STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

7 August 1986

COMMISSION HEARING

IN THE MATTER OF:

Application of Jerome P. McHugh and Associates for an amendment to the special rules and regulations of the Gavilan-Mancos Oil Pool... CASE 8946

and

Application of Benson-Montin-Greer Drilling Corporation for the amendment to the special rules and regulations of the West Puerto Chiquito-Mancos Pool ... CASE 8950

BEFORE: Richard L. Stamets, Chairman
Ed L. Kelley, Commissioner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation Division: Jeff Taylor
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

A P P E A R A N C E S

For Jerome P. McHugh

W. Thomas Kellahin
Attorney at Law
KELLAHIN & KELLAHIN
P. O. Box 2265
Santa Fe, New Mexico 87501

For Benson-Montin-Greer

William F. Carr
Attorney at Law
CAMPBELL & BLACK P.A.
P. O. Box 2208
Santa Fe, New Mexico 87501

For Mobil Producing:

W. Perry Pearce
Attorney at Law
MONTGOMERY & ANDREWS
P. O. Box 2307
Santa Fe, New Mexico 87501

For Dugan Production:

Robert G. Stovall
Attorney at Law
Dugan Production Company
P. O. Box 208
Farmington, New Mexico 87499

For Koch Exploration

Ernest L. Padilla
Attorney at Law
PADILLA & SNYDER
P. O. Box 2523
Santa Fe, New Mexico 87501

For Koch Exploration

Robert D. Buettner
Attorney at Law
Koch Exploration Company
P. O. Box 2256
Wichita, Kansas 67201

For Mallon Oil, Mesa Grande, and American Penn

Owen M. Lopez
Attorney at Law
HINKLE LAW FIRM
P. O. Box 2068
Santa Fe, New Mexico 87501

For Meridian Oil

Paul Cooter
Attorney at Law
RODEY LAW FIRM
P. O. Box 1357
Santa Fe, New Mexico 87504

For Amoco Production

Kent Lund
Attorney at Law
Amoco Production Company
P. O. Box 800
Denver, Colorado 80201

For Hooper, Kimball and Williams

Greg Owens
Tulsa, Oklahoma

I N D E X

E X H I B I T S

MR. STAMETS: The hearing will come to order.

We will call next Case 8946.

MR. TAYLOR: Application of Jerome P. McHugh and Associates for an amendment to the rules and regulations of the Gavilan-Mancos Oil Pool promulgated by Division Order Number R-7407, to establish temporary special production allowable limitations and gas/oil ratio limitations for said pool, Rio Arriba County, New Mexico.

MR. STAMETS: We'll call for appearances in this case and I will ask that everybody take enough time so that we -- so that Sally and I can both get down all the attorneys and who they're appearing for.

MR. CARR: May it please the Commission, initially I would request that you also at this time call Case 8950, the application of Benson-Montin-Greer Drilling Corporation for amendment of the rules in the West Puerto Chiquito-Mancos Pool. They're going to involve the same testimony and we'll ask that they be consolidated for the purpose of testimony.

MR. STAMETS: Is there any objection?

Well, since Mr. Carr has al-

ready read the style of the case, we will call and consolidate Case 8950 at this time.

We'll call again for appearances.

MR. KELLAHIN: Mr. Chairman, I'm Tom Kellahin of the Santa Fe law firm of Kellahin and Kellahin, representing the applicant, Jerome P. McHugh and Associates.

MR. STOVALL: Robert Stovall of Farmington representing Dugan Production Corp.

MR. CARR: Willim F. Carr, Campbell and Black, P. A., of Santa Fe, representing Benson-Montin-Greer Drilling Corporation.

MR. PEARCE: W. Perry Pearce, of the Santa Fe law firm Montgomery and Andrews, appearing in this matter on behalf of Mobil Producing Texas and New Mexico, Inc.

Also I'd like the record to reflect that my firm is appearing in this matter in association with Mr. Kent Lund, L-U-N-D, of Amoco Production Company of Denver.

Mr. Lund expects to make a statement on behalf of Amoco at the close of the case.

MR. STAMETS: Thank you. Other appearances?

MR. LOPEZ: Owen Lopez with the Hinkle Law Firm in Santa Fe, New Mexico, appearing on behalf of Mallon Oil Company and Mesa Grande Resources, Inc.

MR. PADILLA: Ernest L. Padilla, Santa Fe, New Mexico, appearing on behalf of Koch Exploration.

Also appearing in association with me is Robert Buettner.

MR. STAMETS: Robert Buettner?

MR. PADILLA: He's an attorney.

MR. STAMETS: Thank you.

Are there other appearances?

MR. COOTER: Paul Cooter, with the Rodey Law Firm in Santa Fe, appearing on behalf of Meridian Oil.

MR. OWENS: Greg Owens, appearing on behalf of Hooper, Kimball, & Williams.

MR. STAMETS: Any other appearances?

MR. LOPEZ: Mr. Chairman, I think Ken Johnson is expecting to appear on behalf of Kodiak.

MR. STAMETS: If anybody sees Mr. Johnson they can advise him that we consider him appeared.

MR. LOPEZ: Mr. Chairman, my name is Owen Lopez appearing on behalf of American Penn, as well.

MR. STAMETS: American Penn.

MR. LOPEZ: Yes.

MR. STAMETS: Any other late appearances?

This is a very popular case. Okay, there being no further appearances I would ask Mr. Kellahin to proceed.

MR. KELLAHIN: Mr. Chairman, I would like to make an opening statement on behalf of my client so that you will have the opportunity to have a preview of the testimony that we will present through our expert witnesses with regards to this application.

As you can see from the attendance by those parties that are interested in this case, there's a lot of interest. You characterized this as a popular case. With all due respect, we have a very serious problem requiring emergency attention by the Commission.

This is an application involving a pool that the Commission created at the request of my client several years ago. You may recall that in this portion of Rio Arriba County, just to the west of the Puerto Chiquito-Mancos Pool the Commission established the Gavilan-

Mancos Pool. It was originally established on 320-acre spacing. Jerome P. McHugh and Associates there the original applicants for the spacing.

As the pool has operated and developed, the evidence will show you that we have a state of emergency within this pool that is beyond the scope of the current operators to agree upon a solution.

We come before you today not asking for an ultimate solution but a temporary remedy so that we all might explore what the ultimate solution will be.

It has come to the attention of my client, as well as all the operators within this pool, that this pool is in the midst of a dramatic, irreversible reservoir-wide pressure decline and production changes that are occurring.

Our testimony will show you that the accelerated pressure declines and the increasing dissipation of reservoir energies are resulting in waste. The effects of the way the pool is being operated are going to have economic effects on a great many people and that's why the interest is here today.

We are seeking, and our evidence will show you, that apart from economic concerns, however, this case involves one of the fundamental concepts of the Commission and that is the prevention of waste.

It has come to our attention that this problem exists. We have notified other operators; engineering and other technical committees are being formed, but there's a need for immediate action now.

Our application seeks an emergency order so that the Commission will reduce the gas/oil ratio for this pool and the producing rates. It is our testimony that will do nothing more than buy us some time. The time, however, is very important. The problem is complex and we simply have to have the time to get a solution.

The evidence will show you that the current top allowable for the oil wells in the Gavilan-Mancos, spaced upon 320 acres is 702 barrels a day; that these wells are also being operated at gas/oil ratios on a statewide basis at 2000 cubic feet of gas to one barrel of oil.

It will be our testimony that we will seek from you an emergency order immediately reducing those rates to a daily producing rate not in excess of 200 barrels of oil plus the requirement that those wells also be within a gas/oil ratio of 100,000 (sic) cubic feet to one barrel of oil, so they will meet the two requirements. We that action will be necessary and appropriate. Our witnesses are so convinced and will so testify and that will give us a temporary solution. We're requesting that that

take place for a 90-day period to help us, if not preserve the status quo in terms of the way the reservoir enginergy is being expended, to at least help minimize the waste that we believe is occurring so that the operators and their technical people will have an opportunity within that 90-day period to continue their studies to see if we can come up with more effective answers as to how to efficiently and effectively operate the remaining reserves in this pool.

The testimony from our witnesses will be dramatic. It has convinced them beyond a reasonable doubt and we will attempt to demonstrate that to you, also.

We are not in this alone. We seek the support of a great many operators. I'm certain that there are other perspectives and points of view. Be that as it may, we think this is an unusual and unique case and our testimony is that we will seek and hope that you will feel compelled to aid us in this very serious problem.

MR. STAMETS: Any other opening statements? Mr. Carr.

MR. CARR: May it please the Commission, as you're aware, Benson-Montin-Greer Drilling Corporation operates and has operated the Canado Ojitos Unit in Rio Arriba County for approximately 25 years and they are producing oil from the West Puerto Chiquito-Mancos Oil Pool.

They're producing this pool in a fashion is keyed to the characteristics of the reservoir, that is keyed to the gravity drainage which they experience in that reservoir and they are developing the wells on a very wide spacing pattern.

You have authorized and provided in your rule for a 640-acre spacing pattern, but this particular unit is developed with a very low well density and you'll find that you have really one well to every, approximately, 2500 acres.

The problem we have today comes from what is going on in the Gavilan. The Gavilan-Mancos Oil Pool adjoins the Canado Ojitos Unit. They have a common boundary. There have been a number of hearings concerning the Gavilan Pool in the -- in recent years.

Three years ago we were here before you talking about what would be the appropriate spacing pattern in the Gavilan. At that time the highest capacity well in that Gavilan area produced something in the neighborhood of 100 barrels of oil per day.

Since that time there's been a flurry of activity; numerous wells have been drilled; many of these wells are high capacity wells, and this recent activity and recent events in this area, have shown that there is a serious problem in the area, a problem for those opera-

tors who operate in the Gavilan; also a serious problem for Benson-Montin-Greer.

The number of high capacity wells in the Gavilan, the recent development there, have created a situation where those wells can produce the reserves in the Gavilan in a very short period of time, and this is creating a problem on the western boundary of the Canada Ojitos Unit.

This boundary problem is not new. When we were here three years ago, this commission in its order recognized that that problem existed and the rules that were adopted at that time provided that, among other things, that only one well could be drilled in the east half of those sections adjoining the unit.

The reason for those wells -- for those rules is because we have one common source of supply, in essence. That's why were were here then; that's why we are here now, and we need to have compatible rules on both sides of this common boundary unit.

There are other things that are going on in the unit. We're injecting gas. We'll show you that there is a permeability restriction to the unit and that may provide some effective barrier and may be of some assistance to us, but the bottom line is we're doing things in the unit that affect what's going on in the Gavilan.

They are doing things over there which affect what's going on in the Canada Ojitos, and you see the evidence unfold, I believe you will see that we're clearly at least looking at the possibility of unitization in the Gavilan area, but what we've got to be in a position to do, whether it is the unitization in the Gavilan or just special pool rules, we've got to start from a point where we have rules that are compatible, so whatever agreements we can reach we can do so as effectively as possible because we believe it is essential that certain agreements be entered between the unit and the offsetting operators or we're going to be drilling unnecessary wells and waste is going to result.

We're here today in support of the application of Jerome McHugh. We believe what Mr. McHugh is seeking and what Mr. Greer is seeking in this companion case are desperately needed restrictions on production in this area.

We're going to ask for virtually the same rules on our side of the common boundary as Mr. McHugh is seeking in the Gavilan.

We're going to also present to you some general testimony on the nature of the reservoir, testimony that supports both McHugh's application and that of Mr. Greer, and testimony which we submit will be of general assistance to you in solving what is an extremely

important, complicated problem in the San Juan Basin.

MR. STAMETS: Any other opening statements?

At this time we would like to have all those who may be witnesses in this case stand and be sworn at this time, please.

(Witnesses sworn.)

MR. STAMETS: You may proceed, Mr. Kellahin.

MR. KELLAHIN: Mr. Chairman, I'd like to correct an error I made in my opening statement. I misspoke about the gas/oil ratio. The current statewide rule on the gas/oil ratio is 2000 cubic feet of gas. We are requesting it be reduced to 1000 cubic feet.

MR. STAMETS: Mr. Kellahin, I would hope that before the day is over, I know we're not going to get done today, but I would hope that before the day is over someone might be able to supply me a couple of numbers which would represent the impact on oil production in the pool and the impact on gas production in the pool if McHugh's application were approved as is.

MR. KELLAHIN: We have those exhibits.

MR. STAMETS: Okay. If we don't get to them today, why, I still want to see those numbers.

MR. KELLAHIN: Mr. Chairman, I have a preliminary matter about complying with the notice requirements of the Commission with regards to the hearing and I'd like to take just a few moments to introduce and qualify the landman that helped me prepare the notices and to authenticate a plat that I'd simply like to use to help us keep track of the parties and the wells involved.

If I may do that, I would call Mr. Kent Craig at this time.

KENT CRAIG,

being called as witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q For the record would you please state your name and occupation?

A Yes. My name is Kent Craig and I'm the landman for Jerome McHugh in Denver.

Q Mr. Craig, have you ever testified before the Oil Conservation Division as a petroleum landman?

A Yes, I have.

Q Pursuant to your employment by Jerome P. McHugh, did you prepare or have compiled the (not understood) of working interest owners and operators listed on Exhibit A attached to Exhibit Number One for this hearing?

A Yes, sir, I did.

Q Would you describe for the commission briefly how that document was prepared?

A Basically what we did, Mr. Commissioner, is we had a take-off made of the Gavilan Pool area by an independent broker that worked for us in checking records, in order to identify all the working interest owners of record in the county, as well as owners that we picked up in the BLM office here in Santa Fe, and we compiled that list by virtue of that take-off.

These include not only working interest owners, but in the event we found any unleased mineral owners, they are also listed on there.

Q In your opinion, Mr. Craig, have you made a good faith, diligent effort to notify all the operators and in the absence of an operator, the unleased mineral owners within the boundaries of the pool?

A Yes, sir, we have, as far as -- as far as any interests that are of record.

Q Have you made inquiry of other operators within the pool to determine whether or not they had addi-

tions or corrections to make to the list?

A Initially when we were talking about forming our geological and engineering committees for the study of the Gavilan Pool I inquired as to all the working -- all the operators, excuse me, in the pool to send me a listing of their working interest owners within their wells and all I've -- all but one, I believe, have done so.

Q Have you also made an effort to determine the operators within a mile of the pool boundary?

A Yes, sir, we have.

Q Are those names also located on Exhibit A to Exhibit One?

A To the best of our knowledge they are, yes, sir.

Q Let me direct your attention now to Exhibit Number Two and ask you to identify Exhibit Number Two.

A Exhibit Number Two is just a plat we prepared showing, basically, the 320-acre units within the Gavilan Pool. This -- it's color coded by operator. This by no means -- we are by no means inferring that this acreage that is solid yellow or solid green is 100 percent owned by McHugh or Dugan or whoever.

This is merely the location of the wells, the applicable 320-acre units per well and the operator of that well.

In the lower righthand corner you'll note in Section 24 of 24 North, 2 West, there are two wells located in that section which we've stippled around one of them and circle the other one. Those are out of the Gavilan Pool and I'm not sure as to what their proper spacing is. We just highlighted them in that they are on the border of the pool.

MR. KELLAHIN: That concludes my examination of Mr. Craig.

We move the introduction of Exhibits One and Two.

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

MR. PEARCE: Excuse me, Mr. Stamets, just for purpose of the record, we have not checked this and have no objection to its entry subject to subsequent check for verification.

MR. STAMETS: So --

MR. PEARCE: I don't know that the information here is correct; I don't know that it's not.

MR. STAMETS: Well, what you'd like to do then, is be able to recall this witness --

MR. PEARCE: Yes, sir.

MR. STAMETS: -- will under those circumstances delay admitting these exhibits until Mr.

Pearce has had an opportunity to examine them and we would admit them later.

Any other questions of this witness?

He may be excused at this time.

MR. KELLAHIN: Mr. Chairman, at this time we'll call our geologic witness, Mr. Dick Ellis.

RICHARD K. ELLIS,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Ellis, for the record would you please state your name, sir?

A My name is Richard K. Ellis.

Q You'll have to speak up so we can can all hear you.

By whom are you employed and in what capacity?

A I'm employed by Jerome P. McHugh and Associates as a geologist.

Q Mr. Ellis, would you give us your educational background?

A I have a Bachelor of Science degree in mathematics from the University of Washington in 1975; Bachelor of Science degree in geology in 1975, University of Washington; Master of Science in geology from the University of California at Berkeley, 1977; Juris Doctor degree, 1982, from the University of Denver Law School; member of the Colorado bar since 1983.

Q Mr. Ellis, would you summarize for us what has been your general work or employment experience as a petroleum geologist?

A I began my petroleum geology work with Exxon in the summers of 1975 and 1976 while I was in graduate school.

I went to work full time for Chevron USA in Denver in 1977 and spent seven and a half years with them in the various, different capacities ending with a management position. I was a project leader in one of our exploration districts in the Denver office.

And then I went with Mr. McHugh in his firm in March of 1985. I've been a geologist with him since.

Q Have you previously testified as a petroleum geologist before the Oil Conservation Division?

A Yes, I have.

Q Have you made a geologic examination and

study of the Gavilan-Mancos Pool insofar as Mr. McHugh's application before the Commission is involved?

A Yes, I have.

MR. KELLAHIN: At this time, Mr. Chairman, we would tender Mr. Ellis as an expert petroleum geologist.

MR. STAMETS: Are there any questions about Mr. Ellis' qualifications?

He is considered qualified.

Q Mr. Ellis, I'd like for you to give us some of the background from your own personal knowledge and observations of the Gavilan-Mancos Pool insofar as it concerns the questions of how the pool is operated and being produced.

A All right.

Q When did you first become involved in that project?

A Basically we've looked at the producing situation in the pool since I came with Mr. McHugh last year.

We had some information that came to light toward the end of 1985. Most of it was engineering related data, pressure -- pressure data, specifically, that gave us cause for concern.

As soon as I had cause to believe that we

were dealing with a situation of rapid depletion of the reservoir, I recommended to Mr. McHugh and we initiated as a company an intensive study of the reservoir and we have as part of that study included all the major operators within the pool and we are currently involved in ta very intensive study effort trying to determine just -- just what the solution to the problem is.

Now, we basically feel that our proposal today, the emergency, temporary reduction in the allowables, is necessary to reduce the rate of current withdrawals in the pool. It, the primary reason for seeking this temporary rule, as Tom mentioned earlier, is to allow us the time to complete this reservoir study that we have done, and along those lines, if we're not prepared at the end of this proposed 90-day temporary rule to make application for a Gavilan Unit, then we will be back for a further reduction in production rates at that time.

Now, as I said, we -- we embarked on this study, including all the major operators --

Q Let me ask you some questions about the study, Mr. Ellis. What companies were invited and participated in the studies and generally when did they take place?

A We initiated the study group right after the OCD called an informational meeting in February of this year concerning operational practices in the Gavilan Pool.

There was quite a large turnout for that, indicating some interest in what was going on, and we called a meeting for May 1st of this year and notified all the operators, who in turn notified some of their working interest owners, and we had notified our working interest owners, to come to that initial, formational meeting.

We held the meeting and then determined we needed to share quite a lot of data in the pool, and we did that. We shared data amongst ourselves.

At the second meeting we determined that perhaps the study would proceed a little more rapidly if we were to break down into specific work groups, the engineers and the geologists, and we did that. We held meetings in July of this year, 8th, 9th, and 10th of July, in Farmington and had our small subcommittees working at that time toward an understanding of the problem.

Q Would you identify for us, Mr. Ellis, the areas in which data has been developed to depict or to identify the nature and scope of the problem?

A Yes. We basically three sets of data that we feel clearly depict the gravity of the problem out there now.

The first set is the geologic data and basically I'll present the structural and stratigraphic elements of the pool that we believe show that we're dealing

with a reservoir-wide single, unified production entity.

We'll also show that the damaged, what we feel to be the damaged parts of the reservoir are in direct communication with all of the reservoir.

The second set of data we'll bring out on testimony will be the gas/oil ratio data. That data will show a dramatic increase basically in the last six months of production out of the pool, and you know, from my experience in other reservoirs, this GOR data is a very good yardstick of the efficiency with which that pool is being produced.

And the third, and final, set of data that we would like to bring out on testimony is the pressure data we've acquired in the pool. Basically Gary Johnson, our engineer, John Roe, Dugan's engineer, will be able to present that for us.

Q Mr. Ellis, let me turn now to the package of Mr. McHugh's exhibits.

MR. KELLAHIN: They have been identified, Mr. Chairman, as Exhibit Number Three. Within the book it's been subdivided again into Sections A, B, C, and D.

Q Mr. Ellis, let's turn to the geologic investigation of what is occurring in the Gavilan-Mancos Pool and let me, first of all, turn your attention to Sub-section C of Exhibit Number Three.

Within that, or just after that tab there is what purports to be a structure map and then there's a cross section. Are you with me? All right, sir.

Let me turn to the structure map and first of all have you identify that for me.

A Yes. The exhibit Tom's referring to is a structure map on top of the -- what I call the Niobrara A pick in the field. That's the top of the -- what we consider to be the pay interval in the pool.

Q What have you concluded from an examination of the geology that you can illustrate for us by using this structure map?

A Basically in constructing the structure map we used all the available well data in the pool; used commonly accepted practices with regard to the construction of the map, and from this map I conclude that the Gavilan nose, if you will, is a large, northeast plunging structural feature. All the pool wells completed to date in the pool have been completed from either the crest or the flank of this structural nose.

You can see that I've indicated some minor faulting in the southwest portion of the mapped area. I feel the faulting is significant only in that it probably is genetically related to the development of the fracture system in the Niobrara producing interval that is

responsible for the oil production in the pool.

Let's consider for a second the minor faulting I've indicated there. You'll -- you'll see in looking at that data that we've got throw across those faults in the range of less than 100 feet. What I have concluded from the mapping I've done is that none of these faults are sealing.

We have three wells that lie along the trace of that fault, three McHugh wells in the southeast of Section 29, northwest of Section 33, and the southeast of Section 33, that are basically high capacity wells, or at least they were until we had more pervasive interference in the field.

So I've concluded from that that the faults, rather than being sealing faults in fact probably enhance vertical communication with the fracture system.

These wells, as I have them mapped, including the well in the northeast of Section 32, appear to be in one fault block. We will bring out on later testimony the pressure data that indicates that these wells are all communicative with the pool as a whole, that in fact wells in the southwest side of that fault block are in communication, as are the wells within the fault block.

I've concluded in general from this display here that we're dealing with a structurally unified en-

tity and it's my belief that the nose that's present here in Gavilan is responsible for the pervasive fracture system in the Niobrara interval.

Q When we focus on the identified problem of how the pool is being produced and operated, how does the continuity of the geology for this producing interval affect the magnitude of that producing problem?

A In terms of the -- what I've indicated to be the structural continuity in the map, and because I do feel that it's a single entity that's responsible, and there are no indications that we have isolation due to faulting across this structure, that the net effect will be that we're going to have communication across the structure, pervasive, reservoir-wide communication.

Q Would you describe in your own words what you, as a geologist, see to be the problem that is agreed upon at least within your company involved in the Gavilan-Mancos Pool?

A Well, we -- we recognize that we're dealing with indications of a very rapid depletion in this reservoir that's ubiquitous in the reservoir.

We recognize that problem and after some preliminary study in our subcommittees at least the major operators and many of the working interst owners recognize the problem, and we agree, you know, based on the analysis

we've done from a geologic and engineering standpoint, that the immediate reduction in the current allowable is essential.

Q Do you see geologically any justification for locating or separating out the problem area as being only one portion of the pool or conversely, does it encompass the whole pool?

A No, I don't see any reason for separating out any particular portion of the pool from a structural and geological standpoint.

Q Let's turn now to the cross section, Mr. Ellis. But before we leave the structure map, was that prepared by you?

A Yes, it was.

Q That's your work product and your interpretation and evaluation?

A Yes, sir.

Q All right, let's turn to the cross section. Would you identify that exhibit for us?

A That's what I would call a structural, stratigraphic cross section through the Gavilan-Mancos Pool.

Q Why was this cross section prepared, Mr. Ellis?

A I've done that to provide further evidence of the structural uniformity within the pool and also

to provide some measure of stratigraphic uniformity within the producing interval in the pool.

Q What do you conclude from an examination of the cross section?

A From a structural standpoint, referring back to the structure map, we have a trace of the cross section identified on the map. I've selected this tract to be along the axial plane of the fold and made projections of wells into that axial plane.

Once you construct a structure section of this from the eighteen wells, you can conclude that you have a very low relief, gentle doming in the central portion of the fold and basically structural uniformity across the fold is what I would conclude in a structural sense.

I used the induction log in each of these eighteen wells in the structure stratigraphic cross section to depict the uniformity in the Niobrara producing interval stratigraphy throughout the pool, and if you'll look at these, the representation on the section, you'll see that except for minor character changes in this induction log, and that's related mainly to the hole conditions during logging, that the signature of this producing interval, this Niobrara stratigraphic interval, is uniform throughout, so that is also another conclusion you would draw from this section, is that it is a uniform stratigraphic interval.

You'll also notice that the thickness of these units appear to be invariant except for very small variations throughout the -- throughout the section.

This also brings -- brings up a number of other considerations in trying to establish stratigraphic uniformity in the pool. We, meaning McHugh and the technical people associated with our analysis of the field, believe that the log data is generally suspect in a pool of this types, so we have looked at some core data and, in fact, as part of our overall study efforts, we're acquiring additional core to try and address of the problem of stratigraphic uniformity, and based on the core data that I've been able to see and some of the sample descriptions, these thinly laminated shales and minor very fine-grained, silty laminae, and sandy laminae in the Niobrara are preferentially fractured relative to the more massive shales of the Mancos interval and the Carlisle above and below.

They're preferentially fractured particularly in areas like Gavilan where you have a very low relief hole like this and minor faulting, which creates a lot of internal stresses within the interval.

Now the core data, we believe, is going to be very significant for a lot of reasons, but three of the more significant reasons that I've come up with based on my analysis of the limited core data available in the field,

are that the density of logged porosity that we're seeing in this particular interval through the analyzed core intervals, bears no relation to the core porosities that are analyzed.

Now, in fact, the correlation is so poor that there appears to be no way to calibrate the density porosities with the core porosities as you would expect to be able to do in a true matrix reservoir.

Based on my experience with matrix reservoirs, and this is also another conclusion from some of the core data, the amount of the effective or producable matrix in the Niobrara producing interval section is minimal and I generally use cutoffs in my work of about 0.1 millidarcy permeabilty. I consider anything greater than 0.1 millidarcy to be probably fracture permeability.

And the final conclusion I come up with the respect to the core data and how it relates to the stratigraphic uniformity question is because of the extremely thin, interbedded nature of these very fine-grained sandstone laminae, it's probably difficult in any kind of core analysis, whether it be plug or hole core, to get a statistically valid analysis of the matrix porosity in the rock. It's probably impossible to do that with respect to the fracture properties, and as a result of all this looking at the core data, I've come out believing that the so-called

matrix in the Niobrara will have essentially no impact on present or future reservoir performance.

Just to kind of sum up this particular display and the previous one, I feel that based on the structure and stratigraphy I expect the Gavilan-Mancos Pool, if you will to behave as a single, unitified producing entity, and as we'll see later, the pressure data lends further credence to this conclusion.

Q Let's go on to an examination of the information that you have tabulated on the gas/oil ratios. Once we've done that we'll come back and look at the geology gain to see what conclusions you can draw about the relationship of the gas/oil ratios in certain wells to the geology.

Let's turn to the Tab A of Exhibit Three, which is in two parts, there are two displays there. If you'll describe for us, or at least identify each display.

A The first display is a plot of the producing GOR conditions in the reservoir as of January 1st of this year.

The second display is a plot of the producing GOR conditions as of July 1st of this year.

Q Were these prepared by you or compiled under your direction?

A Yes.

Q Give us an explanation of what the information shows you.

A Well, it's kind of an outgrowth of this concept of stratigraphic and structural uniformity. This data kind of falls into place with respect to that overall conclusion and I'll give you some reasons why here.

The initial display is a depiction of the producing GOR conditions on the first of this year, January 1st of this year. It's compiled from C-115 production data filed with the state.

Basically what I've done for all the wells in the pool is divided the monthly oil production into the monthly gas production and coming up with a producing GOR for a given month.

For this particular month or actually for the month immediately prior to January 1st, December, '85, we have some indicated conditions in the pool that are significant when viewed with respect to the next plot, which is actually six months later.

The nine wells with darker hachuring on this plot are wells that produce at greater than a 2000 GOR. Now there's probably a lot of different reasons why these things are indicated to be high GOR wells but we believe and have always believed that there are areas in this pool where free gas basically has -- has always existed.

The five wells to the north, the five dark hachured wells to the north, are essentially structurally high wells. One might expect that gas, free gas, to have developed in a structurally high position if it was going to develop at all.

The wells the south, the four wells to the south, again are in structural -- structurally higher positions, but they're also very low capacity wells and there could have been free gas stringers associated with this low capacity part of the reservoir.

But the real significant part of this display and what bears on the next display are the two wells that are in the lighter hachures. One is the Native Son 2, a McHugh well, and the other one is the Mother Lode 1, which is a McHugh well. At this time in the reservoir those -- those were the only two what I would call down dip or down structure wells that actually produced with GOR's greater than 1000.

Then we go to the next plot, a producing GOR plot for July 1st of '86. You'll notice immediately the dramatic change. We have fifteen additional wells that have GOR's, producing GOR's greater than 1000. What this is saying is that more and more gas is accompanying each barrel of oil to the well on a poolwide basis.

Now this GOR increase appears to be

spreading rapidly and I'll get to that in a minute with my next two displays, but this rapid spread is occurring in all parts of the reservoirs and it's not necessarily tied to structural position.

Q If they were simply tied to structural position, what then would you conclude?

A It's a pervasive, pool-wide type of effect and --

Q Because it's not tight structure it's pervasive over the pool?

A Yes. Well, the actual progression of the development of these high GOR conditions is -- appears not to be related to purely -- purely structural position in the pool.

Q To make sure I understand your testimony, we're concerned about the way the pool is being produced, the rates. Is there a reasonable geologic explanation so that if this pool was properly producing in its most efficient way, would we see the type of gas/oil ratios on the second display for July? Do those have a geologic explanation?

A You could generally say that because of the stratigraphic uniformity of the Niobrara producing interval the pervasive nature of the fracture system within the producing interval, the fact that it is reservoir-wide

has allowed this kind of a very complete communication within the reservoir and that's the reason why I feel that, you know, the fact that the GOR problem has developed is really not totally related just to structural position on the field. There is a geologic explanation for that. The fact is that the fracture system is pervasive and all-encompassing (not clearly understood) pool.

Q Let's talk about your opinions of the fracture system. You talked earier about the porosity. Sometimes we see reservoirs in which matrix itself contributes, has porosity and contributes to the production.

In some areas we see a combination of matrix production and fracture production.

Give us your geologic opinion about where the porosity system lies for this pool.

A That would be an opinion, at least in my case, based primarily on my examination of analyzed core data and based on that examination, as I indicated earlier, I'm convinced that the matrix contribution in a reservoir like this is essentially minimal and that the porosity system is single and related to fracture porosity only.

Q All right, sir, are you ready to go on to the next display?

A Almost.

Q All right, sir.

A I'd like to -- I's like to point out with respect to this last display that I've got seven wells in there that are basically circled with red, and these are wells that I've indicated in the next two displays and they have their GOR histories plotted. We can go to the next two displays.

Q Those are filed after the B tab in Exhibit Three. The first one is a yellow display and the next one is the bluish green display.

A These next two graphical displays depict the data in the previous exhibits in a time sense. Basically, I've selected four wells from the south and west portions of the reservoir to display on this one. This again is data that's taken from the C-115 producing data filed with the state and again the manner in which I computed the monthly producing GOR was just the monthly gas over the monthly oil produced.

The only real significant point to be made in a display of this type is you, obviously, need to note the fact that there is a very dramatic increase in the GOR over a very specific period of time, from January to June of this year, which comports almost exactly with the two previous pool-wide displays that I prepared.

Okay, now we can move to the north and east portions of the reservoir with the next plot.

I've selected three other wells that basically indicate the same thing, a dramatic increase again occurring between that very limited period from January to June of this year.

And all of the last four exhibits indicate to me and the technical people I'm associated with that the situation is quite alarming and that we feel the -- the real solution to this problem is to control these high GOR wells; basically to preserve reservoir energy and although we've identified an interim stopgap solution to be the reduction of the allowable rates, it's my firm opinion and I have Mr. McHugh's full support on this, that even without further study, that the only solution to this problem, the developing problem as we now see it, is unitization of the Gavilan Pool.

At any rate, the conclusion is that we're looking at a reservoir-wide GOR increase that is indicating a rapid dissipation of reservoir energy.

Q Now that we've examined the gas/oil ratio plats or displays, I'd like to take you back to the structure map for a moment.

Am I correct in understanding that you are finding wells in the pool at locations lower in the structure, those wells having higher gas/oil ratios than you would expect a well at that structural position to have at

this point in its life?

A Yes, that's -- that's generally true. We have seen that areas in the reservoir that have undergone extensive production over a period of time appear to have developed this -- this dramatic increase in GOR in a rather short period of time.

It does, generally in a most efficient development of the reservoir, one might expect the increase in GOR to occur down structure in a very systematic way but in this particular case, as I indicated when we went through that GOR data, it would appear that the increase in GOR's is more related to areas of higher and more extensive withdrawal and it is not necessarily tied to the structural position, although one might expect that in a normal, more efficiently produced reservoir.

MR. KELLAHIN: That concludes my examination of Mr. Ellis.

At this point in the testimony we would move the introduction of his exhibits which are Sections A, B, and C of Exhibit Three.

MR. STAMETS: Are there objections to the admittance of these exhibits?

They will be admitted.

Are there questions of this witness?

MR. PEARCE: There are going to be some. We're just trying to pick the order, Mr. Chairman.

MR. STAMETS: Okay.

(Thereupon a recess was taken.)

MR. STAMETS: The hearing will please come to order.

Mr. Pearce, have you all decided who's going to --

MR. PEARCE: I think Mr. Lopez is going to go first.

MR. STAMETS: Okay. I would hope that we can follow the same sequence in the future examinations and then I can figure out who to start with.

Mr. Lopez?

MR. LOPEZ: Thank you, Mr. Stamets.

CROSS EXAMINATION

BY MR. LOPEZ:

Q Mr. Ellis, I think you were discussing your opinion with respect to fracturing in the area of the Gavilan-Mancos Dome. What's your opinion with respect to regional fracturing in the area?

A That's something that Mr. McHugh and our organization has given some attention to. We, however, have not completed a photogeologic study per se in the immediate area of the Gavilan Dome. The fact that such a study could help bring to light some additional data that bears on the production and the performance in the reservoir doesn't escape me but at the present time I feel that the best data we have concerning the fracturing in the reservoir is production related data.

Q Do you see any evidence of vertical communication within the Gavilan Dome area?

A By inference I certainly do, and as I mentioned with respect to the structure map, the -- the three wells that lie along that northern fault that I've mapped in that fault block to the southwest portion of the map area being high capacity wells, or as I said, they were high capacity wells until all the wells started interfering, is perhaps the best inferential data I have concerning the vertical communication accorded the overall fracture system by the faulting that's in the reservoir.

MR. STAMETS: Mr. Lopez, I'd like a little clarification on your first question.

You were comparing fracturing in the area of the Gavilan Dome versus regional fracturing, and I'm not sure if when you say regional fracturing if

you're talking about something that extends outside the area of what's now classified as the Gavilan-Mancos Pool or outside the plus 550 foot contour. Could you clarify that for us?

MR. LOPEZ: It was my intent to have the question have as broad a meaning as possible. By regionally I mean including the Puerto Chiquito Unit and going westward (not clearly understood.)

MR. STAMETS: So at least those townships which surround what's currently the Gavilan-Mancos Pool.

MR. LOPEZ: And the unit that we're discussing here today.

MR. STAMETS: And under those conditions does your answer remain the same?

A Yes.

MR. STAMETS: Thank you.

Q And if I put it to include the basin as a whole, that would also be the same.

A Do you want to repeat that?

Q The entire San Juan Basin as a whole with respect to any evidence you have or know about with respect to regional fracturing.

A Certain parts of the basin we've spent quite a lot of time doing photogeologic studies on. That's

an exploratory tool we do use in the overall basin area.

With respect to the Gavilan-Mancos Pool, as I mentioned, most of the inferences I have made concerning the fracturing and faulting in this reservoir are production related and also related to the actual correlation of logs within the pool.

So at least it would have to be less than a basin-wide scope, in answer to your question.

Q Is it your opinion that the formation itself that we're discussing is very permeable?

A If by permeable you mean permeability related to the, what I would call the pervasive fracture system, yes, in a general sense. There are obviously zones within this particular pool that have less overall effective permeability than others. We've identified a number that are extremely tight but in general the fracture permeability in large areas of the pool is significant.

Q How about the matrix contribution and what is your opinion on its permeability?

A Based on the core data I've seen, and I've seen very limited core data to date, I believe that there are three wells within the pool that -- or excuse me, not three wells within the pool -- two wells within the pool and one well within the Canada Ojitos Unit that have done some analysis of core permeability of the matrix.

That particular analysis that I have seen indicates extremely low permeability in the matrix, less than 0.1 millidarcy.

Q Then is it your opinion that permeability does in large part depend on the fracture system?

A That's my contention and that's based on work I've done to date. I believe it is necessary to get a statistically valid sampling of the nature of the matrix with respect to the reservoir and that is why Mr. McHugh has recently signed an $80,000 AFE for some additional core data in our pool. We're doing that under the aegis of the study subcommittee that we have set up and Mr. McHugh, even though I've influenced his thinking heavily concerning the -- the lack of contribution from the matrix, has agreed that is a question we need to resolve.

But it is my firm belief, at least based on the data I've seen thus far, and I'm admittedly an open minded person, that the matrix contribution is essentially nil.

Q In both the Gavilan Dome area and in West Puerto Chiquito?

A Well, the, as I said, the limited core data we have would seem to indicate that's true, yes.

Q Do you see any difference between the two, the West Puerto Chiquito Unit and the Gavilan Dome

area?

A Specific numbers?

Q Yes.

A I could pull out my numbers and run through that with you but basically from memory, the range of numbers we're dealing with permeability-wise ranges anywhere from less than .01, which is beyond the limit of resolution and measurement of permeability, up to 11 millidarcies.

Now, as I said, any -- I consider anything above 0.1 millidarcy of permeability in any of those analyses as indicative of some kind of fracture contribution.

I believe that the actual matrix permeability is probably somewhere in the range of less than .01 to possibly as high as 0.3 millidarcy.

Q But because of the fracture contribution the highest number with respect to permeability in the Gavilan Dome area is the number you said, 11?

A Based on the data I've seen, yeah. That's from three different core analyses.

Q Do fractures in the Gavilan Dome run in all directions in your opinion?

A I believe it's generally a pervasive system. I think it's got a multi-directional orientation.

Yes, I do.

Q Have you run and analyzed fracture logs to indicate the direction of any of the fractures?

A We have not done any of that in any of the wells I've been associated with with Mr. McHugh.

Relying from experience and, you know, some of the lab research that was done at Chevron, we're not totally convinced that the fracture logs currently in use in the industry are necessarily a positive indicator of directional fracturing in a borehole.

Q What kind of reservoir producing mechanisms do you discover or find in the Gavilan Dome area?

A Well, I'm not an engineer but the attention I've given to this problem in conjunction with Gary Johnson, our engineer, and Mr. Roe, an engineer from Dugan, and Mr. Greer, the engineer from Canada Ojitos Unit, I think we have generally concluded that we're dealing, at least at this point in the reservoir life, with a solution gas drive producing mechanism.

Q Well, if that's the case, isn't it normal to see gas/oil ratios increase with the depletion of the reservoir?

A You will have -- down to the bubble point there should be very little increase in the overall GOR in the reservoir.

Below the bubble point certainly you would expect to see increasing GOR's under a solution gas drive.

Q Do you have an opinion as to what the average fieldwide GOR is?

A At the current time?

Q Yeah.

A Based on a display that will be presented by our engineer in the next section here, it looks like we're dealing with about a 1500 -- okay, a monthly average about 1450 GOR poolwide.

Q Now, referring to your exhibits under Tab A, and specifically with respect to certain wells indicated on your exhibits, were you aware that the Gavilan Howard No. 1 had experienced a casing leak between the Gallup and Dakota?

A We've had some verbiage to that effect in our study subcommittee meetings. We understand that there was contamination of the reported production data in the Gallup interval from gas leaking behind some kind of downhole plumbing to -- from the Dakota formation. So it is entirely possible that dark hachured zone in the Gavilan Howard could be incorrect, and until we have verification that that was actually the case, why, I'd like to leave that here because the reported production to the state possibly

up to the point at which I made that final graph, could be above 2000.

Q Now, referring to the Gavilan No. 1, which offsets the Gavilan Howard, were you aware that it was commingled?

A Yes, I am.

Q With the Dakota?

A Uh-huh.

Q Have you been able to calculate how much gas has been introduced out of the Dakota?

A That would be extremely difficult to do. We have the reported proportions that are used in the reporting of gas and oil production to the state. We believe, however, that the majority of the production out of the Gavilan 1 is strictly from the Mancos formation. That is problematic, however. If you will notice the two wells you referred to exist on --

MR. STAMETS: Excuse me again. I need a little clarification here because we -- in the -- on this sheet, on Exhibit A, up in the northern part there's a Howard 1-11. Below that there is a Gavilan Howard and I'm not sure which well we're talking about.

MR. LOPEZ: Okay, I think, Mr. Chairman, that it's best to go to the second page of your exhibit because more wells are represented there, and my

first question had to do with the Gavilan Howard in Section 23, the Gavilan Howard No. 1.

MR. STAMETS: Okay, thank you.

MR. LOPEZ: My second question was just the Gavilan No. 1, which is in Section 26.

MR. STAMETS: Okay.

MR. LOPEZ: And now along that same line of questioning I'd like to ask Mr. Ellis if he was aware that the Gavilan No. 2 in the same section we've just discussed is a severely damaged well?

A Yes, it is. I am aware of that.

Q Do you think it's representative of the producing characteristics of the reservoir being in this condition?

A That would be open to some question. The point I began to make here a second ago concerning two, and now all three of these wells, is that all three of them exist on both plots and as I pointed out in the dissertation on the initial plot, the real significant portion of what I was trying to point out is not necessarily the dark hachured wells that exist on both plots.

There are problems concerning the analysis of GOR conditions on those particular wells but the important thing is the change in the remaining wells in the pool between the two plots. That's the point I was making.

Q Now turning your attention back to the Gavilan Howard No. 1, were you aware that Mesa Grande reported 3665 barrels of produced --

THE REPORTER: I'm sorry, Mr. Lopez, I didn't understand your question. Would you mind repeating it again for me?

MR. LOPEZ: Certainly.

THE REPORTER: Thank you.

MR. LOPEZ: We're referring back to the Gavilan Howard No. 1 and I asked Mr. Ellis if he were aware that Mesa Grande recorded that well's production in June so it should correspond to his second page of his Subsection A of Exhibit Three; that there was in fact 3665 barrels of oil produced in that month and 4191 MCF. According to my calculations that would give a GOR of 1143, which was less than the 2000, so I would question how you have characterized that well on your exhibit.

A Well, that, of course, was good news to all of us. We like to see these kinds of changes occurring.

At the time we prepared these graphs we had no C-115 data shared with us by Mesa Grande and I guess the point I'd make is that I made the assumption that the well condition did not change. In fact, what we're seeing here is that that dark hachured area ought to just be a light hachured area. That's, as I said, good news.

Q And were you also aware that the Rucker Lake No. 2 GOR has declined?

A Again, for the same reason, we didn't have the production data in June on that. We have to assume under that scenario that the condition of the well remained the same.

Q Then on what basis did you prepare this exhibit we're discussing?

A All of the wells you see on here are based on actual C-115 data or data provided to us at the last engineering subcommittee meeting.

As I mentioned, the Mesa Grande production data is not yet in our hands from that meeting, so we assume under that scenario that the condition of the well remains the same, a reasonable assumption.

As you've just pointed out, we can -- we can certainly change the Rucker Lake 2 and the Gav Howard 2 to light hachured circles.

Q How do you explain the decline in GOR's?

A That, well, certainly with respect to the Gavilan Howard, if what they indicate is correct, and again we've never seen any actual data concerning a repair of that well, but basically they've corrected the communication problem behind pipe in the Gavilan Howard.

The Rucker Lake Well I'm not familiar

with any kind of production change that would give rise to that decrease in GOR and I'd certainly defer to our engineering experts concerning decreases in GOR in a depletion drive reservoir of this type.

Q Hasn't the McHugh Native Son No. 1 also experienced a decline in GOR and you should be familiar with that one. How do you explain its decline?

A Well, there could be a number of reasons why free gas may not make it to the wellbore in a high capacity well of that sort. There may be -- and again, this is engineering, really, within the realm of engineering testimony, but it is possible you could have had segregation in the area of the wellbore and because of the producing conditions in the wellbore you could have preferentially allowed through some mechanical means the oil to enter the wellbore and not -- not the free gas associated with it.

So although earlier in the life we had a much higher GOR in the Native Son 1, there could be a number of different explanations why that GOR went down.

MR. STAMETS: What's the location of the Native Son No. 1?

A That's the northeast of Section 34.

MR. STAMETS: Northeast of 34. That well isn't even circled on my exhibit.

A Yeah, that well currently produces with a

GOR of less than 1000.

MR. STAMETS: Okay, so you're -- we weren't talking about a well identified as a high GOR well.

MR. LOPEZ: No, since he didn't know about the Rucker, I just thought I would go to a well that I thought he might know about to see if we could find out the nature of the --

MR. KELLAHIN: Mr. Chairman, I don't want to deny Mr. Lopez a full opportunity to cross examine this witness but we do have Mr. Roe, a petroleum engineer, that can talk all day long with Mr. Lopez about gas/oil ratios. He has an explanation of all these questions.

MR. STAMETS: If you could defer that to the engineering witness that might speed things along.

MR. LOPEZ: I appreciate that, Mr. Chairman, I'm just trying to examine Mr. Ellis on the exhibits he introduced and I understand the Commission's concern to get on with the hearing and I will bear that in mind if I may just ask one more question along this line in this vein, with your permission.

MR. STAMETS: Certainly.

Q Mr. Ellis, I refer you on this same exhi-

bit we've been discussing to those dark circled wells that, let's say, begin with the Lindrith 1 and go south in the pool. What quality of well -- wells are those in your opinion?

A As I mentioned earlier, that's a portion of the pool that we feel is extremely low permeability. The capacity of those wells as a result is -- is quite low. That is a problem in terms of analyzing the production associated with those wells to place them into the overall scheme of the pervasive increase in GOR pool -- poolwide, but as purely from a factual standpoint, the production reported to the state indicates that those wells are in excess of 2000 GOR and I think I may have made that particular caveat at the time I explained the displays, that we do have problems explaining why those GOR's are the way they are and we do have at least a perception that it may possibly be related to the development of free gas in that low permeability portion of the reservoir.

Q And since we agree that these are poor quality wells, what effect do you think they have on the reservoir or the GOR to begin with?

A Well, there's no question that the overall effect from those four or five wells, actually, there's many more in there that have never produced but certainly we would expect if they did produce, then to fall into the same

categories as the other four or five, the overall effect, of course, is quite small in terms of any kind of effect on the overall poolwide GOR.

Q Are any of the wells which experienced large increases in GOR's McHugh wells?

A They certainly are. The first display that I presented in yellow is my depiction of the wells in the south and the west portions of the reservoir. Those are all McHugh wells.

Q Are these McHugh wells large capacity wells which have produced large quantities of oil to date?

A Yeah, there's at least one in there that is a very high capacity well. The other two -- other three wells, at least with regard to the overall pool capacity, are average capacity, and the other one well that I'm referring to, the ET No. 1, has been variable throughout its life as either a low or a high capacity well.

Q So can we reach the conclusion that the higher the withdrawals, or that higher withdrawals result in higher GOR's?

A Not necessarily. If you'll look at the next plot, we've got three other wells, and all I meant to do in selecting these wells was select the wells that cover a portion of the field and give a flavor as to what's happening poolwide. That was the whole intent of my presenta-

tion, was to indicate the overall nature of this GOR increase.

These three wells, in terms of their withdrawal, are, of course, much lower than that area in the south and west portions of the reservoir that has produced for a much longer time, and you can see the corresponding, same corresponding effect in the north and east parts of the resevoir, and we do definitely have a couple of high capacity wells, or at least one high capacity well in that blue plot. But is you're speaking with regard to the cumulative withdrawals, this portion of the reservoir has made aobut a tenth of the oil the rest of the reservoir has done.

Q If allowables are severely restricted and pressure stabilized will that result in recharging the reservoir in the vicinity of these wells?

A I believe that might be a question that would be better answered by a reservoir engineer, but, you know, maybe I'm mistaken. I'm --

MR. LOPEZ: Thank you (inaudible).

MR. STAMETS: Are there other questions of the witness?

Mr. Pearce.

MR. PEARCE: Thank you, Mr. Chairman.

CROSS EXAMINATION

BY MR. PEARCE:

Q Mr. Ellis, you mentioned at several points during your direct testimony that you had some limited core data, cores which you had examined or reviewed. Would you state to me, please, what wells you have cores available on, please?

A The well data -- or, excuse me, the core data I've been able to examine, as I mentioned, has come primarily from three cores in the area. I understand there is a fourth core available but because of apparent company policy I don't think we have access to that data at this time.

The three wells I'm referring to are the Canada Ojitos L-11 Well, the Mallon 1-11 Howard Well.

MR. STAMETS: Excuse me, could you give us section, township, and range?

A The L-11, I believe, is in Section 11 of 25 North, 1 West.

The 1-11 Howard is in the --

MR. STAMETS: I'm trying to find these on the --

A Yeah, that would be off the base map we have given you.

MR. STAMETS: Okay, thank you.

A The next one is the Howard 1-11, a Mallon well in Section 1, southwest quarter.

MR. STAMETS: Thank you.

A And then the other well is in the southwest of Section 4, Township 24 North, 2 West, the Mobil Unit B 38 Well.

MR. STAMETS: Southwest of what, please?

A Section 4, Township 24 North, 2 West.

MR. STAMETS: Thank you.

Q And just because I'm nosy, sir, what fourth well do you understand there is a core but you have not seen data?

A I believe there's an Amoco well up there in that northeast Ojito Pool for which they've cored the Niobrara producing interval.

Q And with regard to the three cores that you have information on, did you actually examine those cores or have you examined a core analysis performed by someone else?

A I've looked at the core analyses prepared by an industry -- a third party contractor in the industry, CORE Lab. I have not made a visual examination and a search of the core myself.

Q You said there in your testimony, sir,

that log porosity and core porosity didn't match. I'm wondering what did you do to arrive at that conclusion?

A Basically, as part of our first study committee meeting we had a Mobil representative that shared his log information with us. We were able to share at the time all the information, all the production data from all of our 23 wells, and we appreciate the fact that Mobil was able to share their log data with us.

I took that litho-density log that was run on the Mobil B-38 Well and as was the practice when I used to analyze quite a bit of core data for a major company, I tried to calibrate the log indicated density porosities with core analyzed porosities generated by CORE Lab, and in doing so, in areas where the hole rugosity is at least -- excuse me, where there is no hole rugosity, I came up with an error (sic) curve between the density log porosity and the measured core porosity.

I can, you know, I have prepared, you know, some work on that and we could -- we could certainly go over it at some point, but I haven't made an exhibit for that.

Q Well, sir, my problem is this is probably the only discussion I'm going to have with you on the record, so if you have some information that you could share with us, I'd appreciate you sharing it with us, please.

A Just ask the questions.

Q Okay. You indicated that you had done a curve of the correlation as I understand it, between those two sets of data and you indicated to me, I believe, sir, that you had some work which we could discuss at a future time.

Could you describe for me exactly what you have done and exactly what you have available and then I will ask you the following questions?

A Basically, again, what I've done is I've annotated on the density log for the Mobil B-38 Well the analyzed core porosities for all of the points which were analyzed in the 183-foot interval that they have analyzed with CORE Lab. There's a net 81 feet that was analyzed in that core analysis, plotting each one of those core porosity points on this log, I then compared the measured core porosity to the indicated measured density porosity on the log. In all cases there is a difference between the indicated log porosity and core porosity and in some cases even in areas of the hole where there is no rugosity problem, the error can be as great as in log porosity units 24 percent.

And I did that for the entire interval that was analyzed.

Q Do you have that annotated log available, sir?

A Yes, I'm referring to it.

Q May we see it, please?

MR. PEARCE: Mr. Chairman, at this point I would like to ask that I be able to take this document from the witness, provide it to one of our experts, proceed with some other questioning that I have while they work it over. That may speed the process along, because otherwise I'm going to have to ask you for a recess while some experts look at this log.

MR. STAMETS: Is there any objection?

MR. KELLAHIN: We don't have any objection.

MR. STAMETS: Okay.

Q Thank you, Mr. Ellis.

Now, tangential to that I thought I understood during your direct testimony you indicated that borehole conditions had hampered log quality. Could you describe if that's -- first of all, is that correct? Do you recall that?

A With respect to the B-38 log, yes, there is a zone of rugosity in what I would call the lower part of the A zone of the Niobrara producing interval that effectively renders the density log indicated porosity incorrect in a normal situation.

Q Thank you. During your direct testimony, sir, I understood you to indicate that based on your core data examination you concluded matrix contribution to be minimal. During previous cross examination did I understand you to say that you -- well, could you describe for me how you define minimal in that context?

A The majority of my background in analyzing reservoir properties from a geologic standpoint is in a matrix reservoir and specifically in the sandstone reservoir that I have had some experience with, we have done quite a bit of lab related research bearing on the issue of what is a producable matrix, and in doing that our conclusion, at least with respect to that particular sandstone reservoir, was that we had no effective contribution from that reservoir, although porosities of about 4 percent, and permeabilities less than 2 millidarcies.

Now, it's certainly conceivable that these minimum limits could vary for different reservoirs, and I am of the opinion, at least based on, as I said, the limited core data we've seen here and also some of the core data I've seen from the Niobrara producing interval on the Rangely Anticline in Colorado, that we're probably talking about matrix producable or effective matrix reservoir being in excess of 0.1 millidarcy and I haven't given consideration to what a minimum porosity would be that would allow

this thing to be a producable reservoir, but certainly the permeability, at least in my mind, would almost have to be greater than 0.1 millidarcy to contribute.

Q Mr. Ellis, I understood you to say that you had reached this conclusion based upon some study you had conducted in another reservoir, is that correct?

A That's correct.

Q Could you specify what reservoir that was, please, sir?

A The Nugget Sandstone Reservoir and the Painter Reservoir Field in the thrust belt in southwestern Wyoming is the sandstone reservoir I refer to.

The other reservoir that I alluded to was the Niobrara producing interval on the Rangely Anticline; essentially the same section that produces in the Gavilan Pool.

Q Are those fractured reservoirs?

A There is fracture enhancement in the Nugget Reservoir, but obviously, with the quality of matrix you have in that reservoir the contribution from the matrix overwhelms the fracture contribution. It's not a pervasive fracture system such as we have here in Gavilan Pool.

In the Niobrara reservoir at Rangely, obviously it's a thinly laminated shale, much as we have in this particular instance in the Gavilan Pool. It's our con-

clusion, anyway, based on core data we've had from numerous wells in the field that it is strictly a fracture-type animal; that all permeability related to oil production in the Niobrara on the Rangely Anticline is fracture related.

Q And you performed the studies during a previous employment, is that correct?

A Yeah, that's correct.

Q Is that research reported in a written paper?

A Intercompany reports, yes.

Q I think you touched upon it just now but I'd like for you to explain to me a little more fully if you could, I understood you during your direct to say that you're using a 0.1 millidarcy cutoff for the matrix. Could you go back and review for me, please, what -- what you said on the record and then try to explain to me what it means, because you've got at least twice the education as I have.

A Well, admittedly the determination of what ends up being producable from a matrix standpoint is largely hypothetical, at least from the geologic standpoint. The conclusions that we have come to looking at other, one other Niobrara instance, was that in order for that thinly laminated sandstone laminae that is ubiquitous in the Niobrara throughout the Rocky Mountains, not necessarily in the same proportions or the same percentages, but does

exist, in order for that to contribute from a production standpoint, and from a storage standpoint, you would have to have permeabilities in excess of 0.1 millidarcy.

Now, I'm sure there's quite a bit of engineering theory and empirical data that could be generated to verify that figure but at least from a geologic standpoint we had to place a limit on it and that Niobrara reservoir appears to need at least 0.1 millidarcy to --

Q And did you -- I'm sorry.

A -- contribute oil.

Q In arriving at -- at that cutoff number, did you assume some permeability that needed to be --

A That is a permeability, 0.1 millidarcy.

Q Let's switch to a different part of your direct exam at this time, Mr. Ellis, please.

I understood you to indicate that you believe that there were areas in the Gavilan-Mancos Pool in which gas always existed, is that correct?

A It's certainly a possibility. I don't think anybody knows for sure.

Q As an expert in the field of geology, is that your opinion?

A As a geologist who's listened to quite a few engineers speak of the problem and -- yeah, that's my expert opinion.

Q Would -- would that gas be in the form of an initial gas cap?

A That's -- that's certainly possible, at least some of the preliminary data we looked at indicated that we had much higher gas/oil ratios near the crest of the dome; however, I don't feel that there is necessarily a gas cap per se that would have formed in this reservoir. You know, we could just as easily have had free gas zones that didn't necessarily coalesce to form a gas cap.

Q If you assume an initial gas cap or free gas zone, would that indicate to you that there were portions of the reservoir which were below bubble point?

A As a geologist listening to engineers speak about such things, yes, I think that would certainly indicate that.

MR. STAMETS: Okay, let me follow up on that, if I might, Mr. Pearce.

Are we talking about at initial conditions in the reservoir?

MR. PEARCE: That was -- that was my intention in the question. I understood that we were talking about the initial free gas or gas caps existing.

A Well, that's probabaly a question best left to the engineers to address on their testimony or cross examination, if you wish, but maybe I ought to defer to

them.

Q You indicated, I believe, that you expected the bubble point to be about 1450 pounds at this time, is that --

A I think that was an average poolwide GOR that I was speaking of.

Q And do you know what the average GOR on Mr. McHugh's wells is at this time?

A I could probably come up with a breakdown on a well by well basis. I, because of my belief that we're dealing with a pervasive, totally continuous, uniform reservoir I've never really broken out Mr. McHugh's wells per se, and as indicated on those second two plots of that GOR section, again just an exposition of the production data, the upward pressure applied to the poolwide average GOR is not just a result of the increasing GOR's in the McHugh portion of the reservoir, but also the north and east portions of the reservoir, as I've indicated on the second, blue gas/oil ratio plot.

Q I understood you, Mr. Ellis, to indicate in your direct testimony that you believed that the production mechanism in this reservoir was solution gas drive, is that correct, sir?

A Yes.

Q If the production mechanism in this reservoir is solution gas drive, would you please explain to

me, sir, why you believe increasing GOR's represent an emergency situation?

That's the best slow pitch you will ever have, Mr. Ellis.

MR. KELLAHIN: May I have an opportunity to inject an objection?

I believe that is, in fact, beyond the scope of the expertise of this witness and is truly an engineering question at this point and we have those available and will present them and Mr. Pearce may ask questions.

MR. PEARCE: I appreciate that and I will appreciate the opportunity to ask those sort of questions of the engineers, but I understood this witness to be indicating to me that he believed there was a problem; that he believed the evidence of that problem or that emergency situation was increase in GOR's.

A That's part of the problem.

MR. PEARCE: And I would like to know upon what basis he reached that conclusion.

MR. STAMETS: We'll allow the witness to answer the question if he feels qualified to answer.

MR. PEARCE: Even if he doesn't he can say so.

A That's certainly true and I think I would defer to the engineering experts on that matter, although I have an opinion, I feel that it's probably best explained in the portion of our direct testimony that will deal with all those questions.

Q All right, sir, and I understood you during the previous part of your response to indicate, I think in response to something that I said, that the increase in GOR's in the Gavilan-Mancos Pool were part of the problem.

A That's correct.

Q Could you please specify for me what you believe the other part of the problem to be?

A Well, again, I, basically in preparation for my direct testimony, have dealt with production data and geologic data and both of these sets of data are really data that I consider within the realm of expertise of a geologist to have dealt with. This is merely an exposition of the data. The actual underlying engineering reasoning behind the nature of the problem is something that's best left to the experts in that field, so I'm going to defer that question to our engineering portion of the testimony.

MR. PEARCE: May I have just a moment, please, Mr. Chairman?

All right. I apologize for the delay, Mr. Chairman, just a couple more.

Q One question which has been brought up, Mr. Ellis, is have you made that annotated log available to the other members in your technical committee?

A No, I have not. It was prepared yesterday.

Q Now we move into an area, sir, in which I am going to try to attempt to read you a couple of questions.

Mr. Ellis, did you use density neutron cross plot porosity or density porosity in your annotation and comparison of the core data and log data?

A I've used just the density log porosity. No cross plot was made.

Q Can you tell, Mr. Ellis, whether or not most of the areas on this log that show a large core versus log porosity divergence are in areas of bad hole condition or areas of large shale content?

A Yes, I can.

Q And are they?

A No, they're not.

Q Do any of those instances occur in areas in which there is large shale content?

A Particularly -- yes, in answer to your question, yes. The area of the lower part of what I would call the Niobrara A producing interval has been analyzed by

CORE Lab to indicate shales, or at least they didn't perform an analysis on the rock because they felt it was shale.

Q And in doing a comparison in those areas, did you attempt to make any correction for the presence of that shale?

A Without an analysis on the CORE Lab plot, you know, such a comparison was meaningless because they didn't do an analysis on the shale in that interval.

I only compared the log response in areas where they had determined that there was sand sufficient to justify a plug analysis.

Q Did you compare sonic log porosity with core data?

A No, I did not.

MR. PEARCE: I don't think I have anything further of this witness, Mr. Chairman.

MR. STAMETS: Are there other questions of the witness?

Anything on redirect, Mr. Kellahin?

MR. KELLAHIN: All these lawyers, Mr. Chairman, and no one wants to take him on?

MR. STAMETS: Oh, yes, we want to ask a question about rugosity, if you would explain that for the record, please.

A It's the -- I was referring, and again I have not shown you this particular log, I was referring to a portion of the hole that has caliper indications greatly in excess of the actual gauge of the hole during drilling and in that -- in that particular part of the hole we have a much larger hole diameter than you would normally expect just from bit penetration, and that is what I would term a rugose hole, a rugose portion of the hole.

MR. STAMETS: Okay.

MR. PEARCE: May I just jump back into this, Mr. Chairman?

MR. STAMETS: Why, certainly, Mr. Pearce.

MR. PEARCE: Thank you.

MR. STAMETS: We're always happy to hear from you.

Q Mr. Ellis, I've been requested to have you express an opinion on how isolated gas or in the form of gas caps or free gas can exist in a continuous reservoir.

A I, again, I believe that's properly within the bailiwick of engineering testimony, but it's certainly possible that in spite of the low indicated dips on the structure map here that we could have some form of segregation in this reservoir, gravity segregation allowing the less dense gas to migrate into a high structural position on

the -- on the nose.

Q How could that exist if we have the kind of pervasive fracture system that you were discussing, or -- well, I don't understand.

A Gravity segregation within the fracture system?

Q Yeah, how would you not get free gas over the entire upper extent of the reservoir through the pervasive fracture system?

A Basically, all I was indicating, that there may be zones -- or I will indicate now that there may be zones within that reservoir that do not have the same transmissibility characteristics as you may have in other parts of the reservoir, and that differential may in fact create zones where, you know, you might have preferentially accumulated free gas.

Q And that is some modification to your description. I believe the phrases you have used are pervasive and ubiquitous and you may have used the phrase homogeneous in terms of the fracturing throughout this reservoir. You're now indicating that there are areas which are more or less fractured than other areas.

A Oh, that's certainly true. We can see that in all the production data. We can see that geologically, as you've indicated.

Q Thank you, sir.

MR. STAMETS: Any other questions of this witness?

Mr. Kellahin?

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q So that I understand the question from Mr. Pearce, does pervasive in your definition equate with uniformity?

A It could -- it could certainly mean that in a -- in a general sense, at least as far as I'm able to analyze the reservoir from a geologic standpoint, and again, a lot of that analysis, you know, needs to be inferential and conjectural because of the lack of integrity in -- in, say, the normal formation evaluation methods, at least, you know, it would appear to me that the reservoir is -- is in a general sense highly conductive and uniform stratigraphically and structurally throughout.

Now there is that uniformity. There may be zones within areas within the reservoir, as we've seen since day one in the production data where the fracturing may not be quite as extensive.

Or we may have just missed these zones of higher capacity in the drilling of these wells; maybe the

boreholes just didnt penetrate or reach and communicate with these higher capacity zones of fracturing.

Q Let me ask you a question about the analysis of the gas/oil ratios that you plotted on one of your exhibits.

I believe you've identified for us an area in which we have higher capacity wells which have demonstrated higher gas/oil ratios in excess of 2000-to-1. We've got an area that's like that, do we not?

A We do.

Q Do we also have an area of low capacity wells which also have a high gas/oil ratio in excess of 2000-to-1?

A Yes, on a reported production basis we do have an area of that type.

Q So we don't see the gas/oil ratio problem confined to the high capacity wells in a particular portion of the reservoir?

A No, we do not.

Q Is there any geologic correlation to the gas/oil ratios whereby you can conclude geologically that the wells with the higher gas/oil ratio are confined to higher portions of the structure?

A I don't believe that's true at all. As I indicated earlier, it appears that the -- the development of

this higher GOR production is not specifically tied to the structural position in the reservoir.

Q If you'll take your structure map, which was the first display after Tab C, would you locate for us the Mobil well, I think it was the B-38, on which you examined a core analysis? Let's find out where that is.

A Okay, that particular well was in the southwest quarter of Section 4 in 24 North, 2 West.

Q Down in the southwestern portion of the pool?

A That's correct.

Q Now, would you locate for us the other wells within this display from which there is core information available? Where do we find those wells?

A The other well that I'm aware of within the area represented by this display is in the southwest quarter of Section 1, the Mallon Howard 1-11.

The other core point that I referred to is just off the map to the east in Section 11 of 25 North, 1 West.

Q If I can assume for the purposes of my question, Mr. Ellis, that the Mobil geologist is going to make a different conclusion from an analysis of the Mobil core. I think we can assume that for a moment. All right, if we make that assumption, and he comes to a different con-

clusion from that analysis, would that persuade you as a geologist that we ought to change what we characterize as a problem to being no problem at all?

A No, that wouldn't convince me at all.

Q What would it take you in terms of additional information in order to satisfy yourself that in fact the matrix portion of this interval is going to give you significant contribution of oil production for the pool?

A Before I'd want to make a summary statement concerning the matrix contribution in the reservoir, although I have very firm opinions at least at this point in time, I'd like to see a statistically more valid sampling of the reservoir made both areally in the reservoir, and as I indicated earlier along those lines, we are participating in a core to be taken by Mallon in the drilling of his well in Section 3 of our township, which I hope will buttress the conclusion that I have, at least at this point in time, that the matrix contribution is minimal.

Q If the matrix contribution is in fact minimal, what is your concern, then, about the way the pool is currently being produced? What impact does that have?

A The field as it's currently being produced from all of the production data I've seen and structural and stratigraphic studies I've made, and all of the pressure data that we've been able to analyze, the concern I

have is basically the rapid depletion of the reservoir drive mechanism, being the dissipation of the gas energy in this reservoir, and that problem needs to be addressed.

Q If the Commission approves Mr. McHugh's application and reduces the gas/oil ratio the production rates for a 90-day period, would that be a sufficient period of time to allow cores to be taken in order to provide additional testimony on this issue?

A We certainly hope that that should be much more than a sufficient time to get the core out of the Mallon well and we are prepared in the drilling of our additional pool wells, if in fact we go ahead with that, to take an additional core that should be able to address that problem in a final way.

MR. KELLAHIN: Thank you, Mr. Chairman.

RECROSS EXAMINATION

BY MR. PEARCE:

Q Just a couple more, Mr. Ellis, if I may.

I want to make sure I understand -- understood Mr. Kellahin's question and your answer when he asked you to speculate based upon certain assumptions with regard to what Mobil's witness would say and whether or not that would affect your view of the problem. That was the

same problem that you deferred to the reservoir engineer previously, wasn't it?

A No, it wasn't; not as I understood the question from Mr. Kellahin.

Q Looking, sir, at the January 1st, 1986, and July 1st, 1986, plots of wells with 2000-to-1 or greater GOR's, I notice that a cluster of three of those wells, the Boyt Lola 1, 2, and the Twilight 1, appear on both of those plots, is that correct, sir?

A Correct.

Q Do you know when those were drilled, sir?

A Yes. They were, I believe, completed, and I may have to defer to our engineer for this, last year or the year before. I can't give you an exact date.

Q Do you know what the initial GOR's on those wells were?

A From memory, and again I don't have the information in front of me, those wells had high GOR's, high initial production indicated GOR's.

Q Is it possible that that indicates that those wells penetrated the zone of free gas which we discussed earlier?

MR. KELLAHIN: I'm going to object to the question. It calls for a possibility; anything is possible. We talk to our witnesses in terms of reason-

able geologic probabilities. The question is inappropriate. I object to it.

MR. STAMETS: Will you rephrase the question in terms of reasonable geologic probability?

Q Is there a reasonable geologic probability that those wells encountered free gas or a gas cap, which we discussed earlier in the afternoon?

A That's certainly a possibility. I can update you as to those dates within which those wells were completed, if you wish.

Q Please.

A The Boyt Lola No. 1, 12-2-84.

The Boyt Lola No. 2, 1-10-85.

Twilight Zone No. 1, 1-21-85.

MR. STAMETS: What was the date for the Number 2 well, please?

A 1-10-85.

MR. STAMETS: Thank you.

Q And going back once again to the logs and cores on which you did the annotation of the log that we discussed earlier, did you attempt to do a shale correction on the log porosity itself?

A On the density log porosity itself?

Q Yes, sir. Understanding that --

A No, it was not.

Q In the course of your study of this reservoir, sir, have you attempted to calculate the possible storage capacity of the pervasive fracture system which you have discussed?

A No, I have not.

MR. PEARCE: That's all, Mr. Chairman.

MR STAMETS: Any other questions of the witness?

He may be excused.

I presume you do not have a short witness at this point?

MR. KELLAHIN: Mr. Chairman, that was my brief witness. That was as short as they get.

MR. STAMETS: Okay. We will recess the hearing until 8:15 tomorrow morning at the same location.

(Thereupon the hearing was in recess.)

(Thereupon at the hour of 8:15 o'clock a.m. on the 8th day of August, 1986, in Morgan Hall, State Land Office Bldg., Santa Fe, New Mexico, the hearing was again called to order, at which time the following proceedings were had, to-wit:)

MR. STAMETS: The hearing will please come to order.

Mr. Kellahin, you may call your next witness.

MR. KELLAHIN: Mr. Chairman, we'll call our next witness at this time, Mr. John Roe, a petroleum engineer with Dugan Production Company.

So that you can keep track of where we are, Mr. Roe will identify the balance of the exhibits in the package identified as McHugh Exhibit Three. There is a remaining section in that green booklet. Mr. Roe will discuss those two displays.

In addition, I'm going to hand you Exhibits Four -- I'm sorry, they're numbered Dugan Production Exhibits One and Two, so that now we will have McHugh exhibits, then have Dugan exhibits.

Exhibit Number one for Dugan is

Mr. Roe's work product showing the effect on each of the wells in the Gavilan-Mancos between current production and Mr. McHugh's proposed limitations.

The next exhibit is Exhibit Number Two, which will be a blue booklet of Mr. Roe's engineering displays.

JOHN ROE,

being called as a witness and being duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Roe, would you please state your name?

A Okay, I am John Roe.

Q Mr. Roe, by whom are you employed and in what capacity?

A I'm employed by Dugan Production Corporation in Farmington, New Mexico, and I'm their Engineering Manager.

Q Mr. Roe, for the record would you summarize your educational background and your work experience as a petroleum engineer?

A I attended New Mexico Tech and graduated

from New Mexico Tech in 1970 with a Bachelor of Science in petroleum engineering.

Prior to graduation I worked two summers with a major oil company.

Upon graduation in 1970 I went to work for Union Oil of California and worked with Union through 1982, through August of 1982.

During my employment with Union Oil I worked at various locations throughout the United States, predominately the Rocky Mountain area. The bulk of my experience with Union was in the Reservoir Department; however, while I worked for Union I also had training in the drilling and production and actually functioned as a drilling engineer and production engineer.

At the time I left Union I was the District Engineer in their Oklahoma City District Office.

I went to work for Dugan Production in August of 1982 and have worked for Dugan production since that time, basically providing all of the engineering requirements related to the operations of Dugan Production in the production of our wells and drilling and production of our wells for Dugan Production and on a consulting basis.

Q What involvement have you had as a petroleum engineer on behalf of Dugan Production Company with the wells drilled and operated for Jerome P. McHugh?

A Early in the development of the field Mr. McHugh didn't drill the discovery well but he was the operator of the first several wells in this pool, and Dugan Production served as agent for Mr. McHugh during the permitting, drilling, and completion of the majority of the 23 wells that Mr. McHugh now operates in the Gavilan-Mancos Pool area.

Q Would you describe for us, Mr. Roe, what has been your professional experience with the Gavilan-Mancos Pool?

A As a petroleum engineer, I was involved, as I indicated, in the majority of Mr. McHugh's wells from the permitting phase through the completion and production phase.

As a working interest owner in the general area, Dugan Production has an interest in several of the wells operated by other operators, so I've had an opportunity to follow the drilling and completion of those wells. I was involved in the original spacing hearing that resulted in the pool being temporarily developed on 320 acres. I've been involved in the hearing that resulted in the first northern extension of the pool, and I've been involved in the engineering and geologic evaluation committees that have had four meetings to date studying the area and specifically related to the problem that we're here today.

MR. KELLAHIN: Mr. Chairman, at this time I'd tender Mr. Roe as an expert petroleum engineer.

MR. STAMETS: Without objection the witness is considered qualified.

Q Mr. Roe, let me ask you to direct your attention first of all to Mr. McHugh's package of exhibits marked as Exhibit Number Three for the hearing purposes and looking at those exhibits, if you'll turn to the index tab marked D, would you identify for us the first display after the tab?

A Yes. This is a plot of reservoir pressure corrected to a constant datum of plus 370 feet above ground -- above sea level, and also reflected on this plot is the pool average gas/oil ratio. Both of the pressure and the GOR are plotted against cumulative production from the pool.

Q Are you familiar with the information that went into the preparation of this exhibit and can you attest to its accuracy?

A Yes, I was involved with the preparation of this exhibit and can attest to its accuracy.

Q All right. Now that you've identified the exhibit, would you explain what significance it has to you as a petroleum engineer?

A Okay. The primary importance of this exhibit is that it relates what we believe to be the bottom hole pressure performance in the area that -- predominantly in the Gavilan-Mancos Pool area, but also in the areas immediately adjacent to the Gavilan-Mancos Pool.

It presents pressure data from 18 wells that are -- or 19 wells and from five different operators.

It presents pressure data that indicates the pool is in communication from north to south and from east to west and it indicates to me that its production is increasing and in the latter months the monthly production is increasing. The rate of pressure decline is accelerating. This is to be expected in the production of any reservoir. The fact of pressure declining is not a major concern of mine. It's the fact that we're seeing an acceleration in the rate of pressure decline accompanied by, beginning in the early part of 1986, acceleration in the pool gas/oil ratio.

Q Do you have an opinion, Mr. Roe, as to whether or not the 19 wells depicted on this display are a representative group of wells that are characteristic of all the wells in the pool?

A Yes. In fact, we excluded some of the pressure data that we have available basically because it was redundant. It just added confusion to the plot.

Q Could you identify some of the wells that you've excluded from the display in order to come up with a typical or characteristic curve or plot for the wells?

A I -- there are -- we have pressure data as of right now -- there are 43 wells that have been completed in the pool and are ready to produce. Of those 43 wells we have pressure data from 31 wells. On this plot I've presented only 19. I -- I do not have immediately available wells that we've excluded but I could prepare a list.

Q Yesterday Mr. Lopez asked Mr. Ellis some questions about certain of the wells that had been plotted with gas/oil ratios. I believe one was the Gavilan Howard No. 1 Well. Have you utilized that well in preparing this gas/oil ratio plot?

A No, sir, we did not.

Q And why not?

A Primarily as a working interest owner in that well, from the date of first completion I've been concerned that there was communication between the Dakota and the Mancos. I myself have been convinced that it exists and I think recently the operator did repair that communication, which, the GOR from this particular well from the Mancos was high from the date of first production and I was not certain whether the high GOR was -- was the result of the communica-

or the fact that the Mancos actually had a high GOR from date of the first production, but because of the doubt we had, we excluded that data.

Q And what about the Gavilan No. 1 Well, that was also discussed yesterday, was that included or was that excluded from this display?

A We did not include the Gavilan No. 1 in this particular presentation, mainly because we do not fully understand the GOR performance of the Gavilan No. 1. It is clear in my mind that the high GOR, it has produced with a high GOR from the first completion. The GOR initially declined and then has later resumed an incline.

We excluded that because the Gavilan 1 is anomalous to the rest of the wells.

Q Can you identify for us, Mr. Roe, what the actual and what the adjusted gas/oil ratios are for the pool that you've utilized?

A Yes. During -- during June the pool average GOR, if you utilized the data reported by the operators on the C-115's, during June the actual production from the pool was 5436 barrels of oil per day, 8624 MCF of gas per day, for a poolwide average of 1586.

During June the Gavilan Howard No. 1 averaged 22 barrels of oil per day and 140 MCF of gas per day with an average GOR of 1148, which I might add is up

from May's GOR, and may was the first month that it produced with the communication corrected.

The Gavilan No. 1 during the month of June averaged 31 barrels of oil per day with 530 MCF per day at an average GOR of 14,600. Reducing the pool average production of 5436 barrels of oil per day for these two wells, the average pool production would be 5283 barrels of oil per day and reducing the gas production for these two wells, the average production would be 7954 MCF per day, for an overall average, excluding those two wells, of 1506 standard cubic feet per barrel, and that is the number that's plotted on our graph.

Q Let's look at the plot and have you show us what the gas/oil ratio was for January 1st of '86 and what the gas/oil ratio currently is so that we can see it on the graph itself.

A Okay. During January 1st of 1986 we -- and just as a matter of information, we have identified January 1st of '85 and January 1st of '86 for time reference on this graph.

The graph has cumulative production along the bottom and each data point is a month.

Q What is the significance of the area shaded in pink?

A The significance of the area shaded in

pink would be our feeling, it's our belief that this amount of gas, or the gas under this portion of the curve, is -- is -- I'm calling free gas. Now whether it was free gas in the reservoir initially or it is gas that has evolved from solution as reservoir pressure declines, we haven't made an effort to pinpoint that yet, but it is gas that would be -- result in a GOR above what we believe the solution GOR to be. We've indicated the two pieces of information that we have confidence in from fluid data in the Loddy No. 1, which is a unit well, or a pool well. We have, based upon pvt data that Mr. McHugh acquired, a GOR, a solution GOR of 588 standared cubic feet per barrel.

We also have indicated the initial solution GOR in the Canada Ojitos Unit, based upon a sample analysis provided by Mr. Greer, and that solution GOR was 488 standard cubic feet per barrel.

This would be -- show the range of solution GOR's depicted by the dark gray area.

Now, one thing that I didn't get my -- anser your question fully, Mr. Kellahin, the January GOR, that level was in the range of 1395 standard cubic feet per barrel and it's been fairly constant in that level since, oh, mid-1985. Beginning in January we see the increase in GOR up to its current level of 1500.

Q Do you as a petroleum engineer attach any

significance to the increasing gas/oil ratio from approximately January '86 to the current? In other words, is this a gas/oil ratio change that you would expect in this reservoir or in your opinion is this systematic (sic) of a potential problem in the way the reservoir is being produced?

A The fact that the gas/oil ratio is increasing is something that we would expect to occur as reservoir pressure declines, given the fact that the primary producing mechanism in this reservoir is solution gas drive.

Our primary concern is not the fact that the GOR is increasing, but it does suggest as the reservoir pressure is declining as we've depicted on this plot, that we are -- that we have approached the bubble point pressure and that we are now producing below the bubble point pressure.

Q Would you turn to the second page of the exhibits after Tab D and identify what that exhibit is?

A Yes. The second page is nothing more than a base map of the general area that we are involved with. We've outlined the pool boundary, the existing pool boundary of the Gavilan-Mancos Pool in the solid or the solid cross-hatched line, and we've also identified the extensions to that pool that are in -- currently being considered by the Commission based upon the wells that have been completed, and those are identified with the lighter dashed

line.

Presented on this plat, the only purose of giving this plat is that we have presented the 19 wells and the location throughout the reservoir of these 19 wells that we have plotted pressure data from, and again, our primary emphasis is to show that we're trying to depict reservoir pressure representative north to south and east to west as much as possible.

Q Mr. Roe, I've had a gentleman count for me the number of wells on this display and he says that there are 9 as opposed to 19. Is there any significance to you in dislaying only the 9 wells as opposed to all the 19 wells in which you had the pressures and the gas/oil ratios plotted?

A Yes. The -- I intended to qualify the second pages that in a later exhibit that I will present, it does have --

Q The balance of the wells, then, are going to be on one of your other exhibits?

A Yeah, they'll be on an exhibit that I have prepared and for clarity purposes, like I say, we start out with 31 wells. We are trying to present a picture of the reservoir in as clear a manner as possible. The other data is more or less redundant but the balance of the 19 wells will be on an exhibit that we'll get to in just a

minute.

Q All right, sir, at this time let's turn to what is marked as Dugan Production Corporation Exhibit Number One, which is on legal paper and consists of four pages.

Does this document represent your work product, Mr. Roe?

A Yes, it does.

Q Would you identify that exhibit for us?

A Okay. On Dugan Production Exhibit One we have a tremendous amount of information that is tabulated for the 59 wells in the pool that have been drilled and completed and are either on production or ready to produce.

In addition we have information on the one well in the pool that is drilling.

We have presented information for 13 additional wells that have had locations cleared, staked, and are near the stage of being ready to start drilling operations, bringing --

Q What is the source of the information utilized, Mr. Roe?

A Predominately the records at the Oil Conservation Commission, both from the well files or production information is our -- our source.

Q How many operators have you tabulated on

the exhibit?

A On the exhibit we have a total of ten different operators. I've -- in the study area that is the Gavilan-Mancos or immediately adjacent, we also have 5 wells that are tabulated that are immediately adjacent to our area but within the West Puerto Chiquito Mancos Pool.

So a total of 11 operators counting BMG.

Q All right, sir, if you'll take any one of the wells and operators you would like and start from left to right and have you explain to us how to understand the exhibit.

A Okay. For -- just for simplicity only, on page one under Mallon Oil, I'll choose the Fisher Federal 2-1. Again there's nothing to be pointed out on this well other than -- than it is a well that will provide an explanation on how this table reads.

The Fisher Federal 2-1 is located in Unit A of Section 2, Township 25 North, Range 2 West.

It was completed on June 16th of 1985, and as of July 1st, 1986, it has a cumulative production of 99,375 barrels of oil, 54,196 MCF of gas, and I've taken those two numbers and converted it to what I consider a reservoir voidage, an effective voidage from the reservoir, of 137,138 reservoir barrels of volume.

During June of 1986 this well did average

455 barrels of oil per day; however, -- well, 455 barrels of oil per day, 576 MCF per day, and did produce with a GOR averaging 1265 standard cubic feet per barrel.

The numbers presented under these three columns generally are the actual production that did occur during June. The only times that that is not the case is if June's production was anomalous, either low or high for some reason, or the well is not producing during the month of June but is completed and ready to produce.

In those instances where June's production is not actual, I've indicated those with a small letter "e" indicating that I've estimated it based upon the best information I have available, which is either production in the previous months or my estimate of the potential of that well, if it's a particular -- is one of the 16 wells that are completed but not on production.

I've taken the June production or potential production and converted it to a voidage volume in reservoir barrels per day. This particular well voided 1177 barrels of volume per day during the month of June.

The last three columns on this tabulation are an effort to present what I think the impact on each well will be if the Commission approved Mr. McHugh's application to put an allowable restriction of 200 barrels of oil per day and a GOR restriction of 1000 standard cubic feet

per barrel.

This particular well would be reduced from a daily rate of 455 barrels of oil per day to 158 barrels of oil per day. The little subscript "r" indicates that it -- this particular well, because its GOR exceeds 1000, will be further restricted by the GOR to 158 rather than the 200 barrels of oil per day that we're asking for.

The 200 MCF would be the maximum permissible gas production under our requested allowable reduction.

The 158 barrels of oil per day and 200 MCF per day converts to a reservoir voidage of 409 barrels of volume per day. This basic information is presented on every well in the pool.

Q Let's turn to page two of the exhibit and look at the subtotals under Mr. McHugh's production, and if you'll look at the reservoir barrels a day under the June '86 production number, you get 10,492?

A Yes, sir.

Q And if the Commission adopts the proposed reduction, what will be the change in Mr. McHugh's reservoir barrels a day?

A His voidage would be reduced from the 10,492 to 5237 reservoir barrels of volume per day.

Q And we can find that for each of the

operators listed on the display by making the same comparison to see what the change is for each operator?

A That is correct.

Q Let's turn to the last page and look at page four about midway into the exhibit, it says "Total Gavilan Pool area". CAn you identify for us what the change will be on a barrels oil per day basis for the pool?

A Yes. During the month of June the pool did or had potential to produce 8188 barrels of oil per day. Under our proposal the pool potential production from wells, from the 59 wells that are completed and ready to produce, would be reduced to 4936 barrels of oil per day.

Q And looking at the same line, if you move over to the voidage number for the reservoir barrels a day in June of '86, will you make a comparison in that number to the voidage number if the proposed change is adopted?

A Yes. During the month of June with the production level that did exist or had the potential to exist, we had reservoir voidage of 25,993 barrels of volume per day. That, under our proposal, would be reduced to 14,143 reservoir barrels of volume per day.

Q Below that number you listed BMG Drilling Corporation and their wells in the study area.

A Yes, I have.

Q And then the total study area would

include, then, the Benson-Montin-Greer wells?

A Yes.

Q Mr. Roe, in your opinion is there a reasonable basis for the proposed reduction by Mr. McHugh in the gas/oil ratios and the producing rates?

A Yes, we are making an effort to reduce the reservoir voidage which is currently at unacceptable levels or at the levels that it is currently at it is providing a rate of pressure drop that we feel is fixing the number of days that this reservoir will continue to produce.

We have made an effort to buy some time to evaluate several possibilities of -- of improving the recovery from the reservoir and improving the overall economics from continued operations in the reservoir.

Our proposal, as evidenced by the bottom line of the total study area, would basically reduce the voidage in half from its current level, resulting in some additional time that we won't have if -- if we aren't granted a reduction in allowable.

Q Do you have an opinion as to whether or not the impact of the proposed McHugh reduction has been allocated among the operators in an equitable way?

A Yes, I do.

Q For example, let's look at the McHugh interest. What percentage of the June '86 production does Mr.

McHugh have in relation to the pool production? Have you made such a calculation?

A Yes, I have.

Q And what is that percentage?

A During June, based upon the total study area production, which does include the five Canada Ojitos wells, Mr. McHugh's oil production accounted for 39.7 percent of that total.

Q And under the proposed change what percentage of the pool production does Mr. McHugh have if the change is adopted?

A He will realize a slight reduction to 37.5 percent of the total pool production.

Q Mr. Roe, let's turn to your Exhibit Number Two, which is the package of information in the green folder -- sorry, wrong color, blue folder.

So that I don't have to ask you the same question on each display, Mr. Roe, is the information depicted in your Dugan Production Corporation Exhibit Number Two prepared by you or compiled under your direction and supervision or in the absence of that, have you examined this information and satisfied yourself that it is true and accurate to the best of your informatio and belief?

A Yes.

Q All right, sir, let's turn to the first

display in the package of exhibits. It's on a bright yellow piece of paper. Would you identify that for us?

A Okay, this started out to be -- there's two pieces of information depicted on this, this particular graph.

We've taken a graph that Mr. Greer has prepared for his Canada Ojitos Unit, which is immediately adjacent to our pool to the east. Utilizing fluid data that he has accumulated during the past 25 years of production at the Canada Ojitos Unit he has confidence that if solution gas drive were to be the sole production mechanism, this graph presents the pressure performance and GOR performance that we could expect given the fluid properties, the relative permeability properties that do exist in the Canada Ojitos Unit.

We have superimposed upon this graph the actual pressure performance and the actual gas/oil ratio performance that has occurred to date with the production of approximately 2.3-million barrels of oil from the Gavilan-Mancos Pool and immediately adjacent study area.

Q What conclusions do you draw or opinions do you reach based upon an analysis of the information on this plat?

A Based upon the plat it appears to us that there is enough similarity between reservoir pressure per-

formance and the gas/oil ratio performance that we -- we feel comfortable that it gives us some predictive guidelines as to what the future holds in the Gavilan-Mancos Pool area.

Q If production continues at its current rates and as you may anticipate by the addition of production from wells already completed, can you make any predictions as to what is the likely force of these various curves?

A Yes. As indicated on this -- this curve, now, because I believe that we initially started production above the gas -- above the bubble point pressure, the gas/oil ratio curve for the Gavilan area, even though I've plotted it as it has occurred, the production that did occur above the bubble point probably should have been excluded from our cumulative production. This would result in you actually shifting our gas/oil ratio curve to the left because this curve becomes important only after you go below the bubble point.

So what that does to our gas/oil ratio is it puts it a little more on track with the predicted GOR performance curve and if that is correct, we should expect a pretty dramatic increase in gas/oil ratio in the very near future.

Q What's the explanation, then, for why the gas/oil ratio deviates from the predicted curve?

A The -- again, we -- we're not totally positive because we're right in the midst of trying to resolve some of these matters, but any production that occurred above the bubble point pressure, if such production did occur, and I believe it did, would -- should have been excluded from our cumulative production that we used in plotting the gas/oil ratio data against and had you excluded -- had we excluded that, it would have brought our GOR curve more in line with the predicted GOR curve.

Q Let's go to the next display. Would you identify that for us?

A This is the production -- this particular graph presents the reservoir pressure information and my estimate of reservoir voidage that has occurred between the time period August, 1984, through June of 1986, and on this graph is presented the balance of the pressure data from the 19 wells that were depicted on our original map, showing the area from which we've sampled reservoir pressures.

Q This is the exhibit that you referred to earlier when I asked you about the nine wells on the prior display.

A Yes, this is.

Q All right, sir. Would you explain this exhibit for us?

A Okay. On this particular exhibit there

are 19 wells; 11 of them operated by Jerome P. McHugh; 3 by Meridian; 2 by Mallon Oil Company; 2 by Mesa Grande Resources; and 1 by BMG in the Canada Ojitos Unit.

As I've indicated, we've plotted what we believe the reservoir pressure performance to be depicted by these 19 wells. Along with that I've plotted what I think the voidage from the reservoir that was created by the barrels of oil each month. This would be the bottom line that we've identified as oil voidage. The area under the curve would be the actual volume that was voided.

For instance, during May the oil voidage was 57,000 -- approximately 57,000 reservoir barrels per month -- or per daya, and the -- the -- during the month of June this voidage is estimated to be 8500 reservoir barrels per day.

In the light shaded area is an area that would represent the amount of voidage in addition to the oil production that would occur. All of the gas that we produced was not in fact a free gas phase in the reservoirs but was evolved from oil in the reservoir because we're below the solution GOR, below the bubble point pressure, all gas comes out of solution resulting in an oil shrinkage. That would be the reservoir voidage that is depicted in the light blue and during the month of May that interval was -- the reservoir voidage total was 7000 barrels and if that was the

reservoir voidage during June, the voidage from the reservoir was 9900 barrels of volume per day.

Now depicted as the upper curve and shaded darker blue would be the upper limit of what the voidage would have been if we consider that all gas produced above our solution GOR that we're using for the Loddy No. 1, which was 588 standard cubic feet per barrel, if we consider all gas above that level as free gas when it left the reservoir, that would be -- result in a higher voidage than had the gas actually come out of solution resulting in an oil shrinkage.

The levels of reservoir voidage if the gas was treated as a free phase in the reservoir rather than a dissolve phase, would have been during May 11,016 reservoir barrels per day and during June that voidage would have been 17,163 barrels per day.

The other item of interest, and it's indicated right above the maximum voidage figure for each month, would be the well count that represents the number of wells during any one month that did have production and for instance, during the month of May, 1986, there were 38 wells that did have a production reported, not necessarily for the whole month but the month they did have some production.

During the month of June there were 43 wells that had reported production, and again I will stress

that of the 59 wells that are completed and ready to produce, there are 16 wells that are not depicted on this graph.

Q Let's take some examples on the display, Mr. Roe, of individual wells so we can see what's occurring. Let's start off with the Loddy No. 1, Mr. Roe, and give us a moment to make sure everyone's found that on the -- on the display. It's identified, I believe, in the right margin of the display towards the middle of it.

Have you found that, sir?

A Yes, I have.

Q Would you describe for us what's occurred with its production and let's pick out some dates.

A Okay, the first month that we have data plotted for the Loddy was during the latter part of February, 1986.

Q All right, let's start right there and describe for us what's occurred with that well.

A Okay. What we've done in the Loddy, and by "we" Mr. McHugh is the operator, is we've measured pressure in a well that is currently shut in and really short of the minor amount of production that occurred during the completion and clean-up phase of that well. This well has never produced. We've utilized it as a pressure observation well and we've presented the information on this graph to

show that we feel it is displaying or we are measuring a reservoir pressure that is in line with what we feel to be predominant or existing throughout the pool area and in the absence of production of the Loddy 1 being utilized as a pressure observation well, that pressure has declined and I don't want to get exact numbers off of this graph because I have some very detailed information in a later exhibit that we'll go over, but we do want to point out that this well is presented on this graph, it's declining from a pressure of approximately 1625 psia and this is at a -- all of these pressures are at the same datum that we've selected for the reservoir. It's declined from a little over 1600 psia down to a pressure that we measured in the latter part of July of approximately 1570 psia.

Again, the numbers I've given you -- or 1470, I'm sorry -- the numbers I've given you are only approximate. We have some exact and very detailed informaton we'll go over just shortly.

Q The point is I want you to identify for me some key wells and tell me generally what is occurring and then we'll get into the specifics of the pressure information.

Let's, before we leave the Loddy well, though, tell me if there's anything on the display to show me what has occurred in that well even prior to its first

production.

A Okay, one of the important and probably the primary reason that we're here today is that the initial pressure in the Loddy No. 1, as I indicated, was approximately 1630 psi. This is substantially below the pressure that was, say, in the reservoir the early part of August as measured in the Native Son No. 2 at a level of 1750 psia.

Q I believe that's August of '84, is it not?

A Yes, during August of '84. We -- we again have presented the Loddy on this graph. You can see that the pressure in this well initially in the completion of the well, in other words, this well did encounter a pressure that had been reduced from higher levels that we had measured earlier in the reservoir, and you can also see in the absence of production the pressure that was measured in the Loddy has also declined in this well.

This well is located in the northwestern part of the study area and as I've indicated, we have some very detailed information on this in a later exhibit.

Q Let's turn to the Hill Federal No. 2 Well, Mr. Roe, and have you go through the same question and answer with me with regards to what has happened with this well. You don't have to give me the exact pressures but just give me a general guideline on what's occurring.

A Okay. The Hill Federal No. 2 is basically the same thing. The initial pressure in this particular well was measured during the latter part of February. It was at a level that was again lower than we anticipated for virgin reservir pressure, indicating that there had been some pressure decline at this point in the reservoir and a very minor amount of production has occurred in the Hill Federal No. 2-Y simply because it is not connected for gas sales, so the operator is making an effort to conserve reservoir energy by not venting unnecessarily the gas.

In the absence of production, or a very minor amount of production, pressure in this area of the reservoir is indicated to be declining in recent months, mainly beginning in the early part of March, has exhibited a pretty dramatic increase in the rate in which pressure is declining.

Q Let's go to the Dr. Daddy-O, which is identified in the top of the exhibit towards the middle and describe for us on the exhibit what's occurring with that well.

A Okay, again, the Dr. Daddy-O, the first pressure that we have was reported during the early part of May in 1985. Again it, the initial pressure that we recorded in the Dr. Daddy-O was at a level that was lower

than we had predicted for had the pressure been in fact virgin.

In the absence of a significant amount of production the Dr. Daddy-O is again exhibiting a pretty dramatic decline in reservoir pressure. Rather than getting specific pressures off of this particular graph, we have a later exhibit that we do have detailed, specific pressure information that I will go over.

Q If you'll look at the righthand margin of this display and if you follow up from the June 1st, '86, entry, if you go up into the blue area, there's a blue shaded area. Across the top of that area is the number 43. What does the number 43 mean?

A That is the -- represents the number of wells that during the month of June had a production of some sort.

Q What is the significance of this shaded blue area?

A The -- that is the real point of our concern, that as the amount of blue on this graph becomes greater and greater, the amount of reservoir energy that is leaving the reservoir is increasing in the form of a free gas phase, and because our primary production mechanism is solution gas drive, the gas, it's important. In the interest of maximizing recovery from the reservoir we must util-

ize as efficiently as possible the indigenous gas.

Q During this period you have demonstrated a change in production with more free gas, as you've identified it, being produced. Do you see, or what affect do you see on the production of the wells depicted on the display? What's occurred with the lines of pressure?

A Okay. It's my -- my belief that you can draw, if you just draw some rough average trends through all this data, you can pick up a pretty dramatic steepening of that trend that you would establish beginning in March of 1986.

This also corresponds about the time that we are seeing the well count increase. By well count, in other words, there's been a lot of wells completed for some time but for some reason or another we have not been able or the operators have not been able to get the wells on production, so as these wells come on production along with the fact that the pressure in the reservoir is approaching a level that I believe, or has approached the bubble point pressure, the accelerating production rate by wells coming on plus the amount of gas that is produced in a free phase, because we have gone below the bubble point, that is resulting in an acceleration of the reservoir voidage and that acceleration is resulting in a dramatic increase in the amount of free gas that we're -- we're seeing produced,

which is what we would expect based upon our predicted GOR performance.

Q You have identified 43 wells. How many additional wells are ready to be placed on production in this pool?

A There are 16 additional wells that are ready to produce.

Q Let's go to the next display. It's on green paper. Will you identify that for us, Mr. Roe?

A Okay, this first -- this is the first page of -- of four green pages and it will basically, the purpose of this page is to depict the well locations of -- of several wells within the study area, or three wells within the study area, and two wells in the West Puerto Chiquito Pool, the Canada Ojitos Unit, that were involved in the pressure interference test involving three operators, being BMG, Mallon Oil Company, and Dugan Production. This is a test that was conducted, authorized by the Oil Conservation Commission order, and the test began in December of 1985 and was conducted on a cooperative basis between the three operators involved.

Q Let's look at the exhibit in general and have you tell me what you have concluded from an examination of the interference test.

A Okay. The primary conclusion that I have

reached from the information that we recorded over an approximate four month period is that this particular area, and let me identify more exactly the wells that were involved in this interference test.

The primary pressure observation well was the Canada Ojitos Unit No. 29, which we've indicated here to be E-6.

The Canada Ojitos Unit No. 31 to the north 2858 feet is identified in this graph by the operator's designation of N-31.

The E-6 is located in Unit E of Section 6, Township 25 North, Range 1 West.

The N-31 is located in Unit N of Section 31, 26 North, 1 West.

The Dugan Production Tapacitos No. 4, which is located 3848 feet to the northwest of our primary pressure observation well, Dugan's Tapacitos 4 is located in Unit O of Section 36, Township 26 North, Range 2 West.

Mallon Oil had two wells that we feel we obtained some information during the pressure interference test. The closest well would be their Howard 1-8, which is located 1751 feet west. This well is located in Unit H 8 of Section 1, Township 25 North, Range 2 West.

The second well that we feel we had some interference with is their Howard Federal 1-11. This well

is located in Unit K of Section 1, Township 25 North, Range 2 West.

We -- these four producing wells and one pressure observation well comprised the pressure interference test. There may be even additional wells. These are wells that we've made some effort to try to account for as causing some of the responses that we measured in the E-6 Well.

Some of the conclusions that I -- I feel are indicated from this graph is that these, the four wells, specifically the Howard 1-8, Dugan's Tapacitos 4, the N-31 and E-6, I think the data clearly indicates a direct communication between all four wells and this would be a true example of the drilling of unnecessary wells to develop a fixed amount of reserves.

Basically one well in the center of this location could have produced --

MR. PADILLA: Mr. Chairman, I'm going to object. This is not responsive and not within the scope of the application.

I would move to strike Mr. Roe's last testimony concerning the spacing. This is a collateral attack on the spacing order (inaudible).

MR. KELLAHIN: Mr. Chairman, I'll be brief. I believe it's relevant. The point of the

inquiry is there's an interference test. Mr Roe's testimony is, and will be, that there's communication between the wells that's indicated in the interference test and he has said there's too many wells.

The next question is, what do we do with too many wells. His testimony will be that you reduce the producing rates in order to preserve the reservoir energy and that is the case we're here today to hear.

MR. STAMETS: We'll overrule the objection and allow Mr. Roe to continue.

A Okay, I'll -- I might just comment that all of our information is leading to a demonstration that we have made a real effort to identify a communication in the reservoir that appears to be rather extensive and much better than we originally anticipated. My exhibits are intended to support that statement and the pressure and GOR information we've depicted indicates a need for modifying our development practices in the reservoir almost immediately and this is where we're all leading to with my exhibits.

Q Let's turn to the specific information, then, from the interference test and have you draw our attention to the specific facts that you believe support your conclusion.

A Okay, the second green page of this exhibit is a presentation of what we measured reservoir pressure

in the Canada Ojitos Unit E-6 with a very sensitive -- and all of the pressure presented on -- in my exhibits will -- have been recorded with a GRC Bellows pressure bomb. This bomb is manufactured in a manner that it's sensitivity is far superior to a normal Amerada pressure bomb and it does have an accuracy to .01 psi and we feel, based on some of our graphs, we have verified that accuracy.

Q I'm sorry, I missed. What is the sensitivity of this pressure bomb?

A It is able to measure minor pressure differences as small as .01 psi.

Q And the typical Amerada pressure bomb as used in the industry has a sensitivity range of what?

A Well, dependent upon the element size that you use in your bomb, it would range anywhere from 2 to 6 psi. It's normally .2 of a percent of the element rating.

Q Have you satisfied yourself as a professional petroleum engineer that the pressure bomb instrument used to obtain this pressure for the interference test is one that's reliable?

A It is and I hope to point that out in some of our exhibits, the reliability and accuracy of the pressure bomb.

Q All right, sir. Well, let's look at that second page of the green exhibits, and if you'll look at the

bottom of the chart that says days in January of '86, if you'll look between day 13 and 15 and move up to the column, there's a space between where the circles start and stop?

A Yes, sir, there is.

Q What's occurring?

A Okay. Identified on this graph and all of our presentations we are having to remove the bomb from the hole periodically, and so what's identified or pressure that's presented days, January 10th through the early part of January 14th, was Run No. 9 that Mr. Greer made with his pressure bomb. He pulled the bomb from the hole, recovered the data that was recorded during this time period, reran the bomb on Run No. 10 to the same depth level that he had the bomb landed at on No. 9.

When he got the bomb to that level Run No. 10 recorded the data during the time period the latter part of January 14th through the early time of January 20th, and the important thing here is the gap that you see between the two runs, the last pressure measurement on Run No. 9 and the first pressure measured on Run No. 10, when the bomb was placed back in the hole it measured a pressure that we would have anticipated had we predicted or projected the trend indicated in the latter points of Run No. 9.

In fact, this particular, when we got the bomb back in the hole and placed at the proper depth, is al-

most exactly on that trend, less than a tenth of a pound difference.

Q Is there a special phrase that is used in your profession to describe that incident with the bomb?

A Well, it -- it's slipped my tongue, but it reflects the repeatability of the -- of the bomb and it's --

Q How about repeatability?

A That's -- that's it.

Q All right, sir, anything else on this display?

A Yes, there are several other items that I'd like to point out.

We -- we basically have the same indication of repeatability between Runs No. 10 and 11 depicted on July -- or January 20th. The -- I've identified trends on this curve, say, during the early time period, which is the data in the left of the curve, we have a rate of pressure decline that's averaging/.15 psi per day. I ask you to remember, this is a well that is not producing and has not produced, so the pressure decline we're observing in this well is the result of production occurring somewhere else in the reservoir; not this well. And that pressure is declining at a rate of 1.15 psi per day early in the life.

In the latter part of the day indicated

to be January 16th, we see that trend slowing to a rate of 0.53 psi/day Now, all we're doing to measuring the response to pressure performance in this well and we look around the well to see what possibly could have caused that rate of pressure decline to slow from one, approximately 1 psi per day to about a half a psi per day.

It's interesting to note that on January 17th, in fact, it looks -- it appears that maybe during the 16th Mallon Oil shut their Howard Federal 1-11 in.

For instance, on January 14th the 1-11 was averaging 680 barrels of oil per day. On the 15th it averaged 329 barrels of oil per day. On the 16th it averaged 122 barrels of oil per day. And on the 17th it had no production. It was shut in from the 17th through the balance of the month.

Q How far is the Mallon Howard Federal 1-11 Well from the pressure observation well, the E-6 Well?

A Okay, the 1-11 is, and this information is on the first page of this exhibit, but it is 4757 feet to the southwest.

Q And in your opinion the pressure bomb in the observation well is registering changes in the way the Mallon Well is being operated and produced?

A That is my belief at this time because of all of the other production in the area there were no signi-

ficant changes. The Mallon Howard Federal 1-11 is the only well that had a change and so it is my belief that that is what caused this reduction in pressure.

And I might just add, if that is the fact, this would indicate that at a distance of 4757 feet away within the same 24-hour period we've detected a pressure pulse created and this would indicate a minimum drainage radius of -- that would correspond to somewhere between 1600 and 2100 acres per well.

Q All right, sir, is there anything else on the second page of this presentation that you'd like to direct our attention to in terms of support for your opinion that the pressure information includes excellent communication between wells?

A Yes. The other item of interest that we need to not lose sight of is that the initial pressure that we indicated here was 1711 psi. We, during the nine days of data that you have, or the fourteen days of data you have presented here, the pressure in this well was reduced by 9 psi for an overall average of .64 psi per day.

Again I want to stress that there was no production and there was a 9 pound drop in the pressure at this well in a timeframe that was fourteen days.

Q All right, sir, let's go to the third green page and have you identify that display and explain

its significance.

A Okay. This, the third display presents a continuation of the monitoring of pressure in the Canada Ojitos Unit Well E-6. This well is, again, is still shut in, has not produced and the first piece of information or the data presented on this graph is bomb Runs No. 13 and 14 that occurred between the time February 3rd through February 14th.

The -- one of the important things that we should note is that the initial pressure we measure in the early part of -- the latter part of February 3rd was 1698 pounds, approximately. This is down from 1702 psi, which was the last pressure we measured on Run No. 11, which was presented on the previous graph.

Again pressure during the time February -- January 24th and February 3rd, a continued drop in this well in the absence of production from this well.

Q I direct your attention down to days 13 and 14 in February. If you'll move up from those days, there's a little bump in the information depicted on the display. What's occurred there?

A This is probably one of the -- among one of the most important pieces of information we feel we recorded during this pressure interference, other than the fact we are seeking pressure decline in the absence of pro-

duction.

As it turns out, and this was a planned observation, we intended to have the pressure bomb in the E-6 while Dugan Production stimulated the Tapacitos No. 4, which again is located 3848 feet to the northwest. Our stimulation of the Tapacitos No. 4 comprised or consisted of pumping 2860 barrels of water into the formation as the initial fracture stimulation and we did this at approximately 70 barrels a minute.

The deviation from established decline in pressure, at the particular time and for a little over 2-1/2 days prior to us doing our frac job, the pressure in E-6 was declining at .77 psi per day. We feel that within a very short period of time our pressure pulse that we introduced into the reservoir with our frac job was measured at the E-6 and did result not only in a deviation from the decline that was established but also resulted in an increase in reservoir pressure.

This particular well, it's admittedly a very small pressure increase but with the bomb we had in the hole it's certainly within the resolution of the bomb and the accuracy of the bomb.

Q How far away are the observation well and the Tapacitos No. 4 Well?

A The radial distance, the distance between

the two wells is 3848 feet. If we convert this to a minimum distance that we are able to have pressure communication between wells and say that this could correspond to a minimum drainage radius, that would relate to a drainage radius that would exist somewhere between 1068 and 1400 acres per well.

Q Give us some perspective, Mr. Roe --

MR. PADILLA: Mr. Chairman, if I may, I'm wondering where we're going with this type of testimony. It's the same type of objection I made earlier on the drainage, which seems to go to a spacing change and unless Mr. Kellahin can tell us how this information is relevant to the allowable, I'm going to object.

MR. KELLAHIN: Mr. Chairman, I'm sure the suspense is killing all of us. I assure you that Mr. Roe will get to the point. As I told you earlier, the mechanics of how the reservoir is operated in specific light of its characteristics is the essential underpinnings for the reduction in producing rates as a temporary method to conserve the reservoir energy in this reservoir.

Simply because this same information can be utilized for the spacing hearing in March of '87 doesn't mean it's not admissible now for the very purpose that we intend it.

MR. STAMETS: The objection is overruled.

Q To give us a way to grasp and understand the impact of the interference information, Mr. Roe, do you have an opinion as an engineer whether or not if you laid a pipeline on the surface between the observation well and the Tapacitos No. 4 Well, whether you would have gotten a response any quicker?

A Well, it would depend upon the size of the pipeline and the rate we were pumping down that line, but the normal lines that we would lay and considering that this line would be approximately three-quarters of a mile long, I would say this would indicate at least as direct a communication as you would have had you had a line laid on the surface and trying to pump 70 barrels a minute down that line.

Q All right, sir, let's turn to page 4 of the series of green displays and have you identify that display for us.

A Okay. This graph is the continuation of our monitoring of pressure during this pressure interference test. Again the pressure bomb is located in the pressure observation well, the Canada Ojitos Unit E-6. Again the E-6 has not produced at all. It has been continually utilized as a pressure observation well.

The pressure presented on this graph occurred between the period of March 31st and through the

period of April 11th. The important aspect, and again this was a planned test, we wanted to observe the pressure response that would occur at the E-6 while we were stimulating or while the north well, or the well to the north, the Canada Ojitos Unit 31, which is identified on our map as N-31, was stimulated.

This particular well was stimulated with about 10,000 barrels of water and was stimulated at about 115 barrels a minute.

This stimulation was done on April 1st and we believe is what resulted in the pressure increase that we observed initially showing up within a thirty minute period and resulting in a 6.6 pound pressure increase in the pressure observation well.

And this is the pressure increase that is indicated on the date of April 1st.

Q All right, sir. Is there any further point you'd like to draw our attention to on this page before we leave it, Mr. Roe, that supports your opinion on this matter?

A Yeah, there is one other item of information. Again beginning in our pressure interference test December 15th of 1985 and this would be the last piece of information I have in the Canada Ojitos E-6 that I intend to present at this hearing.

The initial pressure that we measured December 15 was -- the pressure we measured on April 11th has been reduced by a total of 76 pounds and I just want to stress the 76 pound pressure loss resulted totally from no production in this well. It resulted simply from production somewhere else.

MR. KELLAHIN: Mr. Chairman, Mr. Roe has been testifying for more than an hour. I wonder if we might take just a few minutes?

MR. STAMETS: We'll take about a fifteen minute recess.

(Thereupon a recess was taken.)

MR. STAMETS: The hearing will please come to order.

Mr. Kellahin, I presume you're not through with this witness.

Q Mr. Roe, at this time I'd like to direct your attention to the next page of your exhibit. This is on the white paper following the series of green sheets.

Would you identify and describe that exhibit?

A Yes. This is a reproduction of a typical printout of the data that is recorded in this GRC bomb and

our purpose for including this is to, one, show that the way the data is presented and make an effort to -- because generally pressure data historically is recorded with a pressure bomb that is much less sensitive and requires a manual observation of a pressure chart, that chart being recorded with a stylus and a little actual etching of a line on that charts. There is none of that in this pressure bomb. The data is all recorded electronically and in order to have this presentation it's dumped from a recording device in the bomb that is lowered to the depth of a pressure measurement and it's basically an opportunity for introducing any error because of inaccuracy in your -- your ability, your eyeball to detect very minor pressures has been removed in the electronics of the tool.

This particular page, the second item of interest is to note the area that's bracketed. This is an approximate 10 minute interval that existed while we had the pressure bomb in the lubricator being -- preparing to run in McHugh's Dr. Daddy-O No. 1.

It's standard procedure by Mr. Greer's operator and on occasion Mr. Greer would loan his pressure bomb to other operators to run and under those circumstances a contract service might lower the bomb to the level that we're recording pressures. But each time we had the opportunity to verify a pressure that existed, for instance, when

the bomb was in the lubricator we took a dead weight test at the wellhead pressure. A dead weight test, this particular day on July 8th, prior to running the bomb in the Dr. Daddy-O, we measured with a dead weight tester 476 407 psia as being the pressure and you can see that this would correspond to the interval that's bracketed there of approximately 487 psia.

We feel that this is a very close agreement with the dead weight test device and this is reflective only of many instances that we verified the accuracy of the bomb when we had the opportunity.

Q When you look at the top of the exhibit there is some dated information and just above each column, in the center it says DWT, it goes on, and then says psig.

A Yes, sir.

Q What's the difference between that and psia?

A The dead weight tester is in -- the difference is the atmospheric pressure that is not measured with the dead weight tester and that the bomb that Mr. Greer has is calibrated to incorporate atmospheric pressure, so the bomb is reflecting pounds absolute and the dead weight tester is gauge reference.

Q Prior to the break you led us through the pressure information from the interference test up in an

area in the northeast portion of the pool.

Do you have information, pressure information, with regards to other portions of the pool?

A I'm sorry, Mr. Kellahin, I was distracted for a minute. Will you repeat the question?

Q Yes, sir. Prior to the break you led us through your opinions and conclusions concerning the pressure tests, the interference test up in the northeast portion of the pool.

A Yes.

Q Do you have other information, other pressure information, from another area of the pool?

A Yes, we do.

Q Is that depicted on the next page, this blue display?

A Yes.

Q Would you identify for us and help locate the well upon which this information is based?

A Yes, I will. On the blue page we have pressure presented that was recorded with this GRC bomb that was the same bomb we had earlier in the Canada Ojitos Unit E-6.

The Loddy No. 1 is operated by Jerome P. McHugh and it is located in Unit F of Section 20, Township 25 North, Range 2 West, and it is a well that's located near

the northwestern extremity of the pool study area and we're using this as evidence that we have -- well, this would be a pressure sensing point in the western part of the study area.

Q What opinions or conclusions do you draw from the pressure information obtained from the Loddy No. 1 Well?

A There are two pieces of information that I feel are important presented on this, this particular graph.

First off, the pressure we measured in the well upon initially placing the bomb in the well on June 7th, or I guess that's June 6th, and the pressure presented on the graph was recorded during the period of June 6th through June 10th of 1986, but the initial pressure that we recorded was approximately 1627 psia at the bomb depth and converting this pressure to a pressure that exists, to our datum level of a plus 370 feet above sea level, this represents a measured pressure of 1549 or 1550 psia and this is pretty much in line with what our field average pressure is indicated to be from an earlier exhibit that I had and it is also pretty much in line with the last pressure that we measured in the Canada Ojitos Unit E-6, which on March or April 11th was 1559 psia at our datum level of plus 370.

So the level of pressure in the reservoir

to -- in the area to the northeast in the area of our interference test, is the same general level of pressure in the northwestern part of the reservoir.

The second piece of information that is very important from this graph is the Loddy No. 1 other than a minor amount of production that occurred in the completion process of the well, this well has not produced and is during this period shut in. It has not produced prior to running the bomb and this pressure that is declining at an average of .85 psi per day is declining as a result of production in the -- somewhere else in the reservoirs.

The closest well that was on production during this period is McHugh's ET No. 1. It's located approximately 1600 feet away from this well, that being to the southeast.

There are other closer wells to this Loddy No. 1, but it's our understanding that all of the other wells were shut in during this period.

Q You've indicated for us a calculated effective drainage area for some of the wells up in that northeast study.

Have you calculated a similar effective drainage area for the wells involved in this pressure information?

A Yes, I have.

you have pressure data.

A Okay, the next well that we have information on that is presented on this yellow graph is Dr. Daddy-O No. 1, also operated by Jerome P. McHugh. This particular well is located in Unit C of Section 33, Township 25 North, Range 2 West.

Q Have you measured any pressure decline in -- well, let me ask you this.

What is the status of the Dr. Daddy-O Well? Is it a producing well or a shut in well?

A It is a shut in well.

Q Have you --

A At the time this pressure test was recorded it had not produced, other than a minor amount of production associated with the completion process.

Q Does the pressure information show whether or not the pressure has declined in this shut in well?

A Yes, in fact, this is an example of some of the most dramatic rates of pressure decline that we have measured in the reservoir. This pressure was recorded during the period July 8th of 1986 through July 15th of 1986, and during the first, during the period July 8th through July 10th, we've indicated that the pressure was declining at rates up to as high as .95 -- .975 psi per day.

During the period of July 8th through the 15th, the pressure declined a total of 25 pounds during this seven day period for an overall average of 3.6 psi per day.

Q How far away is the Dr. Daddy-O from the closest well?

A Okay, the Dr. Daddy-O is in the vicinity, and this well, by the way, is located in the southwestern part of our study area. It is in the vicinity of some fairly high withdrawals in the Gavilan-Mancos Pool.

The nearest well that was producing at the time we ran this pressure is Jerome P. McHugh's Native Son No. 3. This well is located approximately 800 feet to the southeast and the next closest well would be 4200 feet to the northeast and that would be the Full Sail No. 2, and that is approximately 4000 feet from this well.

Q Based upon the pressure data, Mr. Roe, and your study of this reservoir, what is your conclusion?

A Based upon the -- the fact that we have measured pressure throughout the reservoirs that appeared to be in communication with each other, the individual wells, the pressure throughout the reservoir is declining at pretty much the same rate. We feel that the reservoir is in pressure communication north to south and east to west. The well to well communication that we have measured and I presented on some of our exhibits indicates that we have excel-

lent communication between individual wells that are currently drilled on an established 320-acre spacing unit.

Q Based upon the engineering work you have performed and studied, do you have an opinion as to whether or not the Gavilan-Mancos Pool is one continuous, interconnected reservoir?

A Based upon the engineering data I have available, it's very clear to me that the reservoir is in good communication throughout.

Q Do you have an opinion, Mr. Roe, as to whether or not the pressure depletion occurring in the reservoir is occurring throughout the reservoir?

A Yes. The -- we have -- we've been making a real diligent effort, especially in new wells to observe initial pressure and in existing wells that are currently idle and not producing, we've been trying to use these as pressure observation wells and it's very conclusive to me that pressure is declining throughout the reservoir, including wells that -- that no production has occurred.

I, I did not mention it, but on the Loddy No. 1, we only presented a little bit of that pressure data. That particular well has never produced during the time period. Our initial pressure in that well was February 26th, '86, and we measured a pressure at our datum of 1599 psia and our last pressure was July 29th. We had a measured

pressure of 1474 psia. This well having never produced has had a pressure decline of 135 pounds.

Q Apart from that example, do you have an opinion as to whether or not the pressure depletion that is occurring is in fact occurring in wells or in areas of the reservoir that have not been produced in which there are no wells?

A Yes. I have an opinion on that.

Q Do you have an opinion as to whether or not increasing withdrawals have caused increasing rates of pressure depletion?

A Yes. The amount of pressure decline in the reservoir is accelerating as additional wells are brought on production.

Q Do you have an opinion as professional petroleum engineer with regards to the entire reservoir in it's relationship to the bubble point?

A Yes, based upon the production data and pvt data that we have available, early in the life of the production in this reservoir we were above the bubble point and we are now producing at a level that is below the bubble point.

Q What will be the effect of the continuation of production in the reservoir below the bubble point?

A As indicated on the first exhibit, in my

blue page, continued production below the bubble point will result in an accelerating increased gas/oil ratio. That in turn will result in an acceleration in the reservoir voidage that is occurring, and in my opinion will result, on the existing development of the reservoir, will result in a waste of natural reservoir energy on the part of a competitive operation.

Q Do you have an opinion as to what effect the additional wells that soon will be in a producing status, what effect those wells will have on increasing the rate of withdrawals?

A They will accelerate an already undesirable rate of pressure depletion and just make the currently bad situation worse.

Q Do you have an opinion as to whether or not the reservoir at this point has been over-drilled and whether or not the wells that do exist are draining more than 320 acres?

A Yes. It's my belief that --

MR. PADILLA: I'm going to continue to object on the same basis I have before.

MR. STAMETS: We certainly appreciate your objections, Mr. Padilla, and overrule them once again.

MR. PADILLA: As long as it's

on the record.

A We feel that the pressure data that we've measured and some of that information I've made an attempt to present here today very conclusively indicates that the reservoir has had more than an adequate number of wells drilled and under the existing spacing will require unnecessary wells to be drilled in the future.

Q What is your opinion, Mr. Roe, with regards to the proposal of Mr. McHugh to reduce the gas/oil ratio and the current allowables for the wells involved in this pool?

A Our -- at the current allowable of 702 barrels a day and a maximum GOR of 2000-to-1, individual wells are allowed to produce up to around a million and a half cubic feet of gas a day and 700 barrels of oil, 702 barrels of oil per day.

In order to be competitive with offset wells, it will be the practice to produce your wells at a rate that will result in the individual operators producing their allowable.

Mr. McHugh's intention of asking for an allowable reduction is simply an effort to slow down the currently undesirable rate of pressure depletion and as additional wells are brought on it will be an undesirable event that it will accelerate with additional wells coming

on stream.

So our sole purpose in asking for an allowable reduction is to by some time to on a cooperative basis with all operators involved determine an alternate method to develop in the reservoir other than our competitive 320-acre basis that we now have.

Q If current competitive practices continue based upon the current gas/oil ratios and the current allowables for the wells involved in the pool, do you have an opinion at this point of the anticipated remaining life of this reservoir?

A I do, and just in simple terms, if we can take an overall average of -- of one to one and a half pounds per day and the current last pressure that I indicated on my graph was about 1400 pounds, you're looking at somewhere between a straight line extrapolation providing the reservoir voidage does not increase at all, of somewhere between one and a half to two years of remaining life.

Q Mr. Roe, do you have an opinion at this point as to whether or not the current methods of operating and producing wells in the pool are ones that are effectively and efficiently being maintained in terms of waste of hydrocarbons?

A It's my belief that the existing spacing and the existing allowable is forcing operators to unneces-

sarily produce gas that is the primary mechanism of moving oil to the wellbores in the reservoir and it is also going to cause the drilling of unnecessary wells in order to adequately develop individual acreage and protect individual operators' correlative rights and prevent lease expirations that may or may not exist.

Q Do you have an opinion, Mr. Roe, as to whether or not this is the type of problem and issue that can be referred to a study committee and studied for the next six months or whether this is an issue that requires immediate action?

A The reduction in reservoir voidage already at a currently undesirable -- and I keep saying undesirable, it's at a level that doesn't give us much future time if we allow it to continue at the level it is, it is my belief that we need to reduce that level of voidage immediately and we're asking that this be done on a temporary basis because it's my feeling that most operators in the pool are aware that we do have a situation that warrants further evaluation.

We've indicated that on a cooperative basis we are trying to arrive at an understanding of what would be a better way to develop the reservoir, and we feel that allowable reduction is absolutely necessary in order to have sufficient pressure in the reservoir and minimize the

Q What is that number?

A If the ET No. 1 was the well responsible for causing this decline in pressure, which, again, this would be the closest well to the Loddy No. 1 that was on production, if this in fact was the sole production point resulting in a .85 psi per day decline, this would equate to a minimum drainage radius, that being 6800 feet, would equate to a minimum drainage area of somewhere between 3300 and 4200 acres per well.

I might mention, I've given two numbers for drainage area. The lower of the two numbers would be if we assumed the drainage area to be radial. The second number would be if I simply, which is quite common, assumed that we had a little, square box that the well was in the center of.

MR. LYON: What was that area again, please?

A It ranged from exactly 3335 to 4246 acres per well. I think I rounded those numbers off a little in my original statement.

Q Mr. Roe, do you have pressure data information from other wells in the Gavilan-Mancos Pool?

A Yes, I do.

Q Let's turn to your next display and have you identify and describe for us the next well upon which

amount of wells that are drilled unnecessarily.

On my first exhibit I indicated there are currently 13 wells that are planned and I'm almost certain there are several more that I don't have on my tabulation that are in some stage of planning.

Q Will the adoption by the Commission of the proposed temporary reductions result in the loss of hydrocarbons?

A No.

MR. KELLAHIN: Mr. Chairman, that concludes my direct examination of Mr. Roe.

We move the introduction of McHugh's Exhibit Three-D, being subsection D, and Dugan Petroleum Corporation Exhibits One and Two.

MR. LOPEZ: Mr. Chairman, first of all I would like to object or to join in the objection of Mr. Padilla with respect to testimony regarding the spacing nature of this case, and the implied unitization aspect of it.

With respect to the introduction of the exhibits, my only objection is that I think they were designed to magnify a situation as the McHugh camp sees it, and I know that the Commission will take it to its discretion and good judgment the (not clearly heard) of the exhibits.

MR. STAMETS: Are there any objections to the introduction of these exhibits?

They will be admitted.

For those who have objected, as I say, it's my opinion that the only way we could view the evidence which has been presented relative to drainage would be in relationship to the request for immediate action as opposed to any attempt to change the pool rules at this time, so I understand the nature of your objections but I think in this case what's been presented is important, perhaps, in a different way than we normally look at such (not clearly understood.)

Are there questions of this witness?

MR. LOPEZ: Mr. Chairman, if I might suggest, I think if we took a five minute recess it would save us more than five minutes later.

MR. STAMETS: All right, let's take about a five minute recess.

(Thereupon a recess was taken.)

MR. STAMETS: The hearing will come to order.

Mr. Kellahin, I've been sitting

up here looking at calendars and it looks as though the first opportunity we might have to continue this case would be to the 21st and 22nd.

I'd like you all to be thinking about those dates and checking on that and perhaps after we break for lunch we can determine whether or not those will be acceptable.

Mr. Lopez, I presume you have come up with a couple of questions during the break.

MR. LOPEZ: I can't take all the credit, Mr. Chairman.

CROSS EXAMINATION

BY MR. LOPEZ:

Q Mr. Roe, I'll try and ask my questions in the same order you presented your direct testimony.

I would ask you now to refer to McHugh Exhibit Number Three, Tab D and my first question is why did you only select 19 of the 43 actual wells and I know you stated that in your judgment they represented fieldwide production but my question to you is wouldn't having used the information available from all 43 wells have been representative of the actual reservoir characteristics?

A Yes. If we would have had pressure data from all 43 wells it certainly would have been more repre-

sentative. We were able to record pressure and have data available only in 32 of the 43 wells and so the information we presented here today, we started out with a plot that had all 32 wells on it but we felt that the difference between the 19 and 32, there was no new data added by adding all 32 wells and what happened was our graph became very difficult to read and determine what the real data was because of our mass of well data, which I think I indicated earlier we left off data that was redundant.

Q And referring to the 19 wells that you plotted on the second page of Tab D, or that were plotted, I think you stated that they covered the reservoir generally, but my question to you is how did you select these 19? Did you take into consideration the time they were drilled? Are they old wells or relatively new ones?

A The -- we took advantage -- the wells that are presented on this graph are presented only to represent the fact that we have pressure data in many areas in the pool and certainly at the northeast, northwest, southeast, southwest boundaries of the pool.

Because we did not have the recognition of the problem early in the life of the pool that we do now, our pressure data early in the life isn't as good as our pressure data in the later life. The pressure information that was a big part of some of my exhibits was recorded in

new wells or wells that have not produced simply because artificial lift equipment hadn't been installed in these wells and it's a simple matter to drop in and measure pressure.

Most of the older wells have artificial lift equipment in and you -- obtaining reservoir pressure would require removing the artificial lift equipment.

Q I want to make sure I understand you. Are you saying that the original pressure declines addressed or discovered in the initial stages of the reservoir are the same or different than they are today comparatively?

A I'm not sure I understood your question.

Q Well, I was wondering if the early pressure data from the McHugh wells didn't show a rate of decline for a barrel of oil was drawn to be about the same as the present decline?

A Well, bearing in mind early in the life of the reservoir the reservoir production, reservoir voidage, was fairly small, so the rate at which pressure was declining wasn't as fast as it is now. There wasn't as many wells on production and as one of my graphs indicated, the amount of gas that we were producing was at a lower level, so the voidage from the reservoir was at a lower level.

Was that your question? Or did that answer your question?

Q It's as good as I'm going to get, I

think.

Again referring to this first page of Exhibit D, I think if I heard your direct testimony correctly, that you stated that although the line graphs of various wells you've selected showed pressure decline, that that really didn't concern you terribly, or did I misunderstand you?

A Well, I think what I meant to say was the fact that reservoir pressure is declining with production is something we should expect from any reservoir barring some maintenance of the pressure, either by reinjection or a water drive.

This particular reservoir has -- the only reinjection of gas that exists would be in Mr. Greer's unit and there is no water drive, so -- and I think we indicated that solution gas drive is our primary production mechanism, so with production we should expect a decline in reservoir pressure, yes.

Q And I think, if I understood you correctly, also in the same vein, due to reservoir production that the increase in GOR's didn't trouble you greatly, either.

A The fact that the GOR's, if I said it didn't trouble me, I didn't mean that.

The fact that the GOR is increasing is something that is predictable and we should expect in a

solution gas drive reservoir.

Q Well, isn't your principal concern then the fact that you don't want to drill more wells in order to produce the reservoir?

A Our -- I'd reword it just a little, but, yes, that's the primary concern, that we feel additional wells, we -- we do not feel that one well for 320 acres is going to be necessary to develop the amount of reserves that are indicated to exist.

Q What is your professional opinion as to the bubble point?

A We -- I -- I am using a bubble point pressure, I believe, of 1482 psia, and that is a pressure that was determined from a pvt sample, or pvt analysis of a fluid sample that Mr. McHugh took and CORE Lab analyzed in the Loddy No. 1.

Q If you'd refer to the first page of that graph D, would you show me where the decline in pressure meets the bubble point and then passes it?

A The -- it -- from that graph you're referrng to you'll notice that there's quite a bit of red coloring underneath the GOR curve. This suggests that there was some free gas being produced all along. Whether this was from a free gas stringer, this is a very complex reservoir, we're dealing with a reservoir that's about 400 feet,

the primary producing interval is about 400 feet thick, and we have some pretty conclusive information to indicate that the vertical communication throughout the 400 foot interval is somewhat limited -- not somewhat, it is limited.

So for me to answer your question exactly like I think you meant it, is going to be pretty difficult to do it from this particular graph.

The best I can show you is that if you were to take the graph that you're looking at there, which reflects an average production of all wells in the pool, excluding the two wells that I mentioned earlier, and some of those were producing at a GOR above our 588 early in the life, but if you take and draw a straight line across there, and I think I mentioned prior to January 1st the average GOR on a poolwide basis was 1395.

Beginning about January 1st the GOR started to increase and this is also in a time frame that the reservoir pressure is getting close -- now again were dealing with fieldwide average pressure but we're dealing with areas of the reservoir that probably are operating, the operating wellbore pressure is at levels substantially below what we're plotting here.

What we're plotting here is an effort to represent pressue that would be at some drainage boundary. If you look at what is the pressure in the vicinity of an

operating well, that's going to be down in the 5-or-600 pound range and because of the picture I have of the reservoir, it's a fractured system, you put a fairly large fractured area in an operating pressure of 5-or-600 pounds and the bubble point pressure is 1482, that adjacent area to the wellbore is -- is several hundred pounds below bubble point pressure, and will result in a GOR that you see plotted here.

Q How large an area around the wellbore?

A Well, from the interference test data that I -- we indicated, that I presented, I don't have an exact pressure profile drawn of the reservoir. I think this is one of the things that or engineering study committee might be able to address, because we do have several pressure build-ups that we are working on, but I have indicated that we've established pressure communication between pressure observation wells and producing wells as far as a mile and a half away.

Q Okay, now I'd like to discuss Dugan's Exhibit Number One with you, if you'll just give me a second here.

Okay, now I think the purpose of this exhibit was to show three things, if I might try to make myself clear.

The first was the actual reservoir pro-

duction.

The second is the potential reservoir production or what it's capable of doing after any restriction, bearing in mind that many wells are not productive or were (not clearly understood) for various reasons and what the effects on the production of the various operators would be under your proposed formula of 200 barrels per 1000 cubic feet per well per day. Is that a fair characterization?

A All of that information was presented on this tabulation, yes.

Q And then the -- you didn't calculate but I think on the graph itself, and I think in your testimony, you alluded to how the various operators would be affected from current production levels if the Commission were to adopt your formula.

A Yes.

Q And I noticed that I think you -- have you made those calculations?

A Yes, I have.

Q Could we see them? I think it would be easier for all of us if we could discuss those calculations with you to see -- well, let me back up a minute.

A That is --

Q Well, let me -- I'll back up a minute.

MR. KELLAHIN: Mr. Chairman, I

have an objection.

I think it would help us all if Mr. Lopez would put his comments in the form of direct questions to the witness. I'm having a lot of difficulty following his narrative comments.

A And maybe I didn't understand your question.

Q Well, I think I'll help us all out if you'll bear with me.

Are there other formulas that could be adopted besides the one that you're recommending, that would solve the same problems here?

A Sure, there is -- our primary -- yeah.

Q And I think the principal problem as you've described it is that the declining pressures are going to damage the reservoir (not clearly understood).

A No, I didn't mean to say that the declining pressure would damage the reservoir.

We should expect a pressure to decline. That wasn't what I meant to say if that's what I said.

Q Well, what has the greatest effect on the declining pressure of the reservoir? Is it the oil production or the gas production?

A The gas production has a greater impact on the voidage in the reservoir.

Q So would it be possible, or if a well that was producing a great amount of oil yet had a low gas production, let's say a GOR of less than 1200, or less than 1000, what would be the reason for curtailing the oil production in that well?

A The primary reason for curtailing the oil is, I think, evidenced in the interference test data that we have presented. You have a high rate well, to offset, the people owning the offset acreage are going to be obligated to develop their acreage.

I think the pressure interference and communication data that we've presented indicates that some of the wells in the pool have the ability to drain radiuses that far exceed that that would correspond to 320-acre spacing, and so a well that is producing at a top allowable of 702 barrels a day and no gas, let's just ignore the gas totally, I think our data has indicated that it's likely that a drainage radius far exceeding 320 acres is probably existing, and our primary concern right now is that if we allow this situation to continue there's going to be a significant number of wells that are going to be drilled, going to be drilled into a reservoir that encounters a depleted pressure. They're going to be competing with each other and they are going to interfere with each other, as evidenced in the five wells that were presented on my pressure inter

ference test.

Q Under your formula wouldn't it occur that some wells would experience no reduction in current producing levels while others would be severely curtailed?

A Yes, that is true, but the wells you're talking about are generally the very low rate wells that are providing a fairly insignificant amount of the problem, anyway.

Q I think you stated that McHugh's current production level of 39 percent of the total reservoir volume, including the Greer wells, will be reduced to 37.5 percent.

Have you calculated what Mallon's reduction would be?

A Yes, sir, that information is actually available on this tabulation. It's just a mere calculation.

Q If -- if I were to suggest that the Mallon production would be reduced in greater proportion significantly than the McHugh and Dugan production, that wouldn't surprise you, would it?

A No.

Q Now I'd like to refer you to your Dugan Exhibit Number Two.

First of all, would you explain to me how you arrived at the figure that this reservoir contains 1-

million barrels in place?

A Well, that was basicallyl a manipulation of data. This solution, the curve that Mr. Greer generated for his unit was actually generated for the bottom scale rather than oil was percent of oil recovery and so in order for us to plot our data on this without having a good handle of the oil in place and thus knowing the percentage of that recovery in time, we assigned an oil scale to the bottom that basically would equate to -- in other words, 1-million barrels would be 1 percent of 100-million barrels.

Q In your opinion what kind of producing mechanisms do there exist absent the solution gas drive?

A We feel that gravity drainage is occurring. There is gravity segregation within the reservoir that is occurring. There's possibly some gas cap expansion, although we aren't certain of that, and -- but the primary mechanism is the solution gas drive.

Q I think in explaining how you reached the million barrel figure you said you relied on the information provided by Mr. Greer.

How did you individually arrive at that number for Dugan?

A This graph is not intended to depict the fact that we think there's 100-million barrels in place in the Gavilan. This graph is indicated to depict the fact as

pressure is declining in our area we have a predictable -- we haven't run a material balance and so our calculations are a plot only of actual data on a graph that does -- was generated with real data in the West Puerto Chiquito area.

Q Then how can you plot the Gavilan actual data on this exhibit when you're relying on one that has data that's not applicable to the Gavilan?

A What -- what we did was place a curve that was generated from the closest pool that we have, that we are immediately adjacent to West Puerto Chiquito and the Canada Ojitos Unit.

The actual construction of Mr. Greer's curve, I would defer that, that description to him at a later -- at a later time.

I have satisfied myself that the KgKo data that you used in generating his curve is the best available. It was actual laboratory test date in other pools and he utilized what he felt a representative average of fractured reservoirs, and it was KgKo data for fractured reservoirs, and he used his pvt data to generate this curve.

We feel that we're close enough and his data is good enough that it ought to present a good picture.

Q Wouldn't you agree, then, that the theoretical data shouldn't be compared to the actual data unless there are actually a million barrels of oil in place?

A No, I wouldn't agree with that.

Q Why not?

A The primary relationship that we're trying to generate here is -- and we're -- we're not making an effort to say that Gavilan is going to perform exactly like this. We have not generated this kind of a curve for the Gavilan area. Our study group committee is in the midst of having this work effort now and that's basically why we need an allowable reduction, is to have a time to complete this analysis.

Our intention of using this graph is to show that in an adjacent pool that we've established we're in communication with, that our oil properties or fluid properties are similar, I see nothing wrong with drawing an analogy to what exists at West Puerto Chiquito.

Q I think you just stated that the two reservoirs could be in communication. What evidence do you have that the West Puerto Chiquito and the Gavilan are in communication?

A A big part of my green -- my exhibits that we've identified in the green, and a good part of my previous testimony was spent addressing that exact issue, specifically the Canada Ojitos Unit E-6 and Dugan Production's Tapacitos 4, and Mallon's Howard Federal 1-11 and 1-8, and --

Q You were only addressing those wells in the West Canada Ojitos Unit, though, were you not, and not those farther to the east that have been (not clearly understood).

A At this time I'm not prepared to say what within the unit is actually influencing us. I can say without any doubt that we have communication at least between those two wells, yes.

Q Again, I think we've covered this when we discussed the earlier McHugh exhibit under Tab D, but just to be sure we're clear for the record, these wells that are plotted on your second page of this Exhibit Two, you recognize a downward or a decline in pressures in the reservoirs, and again that's what we expect as a result of production, is it not?

A Yes.

Q And again, only 19 wells were used to -- for the information contained on this exhibit and -- is that correct?

A Well, 19 wells that represent the data that was obtained and amassed out of 32 wells throughou the unit, yes, or throughout the area.

Q And if the 19 wells selected had concentrated voidage around their wellbores, would that tend to accelerate the decline of production as represented in this

graph?

A No, because a of this data was generated not just by myself but it was generated in a cooperative effort of all operators and we spent a fairly significant amount of time trying to generate what is a representative reservoir pressure, not what is an operating reservoir pressure.

As I've indicated, we've got data plotted on this graph that was recorded in several wells that have never produced other than the completion flowback.

Q Now, referring to the third page of your exhibit, please, and specifically to the N-31, E-6, Howard 1-8, and the Tapacitos 4 Wells, could you tell me what effective spacing pattern those wells are located on?

A The effective pattern that they're drilled on would be pretty much 160-acre locations. The actual, official spacing unit is 320 and this is primarily our concern, or McHugh and Dugan Production's concern, that in order to protect your acreage you're going to probably arrive at a spacing pattern real similar to this in other areas of the reservoir.

Mr. Lopez, I might add one thing to that. Even though the wells are drilled on that, we do have evidence that we have a drainage radius between the Tapacitos 4 and the E-6 didn't correspond to a 320-acre distance, rough-

ly, and we have pretty well established communication that far.

Q What is your opinion as to the actual permeability of the fracture intervals in the reservoir?

A We are studying that mass of data right now in the engineering group that has been formed. I know that the reservoir transmissibility or the product of the permeability thickness, the viscosity ratio, is high. I don't have any specific numbers to quote right now.

Q Well, is it at least as great as one millidarcy, in your opinion?

A Again, I am not prepared to relate it back a very footage, or per foot. In other words, in order to arrive at what is the effective permeability I would have to -- you would have to be able to tell me what is the thickness.

I -- I am not prepared to know that. I do know that the product of the thickness times permeability divided by viscosity, the transmissibility is high, which it would have to be in order to have wells that are capable of producing over 1000 barrels a day.

Q But you have no professional opinion as to even the range, whether it's 5 millidarcies or 10 millidarcies based on your professional experience (not understood)?

A No, I have not made any effort to relate it back to an exact permeability, which I think would be a waste of time.

Q Have certain areas of the pool experienced more pressure decline than others?

A No, based upon the last exhibit in Section D of Mr. McHugh's exhibits, and based on one of my exhibits where we plotted the fieldwide pressure not only versus cumulative production but versus time, I think to me it's clearly indicated that the pressure is declining at a similar rate throughout the reservoir.

Q Well, during this period of your proposed restrictions or curtailments of those allowables, is it your opinion that there will tend to be equalization of pressures in the reservoir?

A I'd have to say, knowing a little bit about good mechanics, yes, that will happen, but not to as great a degree as would happen if we were to shut the reservoir in totally.

I don't think Mr. McHugh, and I know Dugan Production is not making a statement that 200 barrels a day is a magic number and an exact rate. All we did was try to arrive at a rate that would allow some continued production but knowing that there are sixteen additional wells fixing to be placed on production, there's one well appar-

ently drilling, and there's thirteen wells that are right now permitted to drill, and I know there's additional wells planned to drill, we want to come up with the rate that's going to maintain approximately the same reservoir voidage as we now have and when I say now have, I mean prior to June; June is an unacceptable voidage. If we are to come up with some other way to develop the reservoir then we need that time to evaluate it.

Q Well, if this equalization of pressures does take place, which I think you said it will, what effect will that have on the correlative rights of the operators in the pool?

A Well, the most immediate effect that I think my pressure interference test data would indicate is that the offset acreage won't suffer quite as much depletion as now is existing.

Q Have the pressure declines been uniform through all the wells in the pool considering the cumulative production from each well?

A I think, referring again to the two graphs that presented pressure information on, we would have to conclude that the general trend of the rate of pressure decline, all wells throughout the reservoir regardless of cumulative production, is declining at similar rates. I think it -- you can make that conclusion, yes.

Q Mr. Ellis, I believe, testified about the pervasive fracture porosity but indicated little, if any, matrix porosity.

Do we have a fracture permeability?

A I think there is no question in my mind that fracture permeability exists, or permeability resulting from fracture, the existence of fractures is present, yes.

Q How much would it be?

A As I indicated earlier, we're -- our study group is trying to come up with a lot of this information now. For the same reason that I was unable to give you permeability by -- any place in the reservoir, I cannot give you a permeability of the fracture. Just what we know about the production and we see from pressure interference we know that it is high.

Q Well, could the uniform decline in pressure among the wells per barrel of oil produced be attributable to the size of the fractures from which each well is drawing?

A It undoubtedly is, yes.

Q On your interference test I believe you shut in one well and produced the others around it.

Would not a more meaningful test have been obtained the other way around by producing the E-6 and shutting in the others and then looking for the interference?

A An interference test could be done in either fashion, and the engineering calculations, if you've got control of all of the offsetting wells, could -- should result in similar answers.

We had one big problem and Mr. Greer was the only operator in the area willing to leave his well shut in while offset operators produced. I would not -- I did not support Dugan Production, support them shutting in their wells while Greer and Mallon produced their wells, and I'm almost certain Mr. Mallon would not have been in favor of that, and it was only because Mr. Greer recognized the importance of running this kind of a test and was willing to leave his well shut in and incur, I forget the exact number, but I think it was about 100 and -- I'll get the exact number -- during the pressure interference test, which began December 15th, and ended in the latter part of April, Mr. Greer experienced a 76 pound pressure drop in his well. He was aware of this happening but his desire to have this information and his recognition that this information is critical to understand the reservoir, he was the only operator that really would -- would be willing to do this.

Q Did you detect a boundary as each of the producing wells started showing (not understood)?

A No, we made no effort to do that.

Q Isn't it also true that while Mr. Greer's

well was shut in that he was allowed to accumulate production on that well?

A Yes, sir, that's true. But Dugan Production was allowed that same opportunity by leaving our well shut in. We delayed the completion on our well several months just to accommodate this interference test, and to improve our control of offset activity while we were running an interference test with the well, so that was a part of the Commission order.

Q In this vein as to how all these operators in the pool are so cooperating, isn't it true that a study committee was discussed at least a year ago for the reservoir?

A I -- my memory is failing me. I'm unaware of that conversation.

Q Did any of the operators in the pool in the last year discuss a willingness to form such a study committee for the purposes of --

A Yes, Dugan Production is reluctant. Dugan Production was the first operator in the pool to accept the fact that we are dealing with a reservoir that's much more transmissibility, a higher transmissibility than we anticipated in the early development of the field.

As other wells came on production I think Mr. McHugh was able to see with his additional wells that

there was need for something different. Until we had this pressure information generated beginning December of 1985, there was not, I think, information available to any other operator that maybe we needed wider spacing and I don't mean wider spacing. We need to use a different method to develop the reservoir, but if feel fairly certain that I could in all certainty say Dugan Production recognized that early.

Q Did Mr. McHugh want to participate in that study committee?

A Well, for the same reason that all operators -- once we got started gathering data and Mr. Greer spent, I'm not sure of his exact numbers, but Dugan Production is an interest owner in his unit and it was about $30,000 to purchase this sensitive pressure equipment, once he -- we started recognizing the need for this pressure information, Mr. Greer almost begged other operators to gather data in their wells and for the same reason that all other operators were reluctant to let that information be gathered, and none of the other operators were willing to spend this kind of money to purchase this kind of pressure recording equipment, Mr. McHugh was no different than other operators. He needed to be convinced internally that we really had a problem here before he was willing forge ahead and I think it should be undisputable that McHugh's efforts to organize such a study committee have been the only reason

such a committee has been formed. He was responsible for the initial two meetings and has incurred a great deal of expense individually attempting to get all operators aware of the pressure data and the majority of the pressure data I've presented here today has been provided to each of the operators through this study committee.

Q And the reason for wanting the study committee wouldn't in any way be as a result that Mr. McHugh has drilled his wells in the pool and has produced the greatest amount and now he'd like to be the operator of a unit.

A I think, no, I think, if I understand your question, that's not why Mr. McHugh's in favor of this but because Mr. McHugh has 23 of 59 wells he certainly has the opportunity collect more data. He recognizes the significance of the problem and I think it would be very clear that he has a majority of the wells that have been completed in the pool.

Q You discussed an increase in the pressures in the E No. 6 Well when the Tapacitos No. 4 was fractured.

This Tapacitos No. 4 is in the northwest of 6. If we assume that fracture --

A I'm sorry --

Q -- is in a northwest-southeast direction, it

would be right on strike with the field fractures, would it not?

A Mr. Lopez, first off, I didn't hear all your question because it's not clear which wells you're talking about.

The well in the northeast, there is no well in the northeast quarter of Section 6.

Q I guess it's in the east section of Section 6.

A Okay, that would be Mr. Greer's well.

Q The E-6 Well I guess is what I'm talking about.

A Okay, that is Mr. Greer's well.

Q Right.

A The pressure observation well.

Q Okay, when the Tapacitos No. 4 was shut in when it was fractured, the Tapacitos -- well, let me start all over.

If I understood my story better I might be able to ask the questions better, but I think I've got the story now, so maybe I'll get further.

Okay. Okay, you stated, I think, or you discussed at least an increase in the pressure in the E-6 Well when the Tapacitos No. 4 was fraced, right?

A Yes, sir.

Q Okay. Now, the Tapacitos No. 4 is located to the northwest of the E-6 Well, correct?

A Yes, sir.

Q Now if we assume the fractures in the northwest-southeast direction, this well would be right on strike with the field fractures, or these wells would be, isn't that correct?

A If we assume that the fractures are developed northwest-southeast, yes, that is correct.

Q Okay. In discussing the pressure decline from the Loddy No. 1 Well you said the nearest producing well is 6800 feet to the southeast, is that correct?

A Yes, that was the nearest well that was producing during the time we recorded this pressure data.

Q Well, wouldn't this also result in the wells being on strike with fractures if they're assumed to be in a northwest-southeast direction?

A Yes. The ET is southeast of the Loddy. I don't think that we can conclude that from the data, though, but with your statement that that is the direction of location it is correct.

Q In discussing the Dr. Daddy-O along the same line, you also discussed pressure decline in that well.

Isn't it also true that the nearest producing well in the vicinity with the highest withdrawals is

the Native Son No. 3 and again we have wells located on strike of a southeast-northwest trend.

A You are correct. Those wells are located southeast of the Dr. Daddy-O, but again I don't think that we can conclude that there's a preferential trend of fracturing in that direction.

I think if you'll remember my exhibits relating to the interference test also established some direct communication between a well almost north or a little northeast of the E-6, at least at a 90-degree angle to the angle you're working at, and possibly more than that.

Q Okay. Assuming that, and recognizing that we are experiencing a pressure decline, and this will increase as we bring new wells on production, I think you've already stated that this is to be expected in any reservoir regardless of whatever the allowables are because of production.

A Yes.

Q Then if the problem is the drilling of unnecessary wells, as you said, how does reducing allowables solve your problem?

A Well, I think one of the things I've indicated is that the data we have indicates that we already have too many wells, that the wells are interfering with each other, with pressure depletion occurring in wells that

have never produced. So what an allowable reduction does, it doesn't solve the problem, it keeps the problem from getting too much worse than we anticipated with additional wells coming on production and what we're proposing is during this time that we minimize the damage that will occur, and again I'm not saying damage in a reservoir. I'm saying we need to, on a cooperative basis, evaluate the true need for creating additional situations like I presented on our interference test data between Mr. Greer's two wells and Mallon's well and Dugan's well, and that's really what we're asking for, is we don't feel we need to spend to the tune of about $500,000 a well. We -- we think there will be true economic waste if we are forced to continue the development of the reservoir on a competitive basis.

MR. LOPEZ: No further questions.

MR. STAMETS: I presume there are other questions?

MR. PEARCE: Oh, I'm sorry, yes, there are.

MR. STAMETS: Mr. Pearce, how long would you anticipate your cross examination will be?

MR. PEARCE: I do not expect that he can teach me enough in twenty minutes, Mr. Chairman, if that's the gist of the question.

MR. STAMETS: Okay, well, in that case this would probably be a good time for lunch and plan on being back here at 1:00 o'clock.

(Thereupon the noon recess was taken.)

MR. STAMETS: The hearing will please come to order.

Mr. Roe is at his station. Mr. Pearce is waiting patiently.

You may proceed.

MR. PEARCE: Thank you, Mr. Chairman, hopefully, over the lunch recess I was able to shorten this some. Let's see if I was successful.

CROSS EXAMINATION

BY MR. PEARCE:

Q Mr. Roe, during Mr. Ellis' testimony yesterday there was some evidence about some wells that were evidencing decreasing GOR's. Does that sound familiar to you?

A Yes, I remember the testimony.

Q And do you have any information available to you about which wells those are and what sort of decreasing GOR those wells were experiencing?

A The wells, I don't remember exactly the wells that were discussed. You might refresh my memory.

Q I do not recall well enough to say, sir. Do you have any information available with you?

A It's my general experience in the pool that the gas/oil ratios are not really in fact decreasing.

The, as I recall, one of the wells that was addressed was the Mesa Grande's Howard Federal No. 1, which from the date of first completion the GOR -- and it ws completed as a dual well, the Dakota formation completed and equipped in a manner that it should be produced on its own and the Mancos equipped in the same manner, that you should be able to produce Mancos without wellbore communication.

The GOR in that particular well was high from the Mancos formation from date of first completion and until Mesa Grande actually did some remedial work on the well and repaired the communication and I believe it was the testimony yesterday that resulted in a decrease in GOR from the Mancos and that is in fact true.

Again, just referring to -- to information that is on file with the Commission in the Form of C-115 Monthly Production records, the Mancos, say, during the month of April of 1986 had an average GOR of 80 -- 8,313 standard cubic feet per barrel. The remedial work, I don't know the exact date, but May's production was in fact lower,

a lower GOR. During the month of May the gas/oil ratio from the Mancos reached 564 standard cubic feet per barrel, which was -- basically reflected a reduction in gas production from somewhere and as it turns out, the Dakota formation, that reduction in gas showed up there. So there was a communication indicated.

Now unless the communication is redeveloped June's production is almost double. During the month of June the GOR from that well was 1144, so it's true during the month of May the gas/oil ratio dropped from 8300 to 560 but I think once we remove the communication from the Dakota, and I might add that is the only Dakota in this pool that has the amount of gas associated with it that has -- well, it is the only Dakota well that has any significant gas production.

The Dakota formation is in an oil pool and an oil pool was established based upon the production potential that -- or production information and completion information that existed at the time.

Mesa Grande's well has performance that really is contrary to the other data that existed at the time we forged ahead with the Dakota formation.

Q Shifting gear slightly to another question we left open during yesterday's testimony. I believe Mr. Ellis was asked if he had an opinion as to whether or

not the adoption of the recommendation made by Mr. McHugh in this case would allow for some recharge of the reservoir contributing in Mr. McHugh's wells from surrounding acreage.

Do you have an opinion on that?

A Yes, I do.

Q What is that opinion?

A The fluid, be it oil or gas, will always flow from an area of high pressure to an area of low pressure, and in the reservoir we're dealing with that is the case.

Now, one of the -- or two of the exhibits that I presented today depicted what we believe the reservoir pressure not in the vicinity of the producing wells but the reservoir pressure away from the producing wells was or is, and of course, the reason it's declining is because there is production from the pool and the -- I don't know if you remember, I could make reference to the specific graphs, but basically all of the data we have available so far and again we have sample pressure from over half of the wells that are completed, 32 out of the -- over half of the wells that are on production, and really over half of the wells that are completed.

To me that pressure information says we don't have dramatic pressure differentials in the reservoir. The reservoir pressure in the vicinity of Mr. McHugh's

wells, in the high withdrawal wells, is not that much different from the average reservoir pressure all the way to the north in the area of Dugan Production's well or Mr. Mallon's wells.

So if we were to shut the reservoir in totally there would be some -- some minor adjustments in the pool, but the data we have right now suggests there are no major pressure differentials across the reservoir and so we wouldn't be really looking at pressure from the area to the north, which Dugan's Tapacitos 4 is in, down to the area in the south, which is where a predominant -- the majority of the production has occurred.

And basically the reason that it's occurred in that area to the south is that's where the bulk of the development activity has occurred. The area to the north is probably one of the areas that has the biggest chance of benefiting from what we're talking about today. That's where a lot of the undeveloped acreage is.

Q I'm sorry, a lot of the undeveloped acreage?

A Yes, sir.

Q There was some discussion with Mr. Ellis yesterday afternoon about the possible presence of free gas in the reservor prior to development. Do you have an opinion of whether or not there was free gas in this reservoir?

A Yes, sir.

Q And what is that opinion, sir?

A In -- based upon the fluid data that we have available, which is primarily some -- some pvt data from the West Puerto Chiquito Pool and we have two fluid samples from the Gavilan area, based upon that information if we had any production that exceeded the solution GOR of somewhere between 480 and 588 standard cubic feet per barrel, you would infer that there is some -- some gas that is being produced in addition to just the amount of dissolved gas that's coming to the wellbore.

Now there's a couple of reasons that you may be seeing a GOR higher than 588. One, these higher capacity wells, you're able to produce the well at a rate that allows your operating bottom hole pressure to fall below the 1482 psi bubble point pressure, you're going to start seeing not only the barrels of oil that come to the surface plus that dissolved gas, but you will see, probably, some dissolved gas from barrels of oil that are adjacent to the wellbore that are in the region, and again I don't know how far this region extends from the wellbore, but you will see that gas come to the surface in conjunction with the oil that you're producing and the reason the oil that's with that dissolved gas doesn't come too, is because of the differences in mobility of the gas in the fractured reservoir

we have.

The relative permeability of gas to relative permeability of oil is very sensitive in a fracture reservoir such that a very small increase in gas saturation results in a tremendous increase in the gas mobility or gas ability to move.

Q What data do you have relating to the relative permeability of this fractured reservoir, gas versus oil?

A We have none that is specifically for the Gavilan Pool area. In fact, I really don't think there is -- this is a laboratory derived piece of information and the data we're relying upon is that that has proven to be fairly reliable in West Puerto Chiquito Pool, and again, this is a pool that's been in operation for 20-25 years and Mr. Greer took advantage of all the laboratory data that had been published at that time in fractured reservoirs.

Q Do you have reason to believe that Mr. Greer's reservoir was similar to reservoirs studied in the published data at that time and now your reservoir is similar to Mr. Greer's, is that the steps of logic dealing with relative permeability? Is that --

A In other words -- yes. I think I understood your question and it's pretty common practice in specifically reservoir engineering but in probably any field,

when you -- you don't have the information you need for your specific instance, then you start looking at a distance away from where you're at and you try to get as close to the area as you're working and finding information that worked in that area.

That's basically what we've done with the Kg/Ko information and to some degree with the pvt data prior to Mr. McHugh actually obtaining this, and this is a fairly expensive operation and it requires a cash expenditure with basically no apparent, immediate return on your investment. Until Mr. McHugh obtained his pvt data and basically McHugh's pvt data is all we had until recently, and prior to that, Mr. Greer's pvt data was all we had to use, and because we are immediately adjacent to that pool we felt it a prudent thing to use that information until we find something different.

Q When you say Mr. McHugh's pvt data was all you had until recently, is that mean that you have recently acquired some other information?

A Well, yes, sir. In Mr. McHugh's, he has, and I actually utilized McHugh's pvt data in my calculations that I've made. That was a fluid sample was taken in the Loddy No. 1 and again that -- that was the first pvt data that we had.

Mr. McHugh did sample the reservoir fluid

in another well but -- and that being the Native Son No. 3. I have a real strong reason to feel that that data is not representative of reservoir fluid and so I've chosen to place my emphasis on the sample that was taken from the Loddy, which basically doesn't cast emphasis one way or the other. It brings us into a range of where I think it should be.

Q Do you have that pvt data available to you today, sir?

A I do not have a copy of it with me, Mr. Pearce. It -- in our study group that we've had basically two engineering subcommittees, I have personally provided a copy of that complete information along with Mr. Greer's pvt data to each of the engineering representatives that have participated in this study group which I -- the data is available. We're -- we're willing to share and give our engineering efforts to these committees to share a tremendous amount of data that Mr. McHugh's accumulated.

Mr. Greer's been more than willing to share his data with us and it's my understanding there is additional data that -- that other -- or it's not my understanding, other companies are beginning to be involved in this process.

Mesa Grande has actualy obtained a fluid sample that -- that we plan to have available to us when

that information is available. It's so recent it's not available.

Q As I understand it at this time my clients do not have available that pvt data and we would like to get it as soon as we can, if you have no objection; whether you provide that through counsel or directly or directly to client. Mr. Kellahin?

MR. KELLAHIN: Mr. Chairman, I understand it's available to parties who attended the engineering committee meetings. If Mobil elects not to attend those meetings, I'll be happy to arrange with Mr. Pearce to provide him that information.

Q Mr. Roe, if you would turn with me, please, to what's been marked as your Exhibit Number Two, a graph which Mr. Lopez questioned you about. It's the orange sheet in front labeled Comparison of Solution Gas Drive Production History.

As I understand it, this graph was initially prepared and used sometime ago and represents the theoretical curves you would expect from a solution gas drive reservoir, is that correct?

A A solution gas drive reservoir that had a fluid in it that was similar to what we find in West Puerto Chiquito and that had a relative permeability characteristics similar to what exist -- what we believe exist in West

Puerto Chiquito, yes.

In other words, in order to compute this curve, in other words, you use a material balance equation. You need some pieces of factual information and Mr. Greer generated this curve in his area using data that was appropriate for his area and said that if solution gas drive is the only mechanism that you have in effect, this is what the performance of your GOR and pressure should be barring any other influence on recovery.

Now, this wasn't a forecast of his unit recovery for the simple reason that he had other factors influencing his production, but had nothing else other than solution gas drive been responsible for oil recovery at West Puerto Chiquito, this is the prediction of gas/oil ratio and pressure performance that we should expect, yes, sir.

Q Would you expect these curves to accurately reflect and/or depict the Gavilan-Mancos Pool production in view of the testimony which is this is at least primarily a solution gas drive reservoir?

A Our primary reason for using these curves is to show -- I'll answer your question specifically but I'd like to add some additional detail.

We use these curves not to predict what the gas/oil ratio is going to do in our Gavilan area. We just -- my reason for using these was to depict what the

gas/oil ratio should do given our permeability properties and our pvt data properties that we think are valid, and so it was just a visual picture to show that as pressure comes down the gas/oil ratio should go up. The rate at which it goes up is something that really accelerates with time. I'm -- I do not intend this to be a predictive tool in our Gavilan area. Our reason for plotting -- I've even indicated that we plotted the gas/oil ratio versus cumulative as it occurred. Had I really wanted to use this as a predictive tool, I probably would have made an effort to reduce the cumulative production and back out the free gas production and try to plot what really happened with respect to pressure and gas/oil ratio.

But to answer your question, it's just to be a pointer of what we should expect and then show that gas/oil ratio is coming up as pressure goes down.

Q Okay, and as a pointer of what we should expect, looking at this graph it does not appear to be related at all to time; that the rate of production, of the recovery reflected along the lower axis does not appear to be affected at all by rate of that production.

A Yes, that's correct.

Q Is that a characteristic of a solution as drive reservoir?

A Yes. In a reservoir that has only solu-

tion gas as your drive mechanism, that is correct.

Q And would you expect that to hold for the Gavilan-Mancos Pool as you understand it now?

A No, sir.

Q And why is that?

A Well, because there are several other factors that -- that are going to come into play here. I do feel that solutin gas drive in our area is the primary means of moving oil from the reservoir boundaries to the wellbore.

I also feel, because we're dealing with a reservoir that's approximately 400 feet from top to bottom and there are some areas of the reservoir where we have a productive interval that extends approximately 800 feet. In other words, there's some areas of the reservoir we have additional pay development lower than what we're calling as the main Niobrara Mancos , Niobrara producing interval and that consists of three zones in the Mancos that are -- comprise about 400 feet.

Within that 400 feet we feel fairly certain that there is some fractures that -- that cover a fairly large vertical area, and within these fractures as you allow your pressure in the wellbore area to reduce, you allow gas to evolve from the -- from its dissolved state and form a free gas phase and that will allow gravity segregation within the fracture or within the reservoir and that in

turn will allow the producing channel for gas to move through the reservoir and be produced without actually displacing oil along with it, and so this is where it becomes important that we give some thought to how the reservoir is produced from here forward because it's conceivable that a high GOR well being influenced by a free gas phase, no matter how it exists in the reservoir, the operator of that well is going to produce up to his allowable whether it's restricted by gas volumes of oil volumes in order to get his -- what he believes his share of the production to compete with his neighbor that may not be quite as influenced with this gas/oil ratio, and that will result in the dissipation of reservoir energy that will not be efficient in producing oil.

And this problem is really enhanced when you put high capacity wells offsetting undeveloped acreage. The people get in there and drill a well, protect their wells, they're going to encounter interference from the high capacity wells and it can possibly even encounter a gas/oil ratio.

Q Okay, that brought to mind another question.

I don't understand how you can calculate or discuss the permeability to gas or oil of a fracture. Could you try to explain to me -- as I understand, a

fracture is just an open channel and I don't understand the discussion of permeability with regards to a fracture. Can you explain it to me?

A I'm not sure what you're asking, Mr. Pearce. You're wanting to know if -- what permeability is?

Q Well, I understood you to say that you had a Kg/Ko, that the relative permeability in this fracture system --

A Yes, sir.

Q -- and perhaps I don't understand when you say a fracture system. I thought of that myself untechnically as an open channel of some size, some dimension.

A That's correct.

Q It sounds to me like that would be infinite permeability as I understand permeability.

A Well, yes, that's correct. It would depend upon the width of the fracture and the continuity of the fracture. When -- whenever rock or anything is subjected to the stresses of fractures the fractures aren't necessarily nice long, continuous holes that are so far apart. Again I'm interjecting a little of my personal ideas of what the fractured reservoir looks like, but it might go for a little bit and it has a deviation over to another fracture that requires interconnection and earlier today there was some -- some direction towards maybe a preferential direc-

tional fracturing and it's not uncommon to see that, but the mechanism that causes fracturing also results in a lot of inner -- inner fracturing and so on a very large scale a fractured reservoir is -- is nothing more than probably would be similar to a reservoir that the matrix productivity is provided by these all interconnected fractures, which is totally that much different from a porous system on a very large scale.

Q As I understand it, Mr. Roe, in the theory of producing solution gas drive reservoirs, it is necessary for the pressure to decline, is that correct?

A Yes, sir, yes.

Q And you've indicated that the primary production mechanism in the Gavilan-Mancos Pool, in your opinion, is solution gas drive.

A Yes.

Q You've indicated to me that pressure in the Gavilan-Mancos Pool is decreasing.

A Yes, sir.

Q And that it is -- production is now occuring below the bubble point.

A That's my belief.

Q Your opinion. If that is what one should expect from a solution gas drive reservoir and we have a solution gas drive reservoir, I don't understand what the

problem or the emergency is.

A The primary concern on our part is that the -- the rate that the pressure is declining is increasing. Two of my exhibits presented that information. In other words, the rate in terms of psi per day in the reservoir that -- the rate at which that pressure is declining is approaching a point that is very high.

To contrast this just a little bit, in the West Puerto Chiquito Pool Mr. Greer has tried to maintain the rate of pressure decline in the range of 10 pounds per year.

On one of my exhibits I showed you a well that was declining that much each day and I -- we're concerned that if we don't do something to reduce -- what we're really asking for is with the study we've done so far, it appears to us that the wells throughout the reservoir have the ability to drain areas much larger than we're currently developing on and if that is the case, which I believe it is, and I know there's a tremendous amount of undeveloped acreage.

On my Exhibit Number One I showed you there's 13 additional wells that are planned right now that I know about.

What -- what's going to happen is the operators in the general area are going to drill these wells

to develop their acreage. They're either just being prudent to protect their leases from drainage; development to keep their leases from expiring; or just flat development because there's a big well offsetting them, and what they're going to find when they get in there and complete a well, they're going to find that the offset well -- our data indicates that they're going to find their part of the reservoir has already been influenced by the offset production and so you're going to have two wells that are going to be competing for the same reserves. That, in my opinion, will result in the drilling of one unnecessary well, but it is going to be a necessary well if we have the current development on 320 acres and competitive. In other words, it's going to be necessary by virtue that independent operators are going to have to develop their leases. We have a tremendous amount of data that says we don't need one well every 320 acres and I've been skirting around it all day, but we have a tremendous amount of information that says we need to look very seriously at unitizing our area so that we can control where we locate the wells, drill only the wells that are necessary in order to produce the reserves that are there, and our pressure data suggests that there is definitely a fixed amount of reserves.

We haven't tried to determine what that fixed amount is but we have determined that there is not an

infinite amount of reserves in that reservoir.

Q Okay, looking back at the graph which we discussed earlier, it appears to me that that graph of solution gas drive reservoir in fact has a steep set of perfs.

A Yes, sir.

Q Pressure decreases steeply. The GOR increases steeply.

A That's what causes us concern, is that's what you should expect, yes.

And in, Mr. Pearce, let me just reiterate. I guess I'm not saying what I mean.

Because the data in the West Puerto Chiquito Pool says that -- and again I'm not saying this is West Puerto Chiquito Pool, because Mr. Greer has gravity drainage and he is maintaining pressure by gas injection, but using his data and accepting it as the best available right now, it tells us if we don't do anything else, which includes take advantage of the minor amount of gas or gravity drainage that probably will occur in our area, I believe we have some gravity drainage. It's not going to be as great as the area to the east of us simply because our beds are not dipping like they are in the West Puerto Chiquito Pool, but any time you have a reservoir that's 400 feet thick, even within the wellbore production -- or the well-

bore area in the production unit, you will have gravity segregation occurring and what this curve is tellling us is exactly what you're saying, the pressure drops and we are approaching a point, and that's why I superimposed some data from Gavilan on this curve, is it says, by golly, we're approaching a point that our GOR is just going to go out of sight. Our production data tells us that's starting to happen on two of the curves that Mr. Ellis presented yesterday. We see that on several of the wells. We are approaching a point that just since the first of the year our gas/oil ratio is starting to go out of sight.

We've got -- Mr. McHugh has one well that the gas/oil ratio is going up every day.

Dugan Production operates, provides the daily operation of Mr. McHugh's wells and we -- we see that gas/oil ratio going up every day and it tells me that whether we're exactly right with our data or not, our data is in the right ballpark. The reservoir is producing like you'd expect it to produce and if we allow right now the -- as my two exhibits indicated, the rate of pressure decline that is occurring in the reservoir is at a rate that is accelerating. In other words, with each month that our voidage goes up our amount of pressure decline in terms of psi per month is accelerating to a point that our solution gas/oil -- this chart says it should, and in my own concern

at this point, is in order to protect acreage from drainage operators are going to be forced to drill unnecessary wells.

They're going to see these are not cheap wells. If you have no trouble at all and you have the best luck possible, you're looking at a half a million dollars per well in round numbers to drill, complete, and equip for production, and at the current market conditions, that's -- this is going to be an economic catastrophe if we go drill another hundred wells in the reservoir in order to protect our -- in order to -- forget whether we protect the leases from drainage, in order to develop your -- your leases you've got to drill to meet offset production and if we do it on the existing one well every 320-acre spacing units, the rate in terms of psi per month that the pressure is going to drop, already to the level where we can see an end to the life of the reservoir.

In other words, I said earlier, another year and a half or two years, that's not a magic number, but we -- the end is in the foreseeable -- we can see the end. In other words, we've come -- we're down to a level of 1400 pounds in the reservoir and we've confirmed that that pressure exists throughout the reservoir, and operators who have undeveloped acreage are really the ones that need to be concerned with what we're telling them here today.

Q But I gather that you do not expect any signficant impact on ultimate recovery from this reservoir.

You're talking about the number of wells that should be drilled to develop the reservoir and the amount of time which should be used to produce those reserves.

A No, that's not what I meant to say. The -- it's also my opinion that recovery from the reservoir will be affected. I did say that in the solution gas drive reservoir if there are no other mechanisms taking place, the faster you produce it or the slower you produce it, the ultimate recovery probably will be the same, but because we, I feel, we do have gravity segregation occurring, we do see wells in the reservoir that are producing with higher gas/oil ratios than other wells, we're going to see gas production in the form of what appears to be free gas at the producing well dissipated and that gas will not aid in any oil production. We'll wind up having a higher residual oil saturation in the reservoir if in an effort to get oil underneath any particular lease we produce a well with a high gas/oil ratio aimed towards getting all the oil we can, and so it is my belief that we do have gravity drainage no matter to what degree, I do believe it exists in our area.

If we could get together on a unit and control the number of wells it would allow us the opportunity to drill a well and produce wells, only the wells that have a lower gas/oil ratio and take advantage of the gas that has formed in a gas cap, if such a gas cap exists, and

it seems only equitable to me that the people that have the undeveloped acreage down dip are the ones that are going to be hurt worst, because if a guy up structure produces an unequal amount of the gas in the reservoir, the guy down dip is not going to have the gas available to displace his oil to his wellbore through this media, the fracture system or whatever we have in the Mancos formation, and if that happens, we can affect oil recovery from the reservoir by controlling the number of wells that are drilled.

Q During his testimony yesterday Mr. Ellis indicated that he believes some period of interim rules were necessary, at least as I recall the gist of his conversation, for two purposes. One, to further study the area, and one to approach other operators in the area about the question of unitization.

A I -- if Dick didn't say that, I feel that that's necessary and I do think he said that.

Q Let's assume for a minute that McHugh and other interested parties are not successful in unitizing the Gavilan-Mancos Pool. How will other interest owners in the area protect their correlative rights?

A The, as I understand it, right now the only way to protect your correlative rights is to drill a well and I think we have a sufficient amount of data that tells us that additional drilling is going to encounter a

reservoir that has been influenced by the existing wells and -- but right now, the only way everybody's correlative rights are going to be protected is with one well on every 320-acre spacing unit.

Q Do you think this reservoir is a likely candidate for some sort of secondary recovery?

A I have a lot of mixed emotions on that. I think if all of the operators agree upon some sort of a unit that would provide an equity everybody was satisfied with, and I think given the current market conditions, in other words gas isn't worth anything anywhere if somebody wants it, I think that it would be a prudent thing to do for the operators in our area, we have a gathering system already installed in the form of a -- in other words, most wells are connected for gas. Out of the 59 wells that are completed only 16 are not connected and some of those 16 are connected, they just haven't got their gas contract squared away, I think it would be a prudent thing to do to on a test basis put some gas into the ground and see if we can't establish a -- or arrest the decline in pressure.

Now, I, because we don't have a lot of structural relief in our area, I'm not optimistic that we're going to have the same pressure maintenance project that exists in the West Puerto Chiquito Pool.

Q In view of your opinions about the frac-

turing and interconnection of these wells, do you suspect that the wells that have already produced in this pool have produced reserves outside of their 320-acre spacing units?

A I think that based upon the pressure interference data that we have, it's very clear to me that any well that has any production at all is probably draining an area larger than 320 acres.

Q To the extent that producition has drained undeveloped acreage at least to this point counter-drainage has not been possible, is that correct? You can't counter-drainage an undeveloped tract, can you, Mr. Roe?

A No, that's what's got us concerned is in order to develop your acreage you need to jump in there and drill a half a million dollar well and when you do you're going to get -- everybody has that right to do that tomorrow if you can get an agreement with the landowner and you can get a -- come up with a half a million dollars, you can find somebody who's going to provide you with tubular goods and find a contractor that's willing to do what you ask him to do, you know, that's -- that's right and right now that's the only way to preserve your correlative rights.

Q When you were discussing an area that was objected to some this morning, I just want to go back and have you explain what you do -- what you did when you were talking about the drainage you suspected was indicated from

those pressure tests that you did, interference tests. You were simply taking the distance to the well that showed the interference, drawing a circle and calculating the acreage inside that circle?

A Yeah, I did two thingss. That was -- that calculation resulted in the lower number and that's why, if I didn't, I meant to say that would to me indiate a minimum drainage radius because that was telling me that something we did at one point in the reservoirs actually influenced a point that far away, therefore that would equate to a distance one directin from the well, and assuming that would be a minimum drainage radius, assuming that it would also affect something the opposite direction away from the well, then scribing a circle that had that radius, that would be an area that would be the lower of the two numbers.

Now the higher of the two numbers that I usually quoted was basically saying okay, we'll -- this imaginary reservoir that exists in nice square units, I just said okay, 6800 would be, assuming the distance between wells was 6800 feet, basically that would be just one-half of a square. It -- the square would be really somethig two times 6800 and then that would give you a nice, neat little square that this well's going to drain, which is the way reservoir's are always spaced, in nice, neat 40-acre units, 640-acre units.

Q In your work with this reservoir, Mr. Roe, have you developed an opinion on whether or not the matrix contributes to the production of the oil in this reservoir?

A I -- I have a personal feeling that the matrix is not going to contribute significantly, but this is a question that we had quite a bit of discussion in our engineering study group. I am aware that there's a big, a big variation from -- from my end of thinking the matrix is not going to contribute to another end of the thinking that the matrix is going to contribute.

With the data that's available right now, I don't think it's totally clear, it isn't clear to the point that we can all agree as engineering people; in other words, not representing individual companies.

When the nine people met at our last engineering committee meeting, we did not all agree what the facts were, or we all agreed what the facts were; we just didn't all agree to the importance of the facts, and so under the guidance of our operating engineering committee I -- I have prepared a letter that was distributed to all of the operators that basically are listed in my Exhibit Number One, requesting that, and this isn't -- I said I did, I took the responsibility to prepare the letter and sent it out, but it was mutually agreed by all at our engineering commit-

tee, because it is that important, apparently, to -- in other words if we're ever going to get a common agreement we have to resolve that issue and so we have proposed, the engineering committee, that on a cooperative basis, and Mr. Mallon has indicated he's willing to let us use his well to do this, that six 60-foot cores be taken and the cost of taking those cores be shared amongst the operators in proposition to the wells that are completed currently.

This core that we're proposing is in Mr. Mallon's well that he's got in the southeast quarter of Section 3, of Township 25 North, Range 3 West, that he spudded just recently and if all operators in fact approve our proposal, Mr. Mallon, providing well conditions permit this core to be taken, we plan to take that core. The analysis of that core will be determined cooperatively and the costs of all of this, which we're estimating to be $80,000, will be shared, and the information gained. The testing procedure will be determined on a property basis, so we think it's important enough to resolve that issue that even though I don't think it's necessary, I have strongly encouraged Dugan Production to participate in this. For what it's worth, the only company that has approved that AFE, or the only one that I'm assuming, Mallon Oil has approved the AFE, although I have not seen their AFE, the only AFE I have that is signed is McHugh's AFE and he represents about 39 percent of

that total expenditure, or he'll have to pick up the tab for that.

And it is also my understanding that Mr. McHugh's people don't think this core is necessary, but because we recognize the importance of having this issue resolved, and it will be important to the reservoir, we're willing to -- to gather the data because if we are -- are wrong, there's no real harm done; we've just delayed things for a little bit. If the matrix does contribute, we're all going to be happier.

My boss thinks -- he hopes there is matrix and that it does contribute because then I'll be wrong and he's going to have a lot more oil than I've told him he's got.

Q But in order to produce that oil out of the matrix the pressure has to be lowered, doesn't it?

A That is -- that is totally correct. One of the basic fluid flow equations relates the rate at which pressure is -- or the rate at which fluid is produced as being dependent upon the amount of pressure drop, but as I've indicated earlier, the -- well, let me qualify that.

Given a constant permeability, the only thing the pressure drop is going to control is how fast the fluid moves from one area of high pressure to an area of low pressure.

Given the pressure performance that I've indicated earlier, pressure is declining in the reservoir and so if -- if there is matrix, it's contributing right now. Now it's true that the maximum rate that that matrix will contribute will be at the economic limit when the reservoir pressure is totally depleted but as far as whether the matrix is contributing or not, unless there's been some new revelations since Marcy did his work, any pressure drop will result in a fluid production and I think I've indicated that we've got wells that have had 300 pounds of pressure drop in them, so if the matrix, like I say, I have -- I don't think it does, but my boss sure hopes it does.

Q Looking, sir, at the plat of the area of the interference test that you discussed earlier, do you have an opinion on whether or not you'd expect to see the same sort of interference test results if this test were conducted in other portions of the Gavilan-Mancos Pool?

A Yes, I -- we would expect similar results. We already have kind of an interference test in effect from other areas of the pool that I presented on my exhibits for the Loddy No. 1 and the Dr. Daddy-O. The only difference between the two is we're not real sure what's causing the interference that we measure in the Loddy and Dr. Daddy-O because this is an area of the reservoir that there's too many other things going on.

One of the things that made this pressure interference nice was it was done cooperatively. Dugan Production, we physically did not complete our well for about three months even though we were ready to, we had one of our partners that had a drilling rig that wanted to do it. I really has my neck stuck way out there because only because I wanted to participate in this pressure interference test, we delayed our well being placed on productionk knowing that drainage probably was occurring, but between Mallon Oil, Dugan Production, and Greer, BMG, we were able to coordinate which wells were producing and which wells weren't producing.

Mr. Greer even delayed the completion on his N-31 in order so the early part of the interference test, the only well that was producing was the Mallon Oil to the -- to the west and Mallon even cooperated to the point of trying to fluctuate which wells he had on production so we could try to pick up which well we were seeing. Were we seeing the 1-8 or were we seeing the 1-11, and I think our test was conducted in a manner that this information is available on graphs and recorded so that I can tell you when we saw a change in the Howard Federal 1-A versus when we saw a change in the Mallon 1-11. I don't personally think that we observed any pressure interference in Dugan's well. The primary input Dugan's well had, once we completed it we mon-

itored reservoir performance when we stimulated our well and the same thing goes with Canada Ojitos Unit N-31, the completion on that well was delayed for a sufficient length of time that it did not interfere with our test.

So even though these are located on 160-acre distances from each other, we -- we basically were observing the production of only one well at a time, not all of the offset wells at a time.

Q All right, sir, looking at that plat, the E-6 and the N-31 are in the Canada Ojitos Unit, is that correct?

A Yes.

Q And as I understand it, that reservoir is subject to a pressure maintenance program, is that correct?

A Yes, it is.

Q Do you have an opinion on what effect the pressure maintenance program in the Canada Ojitos Unit has upon the E-6 and the N-31 wells?

A You're -- you're asking a question that basically is answered only with further study. It's why we're here today. It's why I've been a strong advocate of Mr. Greer being involved in our engineering efforts and it's why Mr. Greer's here today, is we're not sure just exactly how production in our area is affecting the pressure maintenance in his area.

There are some pretty serious problems here and that's one of the primary reasons if we don't do something to come to a better understanding of what's happening in our area, how is our area affecting adjacent areas, there's -- there's some pretty serious problems, and we need that time and that's the basis of McHugh's application.

Q May I have just a moment, sir?

MR. PEARCE: I have nothing further. Thank you, Mr. Roe.

MR. STAMETS: Are there other questions of this witness?

Mr. Padilla.

CROSS EXAMINATION

BY MR. PADILLA:

Q Mr. Roe, you testified about a pressure decline, I believe, in the Dr. Daddy-O Well that was characterized as a drastic pressure decline of 10 psi per day, something to that effect, and you made a comparison with the pressure decline in the Canada Ojitos Unit.

Isn't the pressure maintenance in the Canada Ojitos Unit, isn't it a fact that the pressure declines in the Canada Ojitos Unit?

A Yes, I -- I didn't mean -- yes.

Q You've answered my question. Now, what wells offset the Dr. Daddy-O Well?

A In all directions?

Q Yes sir.

A Okay. To the west is Mobil's Lindrith B Unit No. 34 and to the northwest would be McHugh's Full Sail No. 1.

To the north would be McHugh's ET No. 1.

To the northeast would be McHugh's Full Sail No. 2.

To the northwest, also, is McHugh's Native Son No. 2. Now I'm taking the liberty to give you wells in an area that I think may influence this well.

Quite a bit to the east would be McHugh's Native Son No. 1.

To the southeast would be McHugh's Homestead Ranch No. 2 and to the southeast, also, would be McHugh's Native Son No. 3.

To the southwest Mobil has their Lindrith B Unit 37 -- southeast, Lindrith B Unit 37 and to the south, directly, is their Lindrith B-38.

And in the southwest is McHugh's Lady Luck No. 1.

Now these are all within a maximum distance of 8000 feet. The way I understand the reservoir,

really, everyone in the reservoir offsets the Dr. Daddy-O No. 1.

Q How has McHugh produced the offsetting wells that -- during this time period, your period of --

A Well, all of the wells that I mentioned were -- were producing during the time -- well, I say all of the wells. I think even Mobil's wells. The Lady Luck is the only well that was not producing during our pressure interference test.

Now, again, I called it a pressure interference test. That is the weakness of measuring pressure at a point anywhere. You never really know for sure what's affecting it.

Referring back to that -- that graph that you're making reference to, there were some things that happened that we -- we can get some ideas of which wells may have been influencing the pressure drawdown. For instance, during July 10th the rate of pressure drop in that particular well changed from around 6.25 psi per day to 1.45 psi per day, a very dramatic change in the rate the pressure was declining.

Well, in the --

Q Is this one of the wells, is the Dr. Daddy-O well one of the wells you did not include in your 19 well representative sample?

A No, it, in fact, it was one of the wells. In fact I think we actually pointed that out in my testimony, is that the Dr. Daddy-O and the Loddy and the E-6 all -- all were on both plots.

They were at least on the second plot. I don't remember whether they're on the first one.

Q Well, is that a representative sample, then, the Dr. Daddy-O, is that a representative well in the group with that kind of pressure decline?

A Well, bearing in mind that this pressure is --

Q You're not answering my question.

A Okay, maybe --

Q My question is whether or not the Dr. Daddy-O is a representative well in your sample?

A It -- the pressure that is --

Q In view of the pressure decline.

A All right, forget the pressure decline. The final pressure that is measured --

Q My question is --

MR. KELLAHIN: He's asked the question of the witness. Let the witness answer.

MR. STAMETS: I believe the witness is being responsive to the question and I, like Mr. Padilla, would like to hear his answer to the question.

MR. KELLAHIN: May we have the question over, please?

Q In view of the pressure decline on the Dr. Daddy-O Well is that, is the Dr. Daddy-O Well a representative well in your sample 19 wells?

A Yes, I think so. There are other wells that have that same absolute pressure that we have measured currently in July. This is not the only well in the reservoir that we've measured this pressure in.

Q Well, then let me ask what other wells had a pressure decline that is that drastic, of those 19 wells.

A Okay, well, let me just emphasis the latter part of this pressure decline is more in line with the pressure declines I've presented on several of the other wells. In other words, the final rate of pressure decline is 1.57 psi per day. I believe that's a number that is presented on this graph.

What is happening in the early part where we have this approximate 10 pounds a day, and again, this was a fixed time period that we had approximately 1800 barrels a day in the immediate area, mainly from the wells that I just identified for you. They were all on production and that's what I was going to mention just a minute ago when you asked another question, was on July 10th the rate of

production in a lot of those wells that are in this area was reduced simply because the pipeline pressure went up and the pressure decline changed from 6.25 psi per day down to 1.45 psi per day, and this is one of our biggest concerns, and this is one of our biggest concerns presented right here, is what we're seeing in the Dr. Daddy-O is what you're going to see in every other well out there is that in the vicinity of high capacity wells such as the Dr. Daddy-O.

So this isn't unique. This is what you're going to see. This is the only well we've measured these kind of pressure declines in simply because it's the only well we've had the ability to run a pressure bomb in that is also adjacent to approximately 1800 barrels of oil per day production.

Q But you've never run a formal interference test between this and other wells, is that correct?

A Not the Dr. Daddy-O but there is two other wells in this general area we have recently run a pressure interference test in, yeah.

Q You've testified, Mr. Roe, that you did not make a material balance calculation, is that correct?

A That is correct.

Q Have you used a material balance calculation in your work experience?

A Have I ever?

Q Yes, sir.

A Yes, I have.

Q Can you tell me what the material balance calculation is used for?

A You can do two things with a material balance.

You can, one, get an idea of what your oil in place really is and you can use it as a predictive tool once you -- for the future performance of the reservoir.

Q I refer you now to your Exhibit -- Dugan Exhibit Number Two and go to the yellow sheet.

As I understand in reference to the questions made by Mr. Lopez, the 100-million barrels in place is not -- is a guesstimate of some sort, is that correct?

A It -- it's an effort to provide a scale at the bottom of the graph. Yes, it's an estimate, that's right.

Q Would a material balance calculation help you in inserting a more correct figure in this estimate?

A I don't think it would have affected us putting a million barrels there because the exhibit was -- was prepared simply to reflect the percentage of oil in place, the recovery of percentage of -- recovery in terms of

percentage of oil in place. But, yes, and this is one of the objectives of our study group, is to come up with that.

Q So in other words, we don't have what the total reserves in place are today.

A That is correct.

Q Now that we're on that exhibit, let me ask you some questions so I can understand this graph.

Assuming the pressure decline in the Gavilan would not be as drastic, in other words, the slope could be flatter, what effect -- what effect would that have on the GOR line at the bottom?

A Well, if that's what we're in fact measuring, which it isn't, it would shift everything to the right. In other words, it would delay the gas evolution from -- or it would delay the rate at which gas was evolved from the well.

But I would stress that's not what we're measuring.

Q Is there a relationship between the pressure decline line and reserves in the ground in this case?

A Yes.

Q What is that relationship?

A You want me to tell you what this gas material balance formula is?

Q Yes, sir.

A I can't do that off the top of my head but that information is pretty well documented and anybody that's been through petroleum engineering has had some exposure to that in school.

Q You don't have that figure yourself?

A Do I know it by memory?

Q (Not understood,)

A It's the same formula for any -- any pool. It's a formula that was generated and it doesn't make any difference where you're at, you use the same formula. The only variable would be Kg/Ko and oil pvt data and the properties that pertain to your particular reservoir, but the formula is not something unique to Gavilan.

Q You don't have any independent Kg/Ko data for the Gavilan wells?

A That is correct. We've done the best we can and that's used the data that's available at West Puerto Chiquito.

If all operators were as prudent as Mr. Greer is, that information would be available in the Gavilan.

Q Well, let me ask you, has Mr. Greer divulged that information to all the other people in the study committee?

A Yes, sir. I personally have provided a

copy to each of the engineering representatives that have been in attendance. In fact, I even provided a copy of that to a lot of the working interest owners who've attended either our first or second meeting in Mr. McHugh's office in Denver.

Q But McHugh did not participate in the interference test of the wells in the northeast of the pool.

A Well, he had none of the wells involved. The only people that could participate were the people who had wells in the area, which the people that were there did participate, was, like I say, the only wells that could have been involved were -- were the people that did participate, and that's BMG, Mallon Oil, and Dugan Production.

Q What -- has McHugh formulated any plans to unitize the Gavilan-Mancos?

A We -- we haven't gotten past the point of recognizing -- for a long time there was a tremendous resistance to even considering that possibility. In fact I've made a big effort today to not use the word "unitize".

Q You've used it extensively today, I think.

A Yeah, I know. I'm trying to not use it as often as I wanted to.

There's -- there's a big difference of opinion as to whether we need to unitize or not but I do

think Mr. McHugh's data, Mr. Greer's data, and any data that we've accumulated, plus data that all of the other operators have accumulated, including Meridian and Southland and Mallon Oil, Mesa Grande Resources, we have shared that data and I think the engineering and geologic people that have attended the two subcommittee meetings recognize the importance of evaluating that data and coming to a conclusion that, yes, we do need to unitize or no, the best thing to do is basically rape the reservoir and get what you can with the wells you've got, and a matter of importance is McHugh's in the best position to do that.

Q Has McHugh initiated any voluntary -- any efforts to voluntarily pool his acreage with other people?

A Pool it for units greater than 320?

Q Yes, sir.

A I'm not sure that I understand why there'd be a need for that under existing spacing.

Q You're an advocate of unitizing and I'm just wondering whether or not McHugh has made any efforts to voluntarily unitize the area, his acreage.

A Well, why would you want to have one unit allowable when you're going to be offset by everybody else who's drilling o 320's. I think that's what we need to evaluate at this current date of development. It appears to me that if anything's to be done it is unitization. A

change in spacing isn't going to affect development unless everybody in the pool develops on a larger unit.

But Mr. McHugh has been strongly behind our -- our efforts to get something moving on our unitization evaluation.

In fact our first two meetins were in Mr. McHugh's office and any expenses related to those meetings were totally carried by Mr. McHugh.

Q You testified this morning about a well on your sample of (inaudible) wells and I believe you used the word "anomalous".

A I'm sorry, I didn't hear.

Q There was one well in your testimony that you described this morning that you characterized as anomalous and you took it out of your 19 well sample.

Could you tell me which well that was?

A I don't -- in other words, we excluded from the pressure data?

Q Yes, sir.

A Gosh, I don't think I said that. Now we did exclude production information from two wells that we -- in other words, when are generating our poolwide GOR history, we excluded production information from the Gavilan Howard 1 and the Gavilan 1 because I felt that to be anomalous, but I don't --

Q I believe it was the Gavilan 1. Why did yoiu exclude that well?

A Because from the date of first production it's had a gas/oil ratio of 1000 or greater, and that is anomalous to what we think the reservoir performance -- we don't really understand why it's that way.

Q Well, isn't that indicative that it's in a different pressure system?

A Our pressure data doesn't support that.

Q You don't have any other theory for it being different from the other wells?

A Yeah, I have. This is one of the things that we need to resolve in our engineering committee is what really happened there.

Q Well, aren't we here at a premature time, then, if we haven't resolved that sort of anomaly?

A I don't think so, Mr. Padilla. If we wait for another two months to come back and then discuss what we need to do, the pressure is going to be lower by another 60 to 70 pounds in the reservoir, and in what we would think the performance of the reservir should be, that's going to be a critical -- critical thing. Right now time is of very big importance.

Our study group has been trying to get engineers from all companies together and evaluate this very

matter for some time now and --

Q Don't you also want to wait for the Mallon core sample as well to further study the reservoir?

A We don't want to wait until that -- it is available to start. We've already started. We would -- we're now waiting for the core data, and we are anxious to get that and we recognize there's a good chance that we won't get it.

As I indicated, Mr. Mallon is going to need to know from us within a week what -- whether -- because I'm pretty sure he's not going to pay an additional $80,000 to get a core so we can all benefit from it, and right now Mr. McHugh's the only one that's approved the taking of that core.

MR. PADILLA: I believe that's all I have, Mr. Chairman.

MR. STAMETS: Thank you, Mr. Padilla.

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Roe, it's getting late in the day and I would hope that you can keep your answers as short as they possibly can be.

You've indicated that GOR's are

increasing in this pool and there have been numerous questions saying well, isn't that standard in a solution gas drive pool and everybody's agreed that that is standard operating procedure.

I'm not clear on why these high GOR's are more significant in this fractured shale reservoir than they would be in the sandstone reservoirs that we commonly have for oil.

Could you tell me why?

A Yes, sir, and I might just mention if time is important, I'm pretty sure that Mr. Greer has some of his exhibits that will address that very issue, but real quickly --

Q If Mr. Greer is going to discuss any of these issues then I'll defer to Mr. Greer for everybody's convenience at this point.

A I believe Mr. Greer is in a better position to present his data than I would be.

Q Okay, very good. Let's see if Mr. Greer's going to answer this question.

What potential actions can be picked in this reservoir that have an opportunity to work which will increase the ultimate recovery from the reservoir, not just save dollars on perhaps unnecessary wells, but actually get more oil out of the reservoir?

A Right now my primary thought would be that we could avoid the production of high GOR wells simply to make your allowable. We could preserve that reservoir energy in ower structural wells and that will result in improved recovery from the reservoir.

Q Okay. Perhaps you might want to take a crack at this while we are away before the continuation of this, or maybe Mr. Greer would -- no, he probably doesn't want to do this -- in any event I'm curious if -- if we would be as effective in reducing reservoir voidage by reducing the gas/oil ratio limit to some figure which approximates 588 MCF a barrel as we would be reducing the GOR to 1000 and reducing the oil allowable to 200.

A I made a calculation of just that very case and it's true we will have a reduction in voidage. I haven't -- not that exact case but I have taken a look at, say, reducing to 700 and 1000 GOR, and the reduction in reservoir voidage wasn't -- it didn't bring the reservoir voidage down to the current level or, say, May's level.

Q Let me ask you if you would have any objection to making those calculations at 588 or 600 before the next hearing?

A No, I would be happy to do that.

Q And I also would ask you to, through Mr.

Kellahin, to make it available to the other counsel as quickly as you could so they might be able to get it to their people and save all these conferences that we have every time somebody testifies as to something different.

MR. PADILLA: Mr. Chairman, we have that calculation.

MR. STAMETS: You do? At what GOR?

MR. PADILLA: 588.

MR. STAMETS: Outstanding, so we've just saved you a lot of work.

Would there be any objection to sharing that information with everybody else before it's put on?

I have no requirement at this time; just trying to speed things along.

MR. PADILLA: None whatsoever.

MR. STAMETS: Okay. Again if you could make those available to the other people, we would appreciate that.

Another area that I'm kind of interested in is economics. We are talking about additional and if we are talking about additional recoverable up here, what's the production today, what's the value of that additional recoverable oil? Whatever we do in preventing waste,

we also have to consider that's sufficient economically, so if there will be any information on that by any of the witnesses we certainly will appreciate it.

Perhaps this is a question that doesn't need to be answered now but if you have an answer, I'd appreciate it.

Will ninety days be enough time?

A It conceivably could be and we hope that it is because we see the matter as being that important that we have an answer in ninety days.

MR. STAMETS: Are there any other questions of this witness?

He may be excused.

And as of right now we would reconvene this the 21st of August unless there is serious objection and we also have the 22nd. That would be Thursday and Friday.

The hearing will be in this room. If we have to go on Friday we will have to move up the street to the capitol building which is the only meeting hall available that we can think of.

Does anyone have anything further that they need to get done today?

There being nothing, we will --

MR. LOPEZ: Mr. Chairman, I might just inquire if Mr. Roe will be available for additional examination when we reconvene or whether he's going to be excused and whether we're going to continue the hearing or whether we're going to recess now.

MR. KELLAHIN: Mr. Chairman, Mr. Roe has just been excused as a witness and I don't know that I will recall him.

MR. STAMETS: The Commission always reserves the right to recall a witness; however, considering the number of witnesses we have, it would take something extremely serious which could not be covered by any other possible witness before we'd agree to bring him back.

If there is nothing further then, we will recess this hearing until August the 21st at 9:00 o'clock.

(Hearing recessed.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR