well 2550 feet away. Any method that we can use to calculate pressure distribution as a function of its radius from the well would indicate that if you use this point, 2550 feet, and know that the pressure there is 275 pounds lower, you can project the distribution as a function of radiuses in excess of that, and all of the cases on here would result in -- the calculations would result in maximum effective radiuses considerably in excess of 15,000 feet.

Q All right, sir. Now, you have recommended that the Commission authorize the assigning of up to and including 320 acres for a gas well, have you not?

A That is correct.

Q Do these interference data, which you have just reviewed, indicate to you that a well completed in this pool would effectively and efficiently drain in excess of 320 acres?

A Yes, sir. These magnitudes of the pressure drawdown as a result of other production from other wells, indicate to me conclusively that the reservoir would be capable of draining areas considerably larger than areas of 320 acres.

Q All right, sir. With respect to oil proration unit, it was your recommendation that the Commission adopt 80-acre proration units for this pool, was it not?

A That's correct.

Q In your opinion, would an oil well completed in this pool economically and efficiently drain in excess of 80 acres?

A Yes, sir. From the information available on these pressures, although there may be some difference; of course, there is some difference in the mobility of oils as compared to gas, the magnitude of these figures causes me to conclude that an oil well will drain considerably in excess of 80 acres.

Q All right, sir. I hand you now what has been marked Pan American's Exhibit 7. What does that Exhibit reflect?

A Exhibit 7 is a tabulation of gas-oil ratios together with dates on which they were taken, of the wells in the Angels Peak-Gallup Field, which I have indicated by the red number on Exhibit No. 1.

Q Would you go to Exhibit No. 1, Mr. Marshall, and review these GOR data, and in the interest of saving time, make any comment you would like about the structural position of the well when you are discussing ratio?

A All right, sir. In the order in which they appear on the tabulation, Exhibit No. 7, the McAdams No. 1 had a ratio of 88,500. You'll notice that all of these wells which were listed with ratios in excess of, I believe, 47,000 are well up structure from the orange band. The McAdams No. 2 had a ratio of 129,930. The McAdams No. 3, which is located in the orange band, had a ratio of 5,221. The No. 4 Well, McAdams No. 4 had a

ratio of 116,636. El Paso's Huerfano Unit 99 had a ratio of 5,506. The 10 -- Huerfano Unit 103 had a ratio of 98,947. Huerfano No. 105 had a ratio of 11,310. This ratio is somewhat peculiar. However, it is not too surprising in that in this area the structure is dipping at a less of an angle than it is in this area, and because of the larger aerial extent of the zone in which you have oil immediately in contact with gas, you might expect additional free gas production from this free gas cap area that underlies this well. The Huerfano Unit 107 had a ratio of 2573 cubic feet per barrel. This well is located just at the edge of the orange band, and possibly could be producing some amount of free gas. However, with the amount of pressure drawdown that is evidently occurring in this reservoir, the majority of this high ratio could be explained by the fact that as the reservoir -- as the oil zone is depleting more, the solution gas, more gas is coming out of the solution and that probably a large amount of this is solution gas. The Huerfano Unit 92 had a ratio of 47,375. This well has not had too large -- did not have too large of a gas potential from the Gallup. However, the completion of this well was rather lengthy in that there was trouble experienced in completing the Dakota, and the Gallup was standing with mud on it for a considerable length of time, which, in my opinion, damaged the productivity somewhat of this well. The ratio on the Pan American's McAdams "B" 1, which is also located just inside the orange band, is 26,075 cubic feet per barrel. From the main zone this well also, I think,

probably the ratio is high as a result of depletion in the oil zone with possibly some free gas being produced. And that's all I have.

Q With respect to the oil wells, Mr. Marshall, when you, as a reservoir engineer, consider the structural position, and you also consider the substantial amounts of gas that have been produced from this pool, do you see anything unusual or abnormal about the gas-oil ratios that we are experiencing?

A Would you repeat that?

Q Sir?

A Would you repeat that, please?

Q Yes. Now, with respect just to the oil wells, when you consider their structural position and when you consider the substantial amount of gas that has been produced in this pool, do you see anything unusual about those gas-oil ratios on those wells, or about what you would expect when you consider all the facts?

A Now, as I just mentioned, with the depletion that has taken place, and also the fact that some possibility of free gas production exists in this as well as these in the orange band, there is nothing startling about the way they perform.

Q In your opinion, do you feel that low ratio oil wells will be completed in this pool?

A Yes, sir. I feel that as wells are developed away from this transition zone, which may become further from the edge of the field as we go in these directions that low ratio wells

will be completed.

Q Why, Mr. Marshall, do you need a limiting gas-oil ratio in a pool of this type?

A In order to allow the efficient oil wells to produce their proportionate share of the oil and not have the oil produced inefficiently through inefficient wells with high gas-oil ratios.

Q All right, sir. You recommended a limiting ratio of 2,000 to 1. Why did you make such a recommendation?

A Based on all the information I've -- I can obtain, it is my estimate, my opinion, that the solution ratio in this reservoir is probably in the neighborhood of 550 cubic feet per barrel, or at least I wouldn't expect it to be in excess of 550 cubic feet per barrel with a solution ratio of this magnitude; the limiting ratio should be kept down. It is my opinion that it shouldn't be kept at the solution ratio because of practical considerations as well as the fact that you may be over-penalizing wells which are still being considered efficient, but do not -- are not producing the solution ratio. Now, it is my opinion that the 2,000 to 1 ratio which has been used considerably, the difference between that figure and the solution ratio in this reservoir is a reasonable difference, and consequently, I would recommend the 2,000 to 1 ratio.

Q Let me ask you to make a comparison for me, Mr. Marshall. First, I am going to ask you to compare the recovery we would expect from this reservoir as we know it today with the re-

covery that we could expect of oil if you could completely separate the oil portion of the reservoir from the gas portion?

A Under the -- if the field -- if we assume that the field is produced under the recommendation which I made previously, it is my opinion that it will recover approximately thirty percent more than it would recover were this gas cap not in communication with it or if we did not have a gas cap available to give us an additional reservoir energy.

Q All right, sir, let me ask you this. From the standpoint of physical waste, from the standpoint of increased ultimate recovery of oil, will we recover more oil under a 2,000 to 1 limiting ratio or a 6,000 to 1, which has been recommended here today?

A We would recover more oil under 2,000.

Q What is the magnitude expressed in percentages?

A The difference would be approximately, based on this study, fifteen percent.

Q What would that be, expressed in barrels of oil?

A Somewhat in excess of a half a million barrels.

Q So certainly, then, from the standpoint of serving conservation and increasing the ultimate recovery of oil, a 2,000 to 1 limiting ratio would better serve conservation than a 6,000 to 1 limiting ratio?

A That's correct, and it would result in additional recovery, yes.

Q All right, sir. Now, let's look at it from a correlative rights standpoint. With a limiting ratio of 2,000 to 1 in conjunction with the other rules you have recommended here today, with such a limiting ratio, would that allow the owners of the gas to recover the gas hydrocarbons under their tract?

A Yes, sir. According to volume and reserve calculations by other methods, it is my opinion that they will recover essentially the gas in place under the tract if this recommendation is adopted.

Q Mr. Marshall, under the rules you've recommended, what allowable would accrue to a 160-acre gas well?

A If we assumed, for simplification, that we had 160-acre oil allowable, 600, at 148, it would be somewhat less than 600,000 cubic feet per day per 160-acre gas well.

Q I wonder, Mr. Marshall, are you familiar in any way with the average allowable of some of the gas pools in the northwest?

A Yes, sir.

Q Give me an example of two or three fields, if you will.

Q The Blanco Mesaverde Field during 1958, considering all wells, had an allowable of 3,005 cubic feet per day. The Fulcher-Kutz Pictured Cliffs Field, I believe, had an average allowable of 80 MCF -- no, West Kutz Pictured Cliffs Field had an allowable of 80,000 cubic feet per day.

Q Give us one or two more.

A The Ballard Pictured Cliffs had 148, the Tapacito Pictured Cliffs Field had an average allowable of 320 MCF per day average. All prorated gas fields in the San Juan Basin, weighing the field by the number of wells in the field, the average production per well was 216,000 cubic feet per day, or 216 MCF per day.

Q How does that compare with the allowable of a gas well that would occur under your recommended rule here today?

A A gas well drilled on 160 acres would have an allowable essentially three times the average for prorated gas wells in the San Juan Basin.

Q All right, sir. Now, you also stated, Mr. Marshall, that you would define a gas well in this pool as any well producing with a ratio of 25,000 to 1 or greater?

A That's right.

Q Upon what do you base that recommendation?

A The recommendation to set a 25,000 cubic feet per barrel dividing line is more or less arbitrary in this type of reservoir. It is hard to assign a number above which you should call a gas well and below which you should call an oil well. However, if you'll notice, the well which I would consider an oil well that has the highest ratio in this field is the Huerfano 105, which had a ratio of 11,210. The gas well, or well which I would consider a gas well, with the lowest ratio was the Huerfano

Unit 92, which had a ratio of 47,000. The 25,000 comes out to be between these two. It is approximately twice the highest oil well and half of the lowest gas well, and I think that that would be a fair comparison and would not result in any problems as far as classifying these wells.

MR. BUELL: That's all we have at this time, Mr. Examiner.

MR. NUTTER: Are there any questions of Mr. Marshall?

MR. PORTER: I have a question.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Marshall, I believe you recommended 2,000 to 1 GOR and 25,000 to 1 would be the dividing line between an oil well and a gas well?

A Yes, sir.

Q And 320 acres -- up to 320 acres should be dedicated to a gas well?

A Yes, sir.

Q And that the gas well would receive, in the event you had a 320-acre gas well, that it would receive four times the amount of gas allowed the oil well?

A Yes, sir.

Q Then you could have -- conceivably you could have a well with say 24,999 classified as an oil well, which would receive 300 MCF under present level of allowable and 12 barrels of

oil, whereas you might have another well which would have a ratio of 25,000 to 1 that would get 1200 MCF, and, of course, you couldn't determine the amount of oil because I believe you would concede that the production rate of ten changes the GOR?

A Yes, sir.

Q Had you thought of all these possibilities, that much difference between the allowables assigned, say, adjoining wells?

A Yes, sir, I have, and in arriving at any arbitrary delineation line between these two, you could conceive of the situation which you just described. There are -- it is doubtful in my mind that that situation would exist for a very long period because I expect the ratios of wells to increase. However, that is a problem. There are other considerations for determining or defining gas wells, one of which I believe has previously been mentioned, gravity. However, that has its problems in that they are mixing fluids and you have varying amounts of free gas, and the distillate has a higher gravity than oil, and to pick an arbitrary limit, you are going to have that problem. However, I do not believe in this reservoir that it will be a serious problem.

Q Suppose you had this situation too: A gas well to which you have dedicated 320 acres, and the GOR should fall below the 25,000, necessitating the redefinition of the well to an oil well. What would -- what acreage would you dedicate to it?

A Well, sir, let me say that the way we expect this

reservoir to perform, under our recommendation, we expect the gas cap to always be expanding somewhat, and, of course, as we take the oil out, the pressure is going down so that I cannot visualize a well in which the ratio would go down.

Q But it could happen?

A I guess it could. Anything could.

MR. PORTER: That's all I have.

MR. NUTTER: Any further questions of Mr. Marshall? Mr. Errebo?

QUESTIONS BY MR. ERREBO:

Q Mr. Marshall, if you will refer to your Exhibit No. 1 up on the board there -- before we talk about that, I would like to ask you this: Have you been located in the San Juan Basin for some time with Pan American?

A I have been located in Pan American's office which operates the San Juan Basin for three years, I believe. Three or four years.

Q And in connection with your duties, I take it that you have had an opportunity to study a number of these fields which are similar to this in the Gallup trend, is that correct?

A No, sir, I haven't had an opportunity to study a field similar to this one in the Gallup. I don't know of a similar field.

Q Well, would you consider Bisti, that is a Gallup field, isn't it?

A That is about the extent of the similiarity; they are both Gallup reservoirs.

Q Otero Gallup, that's also in the same general trend, isn't it?

A It's very different in its pay characteristics. It is in the Gallup.

Q Well, that's fine. And all of these fields, I think, are old shoreline deposits, isn't that correct, that provide the primary bases for accumulation?

A That's true in most of the upper Cretaceous.

Q Then, with that knowledge, tell me, what is your opinion with regard to the accumulation of oil and gas insofar as it relates to structural characteristics? Let me rephrase that just a little bit, perhaps to make it more clear, so far as it conforms to structural characteristics?

A The accumulation of oil as it conforms to structural characteristics?

Q Does it generally conform to the structural characteristics, or can the accumulation cross, say, structural line?

A In the Gallup?

Q Yes.

A Yes, there are cases. The Horseshoe-Gallup field is a Gallup sand which practically is perpendicular to the structure.

Q Would you say that is fairly normal in this type?

A Well, it is one of four or five. It is not normal

in that it is the smaller of t he group. Most of them occur generally on trends, trending northwest and southeast.

Q Actually,you have shown this field to follow almost exactly the structural contours, haven't you?

A Well, except for the ends.

Q Except for the ends, but your green line,that follows exactly the 375 line plus 375 on the north?

A Yes, sir.

Q And on the south the green line follows the 550 --

A Yes, sir.

Q -- exactly. It doesn't differentiate from it, does it?

MR. BUELL: Mr. Errebo, let him finish his answer, please.

MR. ERREBO: Excuse me.

A As I have noted on there, these are estimated limits of production. In an area of this size with no more wells than we have in there, I don't think that I would have been wrong to run them anywhere in this direction,however, since it was easy to trace that line.--

Q It was just a matter of convenience, wasn't it?

A Yes. It doesn't mean that necessarily the sand follows the structure. It can cross it or widen out, but this was more or less a matter of convenience.

Q Do you have any opinion as to whether this accumula-

tion actually crosses structural lines at an angle or whether it, probably with the knowledge that you have, now conforms quite closely, in fact, exactly, with the lines that you have drawn now?

A From what we know about the reservoir, well, no, I wouldn't say that. You notice this nosing in here. Now, although I've got the limits nosing too, the quality of pay development does not necessarily change with these contour lines, so that I couldn't say that it absolutely followed the structure.

Q That is exactly what I have been getting around to, Mr. Marshall, in this line of questioning. Then, actually, the fattening at the northwest portion of this yellow band actually is a matter of convenience rather than reality, as far as you know, is that correct?

A You mean between -- you mean the difference in width between here and here?

Q Notice the width of the orange band.

A The width of the orange band is governed by the structure.

Q Yes, sir.

A I have controlled information here, controlled information here.

MR. BUELL: Mr. Marshall, when you say "Here," he can't get the location into the record.

A Excuse me. I have control information on the 107 Well. All wells in the Angels Peak-Gallup field, naturally in

addition to some well that's outside, it is my opinion that in this area right through here, the contour, the structural information is pretty well accurate, it is controlled. Now, naturally, if you've got gas, then it is going to seek its level in relation to oil. As the dip of the bed decreases, the width that you would see, looking down on this area, would get wider. And I don't --

Q Providing there is development along that same area?

A There is a well in the middle of it which had a potential of 4325 cubic feet per day.

Q So then, are you saying this, Mr. Marshall, that actually, then, the oil, the southern oil limit follows contour lines, is that correct, and that you have actual control to lead you to believe that?

A Are you speaking now of the green line or orange?

Q What would be the southern limit of oil accumulation. Would not that be the southern limit or the southern line on your orange band?

A Yes. Oh, I see; yes, that is based on the structural information, that would be where the -- if this gas-oil contact is correct, which I believe it is, that would be the southern limit.

Q Actually, then, that area, that was based on control and not on --

A That's right. The whole thing is based on control, --

Q Well, -- excuse me, go ahead.

A But, the -- except the general location of this line is based on control. The fact that it wiggles around and follows this structure line is convenience, the general location of it is control.

Q Then, actually, the fattening there at the north-west part is control and not convenience, is that right, of the orange band?

A Everything above the orange band, I think in this area here, is -- has good control.

Q Now, Mr. Buell, in his direct examination of you, asked you to accept the hypothesis that the gas and the oil were separated?

A That's right.

Q I might have missed that some way.

A Yes.

Q Now, your estimate of some fifteen percent loss of ultimate recoverable oil, is that based on that hypothesis?

A No, sir.

Q It was not?

A No, sir, the fifteen percent difference between 6,000 limit and 2,000. No, that had nothing to do with it.

Q Had nothing to do with the hypothesis?

A That's right.

Q Actually, how did you calculate that, Mr. Marshall?

A By running material balance on the reservoir; I was studying under the various assumed possible ways that we could produce it.

Q Mr. Marshall, would you tell me in little more understandable language exactly how that worked? I understand when the crank is turned on the material balance, certain things come out, but that doesn't help me to really understand completely how you figured that.

Q Well, --

MR. BUELL: Let me be sure I understand. You want him to explain material balance to you?

MR. ERREBO: In other words, he was telling me and telling us all that we will have fifteen percent more oil production under the rules you advocate. I asked him how he calculated that. He said by material balance. Well, that is fine, but I would just like to know if there is any further explanation that he could give us other than asking us to accept the results of a material balance claculation. In other words, could it be simplified any?

MR. NUTTER: I think it should be appropriate that he explain the fifteen percent that he expects to recover.

A I consider -- as I have stated, I had an area which I had under consideration. Using the assumption that we would produce it with a 6,000 limit, and a 140 oil allowable, and with other factors, which we use in the material balance, assuming that

this area was developed, I calculated a recovery factor from the material balance under those conditions. I calculated a recovery factor using the same conditions except changing the limiting ratio and possibly a few other factors. Let's see, the -- limiting ratio, the oil allowable would have been the same. The gas allowable was changed somewhat, or what we would allow these wells to produce.

Q You say it was changed?

A My recommendation results in a somewhat different gas allowable. In the assumption I used as a gas allowable in the 6,000 to 1 case, I ran the material balance using that method, and I calculated what I estimated the oil in place, and multiplied the two respective recovery factors by the oil in place, and for the fifteen percent, I just took the difference between the two recovery factors, they are fifteen percent apart, the 2,000 is fifteen percent higher than the 6,000.

Q I wonder if you could tell me what the reservoir mechanism or operation is that the results of your material balance indicate? What is going on down there that is reflected by the results of your material balance?

A Well, I don't quite understand your question. You mean is the material balance telling us the reservoir mechanism or the mechanism by which this reservoir would produce?

Q No, I would like to know if you could tell me what the movement of oil, what the production effect is, as actually

present, which is measured by the results from your material balance.

A I think I understand your question to mean why we would get a different answer under the two cases?

Q Yes, I think that is right.

A The reason for that is (1): the fact that because we have this large transition zone, a 6,000 ratio limit will allow production of considerable more gas than a 2,000. The fact that a well has a limit of 6,000 to 1 doesn't affect it if it can't make 6,000 to 1. That fact, together with the fact that under those two cases that I calculated, I was assuming that a gas well drilled on 160 acres would have a daily allowable of 600 MCF per day, and under the other case, I was calculating that a gas well would have an allowable somewhere -- I ran more than one 1500 MCF per day, 1200 MCF per day, and I think one 2100 MCF per day.

Q Actually, how many wells in this field now produce or test at a rate of less than 6,000 to 1?

A Well, it is my opinion -- it depends on how you define the word "Test." Based on information, performance information and test information of your Frost, I think it has a ratio of less than 2,000 to 1. We -- the basis for this statement is the fact that in recovering load oil on the McAdams "B" 1 from the main Gallup sand, it was not necessary to pump it very much, you could agitate it, and with this 2600 ratio it would flow.

Q It is flowing load oil?

A It was flowing load oil, and it would flow for a short period of time. The Frost, it is necessary to pump this well to get every barrel, and I conclude from that test information that the ratio on the Frost will be significantly less than the ratio on the McAdams was, providing -- the only reason -- the only explanation for the fact that it wouldn't be is the fact that depletion has occurred from these gas wells, which would cause the gas saturation around those wells to be higher, but I wouldn't expect it to be that extensive.

Q You appear to be apologizing for the Frost Well. Do you think it needs an apology?

A Not yet, no.

Q Tell me, you haven't shown the gas-oil ratio information for the Frost Well on your Exhibit No. 7, have you?

A No, sir.

Q Why was that?

A Well, as I said, I don't know what it is. I say it will be less than 2600, based on that test information I gave you. There has not been a ratio test conducted on it.

Q Now then, on the McAdams "B" No. 1, what is the initial test on that well?

A That well, we did quite a bit of testing on it. It stabilized at a rate of 48 barrels of oil per day with a ratio of 2675 from the main zone.

Q That was the initial test on the well?

A That was the stabilized flowing rate, yes, sir.

Q Actually, the gas-oil ratio information on your Exhibit No. 7, is that initial test information or just the best information that you have?

A That is the stabilized flowing rate of the well and of the gas-oil ratio taken at that time.

Q I guess I didn't make myself clear. I was talking about all the information shown without regard to any particular well.

A I am sorry. You mean all of the wells?

Q Yes, that purport to be a reflection of initial tests or current tests?

A Well, the dates are given on the Exhibit, --

Q Yes,

A -- which were the dates corresponding to the tests.

Q Actually, there are some tests which have been made which don't show on here, isn't that correct, on some of these wells?

A Oh, yes. This should be the latest test information.

Q This should be the latest. Actually, the McAdams No. 3 has somewhere around 5700 to 1 as previously testified?

A I will put it this way. This is the latest information that has been reported to the Commission, I believe.

Q Now then, you apparently have made a study of the

allowabilities of gas pools in the San Juan Basin, is that correct, at least a cursory study so that you could give the Commission an --

A The average allowable, yes.

Q Now, you came up with an average allowable of 350,000 on the Blanco Mesaverde, is that correct?

A Yes, sir.

Q That was average?

A Yes, sir.

Q And you came up with -- would you state again what the average for the entire number of fields or the basin was?

A The entire number was an average of 216.

Q 216?

A MCF per day.

Q I wonder if you could give me also -- I think it would be helpful to the Commission, an average deliverability of the wells to which those allowables were assigned?

A I couldn't give you that information now.

Q Could you tell me what the average deliverability of wells in the Blanco Mesaverde is?

A No, sir.

Q How about the Fulcher-Pictured Cliffs?

A No, sir. I don't have any average deliverability. Of course, these allowables are based partially on deliverabilities. They depend on other things, but I don't have any average deliver-

abilities of any of these wells.

Q Actually, isn't it true that when you take an average, you have to have some highs and some lows in order to get an average, don't you?

A That's correct. However, with an average of 305, knowing, just knowing the characteristics of the wells in the Blanco Mesaverde.

Q You say knowing the characteristics?

A I don't know the deliverability, but we have a general conception of the type of wells completed out there.

Q But you don't know any of the deliverabilities?

A No.

Q Does Pan American have any wells in the Blanco Mesaverde?

A Yes, sir.

Q Are they within your jurisdiction?

A Yes, sir.

MR. BUELL: May it please the Examiner, I believe we are kind of wandering here at this time. If you feel it is proper to go into the deliverability in the Blanco Mesaverde, give us a little time and we will do it.

MR. ERREBO: Mr. Examiner, I am through with this line of questioning. I did feel it was proper on account of the statement he did make about allowable as directed to the deliverability, and that's the only reason.

MR. NUTTER: I think he is pursuing a point that he brought up. Proceed.

MR. ERREBO: That's all I have.

MR. NUTTER: Do you have any further questions, Mr. Errebo?

MR. ERREBO: I believe that's all. Thank you.

MR. NUTTER: Does anyone have any questions of Mr. Marshall?

QUESTIONS BY MR. HOWELL:

Q Mr. Marshall, referring to Pan American's Exhibit No. 1, I believe you have testified that you consider the area on this map lying north of the orange band and south of the green line as being potentially commercial oil production?

A That's correct.

Q And there are a number of locations which have not been drilled and in which you would expect oil wells to be drilled in the future?

A Yes, sir.

Q Now, I believe you also testified that you would expect in that area to find initial gas-oil ratios to be considerably lower than the wells that have been completed?

A Yes, sir.

Q Now, if the gas cap gas were withdrawn on a ratio of 6,000 to 1, what would be the effect of such withdrawal with reference to migration of oil from any wells located in this area, having a low gas-oil ratio such as 1,000 to 1?

A Well, sir, as I have stated previously, I think the -- part of the result of the ratio and of the Pan American McAdams "B" 1 was because of pressure depletion. I think that that pressure situation would undoubtedly expand in varying degrees.

Q Would that be likely to cause any migration of oil as a result of voiding the gas cap pressures there, lowering the pressures?

A Yes, sir. If the reservoir depletes and goes down in pressure and there is no production, the only place it can go is away from where it is, so there would be migration.

Q Would that be likely too, in your opinion, to create a problem of migration by using the 6,000 to 1 ratio rather than the 2,000 to 1 ratio?

A Yes, sir.

Q And it is a fact, is it not, that whenever oil migrates within the reservoir, that it is extremely wasteful in that the ultimate recovery is reduced?

A Yes, sir, that's correct.

MR. HOWELL: That's all.

MR. NUTTER: Anyone else have any questions?

QUESTIONS BY MR. UTZ:

Q Mr. Marshall, using your 2,000 to 1 ratio, what would you expect the gas-oil contact on the southern edge where you show your gas-oil contact? Will it stay, will it recede or --

A The contact itself?

Q Yes.

A As I said, it indicates that we would have pressure maintenance so that the gas cap would expand to some degree, causing the contact to move.

Q Now, under a 6,000 GOR, what would you expect to do?

A The same situation would exist. We would still have some pressure maintenance by virtue of the existence of the gas cap. As I mentioned, fifteen percent less efficiency. However, the same thing would occur to a lesser degree.

Q And the gas-oil contact, then, under 6,000 would recede, go down structure?

A Yes, sir, somewhat.

MR. UTZ: That's all I have.

MR. NUTTER: Mr. Fischer.

QUESTIONS BY MR. FISCHER:

Q In your Exhibit No. 2, I believe, El Paso Huerfano Unit No. 104 --

A Yes, sir.

Q -- I notice that it potentialed at 393 barrels of oil per day with a GOR of 1500. Do you have it on your Exhibit?

A Yes, sir.

Q Do you know, or were all these perforations as shown on this 104 opened at that time, when that 993 potential was taken?

A As far as I know, they were all opened.

Q Then you have the estimated limit of commercial production here projected in your main Gallup sand over to your lower set of perforations?

A No, I don't mean the estimated limit of commercial production, I mean the wavy line that crosses it, I have the correlative interval extended to the Huerfano Unit 104, the interval that correlates with the main sand further up in the reservoir. The permeability from the logs indicates that the pay is very very poor, if existent at all, in that well. However, it does seem to correlate with a similar interval in which the sand is developed further back to the north. The fact that that well had a gas-oil ratio of 1500 to 1 is not unusual in that if there is any pay development there at all, it is very small, and with a solution ratio of 550, you would normally expect that there was some amount of free gas produced from this well.

Q Free gas from those sets of perforations?

A I couldn't say it was from those sets of perforations, but if my estimate of solution ratio is correct there was free gas produced from that potential test.

Q It seems to me from your SP line that that particular interval in there might be less shaly than the interval up above. Does that seem true to you?

A Well, --

Q In other words, your sand would be cleaner possibly?

A They are both very poorly developed sands, but it is possible that the lower one is a little bit better than the one just above it.

Q In looking at this SP line again, it seems like it is less shaly than just about any other section that is perforated in there except maybe the top set of perforations.

A Well, that would be from the fact that the resistance curves are higher. You wouldn't expect as much shale lying in this as the others. The SP is indicating essentially the same degree of shaliness in each one. It is a pretty fine line, but it does appear to me that the line dividing 5700 feet below that, it appears to me that that interval is less shaly than the majority of the others. But, as I say, there is not very much difference. It is the fact -- of course, we have considerable footage opened all total in the well, and the lower interval is only a small fraction of the total footage opened.

Q In your Exhibit No. 6 where you have this surface pressure data, this shut-in time listed here, was that stabilized shut-in, were all of these wells that stabilized shut-in when these pressures were taken?

A I don't know that they were. Those were the pressures, I assume at the end of seven days. I don't have any build-up information between, prior to the seven days from the permeability. Evidently permeabilities in this reservoir, I would venture an opinion that they are built-up pressures.

Q They were. On your Forst Well, do you know the total amount of load oil in that well when you began?

A Not exactly. It was between 1100 and 1200 barrels, I believe.

Q Do you know at what rate it has been returning day by day? The first day and second day, how much came back?

A A breakdown by days?

Q Yes, do you have any idea?

A Well, no, I don't. It started out a little higher. We have had pump trouble. We had to pull the pump on it, and it had gone down to somewhere around 20 barrels a day, and we pulled the pump on it, and I think we had to repair the pump to some degree, and it was run back in, and I believe we only have one day's production, or one portion of one day's production since then, or at least available to me, and it was about 40 barrels a day. But I don't have a breakdown. I would say it had been averaging about 40 barrels a day, 30 to 40 barrels a day.

Q I don't want an average. Do you have an idea of the breakdown? Has it been decreasing?

A There has been no large degree of decrease, no, sir.

Q Would you venture a guess as to the outcome of the production of this well on completion?

A Well, right now we are contemplating restimulating the well.

Q You don't think too much of it now, however?

A Well, it looks like it is going to be around a 30 barrel well right now, 30 to 40 barrel well.

Q Did you have a GOR test on this well even though it is load oil? Have you taken a GOR test?

A No, sir.

MR. FISCHER: That's all I have.

MR. ERREBO: I have a brief question.

QUESTIONS BY MR. ERREBO:

Q Mr. Marshall, you stated a while ago, talked about the Jack Frost No. 1, which I believe is your latest well up here?

A Yes, sir.

Q That is located generally in the southeast of Section 27, is that correct?

A Yes, sir, that's correct.

Q Now, would you recommend to your management that they drill a well in the NW of the SE of 27, on the basis of what you know now on the Jack Frost No. 1?

A The NW/4 of the SE/4?

Q Yes, sir, that would be as I described it.

A It usually takes me a little longer than this to make a recommendation to management.

Q It would take you a little longer in this case?

A Possibly a little longer in this case. I will say this, there are areas developed by various operators and areas comparable to this, and under certain circumstances I would recommend

that a well be drilled in this area at this location.

Q How about under these circumstances here, would you recommend that?

A Well, these circumstances what do you mean by "These circumstances?"

Q Well, the circumstances that exist as you presently know them with regard to Jack Frost No. 1? You are fully familiar with it, aren't you, Mr. Marshall?

A Yes. Before I made a recommendation to drill a well at that location, possibly I would want more control information on the Frost. As you put it the way you do, would I right now, no, I think probably I would after we have completed the Frost.

Q Then you would what?

A Make a recommendation.

Q So, you are saying now, on the basis of the Frost No. 1, information which is presently available, that you had to make a choice, you would recommend the drilling of another well?

A Well, I would wait until I had the information available, then I would make the choice.

Q You would then make the choice?

A That's right.

Q And your choice would be to drill or not to drill?

A That's correct.

Q Actually, you have seen quite a few wells completed in the San Juan Basin, haven't you, and observed the test informa-

tion and other information which becomes available to a comp: your size during completion of a well?

A Yes, sir.

Q And what do you think of this well, which is still recovering load oil thirty days later? Does that look like a very good well?

A Well, it is better than some we've drilled. It does not appear to be a red hot prospect, so to say.

Q You don't have any evidence, do you, of, or any belief that wells will be drilled in the oil rim which will produce initially or at any subsequent time at a ratio of less than 1,000 to 1?

A Yes, sir, I do believe that.

Q And what is that based on?

A The fact that I estimate the solution ratio to be 550 cubic feet per barrel.

Q That is certainly not based on any information that you have now, is it?

A Yes, sir. It is based on the information that I used to arrive at the solution ratio.

Q But not on any presently known initial gas-oil ratio information?

A We don't have a measurement of a well -- yes, sir, we do. We have a -- it is a little bit involved, but we have a ratio on the McAdams of 2675 cubic feet per barrel.

Q Was that initial ratio?

A That was the initial stabilized pressure. We have reason to believe that the reservoir pressure in this area has been drawn down by virtue of the fact that the gas wells have been producing. You can turn the calculation around, and knowing the approximate magnitude of pressure drawdown, you can go backwards and calculate what you would have expected the ratio to be had there not been any pressure drawdown. So, in that respect, we did have.

Q Except in this case here, you haven't found any with initial pressure of less than that so far?

A Except, I think a thousand, I would say a thousand, no.

Q What evidence do you have as to the -- what the gas-oil ratio in the Frost No. 1 would be?

A As I previously stated, because of the performance of this well in comparison to performance of other wells, I believe that the ratio would be less than 2600 to 1 by a significant amount.

Q In other words, you are saying that you've gotten so far in recovering your load oil you really can't tell now, but based on your observation of other wells, you can't predict what the gas-oil ratio will be, but you can predict whether or not you will drill another well in that area, is that correct?

A Well, the gas-oil ratio is a fact. There are a

lot of considerations that go into whether or not you drill another well. I wouldn't make it on the type of comparison that you did.

MR. ERREBO: Thank you.

QUESTIONS BY MR. NUTTER:

Q Mr. Marshall, do you know what kind of a test this was on this Weaver No. 1 that shows the initial pressure to be 1310?

A No, sir. All I know is that that was the pressure reported as the, I believe it is designated rock pressure on the final log form which is filed with the Commission and the U.S.G.S.

Q And this 1356 is the surface pressure determined on the initial deliverability test?

A Yes, sir. Seven-day build-up.

Q How about all these other tests that were reported here on your Exhibit No. 3 and Exhibit No. 5? Are these all surface pressures that are measured during deliverability tests?

A Yes, sir, there are a few that were measured during packer leakage tests. They are all seven-day build-up tests.

Q All have the same build-up time?

A All except the ones that I have not indicated any build-up time which is the 91, M the second test, and the one which you just referred to. And I do not know the build-up time there, and the 103 had a nine-day build-up.

Q Are these all dead weight pressure gauges, or would

they be spring gauges on top of the wellhead in some cases?

A The deliverability test pressures are, I feel confident they are dead weight pressure tests. I am not too sure on the packer leakage test, as to what type of tests they are.

Q I just wondered how reliable this initial test on the 92 is. What kind of a test is that? That was a packer leakage test, wasn't it?

A Packer leakage test. To me, a packer leakage test should be conducted, naturally, where the pressures are critical. I personally, as long as we are talking about drawdowns in the range of 31 pounds, would have every confidence that that was an accurate pressure for the purposes of that consideration.

Q Do you also feel that it is an -- a natural assumption that this well is showing a drainage radius there of 17,000 acres?

A I feel that this well has felt the effect of production from the wells 15,000 feet away.

Q Notwithstanding the fact that you don't know what kind of a pressure measurement that was on that packer leakage test?

A Notwithstanding that. May I say -- I think I stated it before, another reason that I have confidence in that fact is the magnitude of pressure drawdowns in the other wells which are located closer, and analytically extending that or

extrapolating that pressure build-up by the method that we have to do it with, you can calculate a radius greater than 15,000 feet, so with that information in conjunction with the packer leakage pressure, that is the full reason for my confidence in it.

Q There is also the possibility, isn't there, that there is variation in the permeability in the No. 92 Well, and possibly the shut-in time might have resulted in a lower pressure building up?

A There is a possibility of that. As I said, the logs on the Huerfano Unit 92 are comparable with other wells in the area further up to the northwest. And I would expect seven days to be adequate shut-in time on that well, but, of course, there is that possibility.

Q Now, in compiling the information that you have here on Exhibit No. 5, you show initial pressures of 1,2,3,4,5 wells. Are those the only five wells that you had initial pressure data on?

A No, sir. I had an initial pressure on the McAdams No. 2.

Q When was that pressure taken and what was the --

A It was -- I don't know when it was taken. It was taken during the month of May, and it was reported the same as No. 1, as the rock pressure on the form, final log form, which is filed with the Commission and the U.S.G.S.

Q Now, do I understand you correctly, Mr. Marshall,

when you have proposed that oil wells as well as these gas wells all be subject to a limitation of 2,000 to 1, you have proposed that oil wells have dedicated to them 80 acres?

A Yes, sir.

Q You have proposed that gas wells may have dedicated to them up to 320 acres, --

A Yes, sir.

Q -- any amount of acreage up to 320?

A Yes, sir.

Q Now, what have you proposed for the amount of gas that these gas wells can produce?

A On the 320?

Q Well, for any size of gas proration unit?

A Well, I based it on the 320, and I recommended -- I recommend that a well that has 320 acres assigned to it be allowed to produce four times the gas limit of an 80-acre oil well.

Q How about a well that is on 160 acres?

A Half or the ratio that the acreage bears to 320, or half.

Q In other words, it would be multiples of 80, depending on the amount of acreage that is dedicated to the gas well?

A Yes.

Q Do you feel that the rate of withdrawal -- now, we've been concerning ourselves quite a bit here today with these

four Weaver wells; they are on 160 acres each?

A Yes, sir.

Q So, do you think that the rate of withdrawal for those wells that are 160 acres under this 2,000 to 1 limiting ratio, it would receive twice the amount of gas that the oil wells are receiving right now?

A Yes, sir.

Q Do you think that this is an equitable rate of withdrawal for gas wells versus oil wells?

A Well, it would receive twice the rate of a well, that would, yes, sir, twice the rate of the well that would produce that limit, it would receive twice the gas. Of course, it would be draining a reserve of whatever is under 160 acres whereas the oil well would be draining a reserve of whatever is under 80 acres.

Q And the oil well would also be receiving the volumetric space occupied by whatever fluid it is producing?

A Yes, sir.

Q Have you made any volumetric withdrawal calculations on this thing to determine the amount of gas that should be withdrawn as related to the amount of gas or liquid that are withdrawn down in the lower portion of the pool?

A Yes, sir, I believe that, in effect, these material balance calculations did that.

Q Now, in these material balance calculations, this

fifteen percent more recovery on the 2,000 to 1 rather than on the 6,000 to 1, does that result from decreasing the takes in the gas cap?

A Yes, sir, partially.

Q In other words, you have reduced the takes one-third from 6,000 to 2,000 in making comparison, so --

A Yes.

Q So you are taking one-third less pressure off that gas cap?

A That is partially, and the other part is the fact -- these wells in the transition zone which are producing, which would produce it more efficiently under 2,000 than they would under 6,000, which are classified as oil wells, but which immediately would have a 6,000 limit, and consequently produce that 6,000 limit, and that in addition to the difference in rate, yes, sir.

Q But eliminating that portion of it, this gas cap would be a part of this fifteen percent, would be due to a less efficient gas cap operation?

A Yes, sir.

Q By tripling the withdrawal from the gas cap?

A Yes, sir.

Q Now, you stated that if you isolated the gas cap from the oil zone, you would have 30 percent, you would have 30 percent less recovery than you do now with the gas cap? What would be your mechanism to produce the oil solution, gas drive, or

what?

A Yes, sir, for the purpose of that calculation. I assumed we just had a depletion drive reservoir of the characteristics of the oil area in this reservoir, and ran a depletion material balance on that assumption.

Q You stated that you didn't know the solution gas-oil ratio. I don't suppose you know the bubble point of the oil in this oil zone either, do you?

A Well, its being in contact with the gas, it is under-saturated, so that 16 -- what I calculate to be the bottom hole pressure from the surface pressure information of 1630 pounds.

Q Is that your estimate of the bottom hole pressure?

A Yes, sir.

MR. NUTTER: Does anyone else have any questions of Mr. Marshall?

QUESTIONS BY MR. PAYNE:

Q Mr. Marshall, do you feel that would be the proper way to handle this pool from an engineering standpoint of waste?

A From an engineering standpoint, the field could probably be better produced if there was not the problem of diversion ownership.

Q Now, I realize that you've got the human element in there, but as far as correlative rights are concerned, if there

were poolwide unitization, no correlative rights would be impaired, would they?

A Providing the field was unitized and producing under optimum conditions by virtue of being unitized, I cannot see where there would be any violation.

Q Do you know if your Company has any particular objections to entering into a unitization agreement in this pool?

MR. BUELL: Perhaps I'd better answer that, Mr. Payne. Specifically, with respect to this pool, I have no knowledge of what our Company's attitude would be. I do know that we favor unitization where conservation will be served and where the proper unitized contract could be negotiated. I am sure we will be glad to look at this.

MR. PAYNE: Thank you. That's all.

MR. NUTTER: Any other questions of Mr. Marshall? He may be excused.

(Witness excused)

MR. NUTTER: Do you have anything further you wish to offer?

MR. BUELL: No.

MR. NUTTER: Did you offer your Exhibits, Mr. Buell?

MR. BUELL: I think I did. I will do it again. I formally offer Exhibits 1 through 7 inclusive.

MR. NUTTER: Without objection, Pan American's Exhibits 1 through 7 will be admitted.

MR. NUTTER: Mr. Howell, do you have --

MR. HOWELL: We have two witnesses.

(Witness sworn)

MR.HOWELL: Call Mr. Lemon to the stand.

RICHARD F. LEMON,

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

DIRECT EXAMINATION

BY MR. HOWELL:

Q Would you please state your name for the record?

A Richard F. Lemon.

Q How do you spell that?

A L-e-m-o-n.

Q And by whom are you employed and in what capacity?

A El Paso Natural Gas Company, as senior petroleum engineer.

Q Now, what education did you have in the field of engineering?

A I received a Bachelor of Science degree in engineering from the University of Oklahoma, Master of Science degree from California Institute of Technology, and in addition to that, I have done some graduate work at the University of Houston in petroleum engineering.

Q What year did you graduate from each of the institutions from whom you received degrees?

A 1945 from the University of Oklahoma, 1948 from California Institute of Technology.

Q And by whom have you been employed and in what capacity after your graduation from these schools?

A In 1948 I was employed by Stanolin Oil & Gas Company as a petroleum engineer.

Q In what area.

A Generally West Texas.

Q And how long were you with Stanolin?

A Six years.

Q And by whom have you been employed since that time?

A El Paso Natural Gas Company.

Q And in what capacity have you been employed by El Paso Natural Gas Company?

A As a reservoir engineer.

Q As such, have you made studies of the San Juan Basin area?

A I have.

Q Did you make a study of this particular Angels Peak-Gallup Field to determine the recommendations which you felt should be made to the Commission regarding field rules?

A I studied to the effect of reservoir performance.

Q Just tell the Commission what you did, or what you looked at, and what data you had available.

Q The first thing I paid consideration to was the

matter of drainage, just how much area you might expect an oil or a gas well to drain. Based on the initial wellhead completion pressures on the McAdams No. 1, Weaver's McAdams No. 1, I determined that the initial bottom hole pressure was in the neighborhood of 1625 pounds bottom hole conditions, and from that, I studied the offsetting wells to the Weaver McAdams lease, and from that, based on El Paso's Huerfano Well No. 107, which was completed as an oil well in the oil rim area, with the initial completion of 287 barrels of oil with a GOR of 4142, bottom hole pressure survey on that well run in March of '59, which was approximately roughly a year after the McAdams Well No. 1 was completed. During that period of time from the production in Section 34, the McAdams lease, that roughly approximately 170 pound drop in bottom hole pressure was observed in our El Paso's No. 107. The initial delivery date on the Weaver McAdams No. 1 was, I believe, in April, '58, which would be eleven months, so that during that time and also due to the other wells on the McAdams lease, this drop in bottom hole pressure had occurred. Now, the distance between the nearest well to the 107 is the McAdams No. 3 on the Weaver lease. The distance there would be about a half a mile. So on that basis, it is conceivable that an oil well would drain as much as 320 acres. In addition to the interference data here, the average permeability of the area appears to be around thirty millidarcies, which should afford good movement of the oil through the formation.

Now, dropping down in Section 3, which is south of the Weaver McAdams lease, I looked at El Paso's Huerfano 103. That well was completed in January of '59 with a GOR of 5827. Bottom hole pressure survey was conducted in March, '59 with a resulting bottom hole pressure of 1270. That was corrected to a tentative gas-oil contact of 420, since this well is in the gas area there. The resulting difference in bottom hole pressure from that Weaver McAdams No. 1 was 375 pounds. I would like to correct that to 355 pounds. Magnitude is what is important. Let's see, that well is now tied in, but at the time the bottom hole pressure survey was taken, it hadn't produced any substantial quantities of gas, only that that was taken on potential. The nearest well to the El Paso Huerfano 103 is the McAdams,Weaver McAdams No. 4. There again, there is approximately half a mile distance between the wells. So, from that, it is apparent that you could drain an area of 320 acres,at least.

Another well which offsets the Weaver McAdams lease to the west is the Huerfano 106. In that particular instance I estimated bottom hole pressure based on the surface pressure to be 1360 PSIG, which would be 265 pounds less than the initial pressure I estimate on the Weaver McAdams No. 1. So, there again, we have an indication of good communication between the area there,and the distance again is approximately half a mile, which would surely give you 320-acre drainage.

Q Have you completed that Exhibit?

A That completes it.

Q Did you then conclude as to the recommendations which you would like to make to the Commission as to the acreage to be allotted to an oil well, a well completed in the oil section classified as an oil well, and the acreage which may be attached to a gas well?

A Yes, sir.

Q What are those recommendations?

A My recommendation would be that an oil well be placed on 80 acres, and a gas well would be placed on acreage amounting up to 320 acres.

Q Are you of the opinion that an oil well will efficiently drain an area of 80 acres surrounding it?

A Yes, sir.

Q And are you of the opinion that a gas well will efficiently drain an area of 320 acres surrounding it?

A Yes, sir.

Q Now, to what other points did you address your studies?

A Realizing that the apparent development date, at least, has been in the gas cap area with some wells in the oil rim area, I prepared a correlation which shows graphically approximately the same information illustrated on Pan American's Exhibit No. 1. That is relating to the gas-oil ratio, considering structural effect. That correlates that as you proceed northward, the GOR's

definitely decrease.

Q Let me interrupt you there. Did you prepare that in the form of an Exhibit?

A Yes, sir.

Q And what is that Exhibit numbered?

A Exhibit No. 1.

Q It is El Paso Natural Gas Company's No. 1, which has been distributed?

A Yes, sir.

Q Please go ahead and just state what the Exhibit shows, and if there are any additions that you desire to make to the Exhibit at this time.

A Well, since the hearing commenced this morning, it was brought to my attention that some of these perforations are not exactly as represented on Mr. Weaver's Exhibit. I would like to show that the Weaver McAdams, No. 1 McAdams would have an interval on this diagram of 437 to 469, that being the elevation above sea level.

Also, the Weaver No. 3 McAdams would show an interval of 412 to 434 feet above sea level, and in addition to that, I would also like to add the Pan American McAdams No. 1 "B." That well would be shown with a perforation interval of 370 feet to 402 feet with a gas-oil ratio of 2675.

Q Will you just explain what this Exhibit shows here, and then give the conclusions which you draw from this Exhibit?

A This Exhibit shows that as you penetrate the main Gallup sand lower elevation-wise, you encounter a well with a lower GOR. Thereby, as you would proceed possibly to the northwest through the area that is still opened at present and also possibly to the east, by drilling lower on the structure, the chances of encountering a low gas-oil ratio would be vastly improved.

Q Then, did you do any further studies along this line?

A Yes, sir.

Q Will you tell the Examiner just what else you have done in your studies?

A I would like to turn to Exhibit No. 2. Exhibit No. 2 shows the relative reservoir voidage versus producing GOR for various limiting gas-oil ratios. Along the left-hand margin there, the vertical scale shows the barrels of reservoir space voided per stock tank barrel per day per acre. The reason it was placed on per acre basis was, if you set up your allowables on a multiple of the 80-acre spacing, then per acre-wise, assuming you have each 80 acres developed whether by one oil well or by two or -- excuse me -- or by one gas well on 320, per acre-wise, you would still come out with the same per acre voidage.

This Exhibit was based on the assumption that the initial solution ratio was 620, which was estimated based on the characteristics of the crude in the area, and a bottom hole pressure of 1625

PSIA bottom hole pressure. We observe by looking at this Exhibit that with a limiting gas-oil ratio of 6,000 to 1, wells that would be classified as gas wells or wells that produce above the 6,000 limit, would void approximately nine times the reservoir space that a well with a gas-oil ration of 1,000, or, considering a well with a ratio of 2,000, the withdrawals would be approximately three times in the gas cap area.

MR. NUTTER: Excuse me.

A Yes, sir.

MR. NUTTER: These various columns here, now, all correspond to the various GOR's at the bottom of the page, is that correct?

A That's correct.

MR. NUTTER: Thank you.

A With a limiting ration of 4,000 to 1, the discrepancy or inequality is reduced some, but still a well producing above the gas-oil ratio limit would be voiding approximately six times that of a well with a gas-oil ratio of 1,000 or about twice that of a well with a gas-oil ratio of 2,000 to 1. With a limiting gas-oil ratio of 2,000 to 1, you come closer into balance with the relative withdrawal rate, being about 3 to 1 for the well with a gas-oil ratio above 2,000.

Q (By Mr. Howell) What did you conclude should be your recommendation to the Commission as the proper limiting gas-oil ratio in this pool?

A Due to the nature of a reservoir where you have your apparent gas cap with an oil rim, my recommendation would be to place a limiting gas-oil ratio of 2,000 to 1.

Q Why would you select that particular ratio in preference to 6,000 to 1?

A Well, as evidenced by the chart at the top there for limiting gas-oil ratio of 6 to 1, your relative reservoir withdrawal rate would be substantially higher with the higher gas-oil ratio limit so that your oil wells that have the current gas-oil ratio around 2,000 would suffer some loss and also, if I might say, future expansion of the area, in which case you may find your ratios even lower; the inequality would be increased.

Q In your opinion, would the establishment of a 2,000 to 1 ratio result in a reasonable balance of volumetric withdrawal between wells?

A Yes, sir.

Q Now, is there anything further you would like to say in connection either with the spacing of wells or the gas-oil ratio limitation?

A I don't believe so.

Q Now, what would be the effect of permitting 6,000 to 1 ratio withdrawals from the gas cap as to any wells which would be completed in the northern portion of the field that came in initially with gas-oil ratio of less than 2,000 to 1, as to migration of oil?

A Well, in that instance, I think that it would cause a decrease in pressure in your gas area, due to withdrawals, the higher rate of withdrawals, volumetrically speaking, which would cause the oil from the oil rim section to migrate into the gas section, and assuming that that occurs, your loss would be substantial.

Q That would be oil that never would be recovered --

A That's correct.

Q -- if that migration should take place?

A That's correct.

Q Did you make any studies as to the relative economics of wells completed on the spacing which you've recommended?

A Yes, sir.

Q Would you please state to the Examiner and for the record what your studies are and what conclusions you've reached?

A Well, I assume that we would have a recovery of 82 barrels of oil per acre foot for an oil well, and the associate gas would be 236 MCF per acre foot. Assuming that 20 feet of net pay would be encountered, the oil recovery on 40 acres would be 65,600; the associate gas would be 188 million cubic feet. Assuming that the net income per barrel would be a dollar ninety-five, which would throw out your royalty and allow some for lifting cost but not trucking, and assigning about eleven cents to the gas, the net return for a well on 40 acres would be $148,500. Now, I assume that an oil well to the Gallup section not single completion, com-

plete with a pump would cost around 120,000 --

Q That's a single completion to the Gallup?

A Single completion. The return to your investment on that basis would be 1.2. Considering 80-acre spacing, an oil well would be assigned reserves of 131,200, and gas reserves of 376,000,000. Using the same figures for the average oil and gas price, we would have returned $297,000, which would be a return to your investment of 2.5 on gas wells. In a gas area with little or no oil, the gas reserves for 40 acres would be 328,000,000 cubic feet. Assuming eleven cents for the average price of gas, that would be $35,800, which applied against a well cost estimated at $100,000, there would be no payout. On 80-acre spacing, estimated reserves would be 656,000,000 cubic feet. Using the same gas price figure, the return would be $17,500. That applied against a hundred thousand dollar well cost would still not result in payout. On 160-acre spacing, using one million, three hundred twelve cubic feet reserve, the return would be $143,000 with a net return of 1.4. On 320 acres, estimated reserves of two million six hundred thirty-four thousand, the net return would be 286,000, or a return on investment of 2.9. So, it is indicated with wider spacing, the economics are vastly improved.

Q Now, in a reservoir of the character of this Angels Peak-Gallup Pool, with the permeability such as you find there, does gas pass through the formation more readily than oil?

A Yes, sir.

Q And in order to accomplish a leveling or equality of withdrawal, would it -- is it necessary to have a larger area surrounding a gas well than one would have for an oil well to produce the reserves attributable to each within the same period of time?

A Yes.

Q So that in order to achieve a rateable take as between wells, in your opinion, it is proper to give a well classified as a gas well a larger acreage factor than you give the oil well?

A That's right.

Q Now, have you considered the question as to what should be the breaking point as to whether a well be classified as an oil well or a gas well?

A Only generally, that being a ratio of 30,000 to 1.

Q What is your reason for selecting that point?

A That would be the equivalent point, we will say, assuming three dollars for your oil and ten cents for your gas, that ratio would result in about 30,000 to 1, purely arbitrary.

Q Now, can you think of any other points that you've covered in your study or any other testimony you would like to add as a result of whatever other witnesses may have said, or any other comment you would like to make in the form of recommendations to the Examiner?

A I believe that pretty well sums it up.

MR. HOWELL: That's all. We offer El Paso's Exhibits 1 and 2 in evidence.

MR. NUTTER: Without objection these Exhibits will be received.

MR. HOWELL: I think that's all of this witness.

MR. NUTTER: Does anyone have any questions of the witness?

CROSS EXAMINATION

QUESTIONS BY MR. SPERLING:

Q Mr. Lemon, referring to your Exhibit 2, which I believe reflects your estimates of reservoir voidance, what factor, if any, did you assign to sand thickness within these relative zones?

A Actually, this would be based purely on a stock tank barrel of oil being produced.

Q Could you explain to us how, if you introduced the element of sand thickness within these respective areas, this picture might be changed?

A It is possible that change in thickness would alter the resulting pressure, say, brought about by these withdrawals.

Q And to what extent do you think that that might occur?

A I can't say.

Q You made no study of sand thickness with reference to this?

A No.

Q I see. Now, with the withdrawal that you have proposed here, would you anticipate that with the production of oil on the basis that you propose that there would be expansion to any extent of the so-called gas cap into the oil rim?

A Well, the idea in mind here was that, assuming an average thickness, at least the pressures in the oil and gas would be essentially the same, thereby minimizing any travel of your gas or gas-oil contact.

Q Well, now, you say minimizing. Is that the same as saying it does not occur?

A I would say it will hold it to as -- well, I can't say whether it would occur or not. I will just say that this would minimize any difference that might occur.

Q Then, you are saying that it is possible that there will be expansion of the gas cap area?

A I think that's a general --

Q And with that expansion, do you ordinarily anticipate that oil in place within the gas cap area will migrate toward the oil area?

A I don't think that you would have much oil migrating from the gas cap to the oil zone.

Q In other words, the gas might migrate, but it would leave the liquid within the gas cap area in the gas cap?

A The amount of liquid in the gas cap as oil would be, I would say, rather small.

Q Well, that depends upon what you classify as oil and what you classify as something else?

A That's correct.

Q Do you do that on the basis of gravity?

A I would say that that would be a possible means.

Q Well, what effect would the differential in gravity have with reference to the migration problem that we have been discussing or the possibility?

A I don't think it would have any.

Q Well then, you do know that there are large quantities of associated liquids in the gas cap area?

A In the gas?

Q Sir?

A In the gas?

Q Yes.

A Yes.

Q Would you normally anticipate that with continued production from both the gas and the oil areas, that the gas-oil ratios in the oil area would increase?

A They would.

Q With that increase, additional wells that were drilled might very well anticipate gas-oil ratios in excess of those already drilled, isn't that true?

A That's possible.

Q So that assuming the location or the possibility of

discovery of wells having in the ratio of 1,000 to 1 is pretty remote, isn't it?

A Well, I would say that the fact that the lease appears to be opened ended, that it is highly possible that you would find one with substantially lower ratios than those that we have now, that is, in the range of a thousand or so, considering the solution ratio of 620, it would depend on how much depletion you suffered at the time you completed your well. That is, it is possible that by the time you drilled some of the other areas, that the pressure would have decreased to where you would encounter the wells, actually an oil section, but with sections higher than the solution ratio.

Q What affect would that have on a gas-oil ratio of 2,000 to 1, if you encountered that condition?

A How do you mean?

Q I mean, would that affect your projection here and your recommendation?

A No.

Q Have you computed the average gas-oil ratio within the so-called oil rim?

A I -- not in any detail.

Q Has El Paso taken any bottom hole samples which would, as I understand, furnish much more concrete evidence for the reservoir study that you have attempted with the information at hand?

A Not to my knowledge.

Q Would such samples provide considerably more reservoir information?

A Well, I would say that it would help.

Q Is it your opinion that within the oil rim that the bubble point has been reached with reference to the gas in solution?

A I would say that the gas contact, you would have saturated oil to begin with, so that it is always saturated, you might say, at the contact.

Q Have you calculated area-wise this gas-oil contact area?

A Area-wise?

Q Yes. I mean within the field.

A You mean simply area-wise or volume-wise?

Q Area-wise.

A No, sir.

Q You are not prepared to say where that is occurring at the present time with reference to the field location?

A Well, I would say, based on the current completions that pure saturated oil has not been encountered, that is, wherein what would be considered a transition area.

Q Would you say that with additional development in the field, with the increasing gas-oil ratios that you anticipate, that the average of the gas-oil ratios in the future are much more likely to be in the neighborhood of 4,000 to 1 than they are in

2,000 to 1?

A In which areas are you referring to, the areas that might be indicated to be productive?

Q The oil areas, yes, sir.

Q I think it would be a matter of location, that would have a great deal to do with it, that is, if you should get far enough north there, I believe that the ratios would be closer to 2,000.

Q Well, that's purely speculation, isn't it, Mr. Lemon?

A Well, considering the fact that the reservoir hasn't been delineated, I think it would be a reasonable point.

Q Have you made any study at all, or have you taken into consideration in the preparation of your Exhibits here and your testimony, the experience Pan American had with the Frost Well?

A The well they are currently completing?

Q Yes, sir.

Q I do not have any actual up-to-date information -- excuse me -- I would say that based on what I heard that there was not a great deal of associated gas being produced through the load oil, which would indicate in that particular area it is possible that low ratio oil was being encountered.

Q Have you examined the log on that well to determine indications of permeability and sand thickness?

A I did not actually make the determination of sand

thickness.

MR. SPERLING: That's all.

QUESTIONS BY MR. PAYNE:

Q Mr. Lemon, I take it that you agree generally with Mr. Marshall, the Pan American witness, that there will be greater ultimate recovery from this reservoir if the limiting gas-oil ratio is 2,000 to 1?

A That's correct.

Q Now, is that because the higher gas withdrawal rates would cause the oil to migrate into the dry sands?

A That was my opinion.

Q Now, if the Commission adopted 80-acre spacing in this pool, for both oil wells and gas wells, and adopted a 4,000 to 1 gas-oil ratio limitation, would not the gas withdrawal rate be the same as under your proposal and under Pan American's proposal?

A It would be essentially the same.

MR. PAYNE: Thank you. That's all.

MR. NUTTER: Any further questions of Mr. Lemon?

MR. HOWELL: I have one more I would like to ask.

REDIRECT EXAMINATION

QUESTIONS BY MR. HOWELL:

Q Would a gas well, on 80-acres, with the reserves that you give the area be an economical way?

A According to my calculation, a gas well on 80 acres would return $71,500 as compared with a hundred thousand dollars

development cost, which would not be economically sound.

RECROSS EXAMINATION

QUESTIONS BY MR. PORTER:

Q If it would be under the 2,000 to 1 ratio?

A Actually, the ratio would only determine how much gas per day would be produced. The reserves would not be changed. That is, these reserve figures are only average.

QUESTIONS BY MR. NUTTER:

Q Mr. Lemon, I take it you don't agree with the Weaver witness who stated it costs approximately $78,000 to drill a well?

A I base my assumption on indicated cost on our Huerfano Well No. 106.

Q You didn't take into consideration the drilling costs of any other wells?

A No, sir.

Q Was the 106 an average well, as far as the completion cost?

A Well, I assume that based on the well cost on Mesaverde wells, at around eighty-five thousand, considering this as somewhat deeper, this hundred thousand dollars was a reasonable figure.

Q What's this one hundred twenty?

A That's including the pumping equipment and the necessary tank facilities.

Q Well, you don't have to have the pump equipment on the gas well?

A No, sir, I use the hundred thousand on the gas well, one hundred twenty thousand on the oil well.

Q Just what did you use to determine these reserves that you came up here with, Mr. Lemon?

A I used the core analysis that we had on the Huerfano Well No. 106. The fact that the indicated pay in that well was 22 feet, I assumed that a 20-foot interval would be a reasonable sand thickness for an average figure.

Q What porosity did you use for an average?

A Twelve point nine percent.

Q Twelve point nine?

A That's right. That was the same value that Mr. Weaver's witness reported.

Q Well, what do you use for determining the reserves in the oil area?

A I assumed a 20-foot interval there also; average thickness.

Q And the same porosity?

A Same porosity.

Q Now, I notice that in comparing the recovery rates for the various size proration units, you just doubled up on them?

A I ratioed them up.

Q You are assuming that you would obtain the same amount of production per acre regardless of the size of the area that is being drained?

A For this purpose I was, yes.

Q Is this usually the fact of the matter through?

A Well, I would say so, yes, sir. Generally speaking, in a depletion drive reservoir spacing is not as important. Therefore, you can ratio acreage that way.

QUESTIONS BY MR. PAYNE:

Q Mr. Lemon, that seventeen thousand dollar figure you gave for a gas well on 80 acres, did that take into consideration the liquids that would be recovered from that well?

A In that particular case I assumed that that well would have no liquids. In assuming that, we would have a well, say, that would be -- well, say, would be kind of half and half, assume ten feet of oil and ten feet of gas. On 80 acres, that particular well would recover $184,000, which would, due to the liquid anyhow, show some increase.

Q Do you know of any so-called gas well in this pool that makes no liquid?

A Well, I might add that the data that I based that particular assumption was the oil production that was reported to the Commission, and in those particular examples there was very little oil reported. That is, for instance, the ratio would be in excess of 30,000. In fact, in one instance here, it is a hundred thousand to one, so that with reference to the hundred thousand ratio, that was in the Weaver McAdams No. 4. The Huerfano No. 99 would be based on the reported production, a hundred and

fifty thousand to one. So that, for comparison purposes, your liquid recovery would not be substantial.

MR. PAYNE: Thank you.

MR. NUTTER: Any further questions? Mr. Fischer.

QUESTIONS BY MR. FISCHER:

Q Mr. Lemon, in line with this liquid produced from gas wells, isn't it much cheaper to produce from a gas well than an oil well?

A Assuming that no pump equipment is needed.

Q And lifting cost, too.

A That's right.

MR. NUTTER: Any further questions?

QUESTIONS BY MR. UTZ:

Q Mr. Lemon,using your 2,000 to 1 ratio, producing the pool at that ratio, in your opinion, what would the gas-oil contact be? Would it be static, or would it move in one direction or the other?

A Considering the current completions and assuming also that the allowables would be worked in the manner described here, I would say that it stays close to its current position whenever that rule is put into effect.

Q How about 4,000 to 1 ratio?

A 4,000 ratio, considering current completions, I would predict that it would possibly move or actually would recede into the gas area. That is pulling the oil in.

Q Move up structure?

A It would move up structure, that is correct.

Q And, of course, 6,000 to 1, then, in your opinion, it would move still more?

A That's correct.

Q When oil moves up structure into a gas cap, it wets the sand, does it not?

A In that case it would wet the sand and would need to build up approximately the same residual saturation that you would have in the oil section, that is, the removable oil so that a substantial portion of it would be lost.

MR. UTZ: That's all I have.

MR. NUTTER: Any other questions?

QUESTIONS BY MR. FISCHER:

Q Mr. Lemon, are you familiar with El Paso's Marye wells in this area?

A In what respect?

Q I mean as to the amount of cement used.

A No, sir.

Q You are not?

A No, sir.

MR. FISCHER: That's all I have.

MR. NUTTER: Any other questions of Mr. Lemon?

MR. SPERLING: Just one.

MR. NUTTER: Mr. Sperling.

QUESTIONS BY MR. SPERLING:

Q Mr. Lemon, have you made any calculations on the length of the payout period on the economic study that you have made there on the respective limiting gas-oil ratios of 2,000, 4,000 and 6,000 to 1?

A Yes, sir.

Q And what did you determine?

A Assuming 80-acre spacing and an oil well producing 150 barrels per day with a 6,000 limit and producing at 6,000 limit, I estimate that the return would be in the neighborhood of $104,000 a year.

Q What about 4,000?

A On the 4,000, I estimate that the return would be $160,000 -- excuse me -- $150,000. And on 2,000, the return would be $119,000 a year.

Q That is assuming a 2,000 to 1 gas-oil ratio --

A That's right.

Q -- and not restricted?

A That's right.

Q Which would not be typical of the wells, at least so far as the present development is concerned, is that right?

A That's correct, except for the three wells that have been pointed out that are producing less than 3,000.

Q If they suffer a penalty, naturally, the payout

period would be standard?

A It would be standard.

Q Did you make any comparable study on the gas cap wells?

A A gas well assuming a spacing of 320 acres with the gas production being based on a limit of 6,000 to 1, estimated $142,600 a year. On a well with a 4,000 limit, that is, for the allowable, would be based on 4,000 to 1 ratio, the income would be $94,000 a year. 2,000 ratio, the income would be $47,000.

Q What about assuming a 160-acre spacing, would that simply cut your --

A I would say for this purpose, it would cut the income in half.

Q So 4,000 to 1, it would be half of $94,000?

A That's correct.

Q Annual income?

A That's right.

MR. SPERLING: Thank you. That's all.

MR. NUTTER: Any other questions of Mr. Lemon? You may be excused.

(Witness excused)

MR. NUTTER: We will have a ten-minute recess.

(Recess)

MR. NUTTER: The hearing will come to order, please. Mr. Howell, did you have another witness?

MR. HOWELL: We have.

(Witness sworn)

DAVID H. RAINEY,

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

DIRECT EXAMINATION

BY MR. HOWELL:

Q Please state your name for the record.

A David H. Rainey.

Q By whom are you employed and in what capacity?

A El Paso Natural Gas Company as an administrative assistant in the proration department.

Q In your capacity as an administrative assistant, have you studied various proration rules that this Oil Conservation Commission of the State of New Mexico has adopted --

A Yes, sir, I have.

Q -- for various pools?

A Yes, sir.

Q Now, first of all, did you prepare the set of rules which have been distributed marked El Paso Natural Gas Company's Exhibit No. 3?

A Yes, sir, I did.

Q Will you go through the rules without necessarily

reading them word for word, and give an explanation of the rules and also your reason for suggesting the particular rule, and if it is derived, or the basis of it is found in rules applicable to other pools, you might mention?

A All right, sir. Rule 1 is the standard rule that goes in nearly all pool rules as to the designation of a wild cat or a field well. Rule 2 is a standard location rule. Rule 3 is the non-standard proration unit type rule which follows the standard form except -- well, it follows the standard form period. Beg pardon, Rule 3 is not the non-standard proration rule. It is the non-standard proration rule, and it is standard. Rule 4 is a non-standard proration unit rule, and follows very closely, except where I changed the wording slightly to fit the particular case here in Paragraph A. We have changed the wording somewhat from the standard to take care of 80-acre oil units and 320-acre gas units. And Rule 4 is the standard provision for administrative approval of non-standard units. Rule 5 is a standard rule which goes in most of the field rules, exempting this particular pool from the statewide Rule 104, Paragraph K.

Q You might mention for the record what statewide Rule 104, Paragraph K is.

A Statewide Rule 104, Paragraph K is a rule which refers to standard statewide spacing and provides that the provisions of Paragraph H and I which do pertain to standard spacing in the State of New Mexico shall apply only to wells completed

after January 1st, 1950. And this material is taking care of exempting these particular Rules from the provisions of statewide Rule. Rule 6 is a rule which, I believe "an oil well in the Angels Peak Pool shall be a well producing a gas-oil ratio of less than 30,000 cubic feet of gas per barrel." There has been considerable discussion about that, and I think it is pretty well recognized that any breaking point ratio that is put in there is more an arbitrary figure, but as Mr. Lemon testified, that seemed like a reasonable breaking point to us on the basis of approximate relative basis of economic values on the production.

Rule 7 reads that "a gas well in the Angels Peak-Gallup Pool shall be any well producing with a GOR of 30,000 cubic feet of gas per barrel of oil or more." That is just a companion Rule to 6, to define gas wells more specifically.

Rule 8. "No acreage shall be simultaneously dedicated to an oil well and to a gas well in the Angels Peak Gallup Oil Pool."

Rule 9 is a no flare order paragraph.

Rule 10. "In order to prevent waste, the gas-oil ratio limitation for the Angels Peak Gallup Oil Pool shall be 2,000 cubic feet of gas per barrel of oil produced." I might point out at this juncture that all of these Rules have been taken as nearly as possible from previously written Rules in some field or another. They didn't, of course, all come from the same field Rules, but the wording is the wording that has been used, as far as possible, in other field Rules that the Commission has written.

Rule 11 is merely a Rule providing that all gas and liquid shall be measured and reported to the Commission in compliance with their rules and regulations.

Rule 12 provides that we shall have semi-annual gas-oil ratio survey periods in the Angel Peak Gallup Pool in the months of March and April and September and October of each year, in addition to the initial gas-oil ratio required in Statewide Rule 301, and then further provides that they should be reported to the Commission in accordance with the appropriate Statewide Rules.

Rule 13. "In order to obtain needed reservoir data, bottom hole pressure tests shall be taken immediately following the gas-oil ratio tests required in Rule 12 and reported to the Commission in compliance with various Statewide Rules." And I think it has been pretty adequately testified to here today that this is a pool of relatively high permeability, and for that reason, I have provided that the shut-in pressure shall only be seventy-two hours. However, if there is some difference of opinion on that, it was just a figure that I put in; it could be seven days if the Commission prefers.

Rule 14 (a) "Any oil well completed on a tract of less than 80 acres in the Angels Peak Gallup Oil Pool shall be permitted to produce an allowable equivalent to the amount determined by," and the word "A" should be inserted, "by a ratio which has the acreage dedicated to the unit as its numerator and 80 acres as its denominator times the normal unit allowable for an 80-acre oil well

producing at the depth of the Angels Peak Gallup reservoir."

Q Rule 14. (b) "Any gas well completed on a tract of less than 320 acres in the Angels Peak Gallup Oil Pool shall be permitted to produce an allowable equivalent to the amount determined by ratio which has the acreage dedicated to the unit as its numerator and 320 acres as its denominator times the normal unit allowable for a 320-acre gas well producing at the depth of the Angels Peak Gallup reservoir."

And Rule 14 (c) provides how the normal unit allowable for 320-acre well should be determined. "For purposes of determining the permitted gas production, the allowable of a top allowable oil well shall be determined by multiplying the normal unit allowable for the Northwest Area by a factor of 2.77, as provided in Statewide Rule 505. The gas limit for a normal 80-acre unit will then be determined in accordance with the limiting ratio as hereinabove set out and in accordance with Statewide Rule 506. Gas wells as classified in compliance with this Order will be permitted to produce up to four times the permitted 80-acre gas limit based on the actual number of acres dedicated to the particular gas well. For purposes of this Rule, any well that has between 316 and 324 acres dedicated to it shall be deemed to be a standard gas unit."

Now, those provide that after you have determined basically -- they provide that after you have determined your basic allowables and basic units, that fractional units shall be in direct proportion to the base 320 and base 320-acre units for oil and

gas. I believe that's all the comments I have.

Q Are you aware of any pool in the state in which there is a spacing established for oil wells, and a different spacing established for gas wells in the pool?

A Yes, sir. There are two pools that I have been able to find, and I think I have looked through all the rules, all the field rules sufficiently to check them out. The Blinebry gas and oil pool in Lea County, New Mexico, is in the rules, the same pool, and it is even contemplated in those rules that a well can fluctuate back and forth from oil to gas, and the spacing for gas wells is 160 acres in the Blinebry gas pool and 40 acres in the Blinebry oil pool. But, as I say, they are the same pool by definition except for the description as to the classification as to whether it is an oil well or a gas well. Also, the Tubb gas pool and Tubb oil pool have separate field rules written for them, but the acreage delineating the two pools both horizontal and vertical is identical. There is a 160-acre gas unit Tubb pool and 40-acre oil unit. As I say, they are separate field rules,but the horizontal and vertical limits are identical.

Q Do you have any other comments you wish to make?

A I might say that it seems it would be a little simplier to go ahead and carry this as the Angels Peak-Gallup oil pool, and provide for different spacing. However, we would have no objection, and I don't think anybody else would, to saying you've got an Angels Peak-Gallup oil and an Angels Peak gas pool, and set

in the same horizontal and vertical limits, which would be exactly what has been done in the Blinebry and Tubb areas.

MR. HOWELL: We offer our Exhibit 3 in evidence.

MR. NUTTER: Without objection, it will be received.

MR. HOWELL: That's all our testimony.

MR. NUTTER: Any questions of Mr. Rainey?

CROSS EXAMINATION

BY MR. FISCHER:

Q Mr. Rainey, being employed by the Company that also takes the gas in that pool, do you know of any other line besides the one line, gas gathering line in that pool?

A As Mr. Dugan testified earlier, I think the line is 150 pound line, but we hold back pressure on those wells because our Gallup and Dakota contract provide for 500 pound pressure.

Q Is this only the one line?

A That's right, to the best of my knowledge.

Q In your proposed rules, would you want to put in there a deal where the Secretary Director could approve administratively for exceptions to this no-flare order?

A In cases.-- I didn't realize that there was any flaring going on out there. All the wells were hooked, were capable of producing into our system, and I think it would be appropriate in cases like these two oil wells, where there is relatively insignificant volumes of gas and that it is virtually impossible to do anything else with it.

MR. FISCHER: Thank you. That's all.

QUESTIONS BY MR. NUTTER:

Q Mr. Rainey, it appears from Rule No. 11 that if you had more than one oil well on a lease, you would have to have a separator on every one of those oil wells. Did you intend to --

A That Rule is copied directly from similar rules in other field Rules in the State of New Mexico, and I hadn't given that particular question too much thought. Let me re-read the Rule, if you will.

It is my impression that there is a provision in the Statewide Rules, and it is generally accepted procedure to get a permit from the Commission to commingle various types of production, and that probably would be taken care of as an exception under that rule. I think there should be some method, however, particularly in view of the apparent controversy over the reservoir in general to measure the liquid and gas from each of the zones separately so that we can learn a little more about what this reservoir might be and what we might expect from it.

MR. NUTTER: Any further questions of Mr. Rainey?

QUESTIONS BY MR. PAYNE:

Q Mr. Rainey, do you believe that the special rules for the Tubb gas pool and the Blinebry gas pool was the best possible way to handle those two pools?

A I think so, yes, sir. It is - my recollection of the oil situation in those pools is that they were but gas pools

at the outset, and suddenly there were -- two oil wells appeared in the middle of them. We had a bunch of gas wells drilled, and there were some oil wells drilled along the rim, and I can't really conceive of any other way to handle the situation, and I think it is probably within the scope of the Commission to either do it in one set of field rules or write two separate sets with the same horizontal and vertical limits for the two pools.

Q How about pool-wide unitization? Don't you think that is a more expeditious way to handle a situation like that, especially when you have wells in a small pool like we have here?

A My feeling on that is that there is some considerable doubt, and in light of the testimony here today and what I know about this reservoir on my own, as to whether or not this is a small field or whether it is going to be a pretty extensive field.

Q Even assuming it is extensive, there is a relatively small number of operators, are there not?

A Depends on how far it is extended because there are other operators in adjoining sections who produce at the present time.

Q The pool, as we know it now, only has three operators, does it not?

A To my knowledge.

Q Do you know of any oil pool in New Mexico that has double spacing, one for oil wells and one for gas wells?

A No, not a pool defined as such, other than, as I say, the Tubb and Blinebry oil pool, or synonymous with the Tubb and Blinebry Gas Pools.

MR. NUTTER: Mr. Rainey, has the Commission created a Tubb oil pool?

A I believe so.

Q You made reference to oil wells in the Tubb gas pool. It was my impression that there was no separate Tubb oil pool.

A I stand corrected. There is no separate Tubb oil pool, but there are oil wells in the Tubb pool on difference spacing than the gas wells.

MR. NUTTER: Any other questions of Mr. Rainey? If not, he may be excused.

(Witness excused)

MR. NUTTER: Does anyone have anything further they wish to offer in this case?

MR. ERREBO: I have just a few words in way of a statement. If the Commission please, the applicant has no objection to 320-acre gas spacing as proposed by Pan American and El Paso. They have put on good evidence in this regard, and we certainly have no objection to it. One thing I would like to effectively ask the Commission to keep in mind in considering this case, and that is, it has been brought out here today that certainly the

wells on the Weaver lease will receive comparatively high ratios under the rules which we advocate, but I think that we have to keep in mind the fact that we are thinking in terms, when we think about allowables, of the allowables that are taken from the Mesaverde and Pictured Cliffs Pools in the San Juan Basin. Those wells, of course, are relatively poor wells compared to the nine and ten million wells that there are in this field. And I think that that fact has to be kept in mind, and certainly we don't want to -- I don't think we should reduce the good wells which Mr. Weaver has been fortunate enough to find, to the denominator of a poorer well which we find in the Mesaverde and Pictured Cliffs throughout the San Juan Basin area. Another thing is that expansion of the gas cap is something which has been talked about quite a bit here today. All witnesses have admitted the gas cap would expand. Now, when that gas cap expands even under 2,000 to 1, when that gas cap expands, it is Mr. Weaver's gas that is migrating to the offset leases to the north, it is Mr. Weaver's oil that underlies the northeast portion of his lease that may be pushed on to those other leases. Certainly, we believe that is unequitable. The Commission does not want to permit that, and we think certainly the way to slow down that expansion is to adopt 6,000 to 1 ratio, which we propose here today.

MR. NUTTER: Anyone else have anything?

MR. BUELL: On behalf of Pan American, I hope we have made our position clear enough in the record. Thank you.

MR. NUTTER: If there is nothing further in case --

MR. COOPER: May I make a statement, please? My name is A. T. Cooper with Three States Gas Company. We are a non-operating interest owner in that area and we would like to ask the Commission to adopt the Rules proposed by El Paso.

MR. NUTTER: Any further statements? If not, we will take Case 1641 under advisement, and the hearing is recessed.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

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

WITNESS our Hands and Seals this, the 15th day of May 1959, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My Commission Expires:
June 19, 1959

Joseph A. Trujillo
NOTARY PUBLIC

My Commission Expires:
Oct 5, 1960

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 1641 heard by me on May 7, 1959.

....., Examiner
New Mexico Oil Conservation Commission