STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:	CASE NO. 11,996
APPLICATION OF PENDRAGON ENERGY PARTNERS, INC., AND J.K. EDWARDS ASSOCIATES, INC., TO CONFIRM PRODUCTION FROM THE APPROPRIATE COMMON SOURCE OF SUPPLY, SAN JUAN COUNTY, NEW MEXICO	ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS, Volume IV

COMMISSION HEARING

BEFORE: LORI WROTENBERY, CHAIRMAN
JAMI BAILEY, COMMISSIONER
ROBERT LEE, COMMISSIONER

August 20th, 1999

Santa Fe, New Mexico

This matter came on for continued hearing before the Oil Conservation Commission, LORI WROTENBERY, Chairman, on Friday, August 20th, 1999, at the New Mexico Energy, Minerals and Natural Resources Department, Porter Hall, 2040 South Pacheco, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

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I N D E X

August 20th, 1999 (Volume IV)
Commission Hearing
CASE NO. 11,996

(Continued...)

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EXHIBITS (Volume IV)

* * *

(Continued...)

E X H I B I T S (Continued)

Whiting/Maralex	Identified	Admitted
Exhibit JTB-15	1080, 1152, 1172	1102
Exhibit JTB-16	-	1102

* * *

	Identified	Admitted
Exhibit WA-1	-	1207
Exhibit WA-2	1185	1207
Exhibit WA-3	1184, 1190, 1202, 1211, 1224, 1277	1207
Exhibit WA-4	1184	1207
Exhibit WA-5	-	1207
Exhibit WA-6	-	1207
Exhibit WA-7	-	1207
Exhibit WA-8	1218, 1250	1207
Exhibit WA-9	1215, 1218	1207
Exhibit WA-10	1215, 1218	1207
Exhibit WA-11	-	1207
Exhibit WA-12	1215	1207
Exhibit WA-13	1188	1207
Exhibit WA-14	1189, 1240, 1253	1207
Exhibit WA-15	1193, 1197	1207
Exhibit WA-16	1193, 1196	1207
Exhibit WA-17	1193, 1197, 1222	1207
Exhibit WA-18	1206	1207
Exhibit N-50-1	1221	1233

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(Continued...)

E X H I B I T S (Continued)

Whiting/Maralex	Identified	Admitted
Exhibit BR-1	1260	-
Exhibit BR-2	1261	-
Exhibit BR-3	1262	-
Exhibit BR-4	-	-
Exhibit BR-5	-	-
Exhibit BR-6	-	-
Exhibit BR-7	-	-
Exhibit BR-8	-	-
Exhibit BR-9	-	-
Exhibit BR-10	-	-
Exhibit BR-11	-	-
Exhibit BR-12	1264, 1292	-
Exhibit BR-13	-	-
Exhibit BR-14	1293	-
Exhibit BR-15	-	-
Exhibit BR-16	1268	-
Exhibit BR-17	-	-
Exhibit BR-18	1270	-
Exhibit BR-19	-	-
Exhibit BR-19 (d)	1268	-
Exhibit BR-20	-	-
Exhibit BR-21	-	-
Exhibit BR-22	-	-
Exhibit BR-23	-	-
Exhibit BR-24	1270	-
Exhibit BR-25	1272	-
Exhibit BR-26	1279	-
Exhibit BR-27	-	-
Exhibit BR-28	-	-
Exhibit BR-29	1275	-

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(Continued...)

E X H I B I T S (Continued)

Applicant's	Identified	Admitted
Exhibit A-9	1095	421
Exhibit A-10	1095	421
Exhibit C-51-1	1089	1102
Exhibit Cox-5	1126	648
Exhibit Cox-10	1098	648
Exhibit Cox-11	1098	648
Exhibit M-1	1001, 1006	476
Exhibit N-2	1030, 1207	104
Exhibit N-19	1128	104
Exhibit N-21	1128	104
Exhibit N-28	989	104
Exhibit N-37	1088	104
Exhibit N-45	1195	104
Exhibit N-61	1029	104
Exhibit O-3	1017	1023
Exhibit O-4	1032	1047
Exhibit N-7-A-3	1051, 1061	879
Exhibit N-37-E-1	1089, 1160	1102
Exhibit N-37-E-2	1089	1102
Exhibit N-37-E-3	1089	1102
Exhibit W-30	1099	1102
Exhibit Brown-1	1115, 1154	1175
Exhibit Brown-2	1116, 1130	1175
Exhibit Brown-5	1119	1175
Exhibit Brown-6	1120	1175
Exhibit Brown-7	1121	1175
Exhibit Brown-15	1159	1175

(Continued...)

E X H I B I T S (Continued)

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A P P E A R A N C E S

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ALSO PRESENT:

ERNIE BUSCH
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NMOCD

* * *

WHEREUPON, the following proceedings were had at 8:30 a.m.:

CHAIRMAN WROTENBERY: Good morning. Are we ready?

MR. CONDON: Yes, ma'am, we are.

CHAIRMAN WROTENBERY: Go ahead.

<u>ALEXIS MICHAEL "MICKEY" O'HARE</u>,

the witness herein, having been previously duly sworn upon his oath, was examined and testified as follows:

CROSS-EXAMINATION (Continued)

BY MR. HALL:

Q. Good morning, Mr. O'Hare.

A. Good morning.

Q. Last night before we adjourned we talked about a number of things, including methodology used for evaluating the Pictured Cliffs in 1994, and I thought I heard you say that -- you said reservoir pressure is not a part of the volumetric gas-in-place calculation. That's not correct, is it?

A. Yes, I'd like to correct to statement. When he asked that question last night my mind automatically reverted to Fruitland -- or coalbed methane volumetric calculations, which does not have a pressure component except in the gas-content information.

The conventional reservoir volumetric gas-in-place calculation equation does have a pressure component, and if I were to tell you what pressure I used at this point in time, back in 1994, I would probably be lying, because I honestly don't remember what that pressure was.

Q. Well, whatever it may have been, you did testify that when you first looked at these wells about that time, the wells were logged off, and you explained that "logged off" meant that they were water out?

A. No, sir, I said that some of the wells may have been logged off, and some of them were probably shut in.

Q. Well, which were which? Can you tell us?

A. At the present time I cannot tell you. Again, there were a list of about 27 wells that we were considering during that evaluation, and we did do a field inspection at that time. The field inspection revealed that some of those wells had been shut in by the operator, which was Merrion and Bayless, and it also revealed that some of the wells that were left on production were not making any rates on the chart at that time.

And again, we were doing an evaluation to determine whether or not we wanted to buy this package of wells. We decided that it was not in our best interest to buy those wells at that time. We never dreamed, in our wildest dreams, that those wells would be used to steal our Fruitland formation gas at some point in the future.

Q. Well, let's assume that you were using some surface pressures, and let's also assume that some of the Pictured Cliffs wells that you looked at, that are involved in this case here, were logged off. That would have affected reservoir pressure --

A. Excuse me, we would never use surface pressures when we're calculating a gas-in-place number. That's always a reservoir pressure, and it's always at absolute pressures, not gauge pressures.

Q. Well, assuming that some of these wells were logged off, your reservoir pressures would have been incorrect; is that correct?

A. Would you restate the question, please?

Q. Assuming that some of the wells that you evaluated had logged off, that would have affected the reservoir pressures you assumed in your evaluation?

A. No, sir, we would not use any of the field pressures noted at the time of our field inspection for our gas-in-place calculations. We would go back to the initial reservoir pressure as reported by the operator, either on state reports or, if we had access to the well files at that time, shown in the well files of the operator.

Q. Let me talk to you briefly about your three exhibits you prepared on the drainage boundaries, AMO-20, AMO-21 and AMO-22, if you want to put those in front of you. And again, with respect to your evaluations of the PC, you have assumed that the wells are only capable of draining 160 acres; isn't that what you said last night?

A. No, I will state that -- I'm not exactly sure what I said last night, but the spacing for the wells was on 160 acres. And so we assumed for our gas-in-place calculations that those wells were spaced on 160 acres.

I think if you look at my Exhibit AMO-2 you will actually see that there are a number of 60-acre spacing units that have more than one Pictured Cliffs well in the area in question.

For example, in the southwest quarter of Section 1, you'll see that there is a Chaco Limited 1-J and also a Chaco 7, and it looks like it was initially noted as a Chaco Limited Number 1 and is now called the Chaco Number 7.

Both of those are designated as PC wells, and they're on a single 160-acre spacing unit. So basically you have 80-acre spacing in that case. But even with that, we assumed 160 acres in our initial evaluation of gas in place.

Q. Well, you don't mean to suggest that those two wells on the 160s are producing at the same time, do you?

A. I can't say that they are.

Q. You don't know that there's been a simultaneous dedication for them or anything, do you?

A. No, I don't.

Q. Likewise, you didn't do any evaluation to see if the PC wells could, in fact, produce more than 160 acres; you just made that assumption based on the spacing, correct?

A. Again, we weren't assuming any kind of drainage, as much as we were looking at the spacing to determine if the recovery factors at that time were greater than what would be reasonable for a conventional sandstone reservoir.

Q. The answer to my question is, you just plugged in 160 acres, you did not evaluate the actual drainage area for the Pictured Cliffs wells?

A. We are evaluating the drainage area when we're looking at the recovery factor. If the recovery factor is greater than a typical recovery factor of 60 or 70 percent, that would indicate that you're probably draining more than 160 acres. If it's less than that, that would indicate that you may be draining less than 160 acres.

So in an offhand way we evaluated that drainage pattern, and I can tell you that it did justify our conclusion at the time that the Pictured Cliffs was virtually depleted back in 1994.

Q. Which wells drained more than 160 acres?

A. We didn't see any that drained more than 160 acres during that evaluation.

Q. Can you tell us what the drainage was on the Chaco 4, for instance?

A. No, at this point in time I can't. But I know that the recovery factors in the area were less than -- in general, were less than the 60- to 70-percent number that we were looking at, and I think that the Chaco Number 4 that I presented last night in my summary was somewhere around 55 percent of the gas in place calculated.

Q. So I mean, you can't show us your drainage calculations here today, can you?

A. Again, it was not an explicit drainage area calculation, it was just a rough idea as to the recovery of the reserves from the Pictured Cliffs formation based on the volumetric calculation.

Q. Mr. O'Hare, what is the average reservoir pressure in the Fruitland Coal, presently?

A. I would say in the area of our wells, as outlined on AMO-2, that we're looking at somewhere around 80 to 85 p.s.i.

Q. And what is the --

A. And that's based on a July shut-in period of about eight days.

Q. All right. And what's the average reservoir pressure in the Pictured Cliffs presently?

A. Based on the bottomhole pressure readings that were taken by Pendragon in April, I would say the average reservoir pressure in the PC is -- The Chaco 1 was showing 73 p.s.i., the Chaco 4 was 67 p.s.i., the Chaco 5 was 85 p.s.i., the Chaco 2-R was 101 p.s.i.

Q. So now looking at your exhibit AMO-20, your drainage boundary alteration of Mr. Nicol's exhibit -- Do you see that there?

A. Yes.

Q. Now, you believe that the average pressure in the Fruitland Coal is presently lower than the Pictured Cliffs pressure; is that what you said last night?

A. The shut-in reservoir pressure, we believe, is either right at or right below the average shut-in reservoir pressure in the PC --

Q. Now, how do you --

A. -- currently.

Q. I'm sorry, are you finished?

A. Yes.

Q. How do you account for the declining pressure at the Chaco 1?

A. I think Mr. -- I'm sorry, I don't recall which of your witnesses presented the fact that there are three other coalbed methane wells within 160 acres of the Chaco Number 1. They are basically the same distance or closer to the Chaco Number 1 as our 7-1. So now there are four wells, Fruitland Coal wells, that are producing from the same source that the Chaco Number 1 is producing from.

So the interference on that Chaco 1, I believe, has increased here during the last year -- or two years, actually -- since those additional Fruitland Coal wells were put on.

Q. Would you point those out on the map for us?

A. The other -- ?

Q. The Chaco 1 and the wells you say are interfering with the Chaco 1.

A. This is what your witness said. The Chaco Number 1 is located here, in the northwest quarter of Section 18. There is a coal well in the northeast quarter of Section 18. Our coal well in the southwest quarter of Section 7. There is a coal well in the northeast quarter of Section 13. And I believe the other one was in the southwest quarter of Section 12, but I'm not absolutely positive of that.

Q. Yes, you're correct, our witnesses did say that your coal wells are interfering with the Pictured Cliffs wells.

What is your explanation for the pressure-decline trend at the Chaco 1?

MR. CONDON: Well, I just want to object to

Counsel's testifying in the proceeding. I think the record will show what each of the witnesses said.

CHAIRMAN WROTENBERY: Do you want to rephrase your question?

Q. (By Mr. Hall) What's your explanation for the decline in pressure trend at the Chaco 1?

A. The Chaco Number 1 is currently communicated with the Fruitland coal gas formation. The pressures that are exhibited in the Chaco Number 1 are being impacted by the production of Fruitland Coal Gas at four different Fruitland Coal Gas wells.

Q. Let me get this straight. Last night I thought I understood you to say that the Fruitland Coal gas is crossflowing into the Pictured Cliffs. Did I misunderstand that?

A. Yes, sir, you must have. What I said was, on the occasions when Fruitland Coal gas wells are shut in and the pressure is allowed to build so that the pressure exceeds the Pictured Cliffs formation pressure, at that point in time there may be some crossflow of Fruitland Coal gas into the Pictured Cliffs formation.

However, when the Fruitland Coal gas wells are producing, the reservoir pressure a significant distance away from those wellbores is actually lower than the formation pressure in the Pictured Cliffs. And so we believe at this time that there is actually crossflow during the production of the Fruitland Coal gas wells at the Chaco wellbores of PC gas into the Fruitland Coal formation.

Q. How do you explain the declining pressure trend on the Chaco 5?

A. The Chaco 5 is also communicated with the Fruitland Coal formation in that wellbore at the Chaco 5, or immediately outside the wellbore through the fracture-stimulation that Pendragon or Edwards applied on that well in 1995, and the production from our Gallegos Federal 6 Number 2, 12 Number 1, and 7 Number 1 wells is very likely drawing those Fruitland gas reserves away from that Chaco wellbore.

Q. All right, even though they are shut in presently?

A. The Gallegos Federal wells are not shut in.

Q. No, I'm speaking of the Pictured Cliffs wells. You say they are drawing the Fruitland Coal gas reserves; is that what you said?

A. That is correct, due to the drawdown and the high permeability in the Fruitland Coals, we see a drawdown pressure at the Chaco 5 Number 1 well that is lower than the Pictured Cliffs pressure, gases desorbing from the Fruitland Coals in and around that wellbore and flowing to our Gallegos Federal producing Fruitland wells.

And the pressure that's being read in the Gallegos 5 -- I'm sorry, the Chaco 5, and all of the Chaco wells, is Fruitland Coal gas pressure. Whenever that pressure -- Whenever our wells are shut in, that pressure is not a true reading, because the gas is bleeding back into the PC, until the point in time when the shut-in reservoir pressure in the Fruitland wells is below the Pictured Cliffs shut-in pressure. That's the only time it will truly read a Pictured Cliffs pressure.

Q. How do you explain the pressure-decline trend on the Chaco Number 4 well?

A. The same way as on the Chaco Number 5. Again, that wellbore has communicated from the Pictured Cliffs formation up into the Fruitland Coal through the fracture-stimulation that was imparted by Pendragon, or Edwards, on that well. Our Gallegos Federal 6 Number 2, 12 Number 1, and 7 Number 1 wells are drawing gas from that Fruitland Coal formation.

As we reduce the pressure in the Fruitland Coal below the Pictured Cliffs formation pressure, there is crossflow in the Chaco 4 wellbore into the Fruitland Coal, and that draws down the pressure in the Pictured Cliffs formation.

Q. Can we agree that the pressure in the Pictured

Cliffs now is greater than 80 p.s.i.?

A. No, sir, your bottomhole shut-in pressures recorded on April 22nd, 1999, indicated that on at least two wells the bottomhole pressure in the Pictured Cliffs formation is less than 85 p.s.i.

Q. What would you say the average pressure is now in the PC?

A. I would say it's somewhere on the order of 90 p.s.i. on average. The 1, 4 and the 5 average is going to be probably 76, 77 p.s.i.

Q. Okay, so we do agree, for the average reservoir pressure it's greater than 80, in the range of 80 to 90?

A. In the area of the Chaco 1, 4 and 5, I'd say less than 80. In the overall total area, if you include the 1-J and 2-J on the northwest side, then it would probably be above 80.

Q. Okay. Is it also safe to assume that the reservoir pressure in the PC was higher in 1995?

A. Higher than the Fruitland pressure?

Q. No, the 80 to 90 pressures we're seeing now in the Pictured Cliffs?

A. Yes, we believe that the average -- Or, I'm sorry, the average Pictured Cliffs pressure in 1995 was somewhere on the order of 100 to 120 p.s.i.

Q. The Pictured Cliffs wells have been open for production since 1995, correct?

A. That is correct.

Q. How can crossflow only occur --

A. I'm sorry, let me correct that statement. They were open for production until they were shut in by order of the Court June 30th of 1998, so they were open a little over three years.

Q. Yes, thank you. They're open for production since 1995 then.

How is it that crossflow only occurs when your wells are shut in? I still do not understand that. Why don't you explain that to me?

A. I don't think I stated that crossflow only occurs when our wells are shut in. The crossflow from the Fruitland formation into the PC can only occur when our wells are shut in, while the Chaco wells are shut in, and that's only if the Fruitland Coal formation pressure is higher than the Pictured Cliffs formation pressure. That was true about a year ago.

At this time, based on a shut-in that we had in July, we believe that the reservoir pressures in our Gallegos Federal 6-2, 7-1 and 12-1 wells is now at or below the shut-in reservoir pressure on the Pictured Cliffs formation.

So crossflow at this point in time, if all of the wells are shut in, probably will not occur because the pressures are so close together.

However, a year ago when our wells were shut in for a Chaco Plant shutdown and our pressures were substantially higher than the Pictured Cliffs pressures in that area there, there was crossflow of Fruitland formation gas into the Pictured Cliffs formation.

Q. So as I understand your testimony, the crossflow occurs only on those rare instances now when both the Coal wells and PC wells are shut in?

A. Crossflow from the Fruitland formation into the PC formation probably is not occurring now because those pressures are so close together. Okay? There is, in my view, probably crossflow from the Pictured Cliffs formation into the Fruitland Coal gas formation at this time, when our wells are producing, since the Chaco wells are shut in. And that's because the reservoir pressure, the flowing bottomhole pressure at our wells, is much, much lower than the shut-in pressure at the Pictured Cliffs formation.

And even out away from our wellbores, the permeability is great enough to transmit that pressure sink a great enough distance into the formation to allow crossflow of Pictured Cliffs gas in the Chaco wells, into the Fruitland formation.

Q. So it sounds like we're in agreement, then, that the pressure declines being shown on the Chaco wells are attributable to the interference from the Fruitland Coal wells when they are on production?

A. No, sir, we're not in agreement. That interference is being caused by the fact that the Chaco wells were frac'd into the Fruitland Coals. The initial interference was created in 1995 when Edwards and Pendragon purposely frac'd their wells and communicated their Pictured Cliffs formation with the Fruitland Coal gas formation.

Q. So are you telling me that production from the Fruitland Coal wells now is not affecting the pressure decline on the Chaco wells now?

A. No, sir, I think I explained that very extensively. There is more than likely some crossflow of Pictured Cliffs gas at the Chaco wellbores into the Fruitland Coal gas formation at this time.

Q. Is it your opinion that the Chaco 2-J is in direct communication with the Fruitland coal?

A. I believe the Chaco 2-J is in direct pressure communication with the Fruitland Coal, and by that I want to distinguish between pressure and production communication. If you have any kind of pathway to the wellbore, there is going to be pressure communication.

That pathway may not be sufficient to allow significant volumes of gas to flow through it. But if the pressure communication is established, you will still see an equalization of pressures. It won't be a perfect equalization of the pressures. It will be like a downhole choke, preventing the gas from flowing fast enough into one or the other formation to equalize those pressures. But there will be pressure communication there. And that's what I believe we have at the Chaco Limited 2-J.

Q. And you're aware that the pressures in the 2-J right now are about 190 p.s.i.?

A. I'm aware that that's what Pendragon has been trying to claim. There is a fact that the Commission must be made aware of, and that is the pressures that Pendragon has been submitting on the Chaco 2-J are shut-in tubing pressures. Whiting has been very consistent in providing shut-in casing pressures. And there's a reason for that.

Number one, fluids are more likely to build in the tubing than they are in the casing, just due to capillary pressures, capillary forces.

Number two, if you have a higher pressure in your tubing than you do in your casing, it is indicative of downhole problems. And generally it is indicative of collapsed casing or some kind of isolation of the pressure in the casing from the formation. I'm -- That's all right, from the formation. From the surface, I should say.

Now, if the pressure in the tubing -- If there is no wellbore problem and the pressure in the tubing is higher than the pressure in the casing, that has to be due to a false reading. At least I am unaware of any kind of explanation that would show why the tubing pressure would be higher than the casing pressure, unless you had a packer in the hole or something else that was isolating the formation pressure from the casing.

Q. Your pumpers were accompanying the Pendragon pumpers to take the pressure readings, weren't they?

A. Yes, they were. They still are, I should say.

Q. But you still refute the 190-p.s.i. pressures for that well, the 2-J?

A. One of our witnesses will address that in more detail, but you'll see that the exhibit we have shows that the casing pressures on that particular well have not exceeded something like 125 or 130 pounds here, even though Pendragon has been citing pressures as high as 190 pounds.

As far as what the pumpers are reporting, he's probably right, they may be reporting 190 pounds on the tubing. But it again is not realistic to see a pressure on the tubing that is that significantly higher than your casing pressure, without some kind of other explanation, external explanation.

Q. So you can't show us a coal well that approximates that pressure, can you?

A. One of our coal wells?

Q. Correct.

A. At the present time I don't think we have a coal well that has pressures that high.

Q. Is it your opinion that the Chaco 1-J is in direct communication with the Fruitland Coal?

A. Again, it is my opinion that the Chaco 1-J is in direct pressure communication with the coal. I don't think there has been established a sufficient flow channel to allow significant volumes of coal gas to be produced at the Chaco 1-J.

Q. And the 1-J has shown a pressure of about 145 p.s.i. for about a year now; isn't that right?

A. I am not as familiar with the pressures on the 1-J as I am on the 2-J. I know your bottomhole pressure was recorded at 154 pounds, so I would say 145 pounds would probably be a realistic shut-in pressure number.

Q. Now, referring back to your series of Exhibit AMO-20 through -22, by your whirlpool theory, I believe you called it, I understand that it's your opinion that the coal pressure has just dropped below 145 p.s.i. to show this type of result; is that accurate?

A. Our shut-in reservoir pressures, I believe, are less than 145 on the coals, yes.

Q. But the average producing pressure, how about that? Are you contending that's dropped below 145 p.s.i. in coal?

A. Well, the producing pressure has to be significantly below the reservoir pressure to give us the kinds of rates that we are seeing in our 1-1 well and our 1-2 well. So obviously the flowing bottomhole pressure is going to be lower than the reservoir pressure.

Q. Last night I thought I heard you address some of Mr. Cox's testimony, and I believe I heard you say that if you followed Mr. Cox's rationale, then millions of cubic feet per day were going from the coal into the Pictured Cliffs formation. Do you remember saying that?

A. I said that if you believe Mr. Cox's testimony, it would take millions of cubic feet of gas a day going through the Pictured Cliffs formation to show the pressure jumps in the Chaco 4 and 5 that were exhibited at the August shut-ins last year.

There's no way that you can get that quick a pressure response on a low volume of gas. It has to be a very large volume of gas in a very short amount of time, which means very high rates of gas had to be crossflowing from the Fruitland formation into the PC, if you believe Mr. Cox's testimony.

Q. And what's your basis for that number, though?

Did you calculate it?

A. One of our other witnesses did calculate that for us and showed that the volume of gas that it would take to increase that pressure over that distance amounted to millions of cubic feet of gas.

Q. Now, which witness is that?

A. It was either Mr. Robinson or Mr. Brown, I don't recall.

Q. Now, will they be rendering testimony on how they derived that?

A. We could probably prepare an exhibit.

Q. Well, my question is, are they going to testify about that?

A. I haven't seen what their rebuttal testimony is going to be, so I don't know, but I would be happy to ask them to.

Q. But you don't have any basis for that number, you didn't do the calculations yourself?

A. Again, I was there when they performed the calculations, I observed them and feel very comfortable that their numbers are right.

Q. Last night you also said, the same line of rationale, that if Pendragon is correct the pressure in the Chaco wells would be stable. Do you recall that?

A. Would you refresh my memory?

Q. To account for this flow from the PC into the Fruitland Coal?

A. Are you talking about my description of this exhibit?

Q. Yes, correct.

A. No, what I said was, if Pendragon's theory was correct, then this would be a more accurate representation of the pressures in their wellbore, the Chaco wellbore, than what Mr. Nicol was trying to present. If there is no communication in their wellbore, then their pressure has to have reached a stabilized rate. And the effect of any communication in our wellbores would be to drop this rate at a great distance away from this wellbore.

MR. CONDON: Mr. O'Hare, just for the record can you identify which exhibit you're referring to?

THE WITNESS: This is Exhibit AMO-20.

So my point was, this would be a much more accurate representation of what was happening if their theory was correct. There would be a fairly stabilized pressure regime around the Chaco wellbore in the Pictured Cliffs formation. There would be very little drawdown of the pressure until you got a great distance away from that wellbore, if the communication was in our Fruitland Coal wellbores.

Now, I didn't intend to make a statement that said this is what is happening there, but this is what would have to be happening if Pendragon's statement was correct, that there was no communication in their wellbores.

Q. (By Mr. Hall) So again, what's the current PC pressure at the Chaco 5?

A. As of April 22nd, 1999, the bottomhole pressure was 85 p.s.i.

Q. You don't have any more current information than April?

A. As far as the current bottomhole shut-in pressure or reservoir pressure?

Q. Yes.

A. No, sir, this is the last bottomhole pressure measurement taken by Pendragon.

Q. And what's the producing pressure on the 6 Number 2 Gallegos Federal well?

A. I believe that's somewhere around 5 or 6 p.s.i. at the surface.

Q. Well, if it's at 5 or 6 p.s.i.g. and it's directly connected to the PC, as you say --

A. I don't say that. Our wellbores are directly connected to the PC.

Q. Well, you say the two formations are connected at some point, correct?

A. We believe that the PC and the Fruitland are connected in the Chaco wells.

Q. And do you also believe that the 6 Number 2 well is incurring interference as a result of that communication?

A. We believe that the 6 Number 2 well drawdown pressure there is low enough to -- and the permeability is good enough, to where the flowing bottomhole pressure in the vicinity of the Chaco 5 wellbore and the Chaco 4 wellbores is sufficient to allow crossflow from the Pictured Cliffs formation into the Fruitland Coal gas formation.

Q. If the producing pressure at the 6 Number 2 well is 5 p.s.i.g., it's not going to produce any significant volumes from the PC, is it?

A. I'm sorry, I didn't understand your question.

Q. If the producing pressure at the 6 Number 2 well is 5 p.s.i.g -- 5 or 6 p.s.i.g, as you say -- is it going to be capable of producing much by way of volume from the Pictured Cliffs formation?

A. The producing pressure at the Chaco Number 5 -- I'm sorry, at the Gallegos Federal 6 Number 2, has an impact on the bottomhole pressure some distance away from that wellbore, and that distance, I believe, is great enough, especially with the permeability that we have in the coals, to impact the pressure at the Chaco Number 5 wellbore.

The communication between the two zones there means that maybe that pressure isn't 5 or 10 or 15 p.s.i. flowing bottomhole pressure at the Chaco 5, but maybe it's on the order of 50 or 60 p.s.i. And since the Chaco 5 has 85-p.s.i. shut-in reservoir pressure, there is going to be some crossflow from the PC into the Fruitland formation at the Chaco Number 5 under the current flow conditions.

Q. I thought I understood you to say last night that the crossflow from the Chaco Number 5 into the 6 Number 2 well was on the order of about 5 MCF a day; isn't that what you said?

A. Again, I believe the rate from the Pictured Cliffs formation is going to be relatively low. With that low of a reservoir pressure and a drawdown basically of -- maybe it's 20, 30 pounds, the flow rate out of the Pictured Cliffs formation cannot be very significant.

Q. Well, why is it limited to an insignificant amount, 5 MCF a day, as you say, when you have a 5-p.s.i.g. flowing pressure and you had a large frac on the 6 Number 2 well?

A. Well, it's limited for two reasons. Number one, the Pictured Cliffs formation is depleted, there's not much gas left in there to be able to produce at high rates.

And number two, the drawdown at the Chaco Number 5 is not going to be anywhere near as great as the drawdown that we have on the Gallegos Federal 6 Number 2.

Q. Let's discuss some more of your pressure assumptions on the Pictured Cliffs. Mr. Nicol's Exhibit N-28, I think we reviewed with him the other day, last week, showed that the Chaco 2-J was blown down by compressor for one or two days in July of last year to check for a downhole problem. Do you recall him testifying to that?

MR. CONDON: I'm sorry, could the witness be provided a copy of the exhibit if you're going to question him about it?

MR. HALL: Sure.

MR. CONDON: Okay, I can't even find a copy of mine, N-28

Q. (By Mr. Hall) Let me show you N-28, Mr. O'Hare. That was provided to you some weeks ago. I don't know if you had an opportunity to look at our N-28 when it was provided. Did you?

A. Yes, I did. This is the July 15th, 1998, pressure buildup test on the Chaco 2-J.

Q. And what's the highest pressure it shows there on the bottomhole pressure reading?

A. It builds up to 178 p.s.i. a little more than a year ago.

Q. Would it extrapolate to an even higher pressure had the test been run longer?

A. It's possible that it might build another one or two p.s.i., but it wouldn't be much more than that, based on that plot.

The interesting thing is that your bottomhole pressure noted in April of 1999 on the Chaco 2-J was 125 p.s.i., which is significantly below the 178 p.s.i. a year before, and that actually implies that the pressure communication is showing depletion in that part of the Pictured Cliffs reservoir as well as what we saw in the rest of the Pictured Cliffs reservoir in this area.

Q. Can you take your Exhibit AMO-16 in front of you, please, sir?

MR. CONDON: Here, take this one.

THE WITNESS: Thank you.

Q. (By Mr. Hall) You might refresh our memories from last night. What was the purpose of this exhibit?

A. This exhibit shows that there is more than sufficient gas in place in the Fruitland Coals to be able to produce not only all the gas that has been produced to date by the Gallegos Federal wells, but also all the gas that has been produced to date by the Chaco wells following the 1995 stimulations, and all of the gas that will be produced by the time that we abandon our Gallegos Federal wells.

Q. Now, which of the coal wells are included in this chart?

A. This includes the Gallegos Federal 26-13-1 Number 1, the Gallegos Federal 13 -- I'm sorry, 26-13-1 Number 2, the Gallegos Federal 26-13-12 Number 1, the Gallegos Federal 26-12-6 Number 2, and the Gallegos Federal 26-12-7 Number 1 Fruitland Coal wells.

Q. Now, I understood you to say last night that your maximum gas in place case shown here included all the coals; is that correct?

A. That is correct. It includes all of the coals that we have identified in each one of those wellbores.

Q. Now, how much of your total gas in place is attributable to the upper coals?

A. Just based on the numbers that we're looking at here on this Exhibit 16, I would say it varies from about 4 BCF to a maximum of about 6 BCF for the five Fruitland Coal wells.

Q. And what percentage of the total is that?

A. It's roughly a third of the total.

Q. Okay.

A. You'll see that the recovery factor shown on the bottom there is a percent of the most likely gas in place, not of the maximum gas in place.

Q. So for this gas-in-place calculation, you necessarily assumed that your hydraulic fracture grew upward to include those upper coals; is that right?

A. No, sir. The only reason I included the maximum gas-in-place number is because Pendragon was trying to claim that our fracs went out of zone down into the Pictured Cliffs, and my contention is, it is equally likely for fracs to grow up out of zone and communicate with those upper coals as it is for it to grow down into the Pictured Cliffs.

And so if you're going to look at one side of the equation, I think you should look at the other side also. And that side shows that there is great potential for recovery of the volumes of gas that we are seeing in the Fruitland Coal wells, plus the gas produced from the Chaco wells.

Q. Let me make sure I understand the import of that answer. Since you don't assume that the fractures grew up into the upper coals, then your recoverabilities are too high?

A. No, sir, this shows just the opposite. If you look at the most likely case, which is assuming only the coals that are currently perforated are contributing to the gas in place, we have recovery factors that vary from 62 percent to 94 percent.

I'm not going to sit here and tell you that we're going to get 94 percent of the gas in place out of the reservoir. My feeling is, it's more likely that our initial gas content estimation is conservative. We underestimated that 110 standard cubic feet of gas in place, standard cubic feet per ton of gas in place in the coal.

My personal feeling is, this is a more accurate estimate of the gas content of the coal --

MR. CONDON: I'm sorry --

THE WITNESS: -- 130 stan- --

MR. CONDON: -- when you say "this", would you just, for the benefit of the record, explain which column you're pointing to on the exhibit?

THE WITNESS: 130 standard cubic feet per ton, I believe, is the more accurate representation of the actual gas content of the coal. And if you use that number, ignoring all the upper coals, just looking at the coals that are currently perforated in our wells, you have a recovery factor of about 80 percent.

Given the high permeability of our coals and the very low pressures that we are producing those against, I think that is a reasonable recovery factor.

Q. (By Mr. Hall) So I understand your portrayal for the most likely gas-in-place case, the horizontal line at the bottom here, that case is based on the actual completions in the coal; you only considered those coals where you actually had perforations?

A. That is correct.

Q. And that is the gray -- the darker gray vertical column on AMO-16, correct?

A. That's correct.

Q. Can you tell us what your gas-in-place calculation was for each of the coal wells, as shown in those columns for the most likely gas-in-place calculation?

A. I don't believe I have that calculation with me, but I could re-calculate it for you.

MR. CONDON: Do you want him to re-calculate it?

MR. HALL: Yes.

THE WITNESS: The numbers that I'll have to use for the density -- What we did when we initially calculated this was used Mr. McCartney's density numbers and plug those in to the equation. Since I don't have those in front of me, if you'll allow me, I'll use a standard density number for the coals of 1775 tons per acre-foot.

For the -- The other factor I need is the coal thickness for each of the wells. If I could have some assistance from -- Oh, here it is. Never mind.

For the Chaco 7-1, that number comes out to 1.403

BCF.

Q. (By Mr. Hall) What kind of thickness did you assume for that?

A. 19 feet. This was not based on Mr. McCartney's --

MR. CONDON: Was there an exhibit from Mr. McCartney that you would like to look at?

THE WITNESS: It would be faster to just punch the numbers out here.

MR. CONDON: Okay.

THE WITNESS: The number on the 6-2 is the same.

And the number on the 1 Number 1 will be the same.

The 1 Number 2 calculates to 2.732 BCF, and that's significantly higher because there is quite a bit more coals open to the wellbore in that well.

And the 12 Number 1 will also be 1.403 BCF.

The only other addition would be the 160 acres around the Chaco Number 1. That was included because we included the production from the Chaco Number 1 in the row that's labeled "Ultimate Fruitland Coal Production". So that total gas production includes the production from the Chaco Number 1 from the frac- -- the 1995 fracture-stimulation, forward.

Q. (By Mr. Hall) All right. The numbers you just gave me for the most likely gas-in-place calculations for each of the wells for your first vertical bar, that assumed gas content in the coal of 110; is that correct?

A. No, the numbers I just gave you were based on 130.

Q. I see. Referring back to the Gallegos Federal 1 Number 2 well, I believe you said the gas-in-place number for that was 2.732 BCF; is that right?

A. I believe that's correct. I didn't write them down.

Q. And that well is perforated in the upper coals?

A. That is correct.

Q. How much -- What percentage of the gas in place is contributed by just those upper coals?

A. About 4/10 of that total would be coming from the upper coals, 40 percent.

Q. Forty percent. And what's the cum production for that well, the 1 Number 2?

A. If you'll give me a minute to look it up, I can give you an exact number as of June 30th, 1999. That well had produced 320,018,000 cubic feet of gas as of June 30th, 1999.

Q. That's probably your weakest coal well that's involved in this proceeding, isn't it?

A. It is, up to this date, the lowest producer.

However, it is still on an incline and is approaching a rate of 400 MCF per day.

Q. So as I understand it, you're representing to the Commission that the coals contain, for this well anyway, about 40 percent of the gas in place, contributing significant volumes of gas, right?

A. Yes, that is correct, in this well.

Q. What do you think the current gas production rate is from just that upper coal?

A. We have no way of knowing what that is without doing a downhole test, basically setting a packer between the two zones and producing the upper zone independent of the lower zone, and we have not attempted to do that.

MR. CONDON: Could we, just for a point of reference for the Commission, have you just take the Ayers cross-section so that the Commission knows what you're referring to when you're talking about upper zones, as opposed to talking about it in a vacuum?

THE WITNESS: The upper zones we're referring to are the coals that are located a significant distance above the thicker coal that we're typically producing from in most of the Gallegos Federal wells. This cross-section does not have the Chaco -- I'm sorry, the Gallegos Federal 1 Number 2 on it.

Q. (By Mr. Hall) What is your basis for using these various gas-content figures in your three scenarios?

A. Well, a company that we operated for, we actually put together another project to the west of this project, and -- several years ago. I believe it was in 1993 or 1994, we took a pressurized core through the coal, and we desorbed the gas from the coal and measured that desorption process.

Unfortunately, the pressurized core barrel leaked and we did not have a pressurized core when we got the core to the surface, so the numbers that we got from that desorption of the gas from that coal sample were adjusted, and the adjusted numbers came out to 110 standard cubic feet per ton.

Again, we feel that that is a minimum number, and we feel the maximum number is going to be somewhere on the order of 130 to 140 standard cubic feet per ton.

If you look at the recent literature -- In fact, there's a new book out by Matt Maver and Charles Nelson at the GRI that basically goes through and tries to actually quantify the amount of gas that is being lost or not recognized in the coals, and they are giving numerous examples where the gas content of the coals across the country is being underestimated on a regular basis.

Q. Refer to the core analysis. What well was that?

A. It was the West Bisti 26-13 -- It was either the

20 Number 2 or the 21 Number 1. I don't recall for sure.

Q. I recall you testifying to that last year, remember that well name. You said the adjusted number was about 110 standard cubic feet per ton?

A. That is correct.

Q. What was the real number, the measured number?

A. I think the measured number from the desorption of the samples was on the order of 80, 84, something along those lines.

Q. Now, on your AMO-16 --

A. There were actually several samples there, and some of those samples may have been lower than that, but I think that was the -- That number sticks in my mind. I can't swear that that is the number.

Q. Let's look back to your AMO-16 for your most likely gas-in place assumption. Your lowest figure is about 8.1 BCF, give or take, right?

A. Correct.

Q. And you heard Mr. McCartney testify. He said that he shows about 6.9 BCF gas in place for these wells. Do you recall that?

A. Yes, I do.

Q. Can you explain the difference?

A. Not without getting with Mr. McCartney to see exactly what he used to calculate his numbers. We tried to take the density numbers that he provided in his calculations. We used 320-acre spacing, and we used the perforated coal interval in each one of our wells to come up with our number. If he used any factors that were different from that, that would explain the difference in our numbers.

Q. Now, what drainage area per well did you assume for your calculations?

A. Again, I just stated, we used 320 acres for our drainage area.

Q. And --

A. And that is the current spacing of the coals in this project.

Q. All right. So you just assumed that the spacing for the coal wells is an accurate reflection of drainage?

A. Yes, and that is an erroneous assumption from the standpoint that the Chaco wells were much closer than 320 acres away, and they were definitely producing Fruitland Coal gas.

So we were sharing reserves between those wells. And that's why I included the total production from the Chaco wells, from the 1995 stimulations forward, in the ultimate Fruitland Coal production number that's included in this exhibit.

Q. Would you define the term Langmuir volume for us, please?

A. Not off the top of my head. That is a -- basically, it is a constant number -- I shouldn't say a constant. It is a variable number dependent on pressure, that is determined for individual coals, and it helps define the curvature of the isotherm curve that tells us how much gas is going to come out of the coal at different pressures.

It's actually generally determined from adsorption data, meaning that they are pumping methane into the sample at varying pressures and measuring how much of the gas comes out and assuming the difference stays on the coal. And at different pressures, you have -- Mr. McCartney's Exhibit M-1 shows the results of that test.

Q. The Langmuir volume assumes infinite pressure, doesn't it?

A. I do not recall off the top of my head.

Q. You're the engineer, you have to help me out. Let's assume that it does, Langmuir volume assumes infinite pressure. Doesn't it show the maximum amount of gas that can be stored at infinite pressure? Isn't that what it's used for?

A. The Langmuir volume does define the maximum amount of gas that can be stored in a coal under certain conditions. Now, I cannot swear that it is infinite pressure, but it is the maximum volume of gas that can be stored.

Q. Well, if we assume that Langmuir volume does assume infinite pressure, at pressures less than infinity p.s.i. the coal will actually hold less than Langmuir volume; does that sound right?

A. There is a breakover point on all coals where it doesn't matter how high the pressure gets after that, it will not accept any additional gas. And the way that works is, there are very minute coal -- or methane molecules that adsorb onto the coal particle in micropores. And so even if you're trying to cram more of those molecules into the same space, there's just no room for them to attach themselves to the coal. And so the maximum pressure may be somewhere around 2000 p.s.i., after which there is no additional room on that coal particle for additional methane molecules to attach themselves.

So if you go to twice that pressure or five times that pressure or 100 million times that pressure, there is no additional gas being attached to the coals.

Q. Did you get an opportunity to review Mr. Robinson's prefiled testimony for this case?

A. No, I did not.

Q. Well, were you aware that he stated that the gas content in the coal here is 80 to 110 standard cubic feet per ton?

A. I believe Mr. Robinson used those same numbers in his 1998 presentations.

Q. Well, do you not agree?

A. No, I don't agree. I think Mr. Robinson was trying to be extremely conservative, going out of his way to find the worst case for us, and consequently he used numbers that, in my opinion, were too low.

Q. Well, in your less conservative case, you show the wells will produce, in all, about 7 billion 659 cubic feet [*sic*]; isn't that right?

A. I show that in all my cases. That is my estimate of what the ultimate recovery will be from the Fruitland Coals in this area, again including 160 acres around the Chaco Number 1.

Q. And what is the current cum production from the coal wells?

A. Our wells have cum'd, as of June 30th, 1999, 3.705 BCF. And the Chaco wells had cum'd about .98 BCF when they were shut in.

Q. So some 317 million is from the upper coals; would that be accurate?

A. No, sir.

Q. Well, you said earlier that the 1 Number 2, about 40 percent of the production from that well is attributable to the upper coals?

A. From that well, but that production is only 320 million.

Q. So the current total cumulative production corresponding to the 7 billion cubic feet on AMO-16, your Exhibit AMO-16, is about 4.7 BCF; is that right?

A. Cumulative production to date is about 4.7 BCF, yes.

Q. And the current production rate from your five wells now is what?

A. The current production rates -- I don't have that in front of me, but I can estimate it if that's your desire.

Q. Go ahead.

A. I'm guessing the current rate is somewhere around 2.9 million cubic feet of gas a day.

Q. So with the remaining reserves you assume, how many years of production at today's rates remains if the wells do not decline?

A. Well, if you take the 7,659,000,000 cubic feet of gas that we think is going to be produced and subtract from that the 4,700,000,000 that has been produced to date, and then divide that by 2.9 million a day, you would come out to -- 1020? That's not right. 1020 days, assuming constant rate, 2.8 years.

Q. So that's your remaining life of the wells; is that what you're saying?

A. No, that's not what I'm saying. Let me back up a little bit.

We have seen a very steep decline on our Gallegos Federal 7-1 well. That well is currently declining at about 55-percent exponential decline per year.

We have a decline on our 6 Number 2 well of somewhere around 40 percent and a decline on our 12 Number 1 well of about 25 percent, currently.

The 7 Number 1 well will probably not produce for two more years, and it will be depleted.

The 6 Number 2 may be another, oh, three to four years.

The 12 Number 1 may be another four to five years.

The 1 Number 1 and the 1 Number 2 wells are both still inclining in production, so we expect to see some additional -- or longer lives on those two wells than the other three wells.

So on average, if we were to assume that we could keep our 2.9-million-cubic-feet-a-day rate constant through abandonment, we would only have an average of 2.8 years left for this five-well project.

Keep in mind, though, those wells are declining in production, at least three of the five wells are declining in production, and it's not likely that we're going to be able to keep anywhere close to the current rate.

Q. Well, let's look at your recovery factors. What reservoir pressure does a 94-percent recovery factor correspond to?

A. That comes very close to what we talked about on Mr. McCartney's M-1 exhibit last night, where we would have a 5-p.s.i. abandonment pressure.

Again, if you look at that curve -- and I don't have that in front of me, but if you look at that curve and you come up at 5 p.s.i. to the isotherm line that Mr. McCartney fitted to the 110-standard-cubic-feet-per-ton gas content, and go to the left, to the scale on the left, it will show that there's about a 6- or 7- or 8-standard-cubic-feet-per-ton amount of gas remaining in the reservoir at that abandonment pressure. This is the curve I'm referring to.

So if you take 110 standard cubic feet per ton and subtract 7 from that and divide that by 110, you get a recovery factor of 93.6 percent, which is very close to what we're showing as the recovery factor on the 110 case of 94 percent.

Q. Now, I'm sorry, that was McCartney Exhibit --

which?

A. M-1.

Q. M-1? What abandonment pressure did you say you felt the reservoir would reach?

A. For this assumption?

Q. Yes.

A. That was the same abandonment pressure that Mr. Cox was presenting in his testimony of 5 p.s.i.

Q. Wasn't Mr. Cox talking about 5 p.s.i.g.?

A. That's not my recollection, but it may have been. I thought it was 5 p.s.i.a.

Q. Well, if it were 5 p.s.i.g., would that affect your conclusion?

A. It would not affect my conclusion that we're going to be recovering about 7.6 BCF of gas from our project here, and that there is sufficient gas remaining in the Fruitland Coal to justify that recovery number, no.

Q. So to do that, you're going to have to draw down the reservoir pressure, 1000 feet or so into the reservoir, down to 5 p.s.i.a.; is that what you're saying?

A. Again, it's not my contention that we're going to get a 94-percent recovery factor. My contention is that the 110-standard-cubic-feet-per-ton number is probably conservative, which is what we had intended from the start. When we calculate our reserves, we try to be conservative.

I really believe that our gas-content number is closer to 130 standard cubic feet per ton, and we're going to be looking at more like an 80-percent recovery factor.

Q. There's no scientific basis for your gas-content factors, is there?

A. The scientific basis comes from the core work that was done in the area and the recent literature that is very emphatic in stating that coal gas contents are very conservative across the country.

Q. If your cum production from the coal wells and the Chaco wells is about 4.7 BCF and your most likely gas in place is 8.137 BCF, what recovery factor would that be to date?

A. Using 4.7 BCF?

Q. Correct. I'm sorry, the 9.6 BCF on your AMO-16.

A. That would be a 49-percent recovery factor.

Q. And what would the average reservoir pressure be to do that?

A. If we accept Mr. McCartney's isotherm data, we can calculate what that pressure would be by making a multiplication of that 48 percent to come up with the 53 standard cubic feet per ton, 53.8 standard cubic feet per ton, going across to the curve and then dropping down to the pressure axis, the X axis, and reading the pressure off of that, you would get somewhere around 85 p.s.i., which coincidentally happens to be very close to where we are, based on the shut-in in July.

Q. Mr. O'Hare, does your company prepare reserve reports on a regular basis?

A. Internal reserve reports, yes.

Q. Is yours a publicly traded company?

A. No, sir, we are a private company.

Q. How about Whiting? Is it a publicly traded company?

A. Not that I'm aware of. One of the other witnesses would be able to testify to that.

Q. All right. Do you know whether Whiting relies on data you provide them to prepare their reserve reports?

A. I don't believe so. I would think they would use their internal data.

Q. Mr. O'Hare, how much has the 1-J taken from the Fruitland Coal formation?

A. The production on the 1-J well has been very low historically, even after the acid job. And again, I think I stated earlier that I'm not convinced that it is in production communication with the coal, but I do believe it is in pressure communication with the coal. If it has taken any gas from the Fruitland Coals, it's been fairly low volume, much lower than the Chaco Number 4 or Chaco Number 5, or even the Chaco 2-R and the Chaco Number 1.

Q. There's no well you can point to that's being affected by the 1-J, correct?

A. Yes, I do not believe that there is substantial reserves, Fruitland Coal gas reserves, being produced from the Chaco Limited 1-J well, and therefore it has not had a big impact on the production of any of our Fruitland Coal wells. But it is in pressure communication with the Fruitland Coals.

Q. Can you refer to your Exhibit AMO-13, your P/Z-versus-cum plot?

A. Chaco Plant Number 5?

Q. Yes. Do you have that in front of you?

A. Yes, I do.

Q. Mr. O'Hare, on there you show two data points on here at about 190 and about 120. Do you see those?

A. Yes, I do.

Q. Why didn't you honor those two data points?

A. This line fit through that curve was computer-generated. It's a best-fit line of the data. It is not a hand-drawn curve; I didn't try to sway the computer in any way to pick the line to place across that.

Q. Why are they shown there? Why are those two data points shown there?

A. Because those are actual data points that we pulled from the NMOCD records.

Q. Do you know why the computer program didn't honor those points?

A. The computer program did honor those points. Do you know what a best-fit line is?

Q. I do not. Why don't you explain that to me? I'm not an engineer.

A. Basically, the computer calculates an equal distance between the points that it has available and draws a line to an equal distance between all those points.

Q. Look at page 24 in your testimony. Do you have that in front of you?

A. Yes, I do.

Q. If you look at about lines 9 and 10, you discuss the water-to-gas ratios for the Chaco 1. Do you see that there?

A. Yes, and I also see a typo there. On line 10 that should be 0.116 barrels per MCF.

Q. Okay, good, glad we straightened it out. Are there any other corrections to your testimony you wish to address?

A. Not that I know of, and I appreciate you pointing that out.

Q. Does it continue to be your testimony that the Chaco wells were placed on pump?

A. I don't believe I ever testified that the Chaco wells were placed on pump. So no, that is not my testimony.

Q. Let's look at page 8 of your testimony, lines 18 and 19. Do you see that there? Let me read it into the record:

> By the following month, we realized that not only were those wells being completed and put on pump, which was most unusual for Pictured Cliffs wells...

Do you see that there?

A. That sentence continues:

> ...but that there had been restimulations of other Pictured Cliffs wells in this area.

What I was referring to there was, there were new wells being drilled adjacent to our Gallegos Federal 6-2 and 7-1 wells, less than 320 acres away, indicating that they were either going to be Pictured Cliffs wells or wells to a deeper formation, like the Gallup, that is on closer spacing than 320 acres.

When we investigated, we found that they had, indeed, been permitted as Pictured Cliffs wells, but upon completion they were put on pump, and that indicated to us that somebody knew exactly what they were doing in trying to help us dewater the Fruitland Coals through the Pictured Cliffs formation.

Q. Well, let's straighten this out. You're not saying that the Chaco wells that are involved in this proceeding were ever put on pump?

A. No, sir, I've never said that or tried to contend that.

Q. All right. At page 23 of your testimony you made some vague reference to --

MR. CONDON: I'm sorry, what page are you on?

MR. HALL: Twenty-three.

Q. (By Mr. Hall) -- made a reference to some water-hauling tickets. It's about lines 14 through 17. Do you see that there?

A. Yes.

Q. Why did you refer to those water-hauling tickets?

A. That to me was an indication that water was being produced from these particular wells and verified our field observations that water had been produced into earthen pits. Coincidentally, all of those water-hauling tickets began in March of 1998, following the field inspection by the NMOCD office in Aztec, and so evidently they were instructed to get the water out of those pits, and they began hauling in March.

And Exhibit AMO-9 contains copies of those water-hauling tickets, at least some of those tickets.

Q. Let's be clear about your testimony here. You're not representing to the Commission, for instance, that the 640 barrels hauled in March of 1998 all came from the Chaco Number 1, are you?

A. I believe that's what the evidence indicates. There was 640 barrels of water that was hauled off as shown on Exhibit Number 9 during that month, and I don't know -- Here it is. The third page in on that exhibit shows the Chaco Number 1 as the well that water is being hauled from, and the total barrels shown at the bottom is 640 barrels. So my testimony is that the evidence shows 640 barrels of water was hauled off the Chaco Number in March of 1998.

Q. I see. Let's straighten this out, though, we ought to be clear on this. You were present at the deposition of James McKnight held in Farmington on September 8th, 1998, weren't you?

A. That is correct.

Q. And who is Mr. McKnight?

A. I believe he is a water-truck driver for Sunco Trucking.

Q. Well, isn't it true that he explained that the invoices show that water was hauled from a number of wells, not just the Chaco 1?

MR. CONDON: I'm sorry, let's have the deposition if you're going to question him on the deposition testimony.

MR. HALL: Well, I can ask him about his recollection.

THE WITNESS: I don't recall specifically him saying that, but without having his -- the transcript of the deposition, I just can't rely on my memory there.

Q. (By Mr. Hall) Well, wouldn't it be accurate to say that Mr. McKnight explained that you couldn't use the invoices to tell the water production from a single well?

A. No, I do not recall that. If somebody is invoicing you for charges -- If I get an invoice for somebody that is charged back to a well and there are charges on it for other wells, that invoice goes back to the vendor to be corrected, because generally -- especially if there are other working-interest owners in differing wells, you don't want to be charging one group of people for charges that they're not obligated to pay. That would be fraudulent in my view.

Q. Didn't Mr. McKnight explain that when the invoices were written up, the charges for water hauling reflected the first well where water was picked up, but that it also showed, as he testified, that water was picked up from a number of wells so he could have a complete load?

A. Mr. Hall, I do not recall that testimony specifically with the Chaco wells at all.

Q. All right. Mr. O'Hare, did Maralex report water to the Oil Conservation Division produced from the Gallegos Federal wells from the time the wells were first completed till first gas sales?

A. From the time that we started flowing back our fracs and -- or producing back the fracs -- keep in mind that these wells are on federal land, BLM land, and the BLM gives us actually a one-year period to utilize our reserve pits before we have to have them closed following the drilling of our well, and that's where the water was going initially until we had tanks set on each location and the wells were tied into the sales line. And we did not report that water production up until the wells were first delivered, and then water production was reported on a regular basis from that day forward.

By the way, all of our reserve pits were lined pits.

Q. Let me get into this just briefly with you, Mr. O'Hare. You've rendered this testimony about your wells having been monitored by Pendragon, Mr. Thompson. Did you ever monitor Pendragon wells?

A. There was one occasion after we discovered that there appeared to be some communication between the Chaco wells, the PC and the Chaco wells in the Fruitland Coals, when I did a field inspection of the Chaco wells, and that was in late 1996, and I physically went to each location, observed water in the pits and also observed the flow rate from the wells through the sales meter, or the allocation meter as the case may have been.

Q. Last night, I believe I heard you say you thought it was improper for Pendragon to have captured some gas samples on its wells; is that correct?

A. I said we were not notified, and I believe under the Court order that shut in those wells, that they should have gotten Court permission before capturing those gas samples. And the reason I say that is, generally, in order for you to capture a gas sample you have to open the well to the atmosphere, through your sample chamber, to purge your sample chamber of any other air or gas or inerts that may have been in that sample chamber from previous samplings. And then you shut in your sample chamber and shut your well back in.

And in my view, any release of gas from the Chaco wells under the Court order would be in violation of that Court order.

Q. Let me show you what's been marked as Exhibit Pendragon O-3. What is that? Can you identify that?

A. Yes, these are gas analyses from Gas Analysis

Service, and it looks like they are on the Chaco Number 5, Chaco Number 4, Chaco Number 1, Chaco Number 2-R, another Chaco 2-R, Stacey Number 1, Leslie Number 1, and they appear to all be dated in October or November of 1997.

Q. Now, at the very top of the exhibit it shows the Maralex Resource fax line, does it not?

A. Yes, it does.

Q. So you were aware of these gas-sample analyses, weren't you?

A. Yes, we were.

Q. And it says it's done for Maralex Resources, Inc. where it says "Company" there?

A. Yes.

Q. Did you order these gas analyses?

A. I would say I approved the gas analyses, yes.

Q. Did you seek Pendragon's permission to capture those gas samples?

A. Not that I recall. I believe these were cloak-and-dagger gas analyses we obtained from the Chaco wells in 1997 --

Q. Can you --

A. -- prior to the -- both our application in front of the NMOCD and our filing of suit in District Court.

Q. Can you explain why the gas analysis reports have the well names changed on them? For instance, the first one shows Bisti 5, and it's handwritten in above that, Chaco Number 5. Did you do that?

A. No, I didn't.

Q. Can you explain why the name was changed?

A. Again, these were cloak-and-dagger samples, and our intent was to make sure we knew where they came from but not necessarily have anybody else know where they came from.

Q. What do you mean "cloak-and-dagger"?

A. We were very far along in our analysis of the interference or the communication study that we had started on the Chaco wells, and we had some gas analyses that had been provided by Pendragon in 1996, but we wanted additional verification that these analyses were valid, and so we took samples without permission from Pendragon.

Q. Is that ethical?

A. Probably not.

Q. Mr. O'Hare, do you agree with Mr. Robinson when he says, We believe that hydraulic-fracturing the Whiting Fruitland Coal wells has created a fracture that extended down to the Pictured Cliffs? Do you agree?

A. No, sir, I do not agree. And in fact, Mr. Robinson and I have had a number of discussions. I think he may have changed his opinion here recently.

My personal feeling, again, is very well reflected by Commissioner Lee's comments here the other day when he said that the simulation of fractures can be used as a tool, more for design purposes. It definitely has many more variables than you could ever hope to pin down.

We don't have a lot of information in the subsurface about what is actually going on downhole, and the models are nothing more than suppositions, and we try to put in the best numbers that we have to represent what is going on downhole, but I don't think we are even close to having an accurate representation of the downhole environment.

Q. Did you ask Mr. Robinson to change his testimony for this hearing?

A. No, sir, I did not.

Q. But you did discuss it with him, I understand you to say?

A. Yes, sir, I did.

Q. And how about Mr. Brown from Whiting? He says basically the same thing, do you agree?

MR. CONDON: I'm sorry, as who?

Q. (By Mr. Hall) As Mr. Robinson?

A. Do I agree that he says the same thing?

Q. Yes.

A. I have not read Mr. Brown's entire testimony, so I cannot say I agree or disagree with him. My personal conversations with Mr. Brown, I have the impression that he feels as I do, that you don't have an accurate representation of the downhole conditions in the Fruitland Coals, and therefore the modeling that we see probably is not accurate.

Again, through my experience in the work that we have done, the testing, especially, that we have done to determine whether or not coal fracs go out of the coal formation, I feel very strongly that they are very well contained in most parts of the San Juan Basin, but in this part in particular, based on even a very recent tracer survey that we ran on a well southeast of these wells, and I'd be happy to introduce that into evidence.

Q. Do you know if Mr. Robinson came by any new information since last year's hearing that caused him to change his testimony?

A. As far as -- I'm sorry, I don't know if he changed his testimony from last year. I believe last year he was focusing on the Chaco wells, and I don't know if he testified -- I don't believe he testified with regard to the fracs on the Fruitland Coal wells last year, so I don't believe he changed his testimony.

MR. CONDON: I'm going to object to this line of questioning. We're already two and a half hours into the cross, and I don't think it's proper to have Mr. O'Hare asked about what other witnesses are testifying about or aren't testifying about. We're going to have those witnesses here. It would be faster to just bring them up and have them testify.

MR. HALL: He has already testified that he discussed the witness's testimony with him, so I think it's proper.

MR. CONDON: Well, only because you asked him --

MR. HALL: That's right.

MR. CONDON: -- and my objection is to the line of questioning, about asking one witness to comment on what other witnesses are or aren't going to testify about.

CHAIRMAN WROTENBERY: I think we'll proceed with the line of testimony.

Q. (By Mr. Hall) So Mr. O'Hare, is it accurate to say that Mr. Robinson's testimony is not supportive of the position you take in this case?

A. That particular line of testimony is not supportive of my position. Still, I did not feel it was appropriate to ask Mr. Robinson to change his testimony. I think all the facts should come out, and again I'm happy to see that the Commission has recognized the limitation of simulations, and so I think the proper weight will be given to that testimony in the Commission's judgment.

Q. So you're asking the Commission to give less weight to Mr. Robinson's testimony?

A. No, I don't think I said that. I believe that the Commission will be fair, and I'm leaving it to their discretion as to what weight they feel should be appropriated to that testimony.

MR. HALL: No further questions.

I'd move the admission of AMO-3.

CHAIRMAN WROTENBERY: Any objection?

MR. CONDON: I'm sorry, that's O-3.

CHAIRMAN WROTENBERY: AMO- -- yeah.

MR. HALL: Beg your pardon.

MR. CONDON: No objection.

CHAIRMAN WROTENBERY: O-3 is admitted into evidence.

Commissioner Bailey?

EXAMINATION

BY COMMISSIONER BAILEY:

Q. Did Maralex ever do any water analyses?

A. We did water analyses in conjunction with Pendragon and the NMOCD's February, 1998, inspection of the wells, and we all jointly reviewed those water analyses and jointly came to the conclusion that they really didn't have any significance with regard to determining whether or not one well was communicated with the other formation.

Q. Do you have copies of those analyses?

A. I believe we do in our files. I don't think we have them -- I know I don't have them with me. I don't know if any of our other witnesses do or not.

Q. I'd like to see those.

A. Okay.

COMMISSIONER BAILEY: And that's all I have.

CHAIRMAN WROTENBERY: Commissioner Lee?

EXAMINATION

BY COMMISSIONER LEE:

Q. You inspected the Chaco well and you saw all the water in the pit?

A. On the Chaco 2-R, it was definitely full and water was continually dumping into the pit when I was there.

Q. What is the time of this?

A. This was in 1996, later in the year.

Q. So the other side -- What's Pendragon's position on this?

A. On the Chaco 2-R?

Q. The water.

A. My understanding from their presentation is that since no water was reported, that there was very little water produced. They take the position that there's no evidence of any water production, primarily because they did not keep evidence of water production, and so you shouldn't consider water production.

Q. And for your calculation for the reserves, the 5 p.s.i.a. is average reservoir pressure?

A. That's correct.

Q. So your wellbore is zero p.s.i.?

A. Yeah, it would have to be on a vacuum.

Q. So 5 p.s.i.a. drawdown, how much production would that be?

A. If we had a vacuum at the surface and 5 p.s.i.a. drawdown?

Q. (Nods)

A. Again, that's going to vary from well to well, and it depends on the point in time -- Let me see if I can explain it using the isotherm curve.

If we have a 5-p.s.i.a. drawdown so our reservoir pressure is less than a vacuum -- I'm sorry, our reservoir pressure is 5 p.s.i.a. and our surface pressure is less than a vacuum -- less than zero, so it's on vacuum. Our rate is tied to both the desorption rate of the gas and the permeability of the reservoir to transmit that gas from the cleat system to the wellbore.

Q. What's your estimate?

A. Very low. I would say probably less than 50 MCF per day.

Q. Maybe less?

A. Yeah.

Q. Is that economical?

A. With rental compression, no.

COMMISSIONER LEE: That's all I have.

EXAMINATION

BY CHAIRMAN WROTENBERY:

Q. Okay, I just wanted to ask you a few questions about the sand that is in dispute here.

A. Yes.

Q. And let me use your terminology. What do you call that sand --

A. This thin sand here --

Q. -- the thin sand?

A. -- between the coals we call the WAW sand.

Q. The WAW sand.

A. Right.

Q. Last night you made some comments about the WAW sand and how it had been perforated in other wells in this same area, and I didn't get your exact wording, so I apologize if I'm mischaracterizing what you said, but you said something to the effect that you believed that other operators in the area had incorrectly filed paperwork showing perforations in that sand. And I just wanted to make sure I understand the basis for your statement, and please correct me if I mischaracterized --

A. No, I think you've got the --

Q. -- what you said.

A. I'm sorry. I think you got my testimony correct there. I did state that in my opinion there are a number of other operators in the area that have designated that as a Pictured Cliffs sand in their filings with the State, and in my view that is erroneous.

In my view, the Pictured Cliffs starts at this point where the top of the first massive marine sand occurs in those wells.

If you look at this thin sand above that, I don't think there is anybody who would characterize that as a massive sand. And as I pointed out on the Schneider Gas Com B-1 well log, there is a stratigraphically equivalent sand up on that Schneider well in this same interval, and nobody has ever attempted to call that particular sand an upper PC sand or a massive marine sand. It has always been characterized as a Fruitland sand in that area of the Basin.

In this area of the Basin, in my view anyway, it had always been characterized as the WAW sand, and several operators had filed the top of the Pictured Cliffs at the top of the WAW sand, erroneously, in my view.

Q. Okay, and how big an area are we talking about?

A. This is probably close to a township in extent.

Let me back up a little bit. The WAW-Fruitland-Pictured Cliffs Sand Pool extends up into Township 27 North, Range 13 West, and down across Townships 26 North, Range 12 West. And at one time there were separate pools here, the NIPP -- N-I-I-P [*sic*] -- Pool was actually on the eastern side here, and at some point the NMOCD combined the two pools into a single pool that the redesignated the WAW-Fruitland-PC Sand Pool.

So it's not a township wide, but if you take all the sections that are included in that pool it's close to a township in areal extent.

Q. And about how many wells are involved in -- I think you mentioned some number like 30-something wells, or somebody did, in this area, that have perforations in this WAW sand?

A. There are actually substantially more than 30-some wells. In fact, I think it may be as much as 60 or 70 wells that are perforated in this sand. But only 34 of them have had the WAW sand characterized as the Pictured Cliffs sand in the filings with the State.

So there are a number of wells that were correctly filed with the State, and I thought I had a list of those, but I guess I don't.

MR. CONDON: What is the list?

THE WITNESS: It shows all of the operators in the WAW sand and the number of wells each one operates.

MR. HALL: Ms. Chairman, it's Al Nicol's Exhibit N-61.

CHAIRMAN WROTENBERY: N-61?

MR. HALL: Just limited to the small map.

MR. GALLEGOS: And are you thinking of a W-30 that shows us all the wells in this field?

THE WITNESS: There was a separate 8-1/2-by-11 sheet that showed -- listed the operators and the number of wells.

MR. CONDON: If I could suggest, maybe if we could finish up with Mr. O'Hare to the extent we can do that, if we take a break, we'll see if we can find that and maybe bring him on to have him address that.

CHAIRMAN WROTENBERY: Okay, I'd appreciate that, because I do have some questions still about the wells in the area and how the WAW sand was handled in those wells.

And we do have also N-61 already --

MR. HALL: That's in --

CHAIRMAN WROTENBERY: -- in evidence --

MR. HALL: -- yes.

CHAIRMAN WROTENBERY: -- but that this was prepared by Mr. Nicol, showing wells that were perforated in what Mr. Nicol calls the upper Pictured Cliffs sand.

MR. HALL: And so we're clear on that, Madame

Chairman, the N-61 list is limited to those reports for the acreage shown on his Exhibit -- Exhibit N-1, correct?

CHAIRMAN WROTENBERY: Okay.

MR. HALL: N-2, rather.

CHAIRMAN WROTENBERY: N-2, okay.

MR. HALL: It doesn't show them across the entire -- There are many more.

CHAIRMAN WROTENBERY: Okay, we'll take that up, then, after a break.

MR. CONDON: All right. Do you want to break now before I do redirect?

CHAIRMAN WROTENBERY: I might just ask one other thing in order to complete the record. Do you have the deposition that you were referencing?

MR. HALL: I do, and to accommodate the request I'd like that entered into the record, if I might. It's the deposition of James McKnight, dated September 8th, 1998.

CHAIRMAN WROTENBERY: Are you wanting the whole thing entered in the record, or just --

MR. HALL: Let me tell you what I've --

CHAIRMAN WROTENBERY: -- leaving the statement that --

MR. HALL: -- done. It's a quick read. Actually, it's double-spaced and large margins. What I'd ask you to do is read pages 1 through 25, which will explain the use of those water-hauling invoices.

There are references to exhibits in the deposition text. The entirety of the water-hauling invoices, I think, was identified as Exhibit 5, and all of those invoices together comprise perhaps two large notebooks like that. I didn't try to include all of those, but we went through the deposition text and identified each specific invoice that was discussed by the witness.

If you want the entirety of the invoices, and I don't think you do, they are available to you.

MR. CONDON: But I would also point out that when he says "the entirety", he's only talking about a period from 1997 on. There were no water-hauling tickets provided by Sunco at the deposition for the period prior to some mid- or late 1997. So --

MR. HALL: Well, that speaks for itself.

MR. CONDON: -- "entirety" is a relative term.

MR. HALL: So I would ask that the deposition be included as a part of the record in this case.

MR. CONDON: Could we just ask that we --

(Off the record)

MR. CONDON: Could I just ask that we --

CHAIRMAN WROTENBERY: Yes?

MR. CONDON: -- have an opportunity to look at that over the break to see if we have an objections?

CHAIRMAN WROTENBERY: That would be fine. And do you want to mark this as an exhibit? Is that --

MR. HALL: Well, I thought we could just refer to it in the record as the McKnight deposition as it's labeled, but I'll be glad to number it if you like.

CHAIRMAN WROTENBERY: Yeah, mark it for identification --

MR. CONDON: Yeah, it's going to be awkward --

CHAIRMAN WROTENBERY: -- yeah --

MR. CONDON: -- I think, if it will be offered.

CHAIRMAN WROTENBERY: -- as an exhibit. What do you want -- We can put an appropriate number on there. What should it be?

MR. HALL: Let's see, let's call it O-3.

MR. CONDON: That was -- We had an O-3.

MR. HALL: I'm sorry.

MR. CONDON: Let's do O-4.

MR. HALL: Let's do O-4, then.

CHAIRMAN WROTENBERY: O-4. Okay, we've marked it for the record -- for identification, I mean, as O-4, and we'll give Mr. Condon an opportunity to look at it during the break.

Okay, so we'll follow up with my questions, then, after the break, and the redirect.

MR. CONDON: Okay.

CHAIRMAN WROTENBERY: It is -- I've got a little after -- about 10:15. Let's start back up at 10:30.

(Thereupon, a recess was taken at 10:16 a.m.)

(The following proceedings had at 10:32 a.m.)

CHAIRMAN WROTENBERY: Mr. Condon, are you ready for redirect?

MR. CONDON: Yes, ma'am.

REDIRECT EXAMINATION

BY MR. CONDON:

Q. Mr. O'Hare, to follow up on what we were discussing, questions about picks by other operators in the area, I believe you've already got a copy of what I've marked AMO-24. Would you explain what that document shows?

A. Yes, this is just a tabulation of the number of WAW-Fruitland-PC wells by operator for the entire pool.

Q. And just so I'm clear, because I got a little confused with the questioning, you're not contending that operators have mistakenly characterized the wells as having been perf'd in this WAW sand, are you, in the filings?

A. No, I think they intentionally perforated it in the WAW sand.

Q. Your question is the characterization of that as part of the Pictured Cliffs or not?

A. That is correct.

Q. Okay. And just so the Commission has some background, were most of these wells originally drilled as Pictured Cliff wells?

A. I believe they were originally drilled targeting the Pictured Cliffs formation, yes.

Q. All right, in what period of time are we talking about?

A. This would be the mid- to late 1970s, early 1980s.

Q. So that would have been prior to the establishment by the Division of the Basin-Fruitland Coal Gas Pool and the Order R-8769 and -8769-A, redesignating the limits of some of the surrounding WAW-Pictured Cliffs pools?

A. That is correct.

Q. Okay. And at the time, the early 1970s, early to late 1970s, early 1980s period of time, was there typically common ownership from the surface of the earth to the base of the Pictured Cliffs in this area?

A. Yes, there was.

Q. Okay. And has the problem that has arisen with the characterization of that sand that you call the WAW sand, has that arisen since and as a result of, in many cases, nonconcurrent ownership from the surface to the base of the Pictured Cliffs formation?

A. In my view, that is the cause of that difference in nomenclature.

Q. Okay. You talked about the 1-J and the 2-J. Mr. Hall asked you some questions and you testified, I believe, that you think those wells are in pressure communication with the coal but not necessarily production communication; is that correct?

A. That is correct. The production communication is limited. There has not been a lot of production from either one of those wells in years and years, and I believe that those wells do not have a sufficient channel of communication between the Pictured Cliffs and the Fruitland to improve the production from those wells.

Q. Okay. Would you be concerned if the shut-in orders that apply to those wells were ever lifted and Pendragon had an opportunity to acidize or fracture-stimulate either of those wells without -- what effect those actions might have on the coal?

A. I would be very concerned. I think any additional stimulation of those wells would improve the communication, the channel of communication, between the PC and the Fruitland Coals, and they are now offsetting the only two wells in this area that are still inclining in production.

Q. Are you similarly concerned if the shut-in order were to be lifted as to the Chaco 1, the 4, the 5 and the 2-R?

A. Most definitely, yes.

Q. Why?

A. Because the decline that we are seeing on our wells indicates that there is not much in the way of reserves left to be produced. If we allow additional wells to come in and pull from those reserves, it will dramatically impact our recovery of the gas from our wells.

Q. There were questions asked you by Mr. Hall about withdrawing the Application that Whiting and Maralex had initially filed with the Division, and I believe there was a question that was asked of you that the relief you were requesting was the same as the relief that Pendragon was requesting in their Application.

Would you just describe for the Commission what relief you were requesting in the Application that you filed with the Division?

A. Yeah, I think we were asking that the Division find that there was communication in the Pendragon wells between the Pictured Cliffs formation and the Fruitland formation and, if that was found, to shut in those Pendragon wells.

I don't remember us ever asking for a finding of wells producing from the appropriate common source of supply; it was always -- at least my recollection of the filing was that we were seeking to have the Pendragon well shut in.

Q. And would you just explain for the Commission why Whiting and Maralex have taken the various positions they have taken with respect to trying to get this matter adjudicated in one forum?

A. Yes, when we initially filed our case before the NMOCD, we were not aware that the agency did not have the authority to award us damages and to adjudicate the ownership issues that we were intending to bring before the Commission.

Once we were made aware of that and told that it would be the District Court that would have that authority, we thought it would be much more expeditious and economical to go directly to the District Court, and that is why we withdrew our original application from the NMOCD.

Q. Okay. How many times, now, have we been through an adjudicatory hearing on this dispute?

A. This is the third time.

Q. Has it been at considerable cost and expense to you?

A. It has been very expensive.

Q. When the District Court referred this matter over to the Division and the Commission, did we request that this matter be set before a Commission hearing initially so we could avoid a Division-level hearing?

A. Yeah, I believe we were trying to minimize the number of hearings and focused on getting it before the body that would have the final authority for the State of New Mexico.

Q. Okay. Let me ask you a couple of other questions, and this won't be very much longer.

There was a reference to the Dome Navajo well made in your cross-examination, as having been a well that was perf'd in what you call the lower bench of the PC?

A. Yes.

Q. Okay. How has that well performed?

A. It's been a very poor well. I think the total recover from that well has only been about 15 million cubic feet of gas, if memory serves.

Q. And then there were a number of questions that Mr. Hall asked you about crossflow in the wells. Is it fair to kind of reduce all that testimony to a basic principle that says crossflow is going to be a function of the relative reservoir pressures in the two formations?

A. Most definitely. If you have a higher pressure in one formation than the other formation, and they're both exposed in the same wellbore, the pressure is going to seek to go to the lower pressure zone.

Q. Now, there were some questions about the monitoring of the performance of your wells on cross. Would you just, on that exhibit that's up there on the board, just explain to the Commission the sequence of events in the development of your wells versus the actions that Pendragon took with respect to fracture-stimulating their wells?

A. The best wells, not just in the area that we're talking about, but for several townships around from the Fruitland Coals, are the Gallegos Federal 6 Number 2 well, Gallegos Federal 7 Number 1 well, and the Gallegos Federal 12 Number 1 well.

The Gallegos Federal 7 Number 1 well reached a peak rate of about 900 MCF per day before it started on its decline, actually a little over 900 MCF per day. The monitoring of the well, we feel, occurred when Mr. Thompson on a regular basis was stopping by to check the flow rates on our wells.

Coincidentally enough, the Chaco wells that performed the best after fracture-stimulation were the Chaco Number 5 and the Chaco Number 4. Those were also the wells, along with the Chaco 2-R and the Chaco Number 1, that are concentrated around the three best wells in the Fruitland Coals in a very large area that were stimulated, fracture-stimulated, by Pendragon. The two wells that were still producing high volumes of water and very low volumes of gas had the offsetting Chaco wells only acidized in January. In fact, to date, those wells have never been fracture-stimulated.

We don't think that is a coincidence. We feel that their monitoring led them to fracture-stimulate the Chaco 4, 5, 2-R and Number 1, to enable them to produce the Gallegos Federal -- I'm sorry, the Fruitland Coal gas, that would be available through those wellbores if a fracture-stimulation communicated the Pictured Cliffs with the Fruitland Coal.

Q. There were some questions asked of you by Mr. Hall on the injection tests that were performed this year.

A. Yes.

Q. And just so the Commission is clear on that, would you tell the Commission how many injection tests were actually run?

A. Yes, there were actually two injection tests performed by Whiting/Maralex here in either June or July of this year. I believe they were both in July of this year. And last night I basically alluded to one, and that was the one that I was most involved with.

That's actually the one -- That's also the one that we had the most trouble with, coincidentally or not. But the data from that first test had to be discarded because of the problems that we had, and we had to run the second test subsequent to that first test, and I neglected to inform you of that last night.

Q. And were the second test results the ones that actually -- where the test was actually completed without significant problems, are those results the ones that were provided to Pendragon?

A. Yes, they are.

Q. All right. One last line of questioning for the Commission's benefit.

Have you been involved in other projects in this area where you have either drilled coal wells in proximity with operating PC wells or operators have been performing work or re-works on PC wells in the area where some of your Fruitland Coals are operating?

A. In other parts of the Basin we have had that experience fairly extensively. We have gone to the extreme in some cases of going to the Pictured Cliffs operator before we did our completions and presented our plans to them, gave them the opportunity to install monitoring devices in their Pictured Cliffs wells to enable them to determine whether or not our fracs were going to communicate with the Pictured Cliffs zone.

And one operator in particular that we did that with was Amoco in the Hart Canyon area, and they were very cooperative with us and we were able to share data going both ways. We have tried to make that a practice whenever there are Pictured Cliffs wells in close proximity to the wells that we will be drilling into the Fruitland Coal and make sure that everybody is aware of the work that we intend to do.

Q. Okay. Did Pendragon notify you prior to the work that they performed in 1995 on the Chaco well?

A. No, they did not.

Q. Do you think it would be helpful for operators in the area to have a protocol established where offsetting PC or Fruitland operators would have to be notified of drilling or re-work or fracture-stimulations performed on the wells, in order to be able to monitor the performance?

A. I think it would be very helpful for both the operators and the regulatory agencies to have some kind of system in place where there was mutual cooperation between the parties or the different owners of the PC and the Fruitland Coals.

MR. CONDON: That's all I have.

CHAIRMAN WROTENBERY: Mr. Hall?

RECROSS-EXAMINATION

BY MR. HALL:

Q. Well, let me ask you again about this monitoring business. I think we established -- Tell me if you disagree. Pendragon acquired its rights in the Pictured Cliffs in December of 1994. Do you disagree with that?

A. No, I don't disagree with that. I don't know if that's on this exhibit or not. It looks like it was effective February 1st, 1995.

Q. And I think there's no dispute that Pendragon began its restimulations in January of 1995, correct?

A. The Lansdale Federal was actually begun in December of 1994.

Q. Well, wait a minute, I'm asking about Pendragon stimulations --

A. I believe --

Q. -- of Chaco wells.

A. I believe even at the time the Chaco wells were restimulated, it was under Edwards.

Q. Okay, and that was, again, in January of 1995 with the Chaco wells?

A. On the Chaco wells, that is correct.

Q. Are you asking the Commission to infer from what you say that in the short span of time from when Pendragon/Edwards acquired the Pictured Cliffs rights in December to the commencement of the restimulations in January, that that was sufficient time for them to have monitored your wells, as you say, and then executed this plan, as you say, to steal your gas?

A. Before I can answer that question, I need to ask a question of the Commission. My understanding was that this appeal or *de novo* hearing was at the request of Pendragon and Edwards, that it was a joint Application. Am I not correct in that understanding?

Q. Let me object, and if you could respond to my question, Mr. O'Hare. If you don't understand the question, say so. Otherwise, if the question is vague for some reason, your counsel will state an objection. I want you to answer my question, please, sir.

A. Would you please restate your question?

Q. Do you want the Commission to infer from your testimony that from the time Pendragon/Edwards acquired the Pictured Cliffs rights, the Chaco area, in December of 1994, until they began their restimulations just a month later, that in that time they undertook to monitor your wells and execute this scheme, as you say, to offset your coal wells and steal your coal gas? Is that what you want the Commission to believe?

A. No, I think I want the Commission to believe that their field representative had been monitoring our wells for more than a year before they purchased the Chaco wells and came up with a plan that would very effectively, very cheaply, very efficiently, produce Fruitland Coal gas from the Fruitland formation that they did not own or would not own, even upon purchase of those Chaco wellbores.

Q. Well, wait a minute. You don't even know when the Pictured Cliffs were offered by Merrion to Pendragon, do you?

A. Yes, I do know that those wells were put into an auction in December of 1994.

MR. HALL: All right, no further questions.

CHAIRMAN WROTENBERY: Commissioner Bailey?

COMMISSIONER BAILEY: I have asked you for your water analyses. Would Pendragon also be willing to give me their analyses, any spreadsheets that they have?

MR. HALL: Yes, we'll give you anything we have.

COMMISSIONER BAILEY: Sometimes the Oil Conservation Division also has analyses and spreadsheets. If those are available, could I have copies of those too?

CHAIRMAN WROTENBERY: We'll make those available to everybody.

MR. CONDON: Okay, that would be great.

COMMISSIONER BAILEY: Thank you.

CHAIRMAN WROTENBERY: Okay, Commissioner Lee?

COMMISSIONER LEE: (Shakes head)

MR. CONDON: Blessfully -- oh, you've got --

CHAIRMAN WROTENBERY: I'm sorry, what?

MR. CONDON: No, I was just going to say blessfully I have nothing else.

CHAIRMAN WROTENBERY: Okay. I still need to get a couple of things clarified.

First of all, I might just ask on the exhibit that was marked for identification O-4 -- this was the deposition of the water-hauler --

MR. GALLEGOS: Madame Chairman, our position on that --

CHAIRMAN WROTENBERY: -- have you had a chance to look at it?

MR. GALLEGOS: Yeah, I've had a chance to go through it, and I took this deposition. And I certainly don't agree with the characterization of the testimony by Mr. Hall, but if we want to impose 43 pages of depositions and exhibits on the Commission we have no objection, because it's much better that you have the entirety and not somebody's attempt to characterize it. So as long as it's going to be considered in its entirety, we have no objection.

MR. CONDON: Could we also, just on that -- I'd like to either work out a stipulation with Mr. Hall or be able to provide you with some of the documents that were produced at the deposition so that you know the time frame for which the water-hauling tickets were actually produced. I'm not sure that -- Is that going to show?

MR. GALLEGOS: Well, the tickets that the witness was referred to, I think, are attached to the deposition.

MR. CONDON: Okay.

MR. GALLEGOS: They were made exhibit.

MR. CONDON: All right. Oh, so those are included? Oh, I didn't realize --

MR. GALLEGOS: Yeah.

MR. CONDON: -- that they were included. Okay.

CHAIRMAN WROTENBERY: Okay. Well, we'll admit O-4 into the record as evidence.

And then -- I'm not sure we actually admitted AMO- --

MR. CONDON: I'm sorry.

CHAIRMAN WROTENBERY: -- -24.

MR. CONDON: I'll move the admission of AMO-24.

CHAIRMAN WROTENBERY: Any objection, Mr. Hall?

MR. HALL: I don't know that a foundation was laid for --

FURTHER EXAMINATION

BY MR. CONDON:

Q. All right, was this document prepared by you or under your supervision and control?

A. Yes.

MR. CONDON: I'll move the admission of AMO-24.

MR. HALL: No objection.

CHAIRMAN WROTENBERY: No objection?

MR. HALL: No objection.

CHAIRMAN WROTENBERY: Okay, AMO-24 is admitted into the record as evidence. And I did have some questions.

EXAMINATION

BY CHAIRMAN WROTENBERY:

Q. I'm still trying to understand, and Mr. Condon's questions were helpful in explaining what you were meaning by some of your statements about the characterization by other operators of the WAW sand. But I still -- I apologize if I'm being -- having a little trouble grasping some of it.

On AMO-24, you have a list here of WAW-Fruitland-PC wells by operator, and there's a number of operators on this list and something like 200 wells.

A. Right, I think I tabulated 211 wells.

Q. And again, what was this -- What is the area covered by this particular list?

A. It's parts of Township 27 North, Range 13 West; 26 North, Range 13 West; 27 North, Range 12 West; and 26 North, Range 12 West.

Q. Okay.

A. Now, there may be a portion of 26 North, 11 West, also included in the pool, but I cannot swear that that is absolutely true.

Q. Okay. And you had remarked earlier, I think, that for some of these wells you felt like the WAW sand had been mischaracterized in the operator's filings with the Oil Conservation Division --

A. That's my --

Q. -- and I'm still trying to understand what you mean by "mischaracterized". How was it characterized in those filings, as opposed to other filings that were submitted by other operators for other wells?

A. Well, I don't know that there were any other filings, other than what the operator reported on their completion report or sundry notices setting out the completion of individual wells, both to the NMOCD and to the BLM.

On the back of the form is a place to insert formation tops, and it's just the top of the formation, such as Pictured Cliffs, and the depth. And I think a number of these operators basically showed the Pictured Cliffs, and the depth to the top of the Pictured Cliffs was actually the depth to the top of the WAW sand.

Q. Okay. And you say that occurred on 30-something wells --

A. Yeah, I don't remember the exact tabulation. I think Mr. Hall quoted 34 wells in the area, but I'm not sure if that's the exact number.

Q. Okay. And then for other wells, how would the reports have been filed?

A. There are a number of other wells that hit the top of the PC, show the depth to the top of the PC at this point here on those wells.

MR. CONDON: I'm sorry, just so the record is clear, when you say "this --"

THE WITNESS: At the top of the massive marine sandstone, as designated by the open-hole logs generally.

CHAIRMAN WROTENBERY: Okay. Thank you, that's the end of my questions.

Did you have anything else? Anything further?

MR. CONDON: I've zipped it up.

CHAIRMAN WROTENBERY: Okay.

MR. CONDON: No more questions of this witness.

CHAIRMAN WROTENBERY: Okay. Thank you, Mr. O'Hare --

THE WITNESS: Thank you.

CHAIRMAN WROTENBERY: -- for your testimony.

MR. CONDON: We would call next Dennis Reimers.

CHAIRMAN WROTENBERY: Let me ask, Mr. Condon, I don't remember seeing his name --

MR. CONDON: He's not an expert, he's --

CHAIRMAN WROTENBERY: -- on the list of witnesses. I just --

MR. CONDON: Oh, he's -- well, he's in the nature of a rebuttal witness with respect to the water-production questions on the Chaco wells and the monitoring, primarily, and he's also the individual who took the photographs that were marked N-7-A-3 yesterday on the Chaco Plant 5 after we got notice that the Chaco Plant 5 was going to be an issue in the case.

CHAIRMAN WROTENBERY: Okay. And I'm sorry, Mr. Reimers, how do you spell your name?

MR. REIMERS: It's R-e-i-m-e-r-s.

DENNIS R. REIMERS,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CONDON:

Q. Would you please state your name?

A. My name is Dennis R. Reimers.

Q. Mr. Reimers, how are you employed?

A. I'm the engineering manager for Maralex Resources.

Q. And what are your job duties in that capacity?

A. Basically as small a company as Maralex is, it's wide-encompassing. Basically all of the supervision of the drilling, the writing of the procedures, actually putting together all the sundry notices and so forth on the -- just the regulatory agencies' permitting, the actual rig supervision.

My experience has been pretty heavily centered on the completion side, so when it came to the stimulations of a lot of our wells I was heavily involved in that, both the design work as well as the field witnessing of that, supervision.

Q. We're not offering you as an expert witness, but would you just please give the Commission a brief description of your educational and work background?

A. I'm a 1978 graduate with a bachelor of science degree in petroleum engineering from New Mexico Institute of Mining and Technology. I have 21 years of experience in the industry, predominantly in Alaska for at least 14 years, both with Amoco and ARCO. In 1986 I was involved in the startup of the third major North Slope field, the Lisburne field, that came on line at about 80,000 barrels a day. I've worked for an independent in Denver, Kosicka Resources, primarily responsible in the Powder River Basin Properties, as well as the tight gas formations, the play that we had in the Piceanace basin. And I've been employed by Maralex since 1992.

Q. Are you familiar with the Gallegos Federal wells and the Chaco wells which are the subject of Pendragon's Application?

A. Yes, very, very closely. When I hired on in August of 1992, that was one of the first projects that we were developing right there.

Q. At what point in time did you become aware that the Pendragon wells have been worked on, fracture-stimulated and acidized?

A. It would have been in late 1995 or 1996 time frame. As previous testimony -- Mr. O'Hare testified, there was nothing that was done up front about it, everything was kind of after the fact. We had worked with a number of those individuals, actually employed Mr. Thompson as a consultant when we drilled our wells. But it was all after the fact. You know, you would see activity on the well itself, a rig on it, or a pumper would report back that there was different things going on.

Q. And did Mr. Thompson ever inform you prior to that work being done that the work was going to be done?

A. No.

Q. How often did you see Mr. Thompson out there in the field?

A. You know, it was on occasion. We moved the office to Ignacio but, you know, there was occasion that we would run into each other, and the comments were heavily centered around our Gallegos program. He was involved with the initial drilling of those wells and was very interested in the production from them. A lot of comments were made that you knew he was at least watching what the rates were doing and seeing the inclines we were observing.

Q. And as of early 1995, I don't want you to go into a great amount of detail, but just explain to the Commission what the status of the Gallegos Federal wells was.

A. Yeah, you've got to kind of put it in perspective; I'm not sure through the testimony that you really understand the nature of what we were doing there. But from the first completions in 1993, upwards to about two years, we were operating in the red. The typical well there in the heart of the field had to withdraw about 40,000 barrels of water before we were finally at a rate on the gas that was economical. So the initial investor in it had already basically given up on the project, were in the process of trying to, you know, sell the project to somebody else.

And it was finally in that time frame, finally in the heart of the area that's in discussion here, that we finally had the gas rates that we were at least paying the bills on the project. The Chaco -- or the 12 Number 1 at that time was doing about 360 a day, with our best well probably being the 7-1, a little over 400 barrels a day. But instead of making the 150 barrels of water a day that they made initially, they were down in the range of 40 to 50 barrels of water.

And as we previously stated, all of our water was contained in the tanks, and between the disposal cost and the trucking, the cost of that water was where most of your expenses were taken.

And that's been one of the disheartening things through the whole process, is to basically get that project to the point where it's operating at a profit, then to have somebody else come in and take the gas.

Q. What was the status of the 13-1 and the 13-2 in early 1995?

A. Those were wells that didn't have the offset support that we had right around the 6-2 and the 7 Number 1. We always knew that those wells were going to be ultimately very good wells. But at that time the 1 Number 1 was still producing 150 barrels of water a day, and I think the gas rate on it at that time was just over 100, and the 1 Number 2 was in the 40- to 50-MCF-per-day range and about a hundred barrels of water still. They were still our high-rate water producers.

Q. Okay. And the Chaco wells, would you just describe for the Commission which of the Chaco wells were frac'd versus those wells that were only acid-stimulated in relation to your wells?

A. Yeah, the Chaco 1, the Chaco 4 and the 5 were given the treatments, with the fracture treatment aggressively trying to stimulate that. Adjacent directly to our best offsets, our lowest water-rate wells, the 1-J and the 2-J were just giving acid jobs.

You can understand the thought with the 2-J only being 180 feet away from one of our wells that was making 150 barrels of water a day, that wasn't a desire to tie into that much water. That would have been very conclusive evidence of what was going on, and they didn't have the facilities or want to be out that expense of dewatering it.

Internally, we always made the comment, we knew that frac was coming as soon as we got that water level down to a certain point.

Q. At some point in time, did you observe evidence of water production from the Chaco wells?

A. Yes, sir. You can't -- In the nature of the field out there, you really can't help but notice what's going on. To drive to our locations, you drive right through a number of their locations. And after we got word of what was happening, you know, we'd periodically make sure we were just checking to visually see what was happening. The Chaco 2-R, the Chaco 4 and the 5 were of particular interest because we knew they'd been frac'd, and the pits were always full of water.

There was also an effort made that you could tell where they'd gone out and actually deepened the pits. They didn't expand the area of it, but they just went in with a backhoe and actually deepened it. So a pit that may have only been two or three feet deep now is, you know, six to seven foot deep.

Q. And why was the water production of interest to you?

A. Well, the nature of the coals in that area. We're in a portion of the Basin where the coals are originally water-saturated, and the PC wells, even at the beginning, didn't make that kind of water production. Some of the previous testimony has talked about the overcoming of damage that occurred on the PC wells. When they were initially produced and no damage, they didn't make that kind of water rate.

So the water rate that was coming out from the, quote, unquote, PC wells was definitely -- you know, the -- strong indications that it was Fruitland Coal-seam water.

MR. HALL: Madame Chairman, I'm going to object to testimony of this sort by this witness. What he's doing is, in fact, rendering opinion testimony on the ultimate conclusion that the Commission will draw from all of the evidence in this case. I don't think it's appropriate for him to opine about the ultimate conclusions here. I think he should limit his testimony to facts only.

MR. CONDON: I don't have a problem with that, and -- well, I'll just -- Let me just re-ask the question, if I could.

CHAIRMAN WROTENBERY: If you will, please.

Q. (By Mr. Condon) Sure. Is it fair to say that you were concerned about evidence of water production because you thought that it may be an indicator one way or another of where the wells were produced?

MR. HALL: Well, I'm -- Just a minute, I'm going to object to the leading nature of the question as well. It's --

MR. CONDON: Okay.

MR. HALL: -- inappropriate.

MR. CONDON: I'll just re-ask the question.

Q. (By Mr. Condon) Why were you interested in looking for evidence of water production from the Chaco wells?

A. Yeah, it's -- You know, initially, it wasn't like we were purposely looking for that, but once we noticed the water production it was a direct indication that that was a Fruitland Coal-seam well now.

MR. HALL: Madame Chairman, same objection. I think he's rendering opinion testimony again.

THE WITNESS: I'm not --

MR. CONDON: I think he's entitled to say what his observations were and why he came to those observations, conclusions. You can give it whatever weight you want to give it, understanding that we're not offering it as an expert witness.

CHAIRMAN WROTENBERY: Yeah, please limit your testimony to your observations.

THE WITNESS: Okay. I observed a lot of water in the pits.

MR. CONDON: Thank you.

(Laughter)

Q. (By Mr. Condon) Thank you, Mr. Ayers [*sic*]. Were your observations of water in the pits limited to time periods when you observed work being done on those Chaco wells?

A. Definitely so. I mean, once the wells had been fracture-stimulated, any water that we saw, standing water in the pit, was obviously after that fact.

Q. Okay, I'm sorry, you may have misunderstood my question. Mr. Thompson testified that his recollection, I believe, was that the only time those wells produced water was in conjunction with times when work was being done on the wells. And my question is, was there a time that you observed water out there in the pits when you couldn't see any evidence that work was being done on the wells at that particular time?

A. That's definitely the case. Even well after the fracs and the acid jobs, there was a lot of water production on a continual basis, dumping from the separator, as well as standing water in the pits.

Q. Did you attempt to check C-115 reports or any other official records to see if you could find any evidence that Pendragon had reported water production from those wells?

A. That's correct, that's the first thing, is, we spent a lot of time at the Aztec NMOCD office just pulling records, and that's one of the first things we had, is that that would be reported, we could see historically what has happened with the water with time, and there was no record of water, you know, before it was reported.

Q. Now, were the -- and the pits, the Pendragon pits, would you just describe what they were like there at the Chaco wells?

A. As I've described, they were earthen pits. They were probably the original production-type pit, not the drilling pit that was put on the well. In almost all of the cases, they were deepened just to handle the increase in water. And for the Bisti to have a pit, you know, that particular area of the Basin, to have free water standing in a pit is pretty unusual. And not only these were just free-standing, but they were quite high levels.

The only other comment I can add to that was that, as previous testimony has said, once we got to the point where we were working with the Aztec NMOCD and we had the joint inspection of both the gas samples and the water samples, it was -- you know, the pits were dry at that time. And it appeared like, you know, a week before or even two weeks before, they had water in them, and now at the time the NMOCD representative was there, they were dry.

Q. And did you take some pictures of the Chaco Plant 5 well and water pit after we were informed that the Chaco Plant 5 was going to be an issue in this?

A. That's correct.

Q. Okay, let me just hand you -- It's already been marked and I believe introduced as N-7-A-3, and just ask you to identify that exhibit for the Commission.

A. Yes, sir, these are the pictures that I've taken.

Q. When did you take those pictures?

A. It was the first weekend of August.

Q. Of what --

A. First weekend of August of this year.

Q. Are those pictures representative of the condition of the Chaco Plant 5 and the water pit as of that time?

A. That's correct. It's a location that's -- Most of these projects are right in the middle of the NAPI irrigation project, so this one is right in the middle of a cornfield. It's got a lot more vegetation on the location than is typical of a lot of them, but this was the condition of the well when I took the pictures.

Q. Is the condition of that pit similar to the pit you observed on the Chaco wells?

A. Pretty much so. Because of the vegetation it's harder to see, but it's typically that type of pit, earthen. It looks like an effort was made to deepen it, it is a fairly deep pit, and with free-standing water, and in this case just a continually dumping separator. It's not one that throttles itself, it's just a continual water stream into the pit.

Q. Okay. And when you say an earthen pit, does that mean unlined?

A. That's correct.

Q. And what is the nature of the soil in the pits in this area?

A. It's a sandy loam soil, ideal for water to percolate through it. As I mentioned earlier, a substantial amount of water can be put into a pit that you won't even see the next day. So to have a free-standing level, you know, usually means quite a bit of water has been coming into that pit.

MR. CONDON: Pass the witness.

CHAIRMAN WROTENBERY: Mr. Hall?

CROSS-EXAMINATION

BY MR. HALL:

Q. Mr. Reimers, you indicated that there was a lot of activity around the area of the Gallegos Federal wells by Mr. Thompson. Are you saying that he did not have a right to be around that area?

A. No, I'm not saying that at all. We employed him as a consultant. He was, you know, familiar with our project. I've done the same thing on a number of projects that I've previously worked on; you always want to follow up to what's happening there.

Q. You aren't accusing Mr. Thompson of divulging any sort of proprietary business information that belonged to Whiting, are you?

A. The public -- You know, the producing gas rates and the water rates off of those wells is public information, so we don't have a problem with that.

Q. You indicated that the Gallegos Federal wells had to withdraw on the order of 40,000 barrels of water before they would produce gas. Is that what you said?

A. That mischaracterizes what I hopefully said. We did a study in that area of the 17 wells that we originally drilled, looking at what made some of them good wells and what made some of them poor performers, and one of the correlations that really stuck out with us was just the time that it took to get the water off of them.

The wells that we had successfully fracture-stimulated were able to get the high-rate water production initially. Once we got up to a level of around 30,000 to 40,000 barrels of water, they were at 100 MCF per day. Now, from the very beginning they were making at least minute quantities of gas, but that acceleration of the desorption of the gas from the coals is enhanced entirely by how much water you can get off of it.

Q. Do you know the time period from when the Gallegos Federal wells were fracture-stimulated to when first gas sales were reported to the Division?

A. It varies on the well. The first well in that project that we probably had commercial gas sales was the 31-1. It's in an area where structurally it's not a predominantly water-wet coal, so there we had one to two barrels of water a day and good gas rates initially. That would have been probably early 1993 time frame.

The other wells, we were hooked up to the El Paso sales lines at least selling some gas within a matter of months, two to three months after they were first delivered.

But to kind of put it in perspective, most of these wells when we first frac'd them, we had a propane tank on them for at least two to three months, just to supply the fuel gas for the pumpjack. There wasn't enough gas coming out of the coals at that time to even run a single-cylinder engine. So there was very little gas initially.

You know, it varies by well. We have found in the Basin, as well as other operators, that if we have the help of the offsetting wells and have a pretty good pattern, then that whole thing is enhanced quite a bit also.

Q. Did Whiting and Maralex make it a regular practice not to report water production prior to first sales from the Gallegos Federal wells?

A. There was nothing being reported, period. There was no gas sales. So once we were hooked up into the El Paso system, we were abiding by the regulations and rules of reporting all production, gas and water.

Q. But prior to that reporting there was water production, correct?

A. There was water production going to the drilling pit, that's correct.

Q. Did you ever observe any of the Chaco Pictured Cliffs wells on pump at any time?

A. In this specific subject area, no. Just offsetting it, one of the Thompson wells, the Stacey or the Leslie, is a dedicated PC well on pump.

Q. And isn't it true that all of the Gallegos Federal wells had to be pumped, continued to have to be pumped, in order to make gas?

A. That's not a true statement. As I mentioned earlier, the 31-1 was in that area that we elected to put a pump on it, but it was a pump that was only handling one to two barrels a day. A number of the wells, especially now, will produce very high quantities of gas without pump, but we get an accelerated rate if we can keep that formation backpressure, the water, completely off of it.

Q. Yes, my question was directed to the five Gallegos Federal Fruitland Coal wells that are involved in this proceeding.

A. Can you restate that, then?

Q. Isn't it true that those wells have always had to be pumped in order to make gas?

A. Yeah, I think the qualifier there is the "always". If the pumpjack is down right now, the wells will produce a lot of gas.

Q. All right --

A. We --

Q. -- very long --

A. Oh, yes, sir. You look at your gas and water ratios, you're producing -- on those wells now, you're down to about seven barrels of water a day, producing half a million cubic feet of gas. That's a phenomenal amount of lifting capability that that flow rate provides for the water.

What we see is an incremental wedge that we get by keeping the pumpjack, you know, on line. It just reduces the backpressure on the coals that much more.

Q. In 1995 would the Gallegos Federal coal wells have flowed without pump-assist?

A. In 1995?

Q. Yes.

A. Yes, sir, they would have flowed without pump-assist.

Q. Did they have pumps in 1995?

A. Since we frac'd them and completed them in 1993, they've been pumped continuously.

Q. Let me ask you about your photograph of the Chaco Plant 5. Let me look over your shoulder since I put mine away.

That picture was taken the first week of August, you say?

A. Yes, sir.

Q. And the picture clearly shows that the corn in the fields there is in pollination stage, right? It's silking out?

A. Yeah, it's the first week in August. It's not mature yet, but it's getting close.

Q. And you've been around the NAPI fields long enough to know that during pollination stage for corn, it's quite common that that's when the farmer will really apply the water to the fields, correct?

A. This is the Navajo Irrigation Project. As you can see in the background of the picture, they have their circular-pattern sprinkler, so they -- I'm not sure what the rotation of that is, but I would imagine that it's getting sprinkled once or twice a week.

Q. Once or twice a week, or a day?

A. Well, it's continuous. I mean, when I was out there, the sprinklers weren't on. But even if they were working continuously, when that's on a location is not daily, I don't believe. I don't know that, but that's not the way I irrigate.

Q. Now -- Oh, are you a farmer?

A. Yes, sir. Well, it depends on what you would classify. I have a garden, I came from that kind of a background.

Q. I see. Do you have a pivot-point irrigation system?

A. No, sir.

Q. I have a couple, that's why I asked it.

Isn't it true that the Chaco Plant 5 is within the radius of the irrigation system you see there?

A. That's correct.

Q. And that's why all the vegetation is there?

A. It definitely helps the weeds and the corn.

Q. And isn't it likely the case that some of the water you see in the pit there is attributable to the irrigation system?

A. I think a good analogy to that is, why isn't there water anywhere else but the pit?

Q. Well, answer my question.

A. No.

Q. You don't think it's attributable to the sprinkler system?

A. No, I do not.

Q. How fast does that sprinkler system move across the field?

A. I do not know that.

Q. Is it fair to say that it doesn't move any faster than a slow walk?

A. I my --

MR. CONDON: If he's already said he doesn't know, I don't know how he can answer a follow-up question.

MR. HALL: Well, he said he's familiar with the systems.

THE WITNESS: Yeah, I'm -- Not for sure. It's not a measurable rate from the eye.

Q. (By Mr. Hall) It's slower than a crawl, then?

MR. GALLEGOS: Who's crawling?

Q. (By Mr. Hall) An infant?

A. I honestly cannot say. I don't know.

Q. But while it's moving across the well site, it is discharging water, correct?

A. That's correct.

Q. Were you involved in the slug test that was performed in July?

A. That's correct, the -- referred to earlier, more involved in the second one than the first one.

Q. You had some involvement in the first one?

A. That's correct.

Q. We weren't aware that more than one were performed until just this morning. Do you know what happened to the data from the first test?

A. The data is all there. I think the question -- and a previous expert witness we have, Mr. Robinson, will probably address that better than I can, but I think it relates to the shut-in of the well. We shut in at the compressor, versus the wellhead itself, and they were concerned about the falloff that we were observing, whereas if we had seen it at the -- shut it in at the well itself, we would not have seen that pressure data.

Q. So Mr. O'Hare was inaccurate when he stated that the data from the first test had been destroyed?

A. I don't think it's been destroyed. I'm not sure that's what Mr. O'Hare said.

Q. Would you be willing to make the data from the first test available to us?

A. I don't have a problem with that. It's one of those fine lines, I'd like to address the Commission on that.

As an operator, we looked at the data, and the data still basically says the same thing. We saw --

MR. HALL: Well, again, I'm going to object to opinion testimony.

MR. CONDON: Well, he's asking him about the slug test, which was not a question on direct. I mean, he's expanded the scope of the witness's testimony. He's entitled to tell you what the results were if Mr. Hall is going to ask him about those results.

MR. HALL: No, the scope of the direct was, I merely asked for the data, period.

CHAIRMAN WROTENBERY: I think Mr. Reimer can comment on this particular point.

THE WITNESS: The way we analyzed the test internally was that there was no difference in how we were measuring the permeability of the coals between the first test and the second test. We were able to clean up the appearance of the test by not having that unexplained falloff. The calculations, I believe, were not affected at all by that, at least from the way I look at it. We were still injecting the same amount of gas with the same delta pressure across the coals.

Q. (By Mr. Hall) Ask you another question about your farming background.

A. Yeah, vice president of the FFA in Bloomfield, New Mexico, got a gold-emblem award from the national FFA chapter, if that helps.

Q. It does, that's impressive, I'm impressed.

(Laughter)

THE WITNESS: If you've got a chicken, I could probably help you a little bit here.

(Laughter)

Q. (By Mr. Hall) Back to your photograph of the Chaco Plant 5, you say you're somewhat familiar with corn irrigation. Isn't it an objective, irrigating crops, to keep the soil moist and the water table somewhat higher than it would be without irrigation?

A. If I understand your question, if you're growing a crop obviously you want to keep enough moisture there to support the crop. But I don't know of anybody that irrigates daily, you know, in the same area.

Q. Isn't it likely that some of the water that's shown in the pit for the Chaco Plant 5 is due to the fact that the water table is elevated from irrigation.

A. We have not observed that in our pits.

Q. In the Chaco Plant 5 pit?

A. In our pits that are comparable depth, the water table on a direct offset, the pit -- it doesn't have free-standing water in it. I think that answers the question.

MR. HALL: No further questions.

CHAIRMAN WROTENBERY: Commissioner Bailey.

EXAMINATION

BY COMMISSIONER BAILEY:

Q. Do you know what the depth to water is in this area, to the water table?

A. I do not. There's usually a fairly good correlation, you know, to any type of wash or basin here. If you're next to a wash, it's quite possible that you can dig down even with a shovel, you know, three to four feet and get it.

In this area here, I would see that very unlikely. And I go back to my earlier statements, if we have a pit that we're not putting enough water in for it to hold, it doesn't stand water. When we do our pipeline work up there, we're digging -- we're burying everything four foot deep. We do not have water that enters into those trenches that we do for our pipeline work.

Q. Do you know if there are any clay layers in this soil horizon?

A. This area here is unique, and it's one of the reasons they selected, I think, for the agricultural irrigation project, but very few if any clay layers. It has an extremely high percolation rate with the sandy loam soils they have.

Q. And the last question, have you been getting a lot of rain in the northwest?

A. That's a good question. That would have been probably a bigger reason for this, but in this specific time right here -- You know, what I really go back to is, I go up on the Bisti, when I took those pictures, it wasn't like there was free-standing water hardly in any places. So it is a contribution, but a minor effect.

COMMISSIONER BAILEY: That's all I have.

CHAIRMAN WROTENBERY: I don't have any questions. Is there anything else for --

COMMISSIONER LEE: (Shakes head)

MR. CONDON: I'm done.

CHAIRMAN WROTENBERY: Okay, thank you very much, Mr. Reimer.

MR. GALLEGOS: We call our next witness, James Brown. The Commission should have his prefiled testimony.

Shall we swear the witness, Madame Chairman?

CHAIRMAN WROTENBERY: Yes.

JAMES T. BROWN,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. GALLEGOS:

Q. Would you state your name, please?

A. James T. Brown.

Q. Where do you live, Mr. Brown?

A. 1808 19th Street, Golden, Colorado.

Q. What is your business or occupation?

A. I am the operations manager for Whiting Petroleum Corporation.

Q. And how long have you held that position?

A. Since March the 1st of this year.

Q. Were you associated in some capacity with Whiting before that time?

A. Yes, sir, I've worked for Whiting Petroleum Corporation for the past five years, prior to my becoming an employee last March, as a consultant.

Q. Okay. Generally, what are your duties for Whiting Petroleum Corporation?

A. I supervise the operations, the operations staff and the engineers for the approximately 600 wells that Whiting operates throughout the United States.

Q. Okay. Included -- Have you provided a booklet comprising your prefiled testimony, along with Exhibits JTB-1 through -16?

A. Yes.

Q. And were the exhibits prepared by you or under your direction and control?

A. Yes, they were.

Q. And do you state in that prefiled testimony, beginning at page 3, the various sources of your data and information that was used in formulating your testimony?

A. Yes.

Q. If you were here testifying under oath, would your testimony be the same as contained in the prefiled direct testimony?

A. Yes, it would.

Q. You adopt that testimony?

A. Yes, I do.

Q. Although you have a résumé included in your booklet, just to -- for the benefit of the Commission would you just briefly give us your background in terms of education and work experience?

A. Sure. I graduated from the University of Wyoming in 1974 with a bachelor of science degree in civil engineering. Upon graduation I went to work for the Shell Oil Company in Houston, Texas. For Shell I worked on a variety of projects throughout the Rocky Mountains and throughout California, including offshore California.

After four years with Shell I went to work for a small independent in Denver called American Quasar. They work primarily in the Rocky Mountain area. I worked for American Quasar for four years, I quit and went to work for Standard Oil, which eventually became BP through various name changes and -- You know how the industry is. At BP I worked in the Rocky Mountain area, in the corporate office in Houston and in Alaska on Prudhoe Bay field.

In 1993 I left BP and moved back to the Golden, Colorado, area and went to work with my partner and set up a firm, Wendt and Associates, a consulting engineering firm. At this firm we did a variety of things, anything from waste disposal for some trona mines in southern Wyoming to a DOE project where we were looking at beneficially using waste methane from underground coal mines.

Finally, I went -- Whiting came in and asked me to do a two-week consulting project for them in 1995, and I never left. So that was sort of my long-term consulting project. In March of this year, Whiting offered me the job of operations manager, and I accepted that job and became an employee as of March 1 of this year.

Q. Okay. Mr. Brown, would you provide the Commission with a summary of your testimony and, in doing so, point out some of the exhibits that you think will be helpful in providing that summary?

A. Sure. In the Division hearing last July there was considerable disagreement over whether communication between the Fruitland Coal and the Pictured Cliffs existed in this area. The existence of that communication is now conceded. It is the primary purpose of my testimony to investigate the following two questions:

Did the hydraulic fractures applied to the Whiting coal wells in December, 1992, and August, 1993, cause communication and result in those wells producing Pictured Cliffs gas?

And second, did the hydraulic fractures applied by Pendragon to the Chaco wells in January and May of 1995 cause the communication and result in those wells producing coal gas until shut-in in July, 1998?

In contrast to computer simulations, I hope to throw in a bit of logic to this whole proceeding and provide the Commission with objectively observable data to answer the two questions that I studied. Most of what I present has remained totally unaddressed by Pendragon's witnesses.

Before looking at the data related to the fracture-stimulations, please refer to Exhibit JTB-3 in my booklet. This plot shows the combined gas-production rate for the six shut-in Chaco wells. It also shows the shut-in pressures that were recorded over time from those same six wells.

In my opinion, the Pictured Cliffs reservoir was a depletion-drive reservoir, and it was at or near the end of its economic life in 1994. Modeling performed on the Pictured Cliffs reservoir and some of the pressure readings indicate that the reservoir pressure would have been in the range of 80 to 100 p.s.i. in 1994, prior to the fracture-stimulations of the Chaco wells. This pressure level is confirmed by volumetrics and by material-balance calculations. There was little, if any, economically recoverable gas left in the Pictured Cliffs formations.

Now I ask you to look at the plat which is JTB-1 in this book, and if you haven't, it's been handed out numerous times. You may have another one sitting in front of you somewhere.

Remember that all of the coal wells were fracture-stimulated by what Pendragon refers to as large treatments. But of the six Chaco wells, only four were fracture-stimulated. The Chaco 1-J and 2-J, closely offsetting Whiting wells, were not treated.

If you will recall my Exhibit JTB-2, you will see that the Chaco 2-J is essentially on the same pad as the Federal 1 Number 1, and the Chaco 1-J is only 740 feet from the 1 Number 2.

The Gallegos 1 Number 2 was fractured in December, 1992, and the remaining coal wells in August of 1993.

So if you would look back to my Exhibit JTB-3, you can see on there that in 1993 there was no response from the Pictured Cliffs wells when the offsetting coal wells were fracture-stimulated. However, in 1995 when the Pictured Cliffs wells were fractured, there was an immediate response in the production from those wells, and it responded to a level higher than those wells had ever produced at any time in their lives.

I would now ask you to just thumb through Exhibits JTB-7 through -15. The first four, I believe, are the Chaco 1, 2-R, 4 and 5. And basically, this outlines the same information I've just told you, on a well-by-well basis. I've indicated the initial production level for each well, the date the well was frac'd, and the production level that the well attained after that fracture treatment.

As you can see on Chaco 1, 2-R, 4 and 5, there was no response to any of those -- the production characteristics to any of those wells when the Gallegos Federal well was frac'd. However, there was a tremendous response that got the well producing higher gas production than it ever had, after the Pendragon frac job was pumped in the PC well.

The remaining plots, Exhibits 12 through 15, are plots from offset PC wells that were not fracture-stimulated -- or -- that were not fracture-stimulated, that's correct.

I've indicated on these wells where the offsetting coal well was fracture-stimulated, and you can see there is little or no response -- I mean, not say "little", there is no response from any of the PC wells following the fracture treatment of the offsetting coal well.

This evidence demonstrates that the fracture-stimulations of the Chaco wells caused communication between the coal and the Pictured Cliffs at the Chaco wells.

Further proof that crossflow of gas occurs at the fractured Chaco wells is contained in Exhibit JTB-5-A. This is a plot of the shut-in casing pressure on the four Chaco stimulated wells that have been recorded over the past year. This is the raw data that has been recorded in the field. There have been no corrections applied to the data or no manipulation of the data in any way.

When the Gallegos Federal wells had been shut in, there is an immediate pressure response in the offset Chaco wells. This pressure increase at the Chaco wells indicates communication between the Chaco and the Gallegos Federal wells at or near the Chaco wellbore, not at the coal wells.

Coal reservoirs produce via a different mechanism than conventional rock reservoirs. We've been through this numerous times over the past four days of testimony. The methane that is produced has to flow from the cleat system into the wellbore. To get into the cleat system, the methane has to be desorbed and travel through the coal to enter into the cleat system. To get the methane molecule from the piece of coal into the cleat takes a driving force. It takes a ΔP to get it there.

When a coal reservoir is essentially dewatered, as the Gallegos Federal wells are, the pressure in the cleat system is a direct function of the bottomhole pressure in the producing well, the cleat permeability, and how rapidly this gas is desorbing from the coal. The pressure in the cleat system has to be below the desorption pressure to allow methane to be produced. However, when the well is shut in, the methane does not stop desorbing. Methane will continue to desorb from the coal until the reservoir pressure is equal to or greater than the desorption pressure. This is the cause for the pressure responses observed in the Chaco 4 and 5.

If I could try my hand at a little artwork, this is a very simple process. I think I can demonstrate that very easily, if I might.

First of all, it is our opinion that we have a very permeable cleat system in our coal wells. We have distance from the wellbore in this direction, and we have pressure along this axis. And this is the wellbore of our coal well right here.

Let's just say that the average reservoir pressure in the coal -- a lot of numbers have been thrown out over the past few days. I'm going to pick 102 p.s.i. It sounds like a good number. That's the pressure with everything shut in and everything equal.

When the coal well is producing and has produced for some time, we believe that the pressure in the cleat system is reduced over a large area. And if we pick a -- you know, just assume flowing wellbore pressure down here, it's very low because these wells are on compression. While that well is producing we see the pressure in the cleat system looks something like this. And let's just say, oh, out here somewhere --let's go a distance of 1803 feet. That pressure out here is 67 p.s.i.

So what happens when we shut this well in? The cleat system has very low porosity. There's not a lot of volume in the cleat system. It has permeability, but not a lot of volume. Immediately, the pressure out here will raise up as the gas that's desorbing fills that cleat system. Then the pressure will continue to rise as the pressures continue to raise in the reservoir to eventually stop the gas from desorbing from the coal.

The fact that pressure increases in the coal wells of several p.s.i. in one day were measured at the Chaco -- or excuse me. The fact that pressure increases of several p.s.i. in one day were measured at the Chaco wells proves that the communication is at or near the Chaco wellbores. If communication were at the Gallegos Federal wellbores, the entire Pictured Cliffs reservoir between the Gallegos Federal well and the offsetting Chaco well would have to be pressured up to see the pressure increase that we have seen.

Please refer to JTB-5- -- or, we're looking at -5-A. On 8-15, 1998 -- and I apologize, as was pointed out yesterday, my lines on here didn't exactly get to the right point. If you look at the 7-1/2-day Chaco Plant shut-in on 8-15, that line should be moved to the left just slightly. The wells did not start to increase pressure before they were shut in.

The shut-in pressure increased at the Chaco

Number 4 about 25 p.s.i. In the first day, the Chaco Number 4 pressure jumped about 11 p.s.i. The spacing between the Gallegos Federal 6-2 and the Chaco 4 well is about 1800 feet. I estimated that somewhere around 10 million cubic feet of gas would have to enter the Pictured Cliffs to raise the pressure 25 p.s.i. This would have to occur in 7 1/2 days at the Gallegos Federal wellbore. This is impossible for a coal well that can produce 500 to 700 MCF a day, to inject that amount of gas into the Pictured Cliffs in that amount of time.

Others have testified there is no evidence of communication between the 2-R and the Fruitland wells. Upon inspection of the plot of shut-in pressure reported on 2-R -- which is also on this 5-A, it's the purple symbols down towards the bottom of the graph -- I believe this same data does show that there is evidence of communication. However, it is not as direct and is not as strong on the other wells. Remember that the 2-R is the only Chaco well that is perforated below the lowest Fruitland Coal and is not perforated in the sand between the lowermost coal and the main coal.

Exhibit JTB-6 shows the total monthly production rate -- there it is -- for the five Gallegos Federal wells. After the Chaco wells were shut in, there was an increase in the production rate from the Gallegos coal wells. The reason for this increase is that with the shut-in of the Chaco wells, additional drainage points were removed from the coal reservoir, and more reservoir energy was available to deliver the gas to the Gallegos Canyon wells -- Gallegos Federal wells, excuse me.

We also looked at gas composition. The gas composition provides further evidence for my conclusions. We did a preliminary investigation into the phase behavior of the gas in the Fruitland and Pictured Cliffs reservoirs. Our results were similar to what Mr. Blauer presented last week. Based on the physical properties of the gas in the reservoir, there is no phase change during the production of these wells. We see no evidence for a change in the BTU content of the gas based on phase-behavior changes.

The reason for the major variation in BTU content is flow of the gas into the PC from the Fruitland Coal formations in the communication channels -- let me say that flow may be either way, depending the pressures that we believe -- caused by the fracturing of the Chaco wells.

Measured BTU values, like wellhead pressure measurements, can be misleading. Using a single BTU measurement without knowing how the sample was collected could lead to the wrong conclusions. The usefulness in BTU information is to look at the trends of a large volume of data. Does the trend and the data show anything? It does.

JTB-4 is a plot of the measured BTU value for the Chaco wells as a function of time. The BTU value for the PC gas is generally in the range of 1075 -- excuse me, is 1075 to 1150. The BTU range for the Fruitland gas is 1000 to 1050. Based on the data presented, the gas produced from the Chaco wells since the fractures is Fruitland Coal gas.

In conclusion, it is my opinion the fracture-stimulations of the Whiting wells, if they extended into the Pictured Cliffs formation, did not cause coal gas to be produced from the Chaco wells, nor did they cause Pictured Cliff gas to be produced by the Whiting wells. The fracture-stimulations on the Chaco 1, 2-R, 4 and 5 established a gas and pressure pathway between the coal and Pictured Cliffs, resulting in coalbed methane being produced from those Chaco wells until they were shut in, in July, 1998.

Q. (By Mr. Gallegos) Mr. Brown, in your statement you referred to your use of recorded pressures in the field, as contrasted with the use of corrected or manipulated data. What did you mean by that?

A. It's my understanding that the pressure data that has been presented in my chart -- what is it, -4? -- and numerous other charts, some of it has been what has been called "corrected", and Pendragon has taken the raw data from the field and applied a correction factor to get what they call or think is better data or more consistent, realistic data. Their corrections are on the order of 1 to 2 p.s.i. on some of the wells. It varies, depending on the number or the size of the data that's being presented.

What we did is, we just plotted the raw data. I mean, it's what the pumpers measured in the field on their gauge. We've been asked to look at pressure differences that are very small, a few p.s.i., and draw big conclusions from small pressure increments. Perhaps these are the same size as the amount the data was corrected.

All our plots are just what was recorded in the field. There's no correction to that data.

Q. I want to turn your attention to some information concerning gas analysis of Pictured Cliffs gas versus coal gas and ask first of all, at my request did I ask you to examine the series of exhibits in Mr. Nicol's book that were -37-A through -E, I believe, which were various listings, just of wells with their BTU at various periods of time?

A. Yes.

Q. Did you familiarize yourself with that information?

A. Yes, I did.

Q. All right. And then did I ask you to look at some plots or graphs that Mr. Cox did where he took BTU data but he built graphs that sort of combined, I guess, in time, the gas analysis from the different formations?

A. Yes.

Q. All right. And did I ask you to take that information and see if it could be plotted in a way so that we could better understand what was being shown by those gas samples of the various wells?

A. Yes, you did.

Q. All right. Let me hand you a series of exhibits, and to relate them to the exhibits of the Pendragon witnesses I've marked the first one as Exhibit N-37-E-3.

This may not be in the order that you used them, but I'm --

A. Okay.

Q. -- just going to hand them out and identify them for the record.

The next one is N-37-E-2. In fact, I'm quite sure I'm doing this in the opposite order that you'll probably want to discuss it.

Next, N-37-E-1.

And finally, because of its relation to the material in the Cox exhibit, Exhibit C-51-1.

Before we talk specifically about what the exhibits show, Mr. Brown, would you explain to the

Commission what your objective was in using this data and plotting it?

A. Yes, as we have heard several times, one of the ways -- or one of the things one is to look at to determine whether gas is coming from the PC or from the Fruitland Coal is to look at the gas analysis and see what it tells you. So that is the prime reason why we looked at the gas analysis, because we thought it might lead us to some conclusion as to where this gas came from.

Q. All right. Would you tell the Commission what you found by plotting the data in a way so that it could be visually understood?

A. Sure. Let me start first with Exhibit N-37-E-1. It should be a green bar chart, several bars on it. This is a plot of the measured BTU value for 65 coal samples. And this -- Like Mr. Gallegos said, this is the data that was presented in Pendragon's testimony. This is all the coal wells that they had in there.

If you'll now refer to Exhibit C-51-1, out of those -- out of that data, we pulled just the Whiting Chaco or Gallegos Federal wells. So this represents the samples that were in that database that came from the Whiting coal wells.

As you can see, there's a very tight grouping of the BTU analysis from these coal wells. And this is from all time. This is from since the Gallegos Canyon [*sic*] wells were frac'd, as recent data as there was available. I don't recall when the last date of the analysis was, but this covers from the time the wells were first placed on production, or first started to produce gas, until recently.

Next, if you would please refer to N-37-E-2, this is a plot for the measured BTU values for the gas from the PC wells, and this is from a time frame when the wells were put on production, or as far back as we had gas analysis, up until 12 of 1993. So this would be prior to any stimulations occurring on the PC wells.

As you can see, there's some variation in the BTU analysis. But if you envision a bell curve through there, it's not a bad statistical variation in the analysis.

Now, if we just take that same PC data and look at the samples that were caught from the PC wells from January of 1994, what you can see -- just hold these above each other in similar fashion -- all of a sudden, we have a large grouping in these PC wells that, darned if it doesn't look an awful lot like Fruitland Coal gas that we saw in our C-51-1.

So from this data I draw that since the PC wells were fracture-stimulated, the gas analysis that we've seen, although there is some spread in the data, a lot of it looks like coal gas, based on BTU values.

Q. Was there any of the sampling data that you eliminated, did not use?

A. Yes, I'm glad you reminded me. There was one well in here that made up a predominant number of the samples, and I've indicated up at the top, at the heading up there, it says "PC Without Designated Hitter #2". I believe there were 22 samples from this one well in the database. This is listed as a PC well, but we're a firm believer that this is also producing Fruitland Gas. So we pulled those 22 gas samples out of this analysis to plot this data.

Q. Okay. Just to go back, in your Exhibit -37-E-1, are the Gallegos Federal wells included in that sampling?

A. Yes, they are.

Q. Okay. Are there other wells included?

A. Yes, there are.

Q. Okay. All designated as coal wells?

A. All designated as coal wells.

Q. All right. And then the Pictured Cliff well samples compiled by Mr. Nicol were used with elimination of the Designated Hitter Number 2 well?

A. That is correct.

Q. Okay. Is there reason to believe that the Designated Hitter Number 2 well, besides being so predominant a sampling, is classified as a Pictured Cliff well but is, in fact, producing Fruitland Coal gas?

A. Just the production characteristic of the well looks very similar to the Chaco wells.

Q. Okay. Are there any other conclusions that you wanted to point out from these graphs?

A. No.

Q. Okay. Does this substantiate the conclusion that you stated earlier, that the production from the Chaco wells, when they were producing prior to their being shut in, was coal gas?

A. Yes, it does.

Q. After the fracture-stimulations --

A. -- was coal gas. Yes, it does.

Q. There's been some testimony by the Pendragon witnesses to the effect that since the Chaco wells were not on artificial lift, not equipped with a pump device of some sort, that that in some way is evidence that they were Pictured Cliff wells rather than coal wells after the fracture-stimulations were applied. Do you agree with that?

A. I'm not certain what I'm agreeing with. Can you run it by me one more time?

Q. All right. Do you think -- Let me phrase the question this way: From what you've seen of the production information and production data on the Chaco wells from the period of 1995, after they were stimulated, until they were shut in, do you think those wells could produce without artificial lift?

A. Yes, I do.

Q. Okay, why?

A. Well, those wells, as has been previously stated, were all slimhole completions. They were all 2-7/8 casing with either 1-1/4-inch or 1-1/2-inch tubing in them to allow the production to flow up the smaller tubing. As you put smaller tubing in gas wells, they can continue to flow and lift water out of the well.

There are some very simple correlations you can use, there are some very simple programs you can run to estimate this -- you know, what gas rate do you need to lift fluids out of a well?

One of the more classic ones is some work that was done by Turner. I don't remember if it was back in the 1970s or as far back as 1968, I believe. It just gives you a nomograph that you can look at and say. this well, with this size tubing, producing, you know, water or producing oil, what sort of gas rate do you need to keep the thing on production?

And if you run that for these Chaco wells, you come out with a value of about 75 MCF a day. So what that tells you is that these wells will continue to lift water out of the wellbore if they're producing somewhere around 75 MCF a day, and that's about 2200 MCF a month. And you can look at the charts, the production charts that have been presented, and it fits reasonably well.

So as long as these wells were producing at higher rates, yes, they can continue to produce and continue to lift water out of the wellbore.

Q. In addressing that particular issue about those wells producing without artificial lift, is it any consequence, in your estimation, that they were fracture-stimulated and put on production at a time that the offsetting Gallegos Federal wells had undergone roughly two years of dewatering?

A. Sure. I mean, you couldn't do this right off the front, because, as Mr. O'Hare and Mr. Reimers testified to, when you're producing all water, this wouldn't work. You have to have a sufficient gas rate to allow these wells to produce.

So you had to wait until part of the dewatering had occurred so that a sufficient gas rate could be expected and you could continue to lift water out of the wells.

Q. Mr. Brown, did I also ask you to give some attention to Mr. Ancell's Exhibits A-9 and A-10?

A. Yes.

Q. Just generally, to remind the Commission, what did those exhibits purport to show?

A. They were production curves -- and I didn't bring a copy with me, but they were production curves of, I believe it was the Gallegos Federal 6 Number 2 and the offset Chaco well, and I believe there's one curve for the Chaco 4, one curve for the Chaco 5.

The -- What was presented last week said that the reason that these things -- the reason the wells dropped off was because we put our wells on compression, it stole PC gas from their Chaco completion and caused -- I believe there was some damage caused -- Let me not testify what Mr. Ancell testified. But anyway, us putting our well on compression caused their wells to fall off in production, steal PC gas, and this was obvious that we were stealing their gas.

I think a simpler explanation is, both of these wells are completed in the Fruitland Coal. As I just testified to, we think that the permeability -- the permeability in the cleat system in this coal is very high. We put our well on compression. We dropped our flowing wellhead -- or bottomhole pressure down to 10 p.s.i., something very low. We got a tremendous increase in the flow of gas to our Gallegos Federal well. Basically, we were stealing our gas back.

So therefore, since their well was not on artificial lift, they no longer had the ability, with the gas rate dropping off, to lift the water out of the well. The well simply loaded up and died, just because we were able to produce the gas through our drainage point rather than through their drainage point.

Q. Are you familiar with the bottomhole pressure tests that have been referred to that were run on the Chaco wells, I think on the four stimulated Chaco wells, in April of 1999?

A. Yes.

Q. All right, and have you given some attention and drawn some observations concerning those pressures?

A. Yes.

Q. All right. Would you explain that to the Commission, what the readings were and what the significance is to be drawn from those readings?

A. The four -- or actually the wells, all the Pendragon wells, have bottomhole pressure measurements taken, I believe, on April 22nd, 1999.

Basically, what -- If I could just concentrate on the Chaco 4 and Chaco 5 for right now, those showed a pressure of 67 p.s.i. and 85 p.s.i. respectively. How I view this is, those wells are -- I mean, they are sitting out there in the coal reservoir, they are Fruitland Coal completions. Basically with those wells shut in, they are monitor wells for us. We can measure pressures in those wells, and we get an exact picture for what is going on in the Fruitland Coal reservoir.

The pressure I happened to write up there was 67 p.s.i. That just happened to be the pressure that was measured in the Chaco 4. Basically, with us producing our wells, the Chaco wells shut in and sitting there, they're just sitting out there monitoring the coal pressure at a point out in the reservoir.

And if you also look at Cox Exhibit C-10 and C-11, that's about the pressures -- if you could draw a line along the bottom edge of where those wells are, that's about where those pressures are. That's the falloff we're seeing.

And I just -- It's my opinion that those wells, at least in the 4 and 5, and perhaps the Chaco Number 1 and the Chaco 2-R, are measuring what our producing reservoir pressure is in the Fruitland Coal.

Q. Now, you mentioned in your opening summary that the data indicated that the -- as of 1994, this so-called WAW-Fruitland-Pictured Cliffs Pool is basically a depleted reservoir?

A. Correct.

Q. Did you prepare what has previously been referred to and passed out here to the Commission, Exhibit W-30? Are you familiar with this exhibit?

A. Yes.

Q. Are you familiar with Exhibit W-30?

A. Yes, yes, W-30, yes, correct.

Q. Do you have extra copies, because some of these things, once they're handed out, in a few days they're nowhere to be found? Just in case.

Do you have your copy?

MR. HALL: I do, thanks.

Q. (By Mr. Gallegos) What does -- First of all, what is contained on Exhibit W-30?

A. Well, let me address the back pages first, and then we'll move to the front.

The back pages are just a data dump from *Dwight's*, which were all the WAW-Fruitland-Pictured Cliff wells, and -- showing their production by year.

The front page is just a summary plot of all of those WAW-Fruitland-Pictured Cliff wells put on one plot, so you can see the total production from all the wells in one place.

Q. So in a way you might say this is the cumulative or this is the typical decline curve, production curve, for a WAW-Fruitland-Pictured Cliff well?

A. One might say that, yes.

Q. Okay, go ahead.

A. Okay. The important points to note out here are, it looks -- as Mr. Gallegos just said, you could draw a fairly reasonable decline through those points, out until about 1995 or so, and then you see the production head up for three years in a row.

If you go in and investigate which wells caused that production to increase, you can see that they're highlighted in yellow on the back sheets. And if you flip to the very back page, we've selected all the wells that were highlighted in yellow and just placed them there towards the bottom third of the piece of paper.

The interesting thing is, if you look down the list of those selected wells and look who the operator is, you happen to see Pendragon's name pop up fairly regularly. So I believe there are twelve wells on that list. I believe they're the operator on nine. Our suspicion is, we're seeing results on those nine wells very similar to what we've seen in our Chaco wells and Gallegos Federal wells.

Q. And absent that bump which can be attributed to some dozen wells, do the production histories of all the wells in this field support your conclusion that this -- as of 1994 this was a depleted reservoir with little economically recoverable gas remaining?

A. Yes, it does.

MR. GALLEGOS: Mr. Brown is passed for cross-examination.

Oh, I do need to offer some exhibits. We offer the testimony and the exhibits that are attached to the prefiled testimony, and in addition -37-E-1, -37-E-2, -37-E-3, Exhibit C-51-1, and I don't think W-30 was -- I'm not sure whether it was offered before, but just to be safe I'm going to offer it now. I'm not sure whether it was admitted before.

MR. HALL: No objection. If I did object to Exhibit WA-30 before, I'll restate that objection. I can't recall either.

CHAIRMAN WROTENBERY: I don't think it was offered before, so do you have an objection?

MR. HALL: Well, it needs to be authenticated through some witness, then, and if that's not done I do object.

MR. GALLEGOS: Well, I thought we did authenticate it with -- Mr. Brown testified as to the source of the data from *Dwight's* and that --

THE WITNESS: Yes.

MR. GALLEGOS: -- was prepared by him.

THE WITNESS: Yes.

MR. HALL: You prepared the cover sheet, the top two sheets?

THE WITNESS: Yes.

MR. HALL: No objection.

CHAIRMAN WROTENBERY: Then we'll accept Mr. Brown's written testimony, prepared direct testimony, the attached exhibits -- and let me just go through and make sure I've got it all straight -- JTB-1 through -16, Exhibit N-37-E-1 through -3, Exhibit C-51-1, and Exhibit W-30.

MR. GALLEGOS: That's what's being offered, Madame Chairman.

CHAIRMAN WROTENBERY: And they are admitted into the record.

Okay. It's a little after noon. Shall we break for lunch now before we --

MR. HALL: Yes.

CHAIRMAN WROTENBERY: -- go into cross-examination? Okay, we'll come back here at 1:15.

(Thereupon, a recess was taken at 12:10 p.m.)

(The following proceedings had at 1:17 p.m.)

CHAIRMAN WROTENBERY: Ready, Mr. Hall?

MR. HALL: We are.

CHAIRMAN WROTENBERY: Mr. Gallegos, ready?

MR. GALLEGOS: Yes.

CHAIRMAN WROTENBERY: Okay, go ahead.

CROSS-EXAMINATION

BY MR. HALL:

Q. Mr. Brown, could I have you refer to your Exhibit JTB-3, please, sir?

A. Yes, sir.

Q. Do you have that in front of you?

A. Yes.

Q. In response to a question from Mr. Gallegos I understand you to say that the Pictured Cliffs was a depleted reservoir as of 1993; is that what you said?

A. That's correct. Let me say -- I don't know that I said depleted. I might have said depleted. What I know I said in other places, it had very little economic reserves left to recover.

Q. Well, let's define that.

A. Okay.

Q. How do you define a depleted reservoir?

A. Well, I would define a depleted reservoir as one that there are very few economic reserves left to recover.

Q. And would you disregard pressure in the reservoir in making that determination?

A. "Disregard" may not be the term I would think of, but it -- I mean, it's part of it.

Q. All right. Well, let's look at JTB-3.

A. Okay.

Q. Let's pick a point in 1993, say your June, 1993, depletion point. How do you explain the pressures in the PC as exemplified by the pressure points for the Chaco 5 you reflect on that exhibit?

A. If you'll recall, the Chaco 5 was a well that when you went to work over on it to give it the frac job, you found a casing leak, I believe at 900-and-some-odd feet, something like that. It's just our opinion that perhaps -- not perhaps, that through that casing leak this well was communicated with the Fruitland Coal formation. So those pressures are not reflective of the PC, they're reflective of the Fruitland Coal pressures.

Q. And at what level was that casing leak, do you recall?

A. I don't recall, I'd have to look back. It was 968, nine hundred -- I don't remember.

Q. Substantially above the coals?

A. That's correct. Pressure will travel up.

Q. How about the pressures for the Chaco 1? You show as far back as 1983 decent pressures from that well, don't you?

A. Yes.

Q. How do you explain that it's a depleted reservoir as of 1993?

A. 1993?

Q. That's what you testified to.

MR. GALLEGOS: It was 1983.

MR. HALL: That's the pressure point. His testimony is, it was depleted in 1993.

THE WITNESS: Well, yes, it depleted, and I said we consider pressure. That well was not capable of producing at economic rates.

Q. (By Mr. Hall) Well, how do you explain those pressures for the Chaco 1 for that period of time?

MR. GALLEGOS: Could the question be made specific? "Those pressures". Is there a particular --

Q. (By Mr. Hall) Well, compare the pressures between 1983 and 1993. Isn't it true that the Chaco 1 hadn't produced anything, much of anything, between those -- in that period of time?

A. That's correct. And I believe that pressure in 199- -- the end out there, the one that is just about in June of 1995, that pressure is after the acid job. We're maintaining that pressure was taken after it had already communicated with the coal formation. So that pressure isn't reflective of the Pictured Cliffs, it's reflective of the Fruitland Coal.

And to be honest, I have not done the vol- -- or I don't recall the volumetrics, I have done it, on the Chaco Number 1. It could be that's what the reservoir pressure is, based on volumetrics. I'd have to look at that and see.

Q. Why doesn't JTB show any data points in the period between June, 1993 -- I'm sorry, between June, 1983, and about June, 1992?

A. The pressure information we had, this was a complete plot of all the data that was available to us. As you'll recall, the pressures used to have to be taken on an annual basis, and I believe sometime in the 1993 time frame that requirement was dropped, so we no longer had annual pressures, and that's been part of the problem with this. We had good -- we had at least pressure data for the first part of it. There was a long period of time in here when we had no data.

Q. Let's look at your JTB-4, please, sir.

A. Okay.

Q. Can you explain why you didn't include the Chaco 2-R on this chart?

A. I looked at the data, and without going back and seeing what exactly the Chaco 2-R -- No, I can't remember why. I know part of my reasoning was because there was the contention that the Chaco 2-R was not communicating.

These are the three wells that I think we pretty much don't dispute the communication between the Fruitland Coal and the Pictured Cliffs.

Q. So do you agree that the Chaco 2-R is not in communication with the Fruitland Coal?

A. No, I do not.

Q. Let's look at your plot for the Chaco 5. Do you see that there, the X's?

A. Yes.

Q. How do you explain the decline in the BTU for the Chaco 5 prior to the time that well was frac'd in 1995?

A. The same way I describe the increase in pressure in the Chaco 5 prior to the well being frac'd. That's the well that had the casing leak. We maintain that it was producing, or at least in communication with the Fruitland Coal. As that well -- As we move forward in time, perhaps that connection with the Fruitland became more and more evident, producing more Fruitland Coal gas, lowering the total BTU of the gas that was being produced from that well.

Q. That's not reflected on the production curve, is it?

A. You know, when you're producing 1 or 2 MCF a day, it's hard to reflect much.

Q. Right. Now let's look at the Chaco 4 plot on JTB-4. It shows a generalized decline prior to frac'ing this well, wouldn't you agree?

A. With the data that you have here, you would say yes. If you would plot the data on further back, you would see that it's in that same span, same group of -- between 1150 and 1100, back earlier in time.

So when you look at this data, yeah, you put a decline through it like that. When you see that same gathering of data out there in the earlier time period, no, you put a line through it that's horizontal, right through the whole works.

Q. Let me make sure I understand. Is the Chaco 4 exhibiting coal gas production prior to the 1995 frac job?

A. No, I don't believe so. If you look, there is one point that's outside of the range from 1100 to 1150. And if you look at data earlier in time, they're between -- they're in that range, 1100 to 1150.

So as I said, if you want to pick one BTU measurement and really -- really, you know, dig into it, you have to know a lot of things about it before you can put a lot of weight on one simple -- one particular measurement.

Q. Now, you have produced a number of charts purporting to show that you see no production response from the coal wells that were frac'd, correct?

A. That is correct.

Q. Did you observe any pressure-rate change at any of your coal wells when other coal wells were frac'd?

A. I didn't look at that.
Q. What would you expect to see?
A. The coal wells -- the 1 well was frac'd in December, the remaining wells were all frac'd in August of the following year. I don't know how you could expect to see much of anything. They were all done at the same time.
Q. Let's refer to the drawing you made up here earlier --
A. Okay.
Q. -- Mr. Brown. You show a 102 p.s.i. for the coal formation up there. At what period of time was that pressure?
A. Well, the reason I picked the 102 was, yesterday when we were reading some charts, that's roughly where the wells were building up to. I realize that's not -- It probably would have built a few more p.s.i. to get reservoir pressure, so we were looking at a time frame approximately a year ago. So let's say, I don't know, October, November of 1998.
Q. And the 102 was an average across the drainage area; is that what you said?
A. Yes.
Q. And you presumed a 320-acre drainage?
A. That's a difficult question to answer. We have six -- excuse me, five coal wells out there producing, and

several other wells that we feel very strongly are producing from the coal. I mean, it's hard to say, Is any one well draining 320 acres? We use that number to calculate volumetrics, so you make sure you cover all the areas. There's probably not a single well out there that's draining exactly 320 acres.

Q. Well, over what area is this 102-p.s.i. average applicable?

A. I was looking in the area of the Chaco 4 and 5, the Gallegos Federal 7-1, 6-2 and 12-1, sort of that -- sort of the sweet spot, if you would.

Q. Let me restate my question. Over what drainage area is your 102-p.s.i. average pressure applicable?

A. Well, stating what I just said, it's the area that's sort of surrounded by those wells, sort of the sweet spot of the coal reservoir.

Q. Well, sort of. I mean, what I'm asking for, what is the acreage number?

A. Now, realizing, Mr. Hall, that Mother Nature isn't an engineer, and things never work out in nice square areas. So -- I would say roughly the center part, let's say the 640 acres that are made up of the 160-acre blocks in the southeast of 1, the southwest of 6, northwest of 7, northeast of 12.

Q. Explain to me how you derived a 67-p.s.i.

pressure 1800 feet away from the wellbore --

A. Your client measured it for us.

Q. Well, let me finish my question. -- with your generalized assumptions with respect to the drainage area.

A. Like I said, your client measured it for us, April 22nd.

Q. Well, my question is, how could you derive that when you don't know what the actual drainage area was?

A. I didn't derive it. It was a measured number, it was recorded. I didn't have to derive it.

Q. Okay. The pressure data you utilized for your evaluation, you said you didn't use any corrected pressures; isn't that right?

A. That's correct.

Q. Wouldn't it have been reasonable to use the corrected pressure data?

A. We've heard so much about pressures in the past, you know, over the testimony.

First of all, we're not certain we can believe any of these pressures, because the pressures all depend on there being fluid levels in the well. Maybe there's a fluid level in the well so that the surface pressure that we're reporting may not be believable. However, we want to go through the effort to correct them a couple p.s.i. So therefore we're going to take a pressure that we can't believe and correct it a p.s.i. or two, and that makes it more believable.

So I don't know, why not just plot the data you get and see what you've got, rather than try to make some correction.

Q. I guess I'm not sure what you're saying. Are you saying the pressure data you used is not believable?

A. Well, no, it's just that we've been told by others who have testified that these are all surface -- except for a few shut-in pressures that were measured with downhole gauges, a lot of these pressures are surface-measured shut-In pressures. The reliability of these pressures is questionable at best, because we don't know what happens below the surface of the earth at that well.

So, you know, I'm back to the same point as I made on BTUs. To take a single pressure and hang your hat on it, on a surface reading, is very difficult. Look at the trend, look at the entire grouping of data. Perhaps that will lead you to some conclusion. But to think that each single pressure is believable, yeah, there is some question to it. We've all questioned the pressures over the past four days of testimony.

Q. So you don't think you should take into account fluid levels or gauge changes, that sort of thing?

A. Well, if you know fluid levels, sure, you should take them into account. That's what makes your surface gauge reading believable, is if you know the fluid level.

Gauge readings -- I don't know, I mean, we're talking about a gauge that's being read within a p.s.i., and we're correcting that to a deadweight that was measured. I wonder what the pumper does with his gauge after he's done reading in the day. It probably gets pitched in the toolbox and off he drives down the lease road. So that correction was good for that one day. Is that correction good for two days from now? I'm not certain.

And the magnitude of the corrections that we're making are, I think, within the magnitude -- or the accuracy of the things we're trying to measure.

Q. Mr. Brown, would you describe the Pictured Cliffs formation in this area a tight reservoir?

A. Are we referring to the southwestern United States or the world in general?

Q. No, I'm referring to the PC reservoir in this subject area.

A. What am I comparing this to?

Q. Well, what's your definition of a tight reservoir?

A. I don't know that there is. There may be. I'm not aware of a standard definition of a tight reservoir.

If you're -- I mean, we're talking something -- I believe the Pictured Cliffs is somewhere on the order of 50 millidarcies, somewhere in that range. And in my view, that's not a tight reservoir.

However, what I was alluding to, part of my experience is in the Prudhoe Bay field and some other fields, you know, that have several darcies of permeability. You compare the Pictured Cliffs to those, this is a tight reservoir. But I think in most people's general thinking about what a tight reservoir is, I would not characterize this as particularly a tight reservoir.

Q. Well, let's look at your testimony on page 4, lines 17 through 19 there. It says:

> The Chaco wells exhibited a classic initial production level at their completion in the 1978-1980 time span, and exhibited a classic depletion drive tight gas production decline profile.

Do you see that there?

A. Yes. Perhaps I should have read my testimony before I answered the last question.

Q. That's always helpful.

A. Yes, it is. Like I said, you know, it just depends on your thinking. There is no standard definition of what a tight reservoir is. Perhaps when I wrote this my thinking was that it was a tight reservoir.

Q. Have you changed your thinking since you wrote this?

A. Yes.

Q. Okay. Do you happen to know what the FERC definition of a tight reservoir is --

A. No, I do not.

Q. -- under the NGPA? Isn't it .01 or less?

A. I'll take your word for it. I do not know.

CHAIRMAN WROTENBERY: Commissioner Lee is pointing out it's 0.1 --

COMMISSIONER LEE: Yes.

CHAIRMAN WROTENBERY: -- millidarcies.

MR. HALL: Thank you.

MR. GALLEGOS: And two other factors besides millidarcies.

Q. (By Mr. Hall) Let me show you what we've marked as Exhibit Brown 1. Mr. Brown, Exhibit Brown 1 is the *Dwight's* production plot for the Chaco 1. Do you see that decline occurring from the period during most of 1982 and into 1983 there?

A. Yes.

Q. Do you have any information which would establish that that decline is not due to formation damage?

A. Can you restate the question? Do I have any information that that decline is not due to formation damage?

Q. Right.

A. No, I do not have any information.

Q. And Brown Exhibit 2 is the completion report for the Chaco 1. Can you see the initial production rate there? It shows 342 MCF?

A. Yes.

Q. And that was production for two hours against a half-inch choke?

A. Yes.

Q. Can you tell me at what rate the well produced when it was first turned on, after it was completed?

A. It looks about 2200, 2300 MCF per month. Or, you mean the very first month?

Q. Yes.

A. Probably 1600 MCF a month.

Q. All right. Then it inclines up to, as you say, to about 2200, 2300 a month?

A. Correct.

Q. Do you know what the line pressures were back when the well commenced production?

A. No idea.

Q. Do you agree that this was a pretty good-looking well when it started to produce?

A. You mean in my experience? No.

Q. Well, let's look at the well's -- It initially tested at 342 MCF, right?

A. Correct.

Q. And when it was first put on production the production was significantly lower than that rate, was it not?

A. That's correct.

Q. What's the explanation for that?

A. Well, the 342 MCF a day, you have no clue what that was -- Like you said, it was a two-hour test against a half-inch choke. I see nothing on here that tells me any -- or there's a casing pressure on here, 62 p.s.i. I don't know what the tubing pressure was.

You know, these wells like this, for very short-term tests, will produce high volumes. I don't know if this thing produced constantly at that pressure for two hours, I don't know if it started at 200 p.s.i. and over the period of two hours dropped to 62 p.s.i. I have no clue what this is.

Q. Does this tell you anything about the reservoir condition?

A. No.

Q. Well, is this consistent with your earlier

statement that you believe this to be a tight reservoir?
A. Tight in my definition, yes.
Q. All right. Wouldn't it have been prudent for an operator to frac into that tight reservoir to increase production?
A. Sure
Q. How far would you think a frac would penetrate in a formation like that?
A. Depends on what size frac you designed.
Q. Do you know what assumptions Mr. Robinson used when he made his calculations? Do you know what his assumptions were about the perm in the Pictured Cliffs?
A. Which calculations are we referring to?
Q. Any of them.
A. No, I do not.
Q. Would you know if there were any other influences governing the rates at which the Chaco 1 would have produced over time?
A. Line pressure.
Q. And you didn't know what the line pressure was?
A. No, I did not.
Q. So it's difficult to make a comparison with pre- and post-production data if you don't know what those other influences were like line pressure?
A. No, but you always assume that these people are

prudent operators and that they're going to be doing whatever they can do to get as much gas out of the ground as they can. That's always been my approach. If you're producing against a line pressure that you can't produce into, you do whatever you can to get that well producing at its optimum.

Q. And a prudent operator would include stimulating the well to increase production, right?

A. That's correct.

Q. Let me show you what's been marked as Exhibit 5. That's the *Dwight's* production plot for the Chaco 4 well.

MR. CONDON: Just plain Exhibit 5?

MR. HALL: Brown-5, thank you. Plain Brown-5.

MR. CONDON: Did I miss 3 and 4?

MR. GALLEGOS: No, he has no --

MR. CONDON: Oh, okay.

Q. (By Mr. Hall) I you would look at the gas production plot for the Chaco well around 1984, 1985, do you see that there?

A. I assume we're referring to Chaco 4 --

Q. Yes.

A. -- on this exhibit? Yes.

Q. Do you have any explanation for the decline in production during that period?

A. Could be a number of things. There are lots of explanations.

Q. What is yours?

A. With all the information I have in front of me is this production plot, the well might have reached a point where it could no longer produce effectively against the line pressure. The well might have reached the point where there was sufficient water in the wellbore that it could no longer flow. I don't know what size the tubulars are. I've got a production curve. It's very difficult to come up with any conclusion.

Q. So you can't preclude formation damage, can you?

A. No. You might wonder why it produced for seven years and then had formation damage, but...

Q. Let me show you what's been marked as Exhibit Brown-6. It's the *Dwight's* production plot for the Chaco 5. Again, let's look at the gas production for the Chaco 5 for the 1980-81 period. Do you see that there?

A. Yes.

Q. To what would you attribute that production decline?

A. Which production decline?

Q. The one demonstrated in 1980 and 1981.

A. I don't have enough data on this plot to make any assumption.

Q. Similarly, you can't preclude the possibility of formation damage, can you?

A. No.

Q. Let me show you the completion report for the Chaco 5. It's marked Exhibit Brown-7.

Now, what was the initial production rate reported on the completion report for the Chaco 5?

A. 1,029,000 cubic feet per day.

Q. You mean to say 1029 MCF per day?

A. Correct.

Q. That's a good rate for a well like this, is it not?

A. Yes, it is.

Q. Now, let's look back at the Exhibit 6, the *Dwight's* production plot for the Chaco 5. What was the production rate for the well in July of 1995?

A. Without having months on this plot, I'm not certain which month on here is July. I'll assume it's the peak month. It looks like it's probably about 11,500, 12,000 MCF per month.

Q. So that would equate to what, 400 MCF a day?

A. That's correct. But we're comparing apples and oranges here. We're comparing a one-hour production test, taken we don't know when, versus 30 consecutive days of production. The two -- You can't do it, it just flat doesn't work.

Q. Well, on page 6 of your testimony, lines 5 through 7, you say:

> There is absolutely no scientific explanation for the reservoir to some way "recharge" so that in 1995 the rates and pressures of these Chaco wells <u>significantly exceeded initial, virgin gas flows and pressures</u>.

A. That's correct.

Q. Where is that shown on Exhibit 6 at all, Brown 6?

A. If you're talking about -- Well, the statement is: "There is absolutely no scientific explanation for the reservoir to some way "recharge"..." That isn't on Exhibit 6. It's hard to derive reservoir recharge from a production plot.

Q. But the pressures in 1995 were nothing like the original pressures, were they? They didn't exceed the virgin pressures?

A. In the Pictured Cliffs reservoir, that is correct.

Q. So all we can derive from these exhibits, the production plots for these wells, is that the wells didn't perform as you would expect from the initial completion reports; isn't that safe to say?

A. What I would say is, it's -- to jump from completion reports to monthly production plots, based on the information I have on these plots, you don't have enough data to say that.

Q. Mr. Brown, did you determine if there are any boundaries for the reservoirs for these producing Pictured Cliffs wells?

A. No, I did not.

Q. Why didn't you do that?

A. I didn't think it was necessary. If you look -- As Mr. O'Hare stated, you look at the number of Pictured Cliffs wells in these sections, and there have been numerous Pictured Cliffs completions over the years.

Q. Do you think these wells are capable of draining more than 107 acres?

MR. GALLEGOS: Is there any specific well being referred to?

THE WITNESS: Yes, pick a well.

MR. GALLEGOS: "These wells" -- what --

Q. (By Mr. Hall) Any of the Chaco wells.

A. Of draining more than 107 acres. Do you have any particular time in mind?

Q. Well, I understand you didn't review Mr. Robinson's testimony, did you?

A. Yes -- His testimony?

Q. Yes.

A. Yes, I did.

Q. Didn't he opine that the drainage areas was between 107 to 147 acres for the Pictured Cliffs wells?

A. That's Mr. Robinson's testimony.

Q. Do you not agree?

A. I'm allowed my own opinion, I believe.

Q. And what is that opinion?

A. Well, given -- I mean, I haven't -- I don't know that I've done -- I've done the -- What do I want to say? -- material balance calculation on all these wells. I didn't take it back to calculate a volumetric drainage area. I know that I did calculate -- or compare them to a 160-acre drainage.

Q. You opine on page 5, at lines 8 through 12 that you believe the acid jobs on the Chaco 1-J and 2-J resulted in communication with the coals as reflected on the shut-in data. What specific shut-in data shows that? Can you point to an exhibit?

A. I can point to my Exhibit 5-A -- excuse me, 5-B.

I'm of the opinion that the pressure in the Pictured Cliff wells, in the Pictured Cliff reservoir, is something on the order of 80 to 100 p.s.i. I have a difficult time explaining pressures of 150 in the Chaco 1-J. It just doesn't fit what I think the Pictured Cliffs is.

The Chaco 2-J could or could not be in connection with the Pictured Cliffs, but there are other things on the 2-J that I just don't understand what is going, but the only explanation I could come up with would be if it was in connection with the Fruitland Coal.

Q. I'm sorry, what exhibit are you looking at?

A. My Exhibit 5-B.

Q. The 1-J and 2-J aren't on there, are they?

A. 5-B.

Q. Beg your pardon, beg your pardon.

What's the closest well to the Chaco 2-J?

A. I have to look, because I always get these backwards. The 12-26-13 1 Number 1.

Q. Did the 2-J ever reflect the bottomhole pressure, anything coming close to the 1-1 well?

A. If you look at this data, which is just the shut-in casing pressure, no. If you look at the measured bottomhole pressures that have been taken over time, yes.

Q. Do you have an exhibit that shows that?

A. I don't have an exhibit. It was the -- I believe they were passed out this morning, or at least talked about this morning, the shut-in pressure that was run in April of 1999.

Q. Well, what was the shut-in tubing pressure of the

2-J in early July of this year?

A. I don't have that data in front of me, which is one of the problems that I alluded to. The 2-J, I believe, is the well that the tubing -- or the casing pressure is just -- I mean, I think we would all call that a fairly flat trend that it has set up. And you look at the tubing pressure, and it is going all over the place. I don't have an explanation.

And I believe if you want to see that, I believe it's Cox Exhibit 5. Am I correct? Yes, Cox Exhibit 5. So I guess I do have that information in front of me. It looks like it's about 190 p.s.i.

Q. All right. And about that same time, what was the casing pressure on the Gallegos Federal 1 Number 1 well?

A. I know I don't have that in front of me. I don't know.

Q. Well, it doesn't -- The tubing pressure on the 2-J of 192 is nothing close to the casing pressure for the 1-1 well, is it, would you assume?

A. Well, no, but the 1-1 was producing. It's hard to compare a producing pressure to a shut-in pressure.

Q. Let's look back to your Exhibit 5-B. What happened there in September of 1998 to make both those wells go down at the same time? Do you know?

A. I don't know, but I believe that's about the time the gauge was lost.

Q. Is that one of the reasons why you should take changes in gauges and fluid levels into consideration?

A. I don't know that it makes any difference. It causes an attorney to ask a question, but I don't think the overall presentation or overall data that's presented by this matters.

Q. Well, if you had made the adjustment for the changed gauge, wouldn't it show the pressures going up after that point, rather than down?

A. Whether it remained flat at 157 p.s.i. or 150 p.s.i., the engineer in me is telling me that's no big difference.

Q. If I understand your testimony, what you say your Exhibit 5-B shows is that the well is in communication with another well 180 feet away. Is that what you're saying?

A. If I said "well", perhaps I meant "formation". Can you point that out to me?

Q. Well, which is it? Which did you say?

A. I don't recall.

Q. Does Exhibit 5-B show that the Chaco 1-J and 2-J are producing significant quantities of coalbed methane gas?

A. No, it does not.

Q. And it doesn't show that these wells are drawing down reservoir pressure in the Fruitland Coal anywhere, does it?

A. I'm not certain. We know the Fruitland Coal reservoir pressure in this area is higher, but I don't know exactly what that number might be.

Q. Well, what position are you taking here today? are you still asserting that the 1-J and 2-J are communicating with the coal or not?

A. They're in pressure communication with the coal, they are not in production communication with the coal.

Q. What was the shut-in pressure on the Chaco 1-J before it was acidized in 1995? Do you know?

A. No, I do not.

Q. Let me refer you to an exhibit, then. Let me refer you to Exhibit N-21. It's the workover completion report for the 1-J. Can you pick out the casing pressure there for February 11th, 1995?

A. Is that a five? Is that what you're --

Q. Yes.

A. 150 pounds.

Q. Does that look like 150 or 158? Can you say?

A. It looks like an eight -- I mean, it looks like a zero to me, 150.

Q. All right, let's look at Exhibit N-19. What was the bottomhole pressure reflected for that well in April of 1999?

A. 154 pounds.

Q. Does it show much of a drop?

A. No, it actually shows an increase.

Q. Well, if you assume that what you read on the previous exhibit was 158 pounds, it's pretty much the same, isn't it?

A. I have a hard time assuming a number was something other than what I read.

Q. All right, it doesn't show much change --

A. No, it does not.

Q. -- by the way?

How much shut-in pressure drop has the Gallegos Federal 1 Number 2 well experienced over that same time period?

A. I'm not exactly certain of that number. I don't know.

Q. If it were about a 100-p.s.i. drop, that a comparatively steep drop --

MR. GALLEGOS: Are you talking about --

Q. (By Mr. Hall) -- when you compare it to the 1-J, correct --

MR. GALLEGOS: Excuse me, are you talking about --

Q. (By Mr. Hall) -- that same period of time?

MR. GALLEGOS: The question doesn't say what kind of pressure we're talking about. Is this shut-in pressure, flowing pressure?

MR. HALL: I said shut-in pressure.

MR. GALLEGOS: Okay.

THE WITNESS: I don't know.

Q. (By Mr. Hall) How much pressure differential is there between the 1-2 and the 1-J when the 1-2 is producing on compression? Do you know?

A. If the 1-2 is similar to some of the other wells I've looked at -- I haven't looked at the 1-2 in detail -- it would have a bottomhole pressure of, let's say, 10 to 15 p.s.i., something in that range.

Q. And what's the differential to the 1-J?

A. If you are assuming the 154 that was measured, you'd be looking at -- what? 140 p.s.i.?

Q. And how far apart are these wells?

A. 700 feet, as I -- That's my recollection.

Q. That's shown on your Exhibit 2?

A. 180 feet. Are we talking Number 2 and Number 1?

Q. We're talking about the 1-J and the 1 Number 2.

A. 740 feet.

Q. All right. Is this the kind of data you say is showing communication with the coal by the 1-J?

A. When I looked at it, yes, it was.

Q. The pre-frac -- The pre-acid-job pressures taken in the 1-J and 2-J in 1995, do you believe those to be valid Pictured Cliffs pressures at the time?

A. As valid as we believe any other pressure, subject to the same qualifications we've placed on all the other pressures.

Q. All right. And you're still maintaining that the acid jobs caused communication with the coal in those two wells, right?

A. That's correct.

Q. Do you have any other evidence, anywhere else in the subject area, that any acid jobs connected to the coal?

A. It's the information that we have used to explain the higher Pictured Cliffs shut-in pressures that were taken between the time the wells were acidized and between the time the wells were fracture-treated.

Q. Well, my question is, do you have any evidence of other wells where an acid job in the Pictured Cliffs communicated with the Coal formation?

A. Do you mean outside of these wells under question here?

Q. My question was with respect to the subject area.

A. Yes, we do, but I -- and one that comes to mind is the Chaco Number 4.

Q. How about outside the subject area?

A. No, I don't have sufficient data outside the subject area to make that finding.

Q. Did you look to see if that data existed at all?

A. No, I did not, because most of this data is hidden in pumper reports, workover reports, and unless you have an in with the operator, you generally can't get to that data.

Q. Well, is it safe to assume that there had been hundreds, if not thousands, of acid jobs performed on the wells in the San Juan Basin?

A. That's probably a true statement, yes.

Q. Do you have any evidence from any of those other acid jobs where it was shown that the acid job communicated to the coal?

A. I didn't look, so --

Q. So the answer is no?

A. No, the answer isn't no. If you don't look, you don't know if that evidence exists. So my answer is, I don't know, not no.

Q. On page 7, line 16, your testimony, you say:

> There was no compression or other...facility work on the coal wells between February and February 1999, so the production uplift was solely due to the shut-in

of the Chaco wells.

Do you see that there?

A. Yes.

Q. Does that continue to be your testimony, that there was no compression on the coal wells during that period of time?

A. When I say there was no compression I meant there was no additional compression added, or other such facility work, such as any line-looping done, that would cause this production increase to have occurred. When we put wells on production, we see a big bump up in production, and we do not add any additional wells during that time period.

Q. Mr. Brown, let me hand you what we've marked as -- what we'll call Pendragon Exhibit Brown-20. Can you identify that, please, sir?

A. It looks like a field report.

Q. Doesn't it say "Invoice" at the top there?

A. Yes, an invoice for the Gallegos Federal 26-13-1 Number 1.

Q. And Exhibit 20 consists of four pages of invoices, does it not?

A. Yes, it does.

Q. Look at the date in the upper left-hand corner of the top sheet there. What is that date?

A. 9-9-98.

Q. And then the customer, it says Whiting Petroleum Corp.; do you see that?

A. Correct.

Q. And there at the line that says "Description of Work" it says "Gallegos Fed 26-13-1 Number 1"; is that right?

A. That's correct.

Q. And what is the invoice describing?

A. You may have to read it to me. I'm...

Q. Well, let's just look at the next page, then, the invoice dated September 10, 1998.

MR. GALLEGOS: Is there anything to authenticate these documents?

MR. HALL: We'll see in a minute.

MR. GALLEGOS: Well, what is the source?

Q. (By Mr. Hall) Look at the --

MR. GALLEGOS: I object to the use of a document here. It wasn't produced in discovery, it hasn't been authenticated. I notice the second page, there's something in here, mention of Walsh Engineering. Is Mr. Thompson -- I don't know where these came from, and I think we ought to have an opportunity to find that out and have a chance to look at these before you throw something out here and start questioning the witness about it.

MR. HALL: He's already identified these as an invoice sent to Whiting Petroleum Corporation.

MR. GALLEGOS: Well, just by reading it. I mean, you -- Anybody can read it and see that on it.

Q. (By Mr. Hall) Let's look at the second page --

MR. GALLEGOS: I object to proceeding --

CHAIRMAN WROTENBERY: Just a second.

MR. GALLEGOS: -- Madame Chairman, until we have an opportunity to see where these came from and an opportunity to look at them. They have not been produced previously in discovery.

MR. HALL: I'm not sure I understand the nature of the objection, if it's a hearsay --

MR. GALLEGOS: Well, I'll make it clear. The documented has not been authenticated, and it was not produced in discovery. It's a surprise. We ought to have an opportunity to know where it came from, an opportunity to view it before we start going into it.

MR. HALL: That's, in essence --

CHAIRMAN WROTENBERY: Mr. Hall, did you ask Mr. Brown if he recognized these documents? We weren't --

MR. CONDON: No.

CHAIRMAN WROTENBERY: -- clear on that.

MR. HALL: Let's see if we can elicit that through him.

Q. (By Mr. Hall) Mr. Brown, do you recognize this as an invoice sent to Whiting Petroleum Corporation?

A. I recognize it as an invoice. The second part, sent to Whiting Petroleum Corporation, no, I've never seen these.

MR. HALL: Madame Chairman, the documents are still admissible. It's not hearsay, it's not being offered for the truth of the matter asserted; it's to test the witness's credibility with respect to his statement that no compression was added between February of 1998 and February of 1999, as he opined on page 7. And the exhibit clearly shows on the second page that compressors were installed during that period of time.

MR. GALLEGOS: I don't know --

MR. HALL: So there's no problem with authenticity there.

MR. CONDON: Sure, there is.

MR. HALL: It's not a hearsay objection that they're making.

MR. GALLEGOS: Well, just looking at it, we've got references on here to work on wells that are not the wells in question, the 10 Number 1, that's not one of the wells, the 11 Number 1. I don't know what this proves as to these wells. We've never seen this before and we don't know where it came from, whether it was ever received by

Whiting or what. So till we find that out --

MR. HALL: Well, it's always admissible if it's helpful to the Commission's understanding of the testimony, and I think it certainly properly frames the testimony we've cited here.

MR. GALLEGOS: That is not the test of the admission and the use of the contents of exhibits, that it's helpful. A newspaper article from ten years might be helpful, but that's not the test under the rules of evidence which are supposed to be applied here.

What's the problem with giving us an opportunity to find out about this document and look into the -- even the applicability of it, let alone the authenticity of it?

MR. HALL: Well, Madame Chairman, the witness has made a sworn statement in his prefiled testimony, and we're entitled to test that.

MR. GALLEGOS: Well, and we're entitled -- You're entitled to test it if you've got some evidence that applies to it.

MR. HALL: That's what this is.

(Off the record)

CHAIRMAN WROTENBERY: I do recognize it as hearsay. We do have some flexibility in administrative proceedings in allowing hearsay evidence into the record and then taking additional testimony about the document and giving it the weight that it deserves.

So we'll let Mr. Hall proceed, and --

MR. HALL: Thank you, Madame Chairman.

CHAIRMAN WROTENBERY: -- Mr. Gallegos will have an opportunity to cross -- or redirect.

MR. CONDON: Oh, you're opening the door.

Q. (By Mr. Hall) Mr. Brown, if you'd look at the second page of Exhibit 20 there, down just below the middle of the document, it says "Gallegos Federal 26-13-1 Number 2".

MR. GALLEGOS: In writing that is different from all of the other writing, I would mark, so we know these are copies. We don't know who wrote that, why that writing is different from the other writing, except we see Walsh Engineering up at the top, as part of the Pendragon --

MR. HALL: The Chairman has already ruled on the objection. If I might be allowed to continue, let me start over.

Q. (By Mr. Hall) Look back on the second page of Exhibit Brown-20. It reads, "Gallegos Federal 26-13-1 Number 2, CPD - line loop & compressor hook-up". Do you see that there?

A. Yes, I do.

Q. Does that tell you that there was a compressor installed on or about September 10, 1998?

A. Yes, it does, but it doesn't tell me where. It says the "26-13-1 Number 2, CPD". I don't know what wells are hooked up to that, what wells are affected by that. I don't know the background behind this whole thing.

Q. And again, let's look at the third page of Brown Exhibit 20. There where it says "Description of Work", the second entry, "Gallegos Federal 26-13-1 Number 2 CDP Backfilled lines." Would that indicate to you that there was a line installed from the compressor to the 26-13-1 Number 2 well?

A. No, it just says that there were some lines installed on the 26-13-1 Number 2 CDP. Like I just said, there are several wells listed on here. You don't know if the lines went to that well or if they were just installed in this particular gathering system.

Q. Do you have any idea why they would have referenced that well, then, for all this work, for compressors?

A. Well, throughout this document it seems to be referred to as the Gallegos Federal 26-13-1 Number 2 CDP. There are lots of places and lots of fields where we refer to things as the -- I can think of a field in Texas where we call it the -- I can't even -- the name -- now that I want it to come into my head, it won't. The Stein gathering system. Well, the Stein gathering system serves a lot of other wells, but if we said we worked on that gathering system, it may not mean that we actually laid a line to the Stein well.

Q. So you continue to maintain that there was no compressor -- compression assist on the subject coal wells between the period of February, 1998, and February, 1999?

A. My basis for that statement was, I asked my engineer who works on this particular field, was there any facility work done in this time period that would have caused this production increase to occur? The gentleman came back to me and said no.

Q. Did you specifically ask him if there were compressors installed during that period of time?

A. Yes, I did, I asked him if any of the facility work that we were aware of, that we had planned, that was ongoing, occurred during this time frame.

Q. Yes, and my specific question was, did you ask him if compressors were installed?

A. Yes, I did.

Q. And what did he say?

A. He said no, he said there was no facility work during that time, compressors, line-looping or otherwise, which was the basis for my statement.

Q. Let's look at your Exhibit JTB-6 briefly. Would you explain what the shaded gray area displays, as opposed

to what the green vertical bars display?
A. The green vertical bars are the actual monthly production numbers, the production for that particular month for the wells shown in the heading. The gray is the average over that particular time frame, from January through June for the first part and from July through the end of the graph for the second part.
Q. What are the averages supposed to reflect, in fact?
A. That just prior to having the Chaco wells shut in, the average production rate from these wells was lower than it was after the Chaco wells were shut in.
Q. And the averages as shown on your exhibit are substantially different than your actuals, aren't they?
A. I haven't compared those, they shouldn't be.
Q. Well, let's look at the actuals for the period between July of 1998 and September, 1998. Do you see that there?
A. Okay.
Q. And then you see the shut-in occurred. You have it commencing it in August of 1998. Do you see that there?
A. It's July.
Q. I'm sorry, I beg your pardon, it is July of 1998.
Why on your actuals does it show the wells took two months to respond to the shut-in?

A. If you would look at several of the exhibits that have been prepared, there were a lot of down times during those two months. We had numerous shut-ins during August and September of 1998. Much of the shut-ins that we've looked at in these other plots occurred during those two months.

So the wells were producing, it's just that they didn't have as many producing days during August and September of 1998.

Q. Do you know when compression may have commenced on the Gallegos Federal 1 Number 1 and 1 Number 2 wells? Do you know?

A. No, I do not. I mean, I've seen it. I just don't -- I'm not able to recall those dates off the top of my head.

Q. Let's look at your JTB-9. Can you pull that in front of you please, sir? That shows the average daily production for the Chaco Number 4, correct?

A. That is correct.

Q. And you're showing in the 1978-79 periods the initial production levels, about 200 MCF a day, right?

A. That's correct.

Q. What this shows is average daily production in six-month increments, does it not?

A. It does.

Q. Why did you choose to show it that way?

A. If you look back at those other production plots, these wells were off and on production so much it's difficult to see what the actual trend in production is. This just smoothes the data and gives you a better feel for what actually occurred.

Q. So is the 200-MCF-per-day rate you show in 1978 and 1979, is that a peak rate?

A. Well, I guess, yeah, that's where it peaks.

Q. Let me show you what's been marked as Brown Exhibit 17. Brown Exhibit 17 is the *Dwight's* production for the Chaco Number 4, correct?

A. That's correct.

Q. If you look on the second page of that, what was the production for December of 1978?

A. 9056 MCF.

Q. So that would be about a 300-MCF-per-day rate; is that right?

A. That's correct.

Q. So -- And that doesn't compare to your Exhibit 9, does it?

A. They're different numbers. Ours is a six-month average, that's a one-month average.

Q. By using six-month averages, do you include down days?

A. No.

Q. How do you explain the difference?

A. Do you want me to run the six-month average right here and we'll just see what it is?

Q. I'm just asking you to explain the difference if you can. Why would Exhibit Brown-17 show about a 300-MCF-per-day peak rate, and yours only shows a 200-MCF-per-day peak?

A. I think we need to go back to basic arithmetic. The 300 is an average calculated over one month. Okay, let's say you have -- a well produces 3000 MCF in one month and produces 6000 MCF the following month. The average for the first month is 100 MCF a day, the average for the second month is 200 MCF a day.

Q. Let's look at --

A. Okay?

Q. Go ahead.

A. So then you average the two of them, you get -- I don't remember my numbers anymore.

MR. GALLEGOS: 150.

THE WITNESS: Yeah, 150 for the average for the two months. That is a lower rate than the 200.

Q. (By Mr. Hall) It's not an accurate depiction of peak rate, is it?

A. Well, this wasn't intended to depict peak rate.

Q. Oh, I see.

A. It was intended to give you a better feel for what the actual production of the well was over time.

Q. I see.

A. We did the same thing, the same treatment to the data was done out here after the frac job.

Q. And if you look on the second page of Exhibit Brown-17, it shows that there are five months of zero production, correct?

A. That's correct.

Q. And it appears that you included that in your calculation as shown on your exhibit, right?

A. That's correct.

Q. So you did show zero production days after all?

A. We showed zero production days. I thought the question was, did you show producing days.

Q. Is it industry practice to show daily averages on six-month increments?

A. I mean, it's not something I see a lot of, but I can't say it's not uncommon.

Q. Let's look at your Exhibit 11, JTB-11. I'm not sure I understand what this demonstrates. Is this intended to show that the Pendragon well, the 1-J, communicated with the coal?

A. No, this is intended to show that here is another

Pictured Cliff well that offset one of our wells that was fracture-stimulated in the coal, and it had absolutely no effect on this well.

The only Pictured Cliff wells that had any response to -- that had any response to the frac jobs that we did on our wells were the Pictured Cliff wells that were fractured in the Pictured Cliffs and communicated with our coal.

Q. Mr. Brown, in your testimony at page 4, beginning at line 23 down there, you say, "Appropriate disposition of these wells..." -- you're speaking of the Chaco wells?

A. Correct.

Q. "...by a prudent operator at that time was to plug and abandon" these wells. Do you see that there?

A. Yes, I do.

Q. And you agree that Merrion and Bayless there are prudent operators, as you would call them?

A. One assumes they are.

Q. And is it because they are prudent that they didn't P-and-A the Chaco wells?

A. All operators are faced, as their wells are near the end of their economic life, what do you do with them? Do you plug and abandon them, which is a cost to you, or do you see if maybe someone else has some utility for them? And the auction is a prime place to get rid of wells that you don't want to spend the money to plug and abandon.

Q. Also on page 5 there, line 13, you say, "The fracture stimulation of the Whiting Federal wells when they were completed in 1993 may have resulted in fractures extending into the Pictured Cliffs formation..." Do you see that text there?

A. Yes, I do.

Q. That continues to be your testimony here today?

A. With the key word being "may", yes.

Q. All right. You agree with Mr. Robinson --

A. No, I do not.

Q. -- in that respect?

A. I do not agree with Mr. Robinson.

Q. How do you disagree with Mr. Robinson?

A. Well, I don't think the fractures on the Whiting Federal wells communicated with the Pictured Cliffs. However, there are those that are going to testify, or have testified, that maybe they will. There is that possibility. But in my opinion, if they did, it wasn't an effective communication with the Pictured Cliffs reservoir.

Q. But you say there was a fracture extending into the Pictured Cliffs. You say that much, correct?

A. No, I said "may have".

Q. Well, by saying "may" is it more likely that it did than did not?

A. No, it's more likely that it did not.

Q. Then why did you say "may have"?

A. Because it may have happened.

MR. HALL: All right, no further questions.

CHAIRMAN WROTENBERY: Commissioner Lee?

EXAMINATION

BY COMMISSIONER LEE:

Q. You just told everybody, you said that they did not communicate, right?

A. That's correct.

Q. On your testimony, on JTB Number 4, you say the reason of the BTU going down is because they are restoring the Fruitland gas; is that your statement?

A. I missed the one word.

Q. The BTU trend is going down?

A. Correct.

Q. It's because of the Fruitland gas?

A. That's correct.

Q. They are not communicated?

A. The Whiting Gallegos Federal wells are not communicated with the Pictured Cliffs. The Chaco wells are communicated with the Fruitland Coal. This plot --

Q. Okay, look at Exhibit, JTB Number 4.

A. That's correct.

Q. The BTU content is going down?

A. Yes.

Q. Your explanation is, the Fruitland gas is coming to the Pictured Cliff?

A. That's correct.

Q. Then they dewater it for you?

A. We dewater it for them.

Q. Right.

A. Yes.

Q. Then they're subject to produce a lot of water?

A. Correct.

Q. Correct. So the water level before 1988 to 1994 is supposed to be substantial?

A. The water level?

Q. The water production?

A. In 1988 to 1994, no.

Q. Why? You're producing the Fruitland gas?

A. Not in the 1988-through-1994 time frame. What I'm saying is, if -- The one well, the red X's on here that are trending down, that have the downward trend --

Q. I think three of them, they do have a downward trend. You're telling people we have to look at the trend.

A. That's correct.

Q. So three trend, for me they are going down.

A. Well, I disagree with that. I don't think they are.

Q. You are looking at this one and you disagree with me?

A. Yes, sir, I do.

Q. They are not going down?

A. Well, you have to -- Hold something over this portion right there.

MR. GALLEGOS: Mr. Brown, he's talking about after 1994.

THE WITNESS: Oh, you're talking after 1994?

Q. (By Commissioner Lee) No, I'm talking about 1987 --

MR. GALLEGOS: Oh.

Q. (By Commissioner Lee) -- to 1994. It is not going down?

A. No, sir, I don't believe it is. And the reason I say that may not be on this graph. And the reason I say that is because if you would plot -- if I would have plotted this further back in time, these wells right here are going to plot BTU values that are, you know, several years before this chart began and are in the 1150-to-1100 range.

Q. Look at 1987 to 1994 on this chart. Let's look at the Chaco 4. Are they going down?

A. Am I to include these two points out here?

Q. Just look at this 1987 through 1994.

CHAIRMAN WROTENBERY: For the Chaco 4.
Q. (By Commissioner Lee) It takes time?
A. No, I'm just -- One could envision a downward trend, yes, I agree.
Q. All right. Another thing is, you're coming here, you say, well, let's plug data, we'll order it. Is that your statement, your implication?
A. I think there are some places where you can order the data and it helps you see things. There are other places where looking at the entire data before you order the data helps you sort it out.
Q. Just pick an example from the JTB Number 7. Is that a six-month average?
A. Yes, it is.
Q. Who plotted the six-month average?
A. I did.
Q. I mean, who else plotted six-month average?
A. Well, a lot of times you plot -- if your data is very erratic, and --
Q. Tell me how you plotted 1995 data.
A. The same way, six-month average. I have --
Q. Six months?
A. Correct.
Q. Which six months --
A. Yes.

Q. -- before or after?
A. Before water?
Q. Which six months? I'm looking --
A. January to June, July to the end of the year.
Q. So you plotted six months?
A. Correct.
Q. So you ignore the daily production, this daily production for monthly average, you put in six-months average?
A. Correct.
COMMISSIONER LEE: No further questions.

REDIRECT EXAMINATION

BY MR. GALLEGOS:
Q. Mr. Brown, on the last question --
CHAIRMAN WROTENBERY: I'm fine.
MR. GALLEGOS: Oh, I'm sorry. No, that's fine, I am through. I was thinking, but I think I'll turn it over to you.
Q. (By Mr. Gallegos) On the last question that Commissioner Lee had, it might be helpful if you turn to Exhibit 15, show where we laid out the averages, and that includes the Chaco 4 and Chaco 5?
A. Yes, if you would flip to JTB-15 in the back of the booklet, this gives the monthly average daily productions for Chaco 4, Chaco 5, 1-J and 2-J.

Q. And it shows the break in 1995?

A. That's correct.

Q. The question was being asked how you plotted 1995 after the fracture?

A. Yes. This shows the actual numbers for the two six-month periods.

Q. That's Exhibit --

A. -- 15, JTB-15.

Q. All right. Let me ask you to take just a couple of brief questions here, probably, just to -- on these white spots, on the Chaco 1, the Chaco 4 and the Chaco 5 --

A. Yes.

Q. -- that were placed before you by Mr. Hall, as compared to your Exhibits 7, 9 and 10, we were talking about the six-month daily averages, these are plotted on log paper?

A. That's correct.

Q. And are they based on monthly production numbers?

A. Yes, they are.

Q. Okay. How do these curves compare, in your observation, on the three wells?

A. I think that they show the same data, or the same trend in the data. It's just the six-month averages take out some of the rough spots here and give you a better feel for the decline that was occurring between each successive data point.

Q. And on an overall basis from initial production up until, oh, about mid-19- -- the mid-1980s, is your observation that the decline curves are similar?

A. Yes.

Q. And are those decline curves similar to the overall observation of wells that are in the WAW-Fruitland-Pictured Cliffs --

A. Yes, they are.

Q. -- field?

A. Yes.

Q. Now, you were asked sort of a negative question about what these show as to damage. Let me ask you, focusing on the Chaco 1, which is Brown Number 1, do you have any evidence that the decline from 1979 to 1985 is due to formation damage?

A. No, I do not. There are several other things that could have caused it, and I do not know what the cause was.

Q. Does this appear to you to be a premature decline, as opposed to a normal decline curve for a gas-drive conventional reservoir in the San Juan Basin?

A. And perhaps one other descriptor on there: This was never a very good well, so it was never what you would consider a strong producer. So no, it does not look all that unusual to me.

Q. Other than conclusory statements by a number of the Pendragon witnesses, have you heard any evidence from any of their witnesses that establishes that the decline curve on any of these three wells is due to reservoir damage?

A. No, I have not.

Q. Did you hear any attempt to quantify any of these conclusory statements about reservoir damage?

A. No, I have not.

Q. Did you see -- Have you looked at the well files on all of these Chaco wells?

A. Yes, I have.

Q. Thoroughly been through them?

A. Thoroughly been through them.

Q. And did you note that along the way, as typical of a well file, there were various sundry notices and daily reports, that kind of information that operators keep as they -- through the life of the well?

A. Yes.

Q. Did you see any references that any of the operators, earlier operators in these wells, were finding, believing or noting that production was declining due to reservoir damage?

A. No, I did not. And you didn't see any of their actions to try to repair any stimulation attempts, any acid jobs.

Q. Okay. Is that what you would expect if an operator who was trying to achieve the maximum economic benefit, who believed that there was reservoir damage, would -- that the action would be taken?

A. You would try something to get that well producing at its optimum rate.

Q. Are you acquainted with any industry methods or practices by which if an operator suspects that there is reservoir damage, there are tests that can be run to answer the question whether there is or not?

A. Yes, and the test can run anywhere from pressure transient analysis, where you run bottomhole surveys to try to quantify the damage to getting samples of core, running core fluid tests and catching samples of fluid that the well produces to see if you can determine if there are any adverse effects with this fluid, with anything -- any of the wells.

And I didn't see evidence of any of that being done at any time.

Q. You were shown a couple of completion reports, I think, on the Chaco 5 and the Chaco Number 1, a one-hour test and a two-hour test. If those were absolute open flow tests with the gas being discharged to the atmosphere, would that be any indication of what the well's capability would be, once placed on a gathering line and on sustained production?

A. No, it would not. You might be able to make some calculations off of that data to determine what it would be, but it by itself is not.

Q. Let me just ask you to clarify something for the Commission if maybe they're not familiar with this particular process in the industry. You mentioned that in 1994, I think, you said in your testimony that the owners and operators of these wells were faced with a plugging-and-abandoning liability?

A. Yes.

Q. Was that your testimony?

A. That was my testimony.

Q. And that would be because of what?

A. Well, it costs money to plug those wells. You would have to go out and pay to have someone do whatever is required to plug and abandon these wellbores.

Q. Several thousands of dollars per well?

A. Usually. I don't know what the cost is in this area, but that sounds -- a couple thousand dollars per well.

Q. And you mentioned that in lieu of doing that, an operator can, as Merrion and Bayless, put these properties up for auction?

A. That's correct.

Q. And what does that refer to? Is there some sort of system available for unwanted properties to test to see if somebody will --

A. Yes, there -- As I'm aware of, there are two companies that run oil-and-gas property auctions, and you contact these firms, give them the details on your wells and put them up for sale. I don't remember the number. The fact that they sold for $7800 gives me some hint of their economic worth.

MR. GALLEGOS: Okay, that's all I have for redirect. Thank you.

MR. HALL: Some additional questions in view of Dr. Lee's questions to the witness.

RECROSS-EXAMINATION

BY MR. HALL:

Q. Earlier, Mr. Brown, I understood you to say that a cutoff for determining whether gas was Fruitland Coal gas is a range of about 1000 to 1050 BTU. Do you recall saying that?

A. Yes, am I going to regret it?

Q. I don't know.

A. I'm just checking to see what I wrote and what I said, so --

Q. Okay.

A. Okay, what did I say?

Q. Your testimony was, you thought that you could use BTU values of around 1000 to 1050. Anything below that should be considered Fruitland Coal gas production?

A. Yes.

Q. And is it safe to say anything above that should be considered Pictured Cliffs production?

A. I think I had a gap in there of some distance. They didn't exactly butt up to each other, I put a little gap in there.

Q. What's the low-end range for a Pictured Cliffs gas?

A. I said 1075 to 1150.

Q. All right, so if a well is producing in the range of 1146, that would be Pictured Cliffs gas; is that right --

A. Like I said --

Q. -- according to your definition?

A. Well, like I said, I also testified to using one single BTU measurement can possibly lead you to the wrong conclusion.

Q. I see. Let's look at Exhibit Brown-15 quickly here. Can you identify that, please, sir?

A. This looks like a gas chromatograph analysis for the Gallegos Federal 26-12-7 Number 1.

Q. And what's the heating value shown for that well?

A. 1146.

Q. So is that Pictured Cliff gas?

A. I don't know.

Q. According to your definition it would be, right?

A. According to the ranges I stated, it would be. According to the additional testimony I made, where basing something on one BTU analysis, can lead to the wrong conclusion. So I'm not ready to conclude what this is.

Q. Is this or is this not a Pictured Cliffs well?

A. This is a coal well.

Q. I see. Referring to your Exhibit N-37-E-1 -- Can you pull that out? It looks like this.

A. Like that?

Q. Yes.

A. Okay.

Q. This well, this sample for the 7-1, should have been included on this exhibit, should it not?

A. That's correct.

Q. Any reason why you deleted that, neglected to put that one on?

A. We used the data straight from what Mr. Nicol and Mr. Cox had testified to.

Q. I'm sorry, I didn't hear you.

A. I said, we used the data straight from what Mr. Nicol and Mr. Cox had testified to. So without looking at exactly what happened, no, I don't know why this one particular analysis is not on there, unless it wasn't included in that database.

Q. Let me show you what's --

MR. GALLEGOS: Here's 37-E. Do you represent it's on 37-E?

MR. HALL: No, he has it.

MR. GALLEGOS: No, he -- Oh, he has 37-E?

THE WITNESS: No, I do not.

MR. GALLEGOS: He doesn't.

MR. HALL: 37-E-1.

MR. GALLEGOS: No, but 37-E-1 is a compilation of what was on 37-E.

MR. HALL: Oh, I see what you mean.

MR. GALLEGOS: So if that's not on there, it's not on the chart.

MR. HALL: All right.

THE WITNESS: Mr. Hall, in my somewhat hurried look through this list, I didn't see it. I'm not going to say it isn't on here. Perhaps you can point it out to me if it is and save us all some time.

Q. (By Mr. Hall) All right, it looks like it was a candidate for inclusion, anyway, doesn't it?

A. But I -- We used this data right here, and like I said, I do not find it on the list.

Q. I understand. Let's look at Exhibit Brown-16. Will you identify that, please, sir?

A. This looks like an El Paso Natural Gas Company compilation of numerous gas analyses.

Q. Let's look at the bottom part of that first page. It shows report dates and meter numbers, and it says "Chaco Meter Run Number 5". I admit it's hard to read there. Do you agree that this is the meter run for the Chaco 5 well?

A. No, it's the meter run for Chaco -- It's Chaco Meter Run Number 5. I don't know if that's the Number 5 well or not.

Q. All right. Assume with me, if you will, that this is the run for the Chaco 5 well. Let's look at some of the data on here. If you would look at the entries for June 1, 1994, do you see that there?

A. Yes, I do.

Q. What's the BTU value on that date?

A. 1022.

Q. And that is a pre-frac value, if we assume that this is the Chaco 5, correct?

A. That's correct.

Q. And similarly, look at the BTU for March 1st, 1995. What is that value?

A. 1022.
Q. And if we look for a post-frac date, let's look for December 1, 1997. Do you see that there?
A. Yes.
Q. What's the BTU value on that date?
A. 1149.
Q. So the pre-frac BTUs are lower than the post-frac BTUs, would you conclude that?
A. Yes, I do. And this is the well with the casing leak that we maintained was in communication with the Fruitland Coal. So it looks like it was producing Fruitland Coal before the frac.
Q. And if we further assume -- and I believe you have heard this testimony since you've been here, that the casing leak in that well was repaired on March 10th of 1995. Do you recall hearing that testimony? Mr. Thompson?
A. I recall hearing the testimony. I don't remember the exact date.
Q. I beg your pardon, I believe he testified the repair occurred in January or February of 1995.
But in any event, wouldn't you agree with me that you can't ascertain any particular trend for the BTU value from this information here?
A. I have to remember that the well was acidized and perhaps frac'd before that 7-1-95 date. So no, I can't say

that this is going to be -- I can't agree with you.

Q. Well, assume with me, if you will, that the casing-leak repair took place between the June 1, 1994, entry and the March 1, 1995, entry.

A. Okay.

Q. Do you see that there? And those BTU values are the same for those entries, are they not?

A. That's correct.

Q. And then here in 1997 it shows a higher BTU. What conclusion would you draw from that?

A. That that BTU reading happened to be higher. As I've said, you can't take one single BTU reading and draw a lot of conclusions from it.

Q. All right. Also in your discussion of BTU data you said that the Designated Hitter Number 2 is producing coalbed methane in your opinion. Isn't that what you said?

A. That's correct.

Q. When did that communication occur in that well?

A. I don't happen to have the data for the Designated Hitter Number 2 in front of me.

Q. Well generally, was it recently?

A. I don't remember, Mr. Hall.

Q. Well, can you -- Do you have some place where you can look and tell us that?

A. Perhaps.

Q. Can you do that, please?

A. Sure. If I go out the back door and don't come back, will anybody know?

MR. HALL: Yes, we will.

I think this might be a good time to take a break, while he's looking for the information.

CHAIRMAN WROTENBERY: Okay, we'll break till 3:10.

(Thereupon, a recess was taken at 2:57 p.m.)

(The following proceedings had at 3:10 p.m.)

Q. (By Mr. Hall) Mr. Brown, I understand you've located some materials that might tell us when you believe the Designated Hitter may have communicated with the coal?

A. That's correct.

Q. And what do you say?

A. It's our opinion that the Designated Hitter has pretty much always produced Fruitland Coal gas, from its initial completion.

CHAIRMAN WROTENBERY: Mr. Brown, may I ask, what is it that you're looking at now?

THE WITNESS: It was the production curve from the Designated Hitter.

CHAIRMAN WROTENBERY: Okay, was that --

MR. CONDON: Is that an exhibit?

CHAIRMAN WROTENBERY: -- an exhibit?

THE WITNESS: No, he just asked me when we thought it was, and this is what I needed to jog my memory.

COMMISSIONER LEE: Can we have that?

CHAIRMAN WROTENBERY: May we have a copy of that, then?

THE WITNESS: No.

(Laughter)

THE WITNESS: I'm -- what's the --

MR. GALLEGOS: Sure.

THE WITNESS: This is my only copy, here it is.

CHAIRMAN WROTENBERY: Okay, we'll get a copy made.

Q. (By Mr. Hall) If you could explain for the record, Mr. Brown, what's your basis for that conclusion that the Designated Hitter has produced from the coal since day one?

A. It -- First of all, the production curve, which we're about to all get copies of, doesn't look like a typical Fruitland Coal well in this part of the Basin.

And secondly, just based on the gas analysis, the measured BTU values on this well, that's what brought us to this conclusion.

MR. GALLEGOS: Excuse me, did you mean to say did not look like a typical Fruitland Coal well?

THE WITNESS: Did not -- No, the production decline does not look like a typical Pictured Cliffs well. Did I say Fruitland Coal?

MR. GALLEGOS: Yeah, you said Fruitland Coal.

THE WITNESS: Excuse me, does not look like a typical Pictured Cliffs well.

MR. HALL: You may need your exhibit back before I ask you these next questions.

MR. CONDON: Copies are being made, so...

THE WITNESS: I could draw it for you.

Q. (By Mr. Hall) Well, let's try. Can you tell us what the water production was in the early years of the life of this well, back in the early 1980s?

A. There was none reported.

Q. Well, is that typical of a coal well?

A. Is it typical not to have water production reported, or is it typical that a coal well should produce water?

Q. Either one.

A. Coal wells, just by their nature, ought to produce some water. What we found here may be typical, that sometimes this water is not reported.

Q. Well, can you say, do you know whether the Designated Hitter 2 made volumes of water in the early 1980s?

A. No, I do not.

Q. So wouldn't it be helpful for you to know whether the well did make substantial volumes of water like a coal well early on?

A. Yes, it would be helpful.

Q. But you didn't look for that when you reached your conclusion?

A. I don't know where else we would have looked. It wasn't included in the *Dwight's* data.

Q. So you have nothing other than your assertion that it is a coal well, that it didn't make water; isn't that right?

A. My assertion is that there was no water production reported. I cannot testify to the fact that it did not make water.

Q. Okay. Your determination that it's a coal well is based only on BTU information, correct?

A. That and the production plot which we're currently all looking at.

Q. Can you compare this production curve to any other coal well we've discussed in the last few days here? Which one does it resemble?

A. The fact that we're saying it produced Fruitland Coal from the start, I guess we could look back at perhaps one of the Chaco wells, and it sort of resembles Chaco Number 4, from 1995 on.

Q. Right. The Chaco Number 4 is a Pictured Cliffs well, correct?

A. In your opinion. In my opinion it's a Fruitland Coal well.

Q. Can you compare the Designated Hitter to any Fruitland Coal well, well that we know is a Fruitland Coal well?

A. I might be able to. I don't have a number of Fruitland Coal wells here with me.

Q. All right. If it was a Fruitland Coal well from the start, if you look about 1980, why don't you show an incline curve for production from that point in time?

A. Well, this is a well that is probably very similar to the Chaco well in that it's Fruitland -- it's a complet- -- Let me start over. It's a Pictured Cliffs completion producing Fruitland Coal gas. So it may not have the characteristics of a Fruitland Coal gas well, similar to the way the Chaco 4 does not exactly have the characteristics of a Fruitland Coal gas well.

Q. Mr. Brown, this production curve -- Let's do this for the record. If you would take that and mark that Exhibit Brown-17 for us so we can make this a part of the record.

Isn't it true, Mr. Brown, that the production curve you show on Brown-17 simply does not model a typical

Fruitland Coal well?

A. That is true, and in the description I gave it's not a typical Fruitland coal well, as far as I know.

Q. So you keep going back to comparisons with the Chaco 4 and Chaco 5, right?

A. That's correct.

Q. Didn't you say that those wells had been dewatered?

A. That's correct.

Q. Yet you don't have any water-production information for the Designated Hitter 2 at all, do you?

A. No, I do not.

Q. Do you know how this well was completed initially?

A. No, I do not.

Q. Do you know if it was fractured in 1979?

A. I don't recall. I'm trying to remember back if we even have a well file on this well, and I have looked at so many well files I just don't remember. Does anyone recall if we have this in our discovery data or not? I'm sorry, I don't recall whether it was fracture-treated on initial completion or not.

Q. So you can't tell us if it was fracture-treated or received an acid job in its initial completion?

A. With my state of knowledge right here, no, I cannot.

CHAIRMAN WROTENBERY: Mr. Hall, just to make sure we don't get confused, we already had a Brown-17. It's the --

MR. HALL: Oh, that's right, yeah.

CHAIRMAN WROTENBERY: -- *Dwight's* information on the Chaco 4.

MR. HALL: I beg your pardon, that's right. Let's re-label this one Brown-18.

Q. (By Mr. Hall) Mr. Brown, earlier you said you believed that the Pictured Cliffs perm is about 50 millidarcies, right?

A. Correct.

Q. And then we discussed the wellhead pressure at the Chaco 5 in 1993, and we established that it was more than 150 p.s.i. Do you recall that?

A. Yes, I do.

Q. And that is a gas pressure, right?

A. It was a recorded wellhead pressure, yes.

Q. Right. It's a gas pressure, right?

A. Okay.

Q. So you agree with me. If the Chaco 5 had gas in it to the level of 150 p.s.i. in 1993 and you had 50 millidarcies of perm, then why didn't this well produce at its near original rates?

A. Because the 150 p.s.i. was in the Fruitland Coal, and I've maintained that the Pictured Cliffs was, you know, near its economic limit.

Q. Well, it still would have produced, wouldn't it have?

A. Produced what?

Q. Pictured Cliffs gas.

A. Well --

Q. Pictured Cliffs gas or Fruitland gas, whatever gas was in the well at the time, in 1993.

A. -- let's flip back to my JTB-15, and if you look in -- What year are we talking? 1993?

Q. 1993.

A. Chaco 5 produced an average of 2 MCF a day for the year. So to answer your question, yes, it would, and yes, it did.

Q. All right. So the well had a good perm, about 50 millidarcies, and there was a pressure of 150 p.s.i. in 1993. What is your explanation for the low production rates at that period?

A. The pressure that you're talking about, the 150 pounds, is in the Fruitland Coal, which is not -- The only way it was communicated to the wellbore was through a casing leak. That normally is not a very effective way to complete a well. The well that was directly completed into the wellbore with perforations was the Pictured Cliffs. As you can see, Chaco 5, the Pictured is at the end of its producing life.

Q. But you can't preclude formation damage to explain those low production rates, can you?

A. I can't preclude it, and I have no information to describe it.

MR. HALL: That's all I have of the witness.

CHAIRMAN WROTENBERY: Commissioner Bailey?

COMMISSIONER BAILEY: No.

CHAIRMAN WROTENBERY: Commissioner Lee?

COMMISSIONER LEE: No.

CHAIRMAN WROTENBERY: Anything else?

Just a housekeeping matter -- well --

MR. HALL: Yes, let me move the admission of some exhibits through Mr. Brown. This will be Exhibits Brown-1, -2, -5, -6, -20, -17, -15, -16 and -18, in that order.

CHAIRMAN WROTENBERY: I'm sorry, I had gotten them in a different order. Let's see, I've got -1, -2, -5, -6 --

MR. HALL: -- then -20.

CHAIRMAN WROTENBERY: That was what I was looking for.

MR. GALLEGOS: We're objecting to -20.

CHAIRMAN WROTENBERY: Ah, -20 was the -- yes, okay.

MR. GALLEGOS: And we object to -20. I won't repeat that, but I --

CHAIRMAN WROTENBERY: Right.

MR. GALLEGOS: -- think the objection is very obvious.

CHAIRMAN WROTENBERY: And that was Brown-20. It was marked as -20, but it's Brown-20?

MR. HALL: Correct.

CHAIRMAN WROTENBERY: -20, and then after -20 what?

MR. HALL: Brown-17 --

CHAIRMAN WROTENBERY: Uh-huh.

MR. HALL: -- Brown-15 --

CHAIRMAN WROTENBERY: Yes.

MR. HALL: -- Brown-16 --

CHAIRMAN WROTENBERY: Yes.

MR. HALL: -- and Brown-18.

CHAIRMAN WROTENBERY: Had you already said Brown-7?

MR. HALL: I did not say Brown-7. I said Brown-17 but not Brown-7.

CHAIRMAN WROTENBERY: Okay, I had a Brown-7.

MR. GALLEGOS: I have a Brown-7. This is a --

MR. HALL: Brown-7 should be on the list.

MR. GALLEGOS: -- a completion report.

CHAIRMAN WROTENBERY: So you're adding Brown-7?

MR. HALL: Yes.

CHAIRMAN WROTENBERY: Okay. Any objection, other than the objection to Brown-20?

MR. GALLEGOS: No objection to the other exhibits. We object to Exhibit Number 20.

CHAIRMAN WROTENBERY: The exhibits are admitted into the record.

MR. GALLEGOS: May I inquire about Exhibit Number 20, Madame Chairman? Is there an original of this that we can see?

MR. HALL: I do not have an original, no.

MR. CONDON: Ask him who the witness is so we can question about it.

MR. GALLEGOS: Are we going to have a witness that is going to establish a foundation for this?

MR. HALL: The exhibit is already in evidence.

MR. GALLEGOS: Well, I take exception to that ruling.

CHAIRMAN WROTENBERY: The exception is noted.

MR. GALLEGOS: Okay, if we can just have a moment to get organized. We're going to call Dr. Walter Ayers next, and so while maybe he's getting up here and getting his things organized we can put our one witness away here.

(Off the record)

WALTER B. AYERS, JR.,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. GALLEGOS:

Q. State your name, please.
A. My name is Walter B. Ayers, Jr.
Q. Where do you live?
A. I live at 2245 Carter Lake Drive, College Station, Texas.
Q. What is your occupation or profession?
A. I'm a petroleum geologist.
Q. Who do you work for?
A. I work for Holditch Reservoir Technologies.
Q. And have you served as a consultant on certain issues that are being addressed in this proceeding, Dr. Ayers?
A. I have.
Q. All right. Your prefiled testimony, which we'll address in just a moment, contains a copy of your résumé, does it not?
A. Yes.
Q. All right. What I'd like for you to do is just, rather than go through your qualifications, in general, if

you will just simply advise the Commission what your particularized experience has been in regard to studying, writing articles on and becoming an authority concerning the San Juan Basin Fruitland Coal formation, and particularly the relationship of that formation to other strata in the Basin.

A. Okay, to focus on that part, not educational background?

Q. Yes.

A. Okay. My background concerning the San Juan Basin goes back to 1987 when I was project manager for a project at the Texas Bureau of Economic Geology. It was funded by the Gas Research Institute. I wrote a proposal and it was funded for four years, almost in its entirety, with continuations. It was a multi-year study to look at the geologic controls of the occurrence and producibility of coalbed methane from the Fruitland formation in the San Juan Basin.

As part of that study, we looked not only at the Fruitland formation and the coals within it, but also at the Pictured Cliffs formation, because it directly underlies the Fruitland formation.

We used about 2500 well logs, we worked at the Texas Bureau of Economic Geology with the Colorado Geological Survey and the New Mexico Bureau of Mines and

Mineral Resources' geologic staff, to map the coals, map the Pictured Cliffs sands, map the water and do some hydrologic modeling in the Fruitland formation and try to understand the origin of the coalbed gas and its relation to the Basin -- the San Juan Basin and basin evolution. In other words, what's commonly called in the petroleum industry a petroleum systems approach to understanding how all this Basin works as a petroleum reservoir in the Fruitland formation.

I published -- I wrote and co-authored several different contract reports for the Gas Research Institute under that work, published several of the articles in refereed journals, and continued to consult in coalbed methane in the San Juan Basin, as well as internationally and domestically in other areas.

Q. Do you hold a bachelor's and master's degree in geology from West Virginia University?

A. Yes.

Q. And do you hold a PhD degree in sedimentary geology from the University of Texas, Austin?

A. Yes.

Q. What is the field of sedimentary geology?

A. That's focusing on the sediments, how they're deposited, what their lateral relationships are among the different sedimentary packages -- for example, the coal and the casing sediments in the Fruitland formation and the adjoining Pictured Cliffs formations -- trying to understand how they were all deposited, what their relations are, why you have thick coals in some places, absent coals in other places, if you're looking at coal sedimentology.

My coal sedimentology goes back to undergraduate days in West Virginia in the 1960s. I continued that in graduate work at the University of Texas. I've done many studies on coal depositional systems and have published a lot in that area.

Q. Now, Dr. Ayers, have you prepared for filing in this matter prefiled testimony which also includes Exhibits WA-1 through WA-14?

A. Yes.

Q. The testimony was prepared by you?

A. Yes.

Q. And were the exhibits prepared by you or at your direction and under your control?

A. Yes.

Q. Okay. And if you had been here and asked these same -- for the same information and testimony under oath in this proceeding, would it be the same as is contained in this prefiled testimony?

A. Yes.

Q. Are there any corrections that need to be made in the written testimony?

A. No.

Q. I'd like to ask, Dr. Ayers, then, if you would proceed to summarize for the Commission your testimony. And if it would be helpful to point out to the Commission any particular exhibits as you do that, please do so.

CHAIRMAN WROTENBERY: One matter, before we go into the summary. We did have a pending objection to one portion of Dr. Ayers' testimony from --

MR. HALL: Yes, if we could --

CHAIRMAN WROTENBERY: -- Mr. Hall, and we might go ahead and take that up.

MR. HALL: All right, Madame Chairman, thank you.

We had interposed an objection to Dr. Ayers' testimony with respect to the gas-analysis differentiation. The objection and motion to strike were directed to the testimony at page 6, lines 13 through 17, and at page 19, lines 3 through 21.

Our concern was, the witness opines on a new expertise. Without qualification, there's no foundation for his qualification to render opinion in this area.

Moreover, there's no effort to establish a factual basis for the opinions. It appears that the nature of the testimony is largely repetition of what is said by an unavailable third party who's not available for cross-examination.

So we object on that basis.

MR. GALLEGOS: I'm going to -- We can establish a foundation quite readily, and I'm going to do that by just asking Dr. Ayers some questions. I thought it would be more -- we could deal with it when we got to that part of his testimony, but we'll do it right now.

THE WITNESS: What pages and lines were those, again?

Q. (By Mr. Gallegos) Well, it's concerning gas composition.

A. Okay.

Q. There's a sentence on page 6, and then there's some information on page 19.

A. Okay.

Q. Dr. Ayers, please tell the Commission what experience you have with the use of gas composition in your work and how often you've had occasion to apply gas composition in order to accomplish the studies that you've done on the coalbed and other formations.

A. We used it as one of the tools that you use in petroleum systems analysis. In the study that I described to you that was done for the Gas Research Institute, we mapped the gas compositions using data that were obtained primarily from the pipeline companies, thousands of data points.

I worked, though, primarily with Andrew Scott, worked under my direction on this project, and we authored and co-authored several papers, which are listed in my résumé here, stating that we were mapping and using the gas analyses to help understand the origins of the gas in the different formations.

Q. On page 19, when you make certain observations concerning the gas samples that were collected in February, 1999, on the Pendragon wells, did you make that investigation and come to the conclusions based on your own knowledge and experience?

A. I did. This was -- I was asked to look at these three analyses. Mr. Hall may remember that in the last hearing he asked me about my expertise in gas analyses and their use in studies in the San Juan Basin, and at that time I had reviewed the work that Whiting had done up to the point. I had not looked at any additional work until I was shown these three examples and asked what I thought of them in context of that past material that I have reviewed.

Q. Is it common and good practice in scientific fields in doing something of that sort that you will confer with colleagues in your area about investigation of this sort?

A. It is, and what I did was, I had an idea of what I thought had happened. I walked down the hall to Dr. McCain, who has authored a textbook on reservoir fluids -- he's a recognized authority -- and I sought a second opinion to see if he could validate what I thought.

Q. And what happened when you did that?

A. He said, This is what I think.

And I said, That's exactly what I wanted to hear, that supports my conclusion.

Q. So if you disregard the reference to Dr. McCain, would your conclusion be any different?

A. No.

Q. And that was simply a matter of conferring with a colleague?

A. Yes.

CHAIRMAN WROTENBERY: Objection overruled, and we can go on with the summary. I'm sorry to interrupt.

MR. GALLEGOS: Okay, thank you.

Q. (By Mr. Gallegos) All right. Now, would you proceed with your summary, please?

A. Yes. I was asked as part of my task or obligations under this work to review the contact between the Fruitland formation and the underlying Pictured Cliffs sand and to look also at how this contact in the area of the Chaco and Gallegos wells compares to the definition of the Basin-Fruitland Coal Gas Pool in the northern part of the Basin, as it was defined by the Division in Rule R-8768.

And so I looked at, if I can refer you to Exhibit WA-4, which is the Schneider Com B Number 1 well. I looked at this Schneider Gas Com B Number 1 well and reviewed the contacts between the Pictured Cliffs and the basal Fruitland Coals and noted that in the description in Rule -- or in R-8768, it was described as being 2880, was this contact, and that's what is marked here on this log.

You'll note that above that is a thin coal. There's actually a silty interval in the well log, a thin coal, overlain by an upward-coarsening sequence with a thin sand on top of it, and then a thicker coal seam.

This is the lithostratigraphic definition that was accepted by the Division for this basal contact here between the Fruitland formation and the Pictured Cliffs coal.

If we compare that to a cross-section which I've put together -- and this is Exhibit WA-3 -- you will see that there is very good agreement, if we place this on the Pictured Cliffs top, with the thin basal coal, thin sand units here, which I'm calling the Fruitland sand, or I can call it a WAW sand, but it's a thin sand in the base of the Fruitland, overlain by a thicker coal, which I will refer to as the B coal here. Very good agreement for this definition of the Basin-Fruitland Coal Pool.

So i think we answered that question that the section here in the Chaco and the Gallegos Federal wells does conform to the description that we find in -- under my Exhibit 1, I believe it's -- or Exhibit 2, excuse me, under Exhibit 2, on page 3 of the Order 8767 --

Q. -68, I think it is.

A. Excuse me, 8768. -- whereas I showed you this is the Schneider Com 1 B well, and it says, this contact was at 2880, which I showed you down here, and I describe the sequence and showed you that it's a comparable stratigraphic sequence.

The important thing is also that in this ruling, that it referred to the area distribution back on the preceding page, page 2 of the Order. It gives the townships and ranges and sections throughout much of the Basin. In fact, somewhere I think it says the Fruitland formation throughout the Basin.

So this is a lithostratigraphic or rock-stratigraphic definition that was applied to this contact throughout the Basin. And this was based upon a recommendation from the Fruitland coalbed methane committee.

Q. Go ahead, proceed with your statement.

A. Okay. The next thing I would like to do is review what I think the origin is of this thin sand here in the lower part of the Fruitland formation. Now, I'm going to refer to that as a Fruitland sandstone because that, in fact, is what it is.

This sand is a Fruitland sandstone that was deposited in a coastal-plain setting.

Now, I want to say that my testimony here is based -- all -- or many of the exhibits that I will show you, like this one, are taken right out of work that was done under the GRI contract report long before this case ever started, and there's no attempt to fit this case into some other model or modify this model. It fits very well with what we have seen when we developed this regional picture of the Basin.

And I think that this sand is -- above the Fruitland-Pictured Cliffs contact, is either one of two things. It's a crevasse-splay deposit that formed back here on the coastal plain, in the lower coastal plain setting, or it is a washover fan back behind the strand plain barrier. And I mention in my written testimony this time, and in the last hearing, both of these options.

In fact, you could have similar geometries of the sand in either case, whether it's crevasse-splay or a washover fan. When you're looking at the distal end of a washover fan, it can look very like a crevasse splay. And we don't have enough information in the area that I mapped to be able to differentiate between the two.

The reason I favor the crevasse splay over washover fan is because again, I mapped a limited area, but the area that I mapped -- let me put this over here -- in the area that I mapped you can see -- I see discrete sandbodies, some back here as small lobes, and then a second sandbody up here.

That implies to me that these may or may not be disconnected, regardless of what you may be told when you're trying to map sands at this scale in this environment. I've mapped a lot of them, thousands and probably tens of thousands of well logs, and you cannot say that this is all one continuous sand that we're looking right here. As you can see, it breaks up and splits, and a lot of that is interpretation, not saying it's all one sand.

But what I'm seeing is a ridge or a run of sandbodies that are back southwestward or landward of the old shoreline here. It could be that I'm seeing a washover fan here, but my best interpretation is, go back further, one sand thickness here or one sandbody, to the southwest or landward. That means it's more likely back in this setting.

The truth is, though, it doesn't matter which setting we're talking about, because as long as you're on this side of this barrier here, you're in a coastal-plain setting, you're in the Fruitland formation. It's not Pictured Cliffs.

One of the lines of evidence that I reviewed was the core data or core reports from the Lansdale Federal Number 1 well, and the -- Actually, there were two reports, Exhibits 13 and 14. If you'll turn to those you'll see that one is called a petrographic -- that's Exhibit 13.

Now the petrophysical or -- excuse me, the petrographical analysis shows that this was not a beach-type sand, because if you will read it, it says that it is a sandstone, silty -- silty sandstone. It's a framework sand, which means that grains are poorly to moderately sorted, angular sand with coarse silt.

What that tells you is, it's not a beach-type sand. A beach-type sand deposited here on this type of shoreline, which is dominated by wave activity, gets very well sorted, because the energy of the waves, you sort out the fine-silting clay materials, you bury them offshore and deposit them, and you're left with clean, well-sorted, generally somewhat rounded grains, because of the wave action rolling them back and forth in the swash zone of the beach. They get rounded.

So you can see that this is not characteristic of a marine coastal sand.

The second -- So what you're left with is, again -- it could be washover fan or it could be crevasse splay. I can't rule it out on this basis.

I would say, again, though, in looking at Exhibit 14, the permeability data from that well -- and these data are not -- they're taken at -- were reported at one-foot increments, and you don't know what part of that one foot they represent.

But if you look at Exhibit 14, samples 1 through 5 come from this sand right here, which is the sand we're looking at. And that's described here as having permeabilities ranging between .05 of a millidarcy and 142 millidarcies. That 142 millidarcy is out of a one-foot increment, or somewhere out of a one-foot increment, but that's probably from a small plug.

So if you average that you get something -- I've forgotten now what that averages out to be, but it was a fairly low average permeability there.

That is not typical of either the Pictured Cliffs in this area or a well-sorted beach sample, either case. Certainly not typical of the deeper Pictured Cliffs. If you look down at sample 11 through 14, which is down at about 1075 or so, when you get down here you're definitely looking at higher permeabilities. So this is not typical of the rest of the Pictured Cliffs, or the true Pictured Cliffs.

We've already established that this is a Fruitland sand, I think, on the basis of the comparison with the Schneider 1 B well.

Q. Dr. Ayers, just for our record purpose, when you say "this", could you describe in words the exhibit you're pointing to and what you're indicating?

A. This thin sand which, in the Lansdale Federal Number 1 well, is referred to as the upper Pictured Cliffs by Mr. Nicol and referred to by me as a Fruitland or WAW sand.

Q. On your Exhibit WA-3?

A. On WA-3, yes. It's around 1060 or thereabouts. 1060 to 1065 depth.

Now, I think we have seen from the Schneider Com 1 B well that this is a Pictured Cliffs/Fruitland contact here below this coal, but that's also the definition that's been accepted over the years from the U.S. Geological Survey work that was done, especially the work by Fassett and Hinds, 1971, and reported in numerous other reports by Fassett after that, in which he describes the contact between the Fruitland formation and the Pictured Cliffs as being at the top of the massive marine sand, below the lowest Fruitland Coal.

So that's a consistent contact, and that's important for this hearing because the description is a formational contact, and that's what Fassett and Hinds was giving us, and that's the definition of the ownership in the properties here, is that Whiting owns the rights to the Fruitland formation, and Pendragon owns the top of the Pictured Cliffs, below the top of the Pictured Cliffs.

Q. Okay. Does that --

A. That summarizes my --

Q. All right --

A. -- testimony.

Q. -- thank you, Dr. Ayers.

Let me ask you specifically, I think it will help, just to remind the Commission, the location of the Lansdale Federal, is that in the same section as the Chaco 2-R, the Gallegos Federal 7-1, and the Chaco 4?

A. Yes, it is. It's right here. Here's the Chaco 2, Chaco 2-R, Chaco 4, this is the Lansdale Federal Number 1, all in the same section.

Q. All right. In addition to your Exhibits 13 and 14, would you relate to the core analysis that was done on that well in 1978? Have you looked at the entire lab report and analysis on that core sample?

A. Yes, I have.

Q. Okay, I'd like to draw your attention to the testimony of a witness for Pendragon by the name of Dave Cox, who assigned a permeability of 150 millidarcies to the Fruitland sand and assigned it three foot of thickness. Do you agree with that permeability --

A. No, I don't.

Q. -- that permeability rating?

A. No.

Q. Okay, why not?

A. Well, as I said, the samples on Exhibit 14, I believe it is here, the samples 1 through 5 came from this sand, and if you look at samples 1 through 5 you see that you have .05-, .28-, 24-, 6.7- and 142-millidarcy permeability. So if you average those, you get a --

Q. Did you calculate that average?

A. I did, but I'm embarrassed to say I put it somewhere, I filed it somewhere. 35 millidarcies.

Q. 35 millidarcies?

A. Yes.

Q. Okay.

A. And the one sample, as I said -- These are usually taken from small plugs, and you're looking at what's listed as a one-foot interval, and that's some subset of that one-foot interval, so it doesn't represent much of the core.

Q. Where you have that one high -- the 142?

A. Yes, the 142.

Q. All right. Now, to go back to the definition of these formations and their setting, what I'd like to do is hand out copies of Exhibit WA-15, -16 and -17.

CHAIRMAN WROTENBERY: I didn't get a -17.

MR. GALLEGOS: Not very good at this. Here's -17.

Q. (By Mr. Gallegos) Do Exhibits WA-15, -16 and -17 help provide an explanation for the conclusions that you've drawn, particularly regarding the depositional setting, difference or distinction between the Fruitland sand and the Pictured Cliffs formation?

A. Yes, they do.

Q. Okay, would you address those and explain to the Commission what is shown by each of those exhibits?

A. Yes, I will, and I would like to address them in regard to -- at the same time, address a couple of other issues that were raised by Mr. Nicol's testimony concerning the origin of this sand that he refers to as upper Pictured Cliffs. And also I would like to address some of the findings in the last Division hearing, because Mr. Nicol and Mr. -- or Dr. Whitehead, have both suggested that this is a marine sand. It is not marine sand, it is a Fruitland sand, and these exhibits will demonstrate that.

The question was raised, is what is the -- by Mr. Nicol and Dr. Whitehead, what is the definition of "massive"? Because the definition that was given in previous reports is that the Pictured Cliffs is a massive sandstone, and the contact between the Fruitland formation and the Pictured Cliffs is at the top of the massive sandstone, of marine origin, underlying the Fruitland Coal beds.

And they said -- Mr. Nicol, and Dr. Whitehead supporting him, said that massive sand is an arbitrary term and that we pick the number by pulling it out of the hat, I guess, but we have used an earlier study in our Gas Research Institute work, a 20-foot cutoff was the thickness of the tongues of the Pictured Cliffs that we mapped in the northern part of the Basin.

Mr. Nicol contends that that is a tongue, and this sand is anywhere from zero to a maximum of 12 feet thick in this area.

I contend that it's a Fruitland sand, and that our 20-foot cutoff is not an arbitrary cutoff. The origin of that term "massive" comes from the definition of the Pictured Cliffs formation. If you go to the lexicon, the *U.S. Geological Survey Lexicon of Geologic Names in North America, 1938*, it states that the Pictured Cliffs formation is described by Holmes in 1877, and it was described along the San Juan River as being a massive sand, 130 feet thick, and he further described it at that point.

Following up in the literature, Fassett and Hinds in 1971 describe it as a massive marine sand, deposited in a littoral environment, and they reference the littoral environment as coming from Reeside, 1924, who described littoral fossils. Littoral means it's formed in this wave zone here on the beach, the shore face.

So we're characterizing this origin of this sand, Pictured Cliffs sand, as a sand that formed in a particular setting. It formed in a beach setting, where the wave action took sand carried in by rivers and transported along the coastline and deposited in these coastal shoreline deposits. It's a very specific rock-stratigraphic definition. No ifs, ands or buts about it, it's a littoral massive sand deposit.

It's not zero to 12 feet thick, because of the geometry of shoreline deposits. This is from a model in the literature by McCubbin, another is after Bernard, based upon the Texas Coast, which is where Mr. Nicol took his model in his Exhibit 45. And you'll see that these coastal deposits have a relief of at least 30 feet or 10 meters, and that's because of the depth of the wave action and how it reworks the sand grains. You don't get thin sands deposited in this environment.

So that is why it's described as a massive marine sand, formed in marine zone, that formed in a littoral environment by alongshore drift. So there's nothing arbitrary about the definition of "massive", and it's a very commonly used term in subsurface geology as well as in describing outcrops. I can tell you similar references from the Parkman sand in Wyoming and other places where they've used that term.

The environment, then, if we go to Exhibit WA-16, instead of looking at a cross-section of the beach going from the ocean back into the land, let me first call your attention to one other thing.

Mr. Nicol said that his sand was deposited in a bay, and he used the Texas coast back barrier setting as the analog. This is what you find in a lagoon, I should say, lagoon, correct myself. This is the type of sediment you find in a lagoon. Silt, clay and mixed silty-clay sands. This is an environment of low-grade sedimentation, low energy compared to the coastline, and there's ample time for organisms living back her to burrow in the sediments, stir it up, reduce the porosity and permeability. Very poor reservoir quality.

Now let's look at a map or plan view of this type of environment.

Q. Which is a blow-up of your WA-16?

A. It is. And in this we see the shore face and the barrier complex in here. I mentioned that there are two possible origins to this -- for this Pictured Cliffs sand that we referred to at about 1060-foot depth in the Lansdale well, and one, I said, could be that it's a crevasse splay.

Secondly, it could be a washover fan back here where at hurricanes and storms the waves can wash across the top and spread a thin sheet of sand there. That is a possibility that we could be looking at, especially if we go up this way to the north, into this sand that seems to be getting thicker.

This is a washover fan in a map view. It is not part of -- in the Pictured Cliffs formation or in any analog, it is not part of the shoreline deposits. Anything on this side is part of the coastal plain environment.

A lagoon is not a marine environment. The waters here can be fresh, they can be the same salinity as the ocean, they can be hypersaline if it's a restricted lagoon. It's not a marine environment, and it's not a littoral environment, which exists in this wash zone here.

Littoral environments, where these deposits were formed, exist, as I said, along the shore face --

Q. And you've put on display now WA-17?

A. Yes. Let me go back to this figure, which is

WA-15.

Fassett and Hinds in 1971 said -- The Pictured Cliffs and Fruitland are hard to tell apart sometimes when you're looking at the sands in these two formations, and so what they would use a lot of times is what are called trace fossils, the burrows and different organisms that worked on the sediments. And they used what is called an ophiomorpha burrow, ophiomorpha major. That is representative of a certain environment or water depth. It's representative of this littoral environment.

And there are paleontologists and ichnologists, or people who study these trace fossils, they're called, these burrows of these organisms. They look at the sediments deposited in waters in different environments, and they classified these different organisms or their traces based upon the environment. This ophiomorpha is part of the skolithos ichnofossil or trace fossil group. Out here further we have cruziana zoophytes, and back here in the bay we have scoyenia.

So there are different trace fossils that you use to recognize these different environments. And Fassett and Hinds used this trace fossil here, ophiomorpha, which is one of the skolithos trace fossils, to identify this environment and to differentiate between Pictured Cliffs sands, formed in a littoral environment, and the Fruitland sands which formed back interbedded with the coals.

What I'd like to show you now is a cross-section, A-A' in Section 16, and that is very similar to the figure that I just had up here, WA-15. But what it does is also shows a washover fan back behind the barrier and makes the point -- as McCubbin here, this author, showed -- that this washover fan is not part of the shore-phase environment, this littoral environment. This is a totally different energy environment back here, totally different sedimentary structures, internal structure to the sands, different environment, different organisms living here, much different reservoir quality than back here.

The definition of the Pictured Cliffs formation is based upon this massive marine sandstone deposited in a littoral environment.

What Mr. Nicol wanted us to believe is something like this, back in and behind this, was a tongue. That is not a tongue.

A tongue of the Pictured Cliffs formation occurs when the shoreline, which has been migrating basinward, building the basin, reverses its direction of migration and moves back landward, depositing the same thick sand deposits. It can't be a 2- to 12-foot-thick sand.

Q. Dr. Ayers, when I questioned Dr. Whitehead about his concept of a tongue he had only one example, and that was in a well in La Plata County, Colorado, north of the hingeline. Would that be where you would expect to see a true Pictured Cliffs tongue into the Fruitland formation? And if so, why?

A. Tongues of the Pictured Cliffs are common in the northern part of the Basin. We mapped -- In the Gas Research Institute project that we did on the Fruitland Coals and Pictured Cliffs, we mapped three sandstone tongues in the Pictured Cliffs, in the northern part of the Basin, all north of a structural hingeline that -- I don't have a figure to demonstrate that, but I can draw very quickly...

If you look at isopach map, which is defined as a generally -- there is a line -- right about the Colorado-New Mexico border, there's a little pink in the outcrop of the Pictured Cliffs sandstone and a lot of faulting in the lines, and we think that there is a -- some sort of a structural zone across there.

But north of this area, the Basin subsided a lot more rapidly than in the southern part of the Basin where the Pictured Cliffs and Fruitland were being deposited. As a result, when the shoreline migrated past this structural hingeline what happened was, the Basin subsided more rapidly and it caused the battle between sediments filling the Basin and the sea level moving back this way to be a hard-fought battle. So at times the shoreline was moving back this way, other times it was building on our and building the Basin that way.

So we get an intertonguing relationship. And so if you take a cross-section across here, what you see is the Pictured Cliffs has a lot of buildup in the northern part of the Basin. There's a lot of thickness increase if you do an isopach map in the Huerfanito bentonite, which is a volcanic layer in the Lewis shale, to the top of the Pictured Cliffs formation.

So there is a reason why tongues are abundant and described in the northern part of the Basin, but you rarely see reference to them in the southern part.

Q. How many logs did you study in your work for the Gas Research Institute on Fruitland Coal in this 1985-88 study?

A. The study was 1987 to 1991, and we used approximately 2500 well logs throughout the Basin. We correlated those logs. That was done by me and primarily by one person working under my direction, and we correlated those logs taken throughout the Basin.

Earlier study by Fassett and Hinds used in 1971 about 300 or 350 wells. An earlier GRI report where they mapped just the coals used about 600-and-some wells. So this is by far the most comprehensive study done in the

Basin, in the public realm.

Q. Okay. Utilizing your Exhibit WA-3, which is your cross-section, Dr. Ayers, if you would put that up, and bearing in mind that the New Mexico Oil Conservation Division has adopted a rock-stratigraphic definition of the Fruitland Coal, would you relate the significance of the proper definition of these formations to the transfer of operating rights?

And I'm putting before the Commission, then, an exhibit that shows the definition of the transfer of operating rights between these two parties, between Whiting and Maralex on the one hand, and on the other Edwards and Pendragon.

A. Well, the operating rights that I'm reading there says that Maralex owns from the surface of the earth to the base of the Fruitland (Coal-Gas) formation.

And then for Edwards it says they own from the base of the coal formation to the base of the Pictured Cliffs.

So the contact, then, is the contact between the Fruitland and the Pictured Cliffs formation, which Fassett and Hinds very well described as the -- The contact is at the top of the massive marine below the lowest Fruitland Coal bed.

Q. All right.

A. Another point or two that I'd like to make is that in the findings of the last Division hearing there were some findings saying that this was a marine sand. I don't think that that was well-founded. There were findings that this lower coalbed is a marine coal. I can assure you after 30 years of working and authoring papers on coal depositional environments, there is no such thing.

Coals do not form in a marine environment because in order to have coal form, you have to have organic material deposited in a reducing environment where it won't oxidize, and we don't have any records of that anywhere, especially not in this setting, but they just don't exist. You might get a carbon streak somewhere, but not thick coal deposits.

Q. Dr. Ayers, I'm going to change the subject here, and to help with my question I'm going to try my hand at just a little bit of an illustration.

Doesn't look like too much right there, but I'm going to just -- what I wanted -- Were you present for Mr. Conway's testimony, the fracture-simulation expert from Pendragon?

A. No, I was not. No.

Q. All right. Well, assume that he forces a well fracture in the coal. Maybe I should label that; it will help a little bit.

Assume that in doing his simulation he does one study where he forces a fracture that's going through and being maintained -- contained in the coal, out for about 750 feet, and then he changes the properties. So he changes the tensile strength from 800 p.s.i. to 50 p.s.i., changes the Poisson's ratio from .5 to .40, changes the Young's modulus from 200,000 to 1 million. And he does this because he says what I've tried to illustrate. There is an encounter, he supposes, there's encountered in the coal what he calls a pod of ash.

Now, do you agree or disagree, knowing the geology of this area, that there could be such a geologic anomaly in the coal?

A. I have never --

MR. HALL: Let me state an objection. I think the question misstates prior testimony. I think Dr. Conway testified to deposits of ash, not pods of ash. So we're accurate on that.

MR. GALLEGOS: Well, he drew something similar to what I attempted to draw there, some sort of a little capsule or --

MR. HALL: Right. I just think "pods" have a different connotation than what the witness actually said, "deposit". Just so we're clear on that.

CHAIRMAN WROTENBERY: I seem to remember the term "intrusion", and then at one point I also remember the word "pod", but I can't remember the context. But maybe we'll just talk about an intrusion.

Q. (By Mr. Gallegos) Okay. Would you address that, that hypothesis?

A. Yes, the layers of volcanic ash, which is what we're talking about here, are called tonsteins, t-o-n-s-t-e-i-n-s. They're common in coal deposits of all ages and all continents. And what they are is, for the most part, airfall volcanic ash deposits that rain down into a swamp and form little time layers across the swamp. They are -- Just as it sounds from the way they form, they are laterally continuous thin layers that represents an ashfall layer that occurred at some point in time.

The ones that I've seen, and they are abundant -- well, I say abundant. They're common in the coal here, but they're anything from a wisp -- and I've prepared this section to describe what I have seen, is, they're anything from a wisp which you barely see as a little gray wispy line going through the coal, to, more commonly, a half inch to an inch thick. And I've seen them in the Fruitland as thick as probably two or three inches. I've never seen them in any kind of a pod form.

Q. Do they occur in continuous and extensive -- you might call it sheets?

A. They occur because, yes, they fall out of -- airfall from ash that's carried by the wind, and so they're in fairly continuous layers. It can be transported once it gets into the swamp a little bit by water, but the swamp is a fairly flat surface that --

Q. Okay, is there any geological support for the notion that Mr. Conway uses in order to justify this fracture going out of zone of the coal because of encountering it?

A. I have not seen anything like that in the Fruitland Coals in the San Juan Basin. This describes what I have seen.

Q. In the 2500 or so logs that you have examined?

A. I haven't seen that in the logs, in thin tonsteins, like I've seen -- mostly show on the logs. You get some of thick ones, but what I've seen in outcrops and in coal mines that I've been in, the active mines here in the Basin, I've never seen anything that meets this description. This is the type of thing I've seen, here in Exhibit WA-18.

Q. And more particularly, Dr. Ayers, have you given extensive attention to the logs of the wells in this particular area, those being the Gallegos Federal wells, the Chaco wells and other wells in this general several-section area?

A. Yes, I have.

Q. And have you seen anything of the sort that would even approximate what Mr. Conway's had to theorize in order to make his simulation work?

A. I haven't seen anything like that.

MR. GALLEGOS: We move the admission of Exhibits WA-1 through -18, and I think -- and the report, and tender Dr. Ayers for cross-examination.

CHAIRMAN WROTENBERY: Any objection to the admission of --

MR. HALL: No objection to the exhibits.

CHAIRMAN WROTENBERY: Okay, WA-1 through -18 are admitted into evidence, and we accept the prepared direct testimony of Dr. Ayers.

And Mr. Hall?

CROSS-EXAMINATION

BY MR. HALL:

Q. Dr. Ayers, I believe you're aware that in the area depicted on Exhibit N-2, which is posted to the wall up there, operators of 34 wells in the area have identified what you contend is a Fruitland sand is, in fact, a Pictured Cliff sandstone? You're aware of that, aren't you?

A. I've read that in Mr. Nicol's testimony.

Q. Are those operators wrong?

A. Yes.

Q. Is it reasonable for an operator going out to this area to develop production to rely on what other operators have determined are Pictured Cliffs sandstone?

A. I can't judge that or answer that question. All I can tell you is that they completed -- whey they completed in that sand, we're questioning they completed in the Fruitland sand.

Q. Is it unreasonable for the Division to rely on what operators of 34 wells have called a Pictured Cliffs sandstone?

A. I don't -- You're asking opinion about how they should go about making decisions. I would think that there would be some guidelines imposed.

Q. Well, those completions in the Pictured Cliffs sand were reported to the Division decades ago, correct?

A. Some of them.

Q. And they have not been challenged by anyone before until Whiting and Maralex came along, right?

A. I think, Mr. Hall, the reason was, there was common ownership early on and it wasn't an issue. I think if you'll read my expert testimony, that I also looked at some tops and did some analysis and found that out of 44 wells -- Dr. Whitehead prepared a cardex list of tops, and I don't know how reliable that is, but I found that out of

44 wells, 61 percent of those were picked, as you say, at the top of that Fruitland sand, but the other 39 percent were not.

And so there's been no consistent pick of that top, and all I can answer you is that it is a Fruitland sand, it is not a Pictured Cliffs sand.

Q. Well, in 44 wells you say you've looked at, of the 27 or so you say the operator picked the top of the PC as the top of the upper Pictured Cliffs sand; is that what you say?

A. Well, what I --

Q. Page 10, I think?

A. Page 10? Yes, that's exactly what I said. So what I did was take the cardex file and go to the well logs that I had available to me and just went through and picked them and see where they fell.

Q. Of the remainder of those 44 wells, how many of those did not even have the upper PC in the well?

A. How many of them did not have --

Q. Do you know?

A. I wasn't looking for that. I was looking for whether the pick agreed with Fassett and Hinds' established definition or not.

Q. Well, let's do it this way. Line 14, you say -- Line 14, page 10: "The contact was selected at the top of the massive Pictured Cliffs Sandstone in 13 wells (30%)..." Do you see that there?

A. I see that.

Q. Of those wells, how many of those 13 wells didn't show the upper Pictured Cliffs in them? Do you know?

A. There is no upper Pictured Cliffs in this area.

Q. Do you know whether any of those wells were or were not Maralex picks?

A. I didn't look at who the operators were. All I did is go through the wells that I had. So it was whatever I had in my library.

Q. Yeah. Isn't it reasonable for industry operators and the Division, regulating agency, to adopt, rely on and utilize a definition for a formation that has been accepted for a substantial period of time, in this case a decade?

A. The definition that I have read for years is Fassett and Hinds, 1971, that says that the pick of the contact is between -- is at the top of the massive Pictured Cliffs sand, underlying a marine sand, underlying basal Fruitland Coals.

Q. Well, let me read to you from Fassett and Hinds, the 1971 article --

A. Sure.

Q. -- and see if you agree with what they say:

On electric logs the Pictured Cliffs/Fruitland contact is placed at the top of the massive sandstone below the lowermost coal of the Fruitland...

...and it goes on to say:

...except in those areas where the Fruitland and the Pictured Cliffs intertongue. On the surface, the contact is placed at the top of the highest ophiomorpha major bearing sandstone. This fossil is here used as a distinctive lithologic characteristic of the Pictured Cliffs in the sense referred to in Article 6.B of the *Code of Stratigraphic Nomenclature, American Commission on Stratigraphic Nomenclature, 1961.* Intertonguing of the Pictured Cliffs and the overlying Fruitland is common throughout the Basin, and the tongues are generally distinct enough in the subsurface and on the outcrop to be mapped or delineated as discrete units.

Do you agree with what Fassett and Hinds say there?

A. Yes, I do.

Q. Let me ask you about your WA-3 quickly here, cross-section. I'm going to ask you something about a well in particular. Let's refer on WA-3 to what you've labeled the Whiting Gallegos Federal 1. Just so we're clear, is this also what we've been calling the 7 Number 1 well?

A. Yes.

Q. And would you tell the Commission where you have picked the top of the Pictured Cliffs in that well?

A. Well, it's hard to read. Looks like it's about 1170 or thereabouts.

Q. All right. Let me have you look at Pendragon Exhibit Ayers-2. It's a completion report for the Gallegos Federal 12-7 Number 1 well.

By the way, who's the operator of that well shown on the completion report?

A. The operator is Maralex Resources.

Q. And what is the Maralex pick for the top of the Pictured Cliffs on the second page of that?

A. 1160.

Q. So you're disagreeing with your client on that pick anyway?

A. That's why I'm an independent consultant.

Q. What does that do to your cross-section with respect to that well? Would it alter it all if you honored your client's pick?

A. Let's see, 1160. Not materially, no. It would just move it up to here. It still leaves the sand. It would put it at the -- question probably where, whether or not you put that other coal as the base of the Fruitland or the sand above that. That's an arbitrary decision there because you have an extra coal in here which could be like this little discontinuous coal in the Pictured Cliffs. We know that they occur there.

So I could have dropped that down 10 feet, it wouldn't change whether or not this sand is called a Fruitland sand or not at all.

Q. Let's talk about those thin coals you show on the cross-section there. Those are -- For the record, those are depicted as occurring in -- deep inside the, as you say, massive of the Pictured Cliffs, correct?

A. These?

Q. Yes.

A. This? Yes.

Q. Are those coals marine in origin?

A. No.

Q. How did they originate inside the massive like that?

A. They are -- They could be either lagoonal, thin lagoonal deposits, or on the flank of a little wave-dominated delta, either environment. Probably some thin lagoonal materials.

You can get thin coals, you know, a foot or two thick in this setting. Very commonly you can get something like that where you have -- here I'm showing marsh, in this area behind the active strand plain and along this edge, you can get thin little coals there. So if this shoreline migrates back a little bit, back and forth, then you'll get those trapped in there. That's a very common occurrence. But it's not a laterally continuous coal.

Q. Are you aware of any articles in the literature that discuss the possible marine originations of coals?

A. Marine origins of coals? No. There are articles that discuss whether or not they exist, and generally nobody believes it, with the exception of the case that I mentioned before: You can get lagoonal -- In my written testimony, you can get some lagoonal deposits that are primarily type-1 kerogens or algae. They form a cannel coal deposit.

But that is not what this is. This has been documented to be formed by peats from forested plants, not algae.

Q. I want to discuss your testimony that the sandstone interval we've been discussing here is the product of a crevasse splay, and I understand from your testimony that's your favorite theory in this case, correct?

A. It's one my two theories, my favorite.

Q. Let's look at your Exhibits WA-10 and WA-9. Do you have a larger version of WA-9?

A. Which is -- ? No, I don't have.

Q. Let me make sure I understand the origins of a sand from a crevasse-splay mechanism. As I understand it -- correct me if I'm wrong, but a crevasse splay would involve a fairly large river which, in this case, would be running to the northeast; is that right?

A. No, it's not. A crevasse splay is a deposit that forms when a river breaks through its levees, natural levee, at flood stage. It can be a very small feature, it can be an extensive feature. It can be so extensive that it becomes the main channel, and the channel can actually become -- you can abandon the old previous channel. It's a quite common occurrence.

I had a figure in here of a crevasse-splay deposit mapped from coal seams in a study I was involved with earlier, on Exhibit WA-12. This is a blow-up of that figure, and what it shows -- Now, this is --

MR. GALLEGOS: Maybe you could step over here, Dr. Ayers, because that's not large enough to --

THE WITNESS: In this case, a stream was flowing -- get myself oriented here -- a stream was flowing in this direction. And the orange represents the river deposit on this Exhibit, WA-12.

The areas that you see colored in yellow here are crevasse-splay deposits, and they are at right angles to the river courses where the stream broke through its bank at flood stage and spread this material across the lower-lying floodplain.

And you can see that this deposit here -- there's a scale on here, 800 feet with a bar scale there -- these can be quite extensive. And as I said, because the floodplain beside the river is often lower, the stream as it builds up its natural levies actually gets higher than the low-lying adjacent floodplains.

And so sometimes what it involves is, these can actually become the major channels and divert this. In fact, the present-day Mississippi River, if it were not controlled by the U.S. Core of Engineers, would be diverted and there wouldn't be a river going through New Orleans, it would be going through -- the Mississippi would be going through the Atchafalaya Basin.

So this is a crevasse-splay. They're very common in coal-depositional settings because what happens is, often these areas are very low, marginal to the channels or out here on the floodplain, and you get lakes in there. And swamps can't grow in the lakes so what happens is, a crevasse splay will build out into the lake, build a little platform. And then the plants will colonize it, and you'll find that the coals very commonly lie on top of crevasse-splay deposits. It's a very common occurrence.

Q. (By Mr. Hall) Your Exhibit WA-12, that's for -- that's an example from the Wilcox Group of East Texas, correct?

A. That's correct, and this was from a coal study, so we're looking at the strata interbedded with coals there.

Q. All right. You don't offer in your testimony or exhibits any example from the San Juan Basin, do you?

A. I show from the model that we developed when we did the study for the Gas Research Institute, this is a generic model or a schematic model, and you can see that we recognize the existence -- you can go back and check the publication that this came from -- we recognize the existence of the crevasse splays.

And also in our report New Mexico Bureau of Mines and Mineral Resources jointly published with the Colorado Geological Survey and the Texas Bureau of Economic Geology, we have core descriptions in there where we actually describe the core from the Blackwood and Nichols 403 well, we described crevasse-splay deposits in the Fruitland formation, very similar to what we're seeing here in this case.

Q. Is that Blackwell and Nichols well, is that up in

30-6 unit or somewhere up there?

A. It is.

Q. My eyesight's deteriorated since we started this hearing. What's that number there on that exhibit?

A. This is WA-8.

Q. Your model is WA-8. Your SP map, WA-9 and your thickness map, WA-10, can you show anywhere on those two exhibits some indication that you have a river system?

A. That's not the intent of either of these maps. But if you look at WA-9 you can get an indication, probably, where a river system entered, right at the -- In fact, very good point, Mr. Hall, appreciate your bringing that out.

If you look at WA-9, in this square on the right, this is Township 26 North, Range 12 West, the area we're working, you see that I have a northeast trend to that sandbody there suggested by the SP response, and that is probably a fluvial system going across there.

Now, I did not map a large enough area. I mapped a very small area here, so I cannot say where that fluvial system would have been, but this could be -- I don't have data points in here -- this could have been something coming off of the fluvial system here, this could be something coming off of it there. I did not map a large enough area to show that.

In any case, whether this is a crevasse splay or it's a washover fan has no material bearing on whether or not this is a Fruitland Coal, because that's what it is by all definitions.

Q. In any event, without data points, as you say, you're simply speculating about the existence of the crevasse splay?

A. No, I'm not speculating, Mr. Hall. I'm basing it on where I know the depositional setting is. And if you'll go back to my previous testimony, I looked at the well-log characteristics -- electric log facies, if you want to call it that -- and the response. We had spikey and upward-coarsening, but primarily well-log responses, which is characteristic of a crevasse splay.

Generally, a crevasse splay is like a mini-delta. So what it is is, out here, the cross-section, when the river overflows its bank, it goes out here on the floodplain, deposits this mound of sediment. This is like a mini-delta. Out here you will get well-log patterns that look like spikey little -- just little shots of sand on the SP or gamma-ray log. Here you will get upward-coarsening patterns, interbedded sands and muds. And then over here you will get a blocky log pattern on SP or resistivity, very much as though you were looking at a delta deposit.

So I used the depositional setting, where I knew this was, and the well-log responses that I saw, to conclude that one possibility, a good possibility in this case, based upon where it is relative to the shoreline, log character and its trends, was that it was a crevasse splay and secondarily could be a washover fan.

Q. Where on Exhibit WA-10 do you show the river?

A. I don't show a river.

Q. Is that because WA-10 shows -- You're mapping the marine Pictured Cliffs sandstone, correct?

A. No, WA-10 is a map of -- Let me explain this to you, Mr. Hall. WA-10 is a map of the thickness of sand between this basal coal and what I call the coal. And that does not mean it's the same sand. It means whatever is in there -- You'll notice over here I have two sands, over here I have two sands. They're not the same sand. And you don't know, just because I connected this one all the way across there, that that's the same sand.

So all I'm doing is mapping the sand there to see, get an idea of the geometry. Now, when I see a geometry like this where I have discontinuous bodies, that suggests the possibility that they are not well connected, but I don't have enough data to thoroughly evaluate what they are.

And again, as I said, it's immaterial here because for all definitions we're looking at a Fruitland sandstone. The definitions of the contact establish that.

Q. Now on your cross-section, the sands that you contend are Fruitland and we contend are upper Pictured Cliffs, are you saying that that sand does not continue out to the northeast in the Basin and thickens?

A. I'm not saying what that sand does. I'm telling you what it looks like right here where I mapped it. And I will tell you that this may or not be connected to that. We have thicknesses here as low as to three feet. I think Mr. Nicol said zero there, I mapped a two-foot interval in there.

I took Mr. Nicol's map, his Exhibit -- I believe it was his Exhibit-50, overlaid my map there, and this is my Exhibit N-50-1, N-fifty-dash-one.

What I did is, I took our values, and I re-drew the map as a sedimentologist would draw it. And it looks a little different from Mr. Nicol's map. Instead of all this -- strange-looking pods, I tried to draw this as a sedimentologist would. And you can say that this is connected to the northeast, or it may not be. It's not material to where the depositional setting is here, is not material, other than the fact that we know we're in the Fruitland formation, as I've already described on at least two occasions.

But you can see that you can make a strong case when you put these two together for something coming off this side, maybe something over here from a river. It could be something different. But that is still further support for an interpretation as a possible crevasse splay. I'm certainly not saying with all certainty it is, but that's my first interpretation.

And regardless whether it's that or, as I said, my second possibility, a washover fan here, in either case it is not part of a massive marine littoral deposit. It is not this shoreline deposit. Everything landward here is coastal plain Fruitland Formation when you look at WA-17. Everything landward or west of the Pictured Cliffs analog here, the shore-placed deposits, is actually in the coastal plain, so it's Fruitland formation.

Q. Now, make sure I understand your testimony. You're not precluding the possibility that what we call the upper Pictured Cliffs sand in this area, your Fruitland sand, coalesces to a larger body to the north and east?

A. I'm not saying one way or another. What I'm saying is, if it does coalesce then what it would be would probably be an alluvial fan -- I mean, excuse me, a washover fan. But that still makes it a Fruitland sandstone.

Q. If there is coalescence at some point to the north and the east, at what point does it go from becoming

Pictured Cliffs to a Fruitland sand? Can you tell us that?

A. Yes, it becomes a Pictured Cliffs sand at the point when, on the well-log cross-sections, you lose a break in between that and the underlying Pictured Cliffs sand. The Fruitland sand does that.

There are established studies for this, Mr. Hall. It's a complex problem, I give you that. But it's been -- it's one that's been worked and overworked in every basin that is.

But that doesn't change the clear-cut definition of this environment. This thin sand was not deposited in a marine littoral environment.

Q. Let me ask you about your use of the definition, the "massive" definition.

A. Uh-huh.

Q. Does that term appear anywhere in Order R-8768?

A. 8768. I believe -- I know it occurs in the coalbed methane committee's recommendation. They specifically say the top of the massive marine sand, but I don't know whether that got put in with the --

MR. GALLEGOS: Order 8768 is defining the Fruitland, it's not defining the Pictured Cliffs. The question makes no sense.

Q. (By Mr. Hall) Well, my question makes perfect sense. Is the term "massive" used in there anywhere?

A. It is used in the coalbed methane committee's report.

Q. The question is, does it occur in the Order at all?

A. I don't know. I don't think so, but I don't know. But they adopted -- They do say in there they adopt recommendations for that contact based upon the Schneider Com B Number 1 well, which was -- that recommendation gave that definition as the top of the massive marine sand.

Q. Let me show you what's been marked as Pendragon Ayers-3 quickly here. Are you familiar with the AGI's *Glossary of Geology*?

A. Yes.

Q. Let me read you the AGI's definition of "massive", as shown on Exhibit Ayers-3:

> Said of a stratified rock that occurs in very thick, homogeneous beds, or of a stratum that is imposing by its thickness; specifically said of a bed that is more than 10 centimeters (4 inches) in thickness...

It cites to Payne, 1942.

> ...or more than 1.8 meters (6 feet) in

thickness...

Citing to Kelley, 1956.

Using the Payne definition, is what we call the upper Pictured Cliff sand really a massive sand, then?

A. Today I'll tell you, Mr. Hall, they use -- What we use as most accepted is the 1.8-meter or 6-foot thickness. But this has nothing to do with what we're talking about here. You're talking apples and oranges.

This is bedding stratification. This is when you're out there looking at beds. If you'll read down here where it talks about -- this for outcrop descriptions, it talks about internal structures, fissility, et cetera. This is part of the classification that have for describing rocks at outcrop, not well-log responses.

And what we're looking at here is whether -- It's broken down into thickly bedded -- I forget the full scale now, but it's thickly bedded, intermediate beds, thinly bedded, and there's a whole classification of about six different bed thicknesses. And what you're looking at is not a well log -- You're not looking at what was the positive in a bundle, like we see on the well log, but what you're looking at is individual subunits within, and you're trying to describe in this definition what do those packages look like? And I assure you, that's the definition that this applies to, not to subsurface geology.

Q. Well, I don't see any limitation in the definition that would limit its use to, like you say, outcrops.

A. Well, that's why I pointed out to here, where you're talking about laminae, you don't see laminae on well logs. Those are -- Laminae are very thin, millimeter-thick units of rock.

So that's why -- I know that's not clear to somebody who isn't familiar with this terminology, but for a clastic sedimentologist this is a very clear point. This is not reflecting the overall thickness of a package of rock that's deposited from the lower, middle and upper shore face here and looked at as one unit. This is looking within that unit at the individual layers that are making up the bundle.

I can show you references on that from Blatt, Middleton, Murray, Reineck, Singh. I can go on and on about -- Pettijohn, Potter and Siever, I can show you all kinds of schematic definitions of that.

Q. Dr. Ayers, when you mapped the upper PC, why didn't you map anything of -- why didn't you map any tongues less than 20 feet thick?

A. Because they don't exist, Mr. Hall.

Q. Then why did you use that 20-foot cutoff?

A. That was not an arbitrary cutoff. I thought I made that clear with one of my earlier exhibits. I used that 20-foot cutoff because that's the minimum thickness that you will find of a literal barrier-type shoreline deposit, if you look at this profile. This is a much-published profile. This is out of the Gulf Coast, the example that Mr. Nicol used as a setting that he thought was comparable to this sand. And very commonly, in fact, these sands are in the neighborhood of 30 to 60 feet thick, you'll find them.

But 20 foot was not arbitrary because, first of all, we knew the depositional environment, or we were fairly sure what we were dealing with.

But secondly, we made cross-sections. In that study, we had 2500 well logs involved. We started out -- We didn't start out just correlating well logs. We made a series of cross-sections northeast and northwest, which are paleostrike and paleodip directions, and we correlated for months on those cross-sections to get our ties down and decide what was going on and what the contacts were and what the relations were.

In this particular case when we saw these tongues, we looked at their distribution, where they were, what the log character was, was it upward coarsening? We looked at all those factors, what the extent was and what was a good cutoff for that unit based upon -- or that facies, based upon what we were seeing in our cross-sections. So it wasn't arbitrary at all. It was based upon months of hard sweat and looking and pondering over how we should pick that.

So that was the decision. It was based upon what we know from modern analogues and what we saw in this basin and looking at published reports in other basins as well, in similar settings.

In fact, if you'll look at Dr. Whitehead's exhibits, I think he used from the northern part of the Basin something like -- I think they had an average thickness of 59 feet on his tongues that he used as his exhibits in testimony last week. So 20 foot was a very reasonable thickness to use.

Q. Let me make sure I understand. Where you've matched the UP1 and the UP2, where they go from 20 feet to 19 feet or less, they simply don't exist; is that right?

A. That was a regional study, and it was a good average place to cut that off. When you're getting any thinner than that -- and they usually drop off very dramatically in thickness in things like you see right here -- you're not in that setting.

And what we had to do was look at the well-log character, as I told you, on the cross-sections, and see where they join, what was that thickness when that contact went away and it became -- the thinner sands of the Fruitland were gone and you were in a massive sand that met the definition of the Pictured Cliffs formation.

So that was based on numerous cross-sections across the Basin, and a lot of work.

Q. So why is it not appropriate for an operator in the San Juan Basin to use a definition of a Pictured Cliffs sandstone tongue less than 20 feet?

A. Because it is not a Pictured Cliffs tongue. By definition Pictured tongue is a marine littoral sandstone deposited in this environment, and you see that they, by the scale here, are thicker than what you're seeing right here.

Q. Now, just a moment ago you said your 20-foot cutoff was the product of an average. Do you recall saying that?

A. Yes.

Q. So --

A. I said it was -- By "average", I meant by looking at a lot of different wells on our cross-sections and deciding that that was a good thickness to pick for making that cutoff.

Q. So the --

A. In other words, you can't go in there, into every well, 2500 wells, and say, Is it 20 feet or is it 25 feet?

Being 20, using a 20-foot cutoff gave us what appeared to be the right pick in this case.

Q. But you agree that the Pictured Cliffs sandstone tongues occur in tongues of less than 20 feet?

A. No. If anything, I would say they're mostly less than that. If you look at our contour maps on thickness, I think you'll see that the contours, which I don't have with me -- I think you'll see that they bunch very closely on that thickness cutoff in the southwest, which indicates that that's pinching out very rapidly.

Q. Is the real reason you picked 20 feet, it was a convenient cutoff for your study, correct? Just a matter of convenience?

A. No, it was not. I think I just said that it was the result of arduous, long hours of looking at 2500 well logs. Less than that, because we were looking at just the northern part of the Basin, but looking at many well logs and studying it and deciding what was the best pick, what was the correct pick.

Q. So a tongue that is 19 feet in thick and in definite communication with a tongue 21 feet in thick should not be considered Pictured Cliffs sandstone; is that what you're saying?

A. I'm saying that a 20-foot cutoff was used in the northern part of the San Juan Basin, based upon intensive study.

Q. Well, can you answer my question?

A. I don't know.

Q. You don't know --

A. Would you restate your question?

Q. My question is, if you have a 19-foot-thick sandstone tongue in communication with a 20- or 21-foot-thick Pictured Cliffs sandstone tongue, that 19-foot tongue is nonexistent? Is that what you're saying?

A. I haven't mapped it. I'd have to map it and look at on cross-section to see how it looks.

Q. Well, are you saying it may exist?

A. It may exist, but I haven't seen it yet.

Q. All right. Assume for me that it does exist.

A. I can't assume that, I have to see the facts.

Q. Yeah, you can assume it.

A. No, I won't.

Q. Please assume that there is a Pictured Cliffs sandstone tongue 19 feet thick that's in direct communication with a tongue 20, 21 feet thick, or more. The fact that it's less than 20 feet thick, you're saying that it is not a Pictured Cliffs sandstone tongue?

A. I think I've already defined my definition of a tongue, based upon -- in the northern part of the San Juan Basin where we have tongues -- down here, I haven't seen any in this area -- as a 20-foot cutoff. As I said, that was based upon looking at a lot of well logs.

Q. So you wish the Commissioners to disregard any sandstone tongue less than 20 feet thick that is in definite communication with a sandstone tongue 20 feet or more in thickness?

MR. GALLEGOS: Can we have a clarification? What is this "in definite communication"? What does that mean?

MR. HALL: In certain communication.

MR. GALLEGOS: You mean this is just an extension of it?

MR. HALL: Yes.

Q. (By Mr. Hall) You're asking the Commissioners to disregard that portion that is less than 20 feet thick. Is that what you're asking them to do?

A. If you want to go ahead and map every sand on a sand-for-sand basis, then you might say, well, you go down to 19 feet in this case. But I don't think that you will find many cases of that, based on what I saw in the northern part of the San Juan Basin. Not unless you're dropping back into the washover fan environment, because as I've already showed you on numerous occasions that I've tried to explain this, it's not a tongue if it's that thick -- or that thin.

If it's 19 feet thick, it did not form, most likely, in this environment, because these are generally 30 to 60 feet thick, and in the Gulf Coast where we don't have a real strong wave activity, it's at least 30 feet thick. So I don't know how to answer that, because it doesn't exist.

MR. HALL: Thank you, Dr. Ayers, no further questions.

I would move the admission of Exhibits Ayers-2 and Ayers-3, Pendragon Exhibits.

MR. GALLEGOS: We don't have any objection to that.

While we're at it, we'd like to move the admission of Exhibit N-50-1 --

CHAIRMAN WROTENBERY: Any objection?

MR. GALLEGOS: -- that came up at the cross-examination.

CHAIRMAN WROTENBERY: Any objection?

MR. HALL: No objection.

CHAIRMAN WROTENBERY: All three exhibits are admitted.

Commissioner Bailey?

EXAMINATION

BY COMMISSIONER BAILEY:

Q. Let's play a series of what-ifs in relationship to the two OCD orders that established the Basin-Fruitland

Coal Gas Pool and the WAW-Fruitland PC Pool.

If you'd refer to your Exhibit 2 --

A. Okay.

Q. -- on page 7 or Order Number R-8768, hold your finger there and page over to page 5 of the Order Number 8769.

On page 7 of 8768, a careful of "IT IS THEREFORE ORDERED THAT:" and then paragraph (1) says that the Fruitland --

> ...classified as a gas pool for production from Fruitland coal seams, is hereby created and designated the Basin-Fruitland Coal Gas Pool, with vertical limits comprising all coal seams within...the stratigraphic interval.

Now, hold your finger there and page over to page 5 of R-8769, and paragraph (z) says:

> ...the WAW Fruitland-Pictured Cliffs Pool... include only the sandstone interval of the Fruitland formation.

So taking your exhibit, cross-section A-A', let's play a series of what-ifs.

A. Okay.

Q. Okay, there's a very thin coal that's indicated in Pendragon Chaco Number 4. What is it, about 1190? That one, yes.

A. All right.

Q. If that were perforated and there was gas production, what pool would you put it in?

A. I --

Q. Now, I'm not asking formation. I'm very specifically asking what pool would that production be out of?

A. Yeah, formation is not an issue, that's very clearcut.

Q. It is not an issue here.

A. It would still be in the -- Let's see. I don't think anybody owns it, because the second one says it's the sandstones only, and the first one is based upon this base right here. So there's no ownership of that coal, right?

Q. Okay, let's move upsection a little bit. Within the Chaco Number 4 there appears to be a coal right at about 1170, a very thin coal.

A. In the Chaco 4?

Q. In the Chaco 4.

A. At 1170?

Q. Uh-huh.

A. Yes.

Q. If there were production from that coal, what pool do you put it in?

A. That is a Fruitland Coal.

Q. Okay. Just above there is a yellow-marked sandstone, and I'm not giving it a name here, you'll notice.

A. Okay.

Q. If there is production from that sandstone, what pool do you put it in?

A. I'm not an expert on pool definitions, but I would presume that it would go, on the basis of pool, in the WAW-Fruitland-Pictured Cliffs, from what I read here.

Q. Okay, which title does say both Fruitland and Pictured Cliffs, the title of that pool. So let's go on up a little bit. There's a massive coal.

A. Okay.

Q. Production from there is --

A. -- Fruitland.

Q. Okay. Farther on up, there's a yellow sandstone. Production is from --

A. WAW.

Q. The WAW.

A. It's Fruitland --

Q. By definition --

A. -- by this definition --
Q. -- of these pool names.
A. -- of the pools, yes.
Q. So we would have production from the WAW-Fruitland-Pictured Cliffs Pool from within Fruitland formation?
A. The way this pool order is defined, I think that's correct. That's the way I read it.
MR. GALLEGOS: May I point out something, because there is a *nunc pro tunc* order that's not included here that was entered because of this (z) that amends that, and I notice we don't have that in here.
THE WITNESS: Is that 69.A?
MR. GALLEGOS: Well, it's adding to 8769 and recognizing that they left the Pictured Cliffs out of here and it was entered later. We've got a copy of that someplace, and it's not in here. I just realized that, because there was a confusion here. It's styled "*nunc pro tunc* order", and it goes back so that this definition has the Fruitland sand and the Pictured Cliffs, I believe. I'm not sure, but I know that --
CHAIRMAN WROTENBERY: That's my understanding of the vertical limit to that pool. This was not intended to exclude the Pictured Cliffs --
MR. GALLEGOS: Yeah, and it was --

CHAIRMAN WROTENBERY: -- sand.

MR. GALLEGOS: -- erroneously written, and then an order was entered later, a little short order was entered --

MR. CONDON: Yeah, 8769-A.

COMMISSIONER BAILEY: It strengthens the point, that both Fruitland and Pictured Cliffs sands are included within that pool.

MR. CONDON: Within the pool.

MR. GALLEGOS: In the pool.

COMMISSIONER BAILEY: Right, that --

MR. GALLEGOS: Here -- this is all -- this is kind of marked up, but --

COMMISSIONER BAILEY: -- is the formation?

MR. CONDON: Correct.

MR. GALLEGOS: See, this was a *nunc pro tunc* order that was entered.

COMMISSIONER BAILEY: Wait, that's the point I was trying to make anyways.

MR. GALLEGOS: Okay.

Q. (By Commissioner Bailey) I was thinking on other things, possibly, and never got a very firm distinction in my notes here. Are there absolutely no fossils contained within this sandstone in question?

A. There are, to my knowledge, none that have been reported in any of the exhibits from this sand.

Q. Have you examined any samples from drilling?

A. No. But the fossils will -- would probably help pin that down. But you would expect to see, if you look at the definition of the Fruitland formation again from the *U.S. Geological Survey Lexicon*, it describes brackish and freshwater sands, shales and coals interbedded and describes the fauna as being both brackish and freshwater fauna.

And so there are descriptions of what organisms we should expect to find if we had them in this particular sand.

Q. But we don't have any way to include or exclude fossils right now?

A. We don't have.

Q. Okay. Should we expect to see erosional effects on that WAW sand?

A. No.

Q. Why not, if it is nonmarine, nonlittoral?

A. I guess I would ask you -- just turn it around and ask you why? Because we're looking at an -- a braiding floodplain, we see that it's pinching out to the south, it's encased in shales top and bottom, there's no evidence of anything having eroded. We're showing a continuous shale above it and then a coal, so there's no evidence of any unconformity here in any of the cross-sections that I've seen.

Q. So based on that, your Exhibit WA-14 cannot be interpreted as having any erosional effects that may possibly have removed those portions of 1074 to 1077, which show high permeability? You said that samples 1 through 5 were from the WAW sand --

A. Uh-huh.

Q. -- and samples 11 through 14 you put in the PC you put in the PC?

A. Yes.

Q. Okay, samples 11 through 13 show high permeability to horizontal and vertical?

A. Yes.

Q. So by your answer of, there is no unconformity and no evidence of erosion in the WAW sand, we cannot infer that these layers were eroded from the WAW sand, that they could have been equivalent at one time but were eroded away?

A. You mean the layers 7 through 10?

Q. There is the possibility that there could be equivalent layers 1074 to 1077 on top of 1060, that could have been eroded away, exploring a lot of different scenarios?

A. I think that would show up on the cross-sections of the type that we have in front of us if we had that kind of an unconformity.

Q. Eliminating the possibility?

A. Yes.

Q. Would six inches of ash in the Fruitland be impossible?

A. Six inches of the volcanic-ash-type tonstein stuff?

Q. Right.

A. That would be possible, yes.

Q. It would be possible?

A. Yes.

Q. Would it show up on logs?

A. On a high-resolution gamma-ray log it would show. It probably would not show on a conventional oil-and-gas well log, or if it did it would just show up as a little blip. It probably would be difficult to measure the actual thickness.

Q. Still going. You read to us the original description of the Pictured Cliffs from back in the 1800s. Was there necessarily a thickness limitation or lower limits?

A. No, it was based upon the outcrop description, the type locality. It was -- simply described what was there, and so there was no lower limit placed. And it gave three different localities with three ranges of thicknesses of the massive sands described.

Q. There were descriptions of the sweet spot in this area of high production around Chaco 4 and 5 and through those -- I can't see from here -- to the west of the gold-colored block, the pink vertical -- yes, that entire pink section was considered the sweet spot of this area.

Are there geologic or structural reasons why that would that would be considered the sweet spot?

A. There may be. There are probably some small folds and faults in here with enhanced permeability.

Burlington Resources published a paper in 1997, the field over to the east here, about twelve or so miles, in which they attributed very high production rates from the coalbed wells to some fractures and tight folds.

I did a preliminary map of structure in this area, and did see a little high here that protrudes northeastward, and so there could be some fracture-enhanced permeability along that.

Q. As the shoreline moved along the coast, it would waver back and forth to the northeast and then southwest over time. As it moved over time, it's very easy to visualize it on a regional basis. Within that single well log, though, could we expect to see thinner and thicker beds of both the Fruitland and the Pictured Cliffs as it moved over time, so that we may perhaps have less than 20 feet up against the barrier-bar sands?

A. Not generally, that would happen, because what happens here -- no, that's probably not as good as this one. If this were to turn around the shoreline start moving back this way, it would, if anything, it would do -- it would cut off the top of this. The tongue coming back to the south intertongued with the Fruitland here would still be this thick shoreline deposit, and it would be reworking part of this lagoonal and lower coastal plain where it first turned around. You wouldn't have a tongue as a result of that. This shore face moving back would be the tongue. So you would still have this same water depth and thickness of deposit.

COMMISSIONER BAILEY: That's all I have.

CHAIRMAN WROTENBERY: Commissioner Lee?

EXAMINATION

BY COMMISSIONER LEE:

Q. You say Mother Nature is not an engineer, so she must be a geologist.

(Laughter)

A. We always get the blame, they take the credit.

Q. Don't they all?

The origin of the gas in the Fruitland and the Pictured Cliffs is from the Lewis shales, right?

A. The Pictured -- The origin of the gas in the Fruitland Coals is primarily from the coals, I believe. The Pictured Cliffs gas can be from the coalbeds or from the underlying Lewis shale, depending on where you are in the Basin and what the relationships are. If you have a coal sitting directly on top of the sand, it may have charged the sandstone.

Q. So they probably are from different sources?

A. Yes.

Q. Then why don't we perform an isotope to separate those two gases?

A. We have done some of that work, and there isn't a lot of data, but we have done some of that work in our regional study for the Gas Research Institute.

We also found that there's a fair component of biogenic gas in the northern part of the Basin.

Q. Excuse me, I'm not a geologist, I'm trying to -- What is preventing the gas in the Pictured Cliffs to invade the coal zone?

A. Probably nothing to prevent it. At the time that the gas was forming, it was forming in all these units at once, Pictured Cliffs, coalbeds, because it's a temperature phenomenon. And so the coalbeds are, in this case, 90- or say 80-percent, say, on average, organic material. So it's a very high source rock, as well as a reservoir.

So it's a self-sourcing reservoir, it forms its own gas. So there's no reason -- if it's forming its gas, then there's -- it would be -- that gas as it forms, we'd be observing an outward pressure, if anything, it would go out of the system.

Whereas the Pictured Cliffs gas coming from the marine Lewis shale which might have -- I don't know what people are reporting for the organic content, say 2 to 4 percent of organics -- you know, it's generating -- there's less organics in the marine Lewis shale to generate the gas to charge the Pictured Cliffs.

Q. Yeah, but the Pictured Cliff pressure is higher than the Fruitland, right? Why don't they just --

A. I don't know what the pressure, under the present-day --

Q. Not present day. I'm talking about before --

A. Oh --

Q. -- we had the coalbed --

A. -- when the coalbeds were being charged?

Q. -- hundred years ago.

A. When the gas was being formed, the pressure would be dominantly out of the system, it would be -- because the coal beds are generating far more gas than they can adsorb at those pressures. So generally it will move out of the system.

Q. Yeah, but the -- a hundred years ago, the pressure of the Pictured Cliff is higher than the Fruitland, right?

A. I don't know that it was, any more than you could account for by the pressure related to depth. It's not an overpressure situation in this part of the Basin.

Q. What I want to establish is, what's the interface between the Fruitland and the coalbed -- Fruitland and the Pictured Cliffs?

A. It varies with where you are in the Basin.

Q. How about in our area?

A. In this area they seem to have maintained separate reservoirs, based upon the different gas compositions.

In some other parts of the Basin that's not true, and in our regional report for the Gas Research Institute we said that regionally the gas contents cannot be used -- or composition, I should say, cannot be used to distinguish between Fruitland and Pictured Cliffs reservoirs, because some places they are communicated.

But we went on to say that locally there are areas where the gas compositions are different, they have not mixed, and you can use that composition to identify the source of the gas, and this is one of those areas.

COMMISSIONER LEE: No further questions.

CHAIRMAN WROTENBERY: I had a few questions.

EXAMINATION

BY CHAIRMAN WROTENBERY:

Q. Back to the definition of "massive", and in particular your comments on the definition of "massive" in the *Glossary of Geology*, the excerpt that was introduced as Ayers-3, this particular definition has three different usages of the term "massive", an (a), (b) and (c). Your comments, I think, related primarily to definition (b). I just wanted to ask, does the fact that there are three different usages laid out there affect in any way your comments on that definition?

A. No, I think it's the same -- (a) and (b) are essentially the same, but different people's definition of what that is -- Oh, no, there is a subtle difference there, whether or not it's bedded. It has to do with whether you can see these beds and how thick they are that you can see them. No, that's exactly in line with what I was saying.

I'd be glad to xerox the pertinent pages of literature and send it to the Commission if that would help.

Q. Not necessary.

I also wanted to ask, I know in your testimony you talked about the Pictured Cliffs sands and terms of its characteristics as a littoral marine sand.

A. Uh-huh.

Q. And I remember you introducing the littoral concept and explaining what that was. What I didn't catch was the source of that particular description of the Pictured Cliffs sand.

A. Okay. The word -- The first place I see that, I think, was in Reeside, 1924 reference, that you can see I referred to in Fassett and Hinds in 1971. And what that did was place the environment in which this sand formed. And as I recall, Holmes described it as a massive sand and gave some of the dimensions and descriptions, and then Reeside described the fossils in the sands and said these fossils are those of organisms that lived in this littoral environment.

And then you read Fassett and Hinds, I think, in 197- -- or 1988, and they further talk about the formation from massive -- or from littoral drift, wave action along the coastlines. But the first time it was introduced was by Reeside in 1924, pinning down the environment.

Q. Also I just wanted to ask you a little bit more about your definition of "marine". I guess from a lay standpoint I tend to think of marine as including bodies like the Laguna Madre, lagoonal environments like that. What is, I guess, your basis for excluding that kind of environment, the lagoonal environment, from the definition of "marine"?

A. The marine environment is that which is directly influenced by the sea and action of the sea. You can say that there is a marine influence back behind these barriers, but that is not a marine environment, because you can have anything from fresh water, to normal fresh -- or rather normal marine salinity, to hypersaline conditions if you have closed-off lagoons.

So this -- Anything that's acted upon by these coastal processes which we saw in the swash zone, that would be marine. But once you get back behind this, then you're in the coastal plain environment, and this would be called distal coastal plain and also referred to as back barrier in this setting.

Q. Do you make a distinction between closed-off lagoons and lagoons behind barrier island structures, which are not really closed off in the same sense?

A. No, because -- I mean, these can close, and you can have a closed lagoon that gets opened by a storm. These tidal inlets that are shown here migrate, so this all changes along this direction, and this opening can change as well --

Q. Okay.

A. -- over time as the shoreline migrates and you have storms.

Q. Along a similar line, when you were talking about the source of coalbeds and you were talking about the only examples of marine coals, I thought I heard you give two different examples, one being a lagoonal environment and another being a delta kind of environment.

A. Yeah, I said you could get something like a little marsh here, or you could have on the flank of the delta like this -- this is a wave-dominated delta because it's a wave-dominated shoreline. You could have some little trapped low places here, say, swales that would have enough peat to give you a thin little layer of coal. But it's not going to be extensive, it's not going to be a continuous layer.

MR. CONDON: Excuse me, just for the record, could he identify the exhibit that he's been referring to so the record will reflect that?

Q. (By Chairman Wrotenbery) Yes, thank you, please do.

A. I'm sorry, that was Exhibit WA-8.

CHAIRMAN WROTENBERY: Okay. Thank you. I think Commissioner Lee had one other question.

FURTHER EXAMINATION

BY COMMISSIONER LEE:

Q. In this area, do you -- all the rock, the vertical permeability, is any of this rock, the permeability, equal to zero, absolute zero?

A. I don't think there is such a rock that has absolute zero.

Q. Okay. Then what holds it there? What is it, holds the gas there?

A. These units are -- the coalbeds are primarily water-saturated, and that maintains a hydrostatic pressure which keeps the gas in an adsorbed state on the coal, and that's why if you pump that water off, reduce the pressure, the gas starts flowing.

Q. So you're saying it's basically -- it's not a hydrostatic fluid, because your gases certainly have more pressure than your adjacent water, all right? On top of it? You've got to?

A. I don't know.

Q. Because there's support of the bottom pressure of the water?

A. I'm not sure. This is a normal to under-pressured environment here, I think.

Q. I think the reason -- what I want to establish is, all the caprock, the reason that the caprock can really prevent the gas from migrating upward is solely because -- not solely -- is mainly because of the caprock pressure.

A. Uh-huh.

Q. Okay? You squeeze -- The caprock pressure for the tighter rock is very, very high. It almost cannot penetrate. Suppose you have a caprock, suppose -- full of gas. It's a caprock. Then you dewater the Fruitland gas and you -- Did you ever think about this problem?

A. That the Fruitland Coal is a seal or --

Q. Fruitland Coal has the water --

A. Yeah.

Q. -- because of the imposed caprock pressure, keeps the Pictured Cliff gas to migrate into Fruitland gas, Fruitland zone?

A. I don't know, but I think that this -- there are some shale units here at the bottom that probably --

Q. That shale is not continuous, right?

A. It's hard to say how continuous any of these units really are. There's an interval here that is dominated by shale that's two to ten feet thick, and then another one up here. So I would presume that they would be fairly effective seals here, because we were not looking at real high pressure differentials.

Q. The seal is below, it's right at the -- that seal is -- How thick is that?

A. This?

Q. Yes.

A. It's -- This one is about probably two feet to non-existent. And then above that is probably three to ten feet, and then this one is probably three to eight feet or two to eight feet.

Q. Even with any kind of rock, you need to have water to prevent the gas from coming up; is that true?

A. I would presume -- Over geologic time, these things can -- you can get cross-formational flow at low rates. But in the times that we're looking at, that's probably true.

COMMISSIONER LEE: All right, that's beyond the scope of this. I'm sorry. I have no further questions.

CHAIRMAN WROTENBERY: Commissioner Bailey?

COMMISSIONER BAILEY: Just one further.

FURTHER EXAMINATION

BY COMMISSIONER BAILEY:

Q. On your Exhibit 14, WA-14 --

A. Oh, that's in the book, okay.

Q. -- could you translate the descriptions that are listed there for samples 3, 4 and 5?

A. The descriptions on the right?

Q. Yes.

A. I can translate everything but the last letter of code there, FL. I'm not sure what that is.

Q. Could that be "clay filled"?

A. It could be. I looked in some different sources and I couldn't find anything definitively. It was just like this, so I wasn't sure. It's a possibility.

But yes, I would say "sand, gray, fine-grained, shaly..." Oh, excuse me, starting with number 1 it's "sand, gray, fine-grained, shaly, clay..." slash FL, which could be "clay-filled".

And then "sand, gray, fine-grained, shaly..." et cetera.

Q. And could you read the descriptions for samples 9 and 10?

A. Uh-huh.

Q. They're identical, aren't they --

A. Yes.

Q. -- to 3, 4 and 5?

A. Yes.

Q. Then you have a very slight change in the description of the samples --

A. Uh-huh.

Q. -- for samples 11 through 14, which you characterize as Pictured Cliffs?

A. Okay. Yes, the "sand, gray, fine-grained..." probably "trace of clay". Could be -- That's possibly "trace of clay".

Q. So the sample descriptions are very close to the same for the WAW sand and the Pictured Cliffs?

A. Well, we're seeing here a trace of clay, where up here we may be seeing clay-filled, if that's what that means, in fact. I can't be sure. But that would be fairly different than -- the permeabilities are quite different.

COMMISSIONER BAILEY: That's all I have, thank you.

CHAIRMAN WROTENBERY: Mr. Gallegos?

MR. GALLEGOS: No, I have nothing further, thank you.

MR. HALL: Nothing further.

CHAIRMAN WROTENBERY: What shall we do?

(Off the record)

CHAIRMAN WROTENBERY: Okay. What we think we'd like to do is take a ten-minute break here and then come back and go for a little while longer. We won't go as late as we did last night. We'll just go until we're ready to break for dinner. Let's take a ten-minute break.

(Thereupon, a recess was taken at 5:45 p.m.)

(The following proceedings had at 6:00 p.m.)

CHAIRMAN WROTENBERY: Are you ready?

BRADLEY M. ROBINSON,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. GALLEGOS:

Q. What is your name?

A. Bradley M. Robinson.

Q. Where do you live?

A. I live at 1019 Muirfield Village in College Station, Texas.

Q. And what is your occupation or profession?

A. I am a principal consultant of well completion and stimulation for Holditch Reservoir Technologies in College Station.

Q. What is Holditch Reservoir Technologies?

A. It's a petroleum and geoscience consulting firm, specializing in studies for the oil and gas industry.

Q. Have you prepared and filed in this action written testimony which included Exhibits BR-1 through BR-29?

A. Yes.

Q. And did you base your testimony on reliable sources of data and information that are normally used in your profession?

A. Yes.

Q. Were the exhibits prepared by you or under your direction and control?

A. Yes, they were.

Q. I would like -- Included in your prefiled testimony, is there a résumé that gives detail about your work history, your education and enumerates the various articles, contributions to literature that you have made?

A. Yes, there is.

Q. Okay. Will you, though, briefly, just to acquaint the Commission with you, describe your education and your work experience?

A. Sure. I graduated from Texas A&M in 1977 with a bachelor's of science degree in petroleum engineering. I went to work for Marathon Oil Company out in Midland, Texas, for about two and a half years, where I was a production engineer over the entire Midland district, which included over 500 wells and some 70 fields. I was the only engineer working in that area. They had a whole group of them working in the Yates field, which was one of the most prolific fields, but I handled everything else.

After about two and a half years with Marathon, one of my old professors, Dr. Stephen Holditch, asked me if I wanted to come back to College Station and be a part of a consulting company that he was starting up. And I said yes, so I went back there in October of 1979, and I've been there ever since, working for what was originally Holditch and Associates and now is Holditch Reservoir Technologies.

While I was back in College Station I pursued and received a master's of science degree in petroleum engineering from Texas A&M and have been working in the analysis, evaluation, stimulation of well completions and fracture-stimulation treatments for the past 20 years, including unconventional gas resources, coalbed methane, Devonian shales, low-permeability gas and conventional reservoirs.

Q. Have you performed a study of the wells that are at issue in this matter that are typically referred to as the Chaco wells and the Gallegos Federal wells?

A. Yes, I have.

Q. And just generally, if you would enumerate for the Commission, what have been the purposes of your study?

A. Well, I was asked to do three things -- I guess that was the purpose of my study.

First of all, I was asked to analyze fracture treatments that had been performed on these wells. And I was initially only asked to analyze the Chaco wells, but since then it became very obvious that it would be important to analyze the fracture treatments on also the Whiting Gallegos Federal wells.

The second thing I was asked to do was to evaluate the production and pressure history of these wells to see if there was any evidence of unusual production behavior, such as were the Chaco wells producing in a fashion that might indicate they were in communication with the Fruitland Coal?

The third thing I was asked to do was, if the second thing was true, and that is if the Chaco wells were in communication with the coal, what might be a way to allocate the amount of production that had been produced from the Chaco wells and distribute that production saying that this much probably came from the Pictured Cliffs and this much probably came from the Fruitland Coal?

So essentially, those were the three primary tasks that I was asked to study.

Q. Mr. Robinson, would you please now summarize your testimony and your conclusions, and as you do so, if it will be helpful in your opinion to illustrate your testimony, refer to your exhibits?

A. Yes. As I've said, the first thing I did was to study the hydraulic fracture treatments performed on several of these wells. And yes, I did do a fracture-model study. And I know what you're saying, Oh, geez, not another fracture-model study. But it's one of the things, it's one of the tools we use when we're studying the benefits or effects of hydraulic fracture. I've been doing this for 20-something years.

We started out -- We still used the models, but they were the simple, two-dimensional models that everybody was using 20 years ago, and as the industry has progressed into using three-dimensional models, of course, we've also adapted and started using those models.

shale layer or something like that, they just could not interpret that. But in most cases, especially in this area which you're going to see, it represents the coal. And of course you see sand down here in the Pictured Cliffs interval.

So what we do is, we divide each of those different types of lithologies into layers, and then it's our responsibility to accurately describe the mechanical properties of those layers, to put them into our fracture models. So that's where we always start.

The principal basis for our analysis is what we call pressure matching. Mr. Conway did it, I did, it's an accepted method within our industry to analyze hydraulic fracture treatment. And more specifically, we analyze what we call a net pressure. Okay? Now --

Q. As you are describing BR-2.

A. BR-2, took the words right out of my mouth. Thank you.

Mr. Conway said it -- Dr. Conway, I'm sorry. I've known Mike for a long time and I'm having trouble calling him doctor.

Dr. Conway said that the behavior of this net pressure describes the growth of the fracture that's generally accepted when you can accurately describe mechanical properties of each of those different layers.

Now obviously there are exceptions, but I'm not going to get up here and pretend to believe that I can give you a unique solution to an analysis of a hydraulic fracture treatment, no more than Dr. Conway can. But this is the accepted method for doing the fracture analysis.

What you see here, the red curve is the actual calculated net pressure observed during the treatment. The green curve, the solid line on BR-2, represents the model prediction of that net pressure. And when we can get close to the actual net pressure, then we feel more confident that our predicted fracture geometry is reasonable.

The slopes and changes that occur throughout the treatment do reflect, if they're calculated properly, they do reflect growth through different layers and different lithologies, and the model will calculate the pressure response as that fracture is growing through a layer.

So when you can match decreases and increases and, more particularly, the net pressure history, as well as what it does when you quit pumping -- which is from this point on we've stopped pumping the frac job and all we're doing is monitoring how the pressure declines -- then you can feel fairly confident that your predicted fracture geometry is reasonable.

And based on that analysis, holding up BR-3, this is the predicted fracture geometry that results. Now, over here on the left-hand side is what we call the stress profile. That is one of the most critical parameters that controls fracture growth, particularly in a vertical direction. These values represent the stress in each of the different lithologies.

This thicker gray line here, or bar, is the coal on Chaco 1. It curves at a depth of about 1100 feet.

This thinner line here is the thin coal.

Below there, there's some mudstones and sandstones that occur at different intervals above and below.

The fracture picture that you're looking at here on the right-hand side of BR-3, what you see here in black represents half of the fracture length that is propped with the sand that we're pumping in.

What you see on the right-hand side here, these contours represent the prediction of fracture growth with time. Very small at the beginning of the treatment. As you continue to pump the fracture grows out until you reach this outer contour, and that's where the extent of the created fracture was. Again, you're looking at a side view of the picture. This is how long the created fracture is in one dimension, and this is how long the propped fracture is.

Based on this analysis, it appeared that a fracture treatment created in the Pictured Cliffs sand in the Chaco 1 grew up through the coal and a little bit above the coal.

Now, I did that also for the Chaco 4, Chaco 5 and the Gallegos Federal 6-2. I used the exact same properties from well to well, I didn't change any of the different layer properties to try to fit the data. We adjusted what we knew we could, what was reasonable, to get an analysis of the data.

And in my report I present the predicted fracture geometries for all those wells, including Gallegos Federal 6-2, which is shown in BR-12. I didn't get a big blow-up of that, and I apologize. But this was a treatment created in the coal, and using the exact same parameters my model predicted a fracture would grow down into the Pictured Cliffs.

So last year I was asked on two different occasions if I thought the fracture treatments performed in the coals could grow down into the Pictured Cliffs, and I answered yes on both occasions. I'm not trying to hide anything, and I want to present those results to this Commission today that yes, indeed, my analysis did show that it potentially could grow down into the Pictured Cliffs.

Now, I didn't change anything. I could have forced it to stay in the coal if I had wanted to, if I had wanted to adjust some parameters in my model, twist the knobs, so to speak. I could have forced it to stay in the coal. In fact, after hearing all the criticism last week on FRACPRO, which is the name of the model I used, I went home this weekend and did it, and I was able to successfully model a fracture contained in the coal by adjusting the same knobs that Mr. -- Dr. Conway did.

But I guess more important than the model study -- and I'm willing to tear that out and throw it in the trash, if I can convince Dr. Conway to do it -- I looked at the actual fracture data. That's where I always start, is with the data.

And I combed the literature as well as reviewed our own internal studies and consistently found the stress in the coal to be at a level of about 0.9 p.s.i. per foot. You'll recall that Dr. Conway used something in excess of 1.1 p.s.i. per foot, because he had to use an artificially high Poisson's ratio.

There's one fundamental principle in hydraulic fracturing, and that is that the pressure in the fracture -- We're looking at different layers here, and this fracture is growing up through those layers. If the pressure inside that fracture is greater than 0.9 -- and it's not quite that simple, but for illustration purposes -- if that pressure is greater than 0.9, that fracture will continue through that zone. That's true in most sedimentary environments. It's not true in coal.

Dr. Conway has already described the processes of shear slippage and the importance of tensile strength and other factors in coal that could cause this fracture to stop. I'm not going to deny that. I know it occurs, I've seen it.

But the point is, the frac pressures in these wells, the Chaco wells, were high enough to propagate a fracture through that coal, if you use the true stress in the coal. And that doesn't take a rocket scientist to figure that out.

If the fracture gets there and stops, as Dr. Conway calculated, what happens at that point? Well, if that coal is nothing but a big blob of elastic material, that's as far as we get. No more flow going up, the fracture doesn't go any farther, and that's where it stops.

The coal isn't like that. The coal is a highly fractured, cleated formation. In fact, Mr. Cox described open fractures between 0.1 and 0.25 inches. So when that fracture hits the base of that coal and starts growing along the base of that coal, every time it crosses one of those fractures it can inject frac fluid and proppant. The fracture is already open. And all it's got to do is exceed

.9 p.s.i. per foot to open it a little bit more and inject some fluid.

Now, if it continues to inject fluid, then it's going to inflate the coal, and eventually the pressure will get too high and it can't inject any more fluid into that fracture. But then it keeps growing and it hits another fracture, and it injects a little fluid and proppant into that.

The low conductivities that Dr. Conway calculated in the top of his fracture were because he didn't allow any fluid flow up into the coal, and it happens. It happens if you've got cleats in the coal. And we know these do, or there are cleats in this area.

The second thing I looked at was the production data. And what we did was analyze the production data on the four Chaco wells to try and estimate the reservoir properties of those wells. And I think some of my numbers have been quoted in this hearing, permeabilities that I calculated up to 100 millidarcies for the Pictured Cliffs, that's true.

What hasn't been quoted are the numbers I calculated down around 25 millidarcies for the Pictured Cliffs. And if you look at the literature, you're going to be hard-pressed to find many Pictured Cliffs that are even that good a permeability. Most of the data published, that

I've found, is less than that. So this is a fairly permeable area for the Pictured Cliffs. I've done studies for the Gas Research Institute and for my firm, and in all those cases the Pictured Cliffs is really much lower permeability. So this is a fairly permeable area, but 25 millidarcies to 50 millidarcies is the real range, not 100 to 150.

Pulling up BR-16, this is one of the results from our production analysis. With a program that we have called PROMAT we can analyze production data and estimate the permeability, the skin factor and the drainage area. These are the drainage areas that were calculated for these wells based on their actual production history up to the point they were fracture-stimulated.

Okay? That's shown here by these orange circles around the four Chaco wells. 107 acres, 130 acres, 147 acres and 109 acres. There's been a lot of comments about those being too small, because this is such a permeable formation. And if these were the only four wells in the field I would agree, but they weren't. There were wells drilled all over this field.

If you look at BR-19 (d), we see that -- and I'm going to explain the legend. The green dots represent producing Pictured Cliff wells that lasted between 16 and 20 years. The black dots are producing wells, but ones that have not produced for that period of time. They have been on three years; they haven't produced 16. The red wells are specifically Pendragon wells, Pictured Cliffs wells. And you see these plugged-and-abandonment symbols scattered throughout this entire area. Of course, that's essentially a plugged-and-abandoned well.

So what you find is, if you look at -- go back to BR-16, is that there are plugged-and-abandoned wells all over the place here, that had produced 10, 15, 20 years, and it depleted the Pictured Cliffs in this area.

Let's look here. In Section 1 we've got one P-and-A'd well here, we've got another P-and-A'd well down here, we've got one over here in Section 12, one down here, one over here in Section 7, here, we've got several over here in 17.

And so you start looking at this and you say, Okay, well, wait a minute. I've got wells basically all around here that have produced for between 16 and 20 years in the Pictured Cliffs, and several still producing. You look at this. So how can you only drain 160 acres, 140 acres? It's simple, well spacing. The wells are drilled on 160-acre well spacing.

But actually, concentrated right in here you find there's actually an average, or has been an average, of five wells per unit, per section, if you look at it on a historical perspective. So the actual average density is probably less than 160. So I didn't feel uncomfortable at all saying these wells can only drill [*sic*] 100 to 150 acres. That's what the well spacing was for the field.

If you look at BR-18 in my report, what you find is a comparison between what I calculated to be the original gas in place on these wells, based on this production analysis, compared to their actual production as of May of 1998. The only way those wells could produce significantly more gas than the gas in place is to have achieved or to have communicated to a different gas source after hydraulic fracture stimulation, which was early 1995.

So since January or May of 1995, production has substantially increased. Let's look at that.

I'm holding up BR-24, which shows a comparison between the four Chaco wells -- this is zero-time average production wells -- compared to the remaining Pictured Cliff wells, not including the four Chaco wells. The green dots represent zero-time average production plot for a Pictured Cliffs well in this area. The red dots, the four Chaco wells.

You see here, essentially at zero-time, they were all about the same in their performance. As we go off in time, the Chaco wells decline a little faster. Why is that? Pendragon says that's due to damage. I say it's due to depletion due to the intense development in this area and drilling around their wells.

There were -- I don't remember the number. Oh, here it is. There were 34 wells drilled in a 12-section area around the Chaco wells, there were 34 wells drilled in the period from 1976 to 1979, the same period the Chaco wells were drilled. That's fairly intense development when you look at where those wells were. They were all surrounding the Chaco wells. So my contention, it was just normal interference due to pressure depletion.

All right, let's go out here to about year 17 and look at what they did after the hydraulic fracture treatments. Before fracturing they were producing, on average, 20 to 30 MCF a month. After fracturing they jumped up here to over 10,000 MCF per month. Now notice -- and lawyers hate logarithmic scales, but this is a logarithmic scale. So we start here, we go up a factor of 10, we go up a factor of 100, we go up a factor of 500-fold increase in production, in the average production of these wells.

And that doesn't even account for the pressure increase. As stimulation engineers and completions engineers, we look at the productivity. And you have to take into account the pressure. So the productivity of these wells is several thousandfold over what they were prior to stimulation.

And I've never seen, in my 20 years, a well that has increased several thousandfold that was fracture-stimulated in the same zone. Now, I've seen it when they fracture into new zones, but not in the same zone, it's impossible. I've never seen it in 20 years.

And that's a real key. It's got to be in the same zone. Somebody will show me a picture, probably, later, where the fracture grew up into a new reservoir, and they may have a comparable production increase. It doesn't work that way.

This is an average zero-time plot for the Whiting well. I just wanted to show you what the average production was on the Whiting wells, about the time Pendragon fractured their wells. 10,000 MCF a month, almost the exact average production that Pendragon wells went to after they were fracture-stimulated. And that was BR-25.

Now, I said earlier that I believe that decline in production -- and the Pendragon wells at the time they were fracture-stimulated, they were pressure-depleted for all practical purposes. The pressure wasn't down to zero in the reservoir, it still had maybe 80 to 100 p.s.i., but it was not economically feasible to produce those reserves.

Pendragon contends that that's due to damage.

And I've heard three different reasons or three different possible damage mechanisms: scale, fines migration and water block. And I can tell you right now, all three of those cannot happen in this reservoir. They can happen in the near-wellbore area only, except even a water block won't necessarily happen in a near-wellbore area, I don't believe that. The other two won't happen as deeply into the formation.

I think even Mr. McCartney in his analysis assumed the entire reservoir permeability was going to decrease down to some 10 or 15 percent of the original value. That won't happen, due to scale deposition. It can't. Scale deposition occurs as a result of temperature and pressure changes, and they've got to be pretty significant, like you get near a wellbore.

Just a few more points, I promise.

There's been reference to the permeability of the coal being only 20 millidarcies and maybe even as high as 50 millidarcies. At my request, Whiting performed an injection falloff test on one of their Gallegos Federal wells. It's a pressure transient test that's commonly used to calculate the permeability of a formation.

And they were hesitant at first to do it. The question was, well, what if we find out that Mr. Cox is right? And I said I didn't care, I want to know what the permeability of the coal is, then we'll know who's right. And so I convinced them to go out and do that.

And the permeability of the coal, based on that injection test, is about 200 millidarcies. It's a highly permeable coal, which is to be expected. You get, really, the same number if you just take the production data and calculate the permeability, as long as you use the right reservoir pressure and the right flowing pressure, you get the same number, 150, 200 millidarcies.

So you've got two different methods that give you about the same permeability.

So what are my conclusions? Well, the Chaco wells have communicated with the coals. I had five different pieces of evidence. And I'm going to throw out the fracture model, so I'm down to four. Okay?

Let's look at the basic data. The frac'ing pressures that were reported on the well were sufficient to open the cleats and inject proppant and fluid into the coal, definitely, based on all the literature I've seen as to the true stress in the coal.

Second thing is the post-fracture production on the Chaco wells. The production alone is a 500-fold increase. If you look at the productivity, it's several thousandfold increase. That's abnormal, that just doesn't happen.

The pressure measured on all the Chaco wells now is also about what it is in the coal, and you've heard all sorts of arguments about fluid levels and this and that and, well, this pressure was measured before or after the frac. After the frac, the pressures in the Chaco wells are about equal to the pressure in the coal. And the production after the frac was almost identical to the average production in the Fruitland Coal, after the fracture treatment of the Chaco wells.

So based on those facts, you know, I've concluded that the Chaco treatments did communicate to the Fruitland Coal.

So what did I do then to try and determine how much Fruitland gas Pendragon may have produced? Well, that's a tough, tough number or series of numbers to come up with. It would take a fairly intensive reservoir study.

So I started out by just looking and allocating the production based on my estimate of gas in place in the Fruitland and the Pictured Cliffs at the time Pendragon did their fracs. I said, All right, there's so much gas here, there's so much gas here, in these two different formations. So I tried to allocate the production based on that, and that's shown on my last table, BR-29.

In addition to the first column, which shows the well, I show the -- in the second column there, the amount of Pictured Cliffs gas produced pre-fracturing, prior to 1995 on the four Chaco wells. Then I've noted the total gas produced as of May of 1998. So I subtracted those two values and came up with the amount of gas produced since the fracture treatments.

Now, I took a couple of different gas contents to try and estimate some conservative values for the gas in the coal, and that's where I get my minimum and maximum allocation. One is based on 80 standard cubic feet per ton and one is based on 100 standard cubic feet per ton.

So I said okay. I subtracted out the amount of gas that I thought was coming from the Pictured Cliffs based on these allocations and then came up with the total amount of gas that I believe has been produced from the Pictured Cliffs and the Chaco wells since the fracs, and that's that column labeled "Total Production, Pictured Cliffs", and there's a range of values there.

Now, if you look at the recovery efficiencies, which is the next -- two columns over, sorry -- for the Pictured Cliffs, you get anywhere from the low 60s for the Chaco 2-R into the mid-80s for recovery efficiencies on these Chaco wells. That is the most gas you could ever expect to produce out of a well, absolute maximum.

So after calculating that, I took what's been produced since the fracs, subtracted it, and came up with my far right-hand column, which was my estimate of how much gas came from the Fruitland. And as you can see, adding the numbers up quickly, it's about a BCF of gas.

And I'm finished.

Q. (By Mr. Gallegos) Okay. Before I ask you to address specifically some of the testimony of the Pendragon witnesses, let me just get a little more clarification on some things you've told us about.

You showed us a fracture model, I think, of the Chaco 1, with your circles from the FRACPRO simulation, but I'm putting WA-3 up here because we've been looking at this quite a few times through this hearing, and it might help if you can now tell the Commission in terms of looking at these relative formations, what was the fracture growth calculated by your simulator on these various wells, if you could --

A. Okay.

Q. -- point that out to the Commission?

A. Yeah, I'd already previously marked this exhibit with the top of my fracture, so you can see it over here on the Chaco 1, this squiggly red line at a depth of about 1050 feet maybe, at this point, slightly above the coal.

And the Chaco Number 4, the estimated top of the fracture was here around 1150 to -60, maybe -- I'm sorry, maybe like -30, 1130.

And then here on the Chaco Number 5 about 1130 also, feet, above the coal.

Q. There's not a -- That cross-section does not include the Gallegos Federal 6 Number 2?

A. I don't see it, no.

Q. Okay, all right.

A. And the fracture, of course, extended down to the bottom of the Pictured Cliffs and terminated at some point in the Lewis shale.

Q. Okay. If the fracture on the 6 Number 2 grew down into the Pictured Cliffs and the fractures applied by Pendragon to the Chaco 1, 2-R, 4 and 5 grew up into the Fruitland Coal, then where does that leave us in regard to the contention of Pendragon that because of the fracture on the 6 Number 2, Whiting has been producing Pictured Cliff gas?

A. Well, Whiting hasn't been producing any Pictured Cliffs gas. I mean, they are just now getting even close to drawing down the reservoir pressure in the Fruitland Coal to a point near what the Pictured Cliffs is. The Pictured Cliffs reservoir pressure, as I said, was maybe 80 to 100 p.s.i. at the time all those wells were abandoned that were on the previous exhibit.

So I mean, there's -- They just haven't produced any Pictured Cliffs gas.

Q. Did you have an exhibit that would demonstrate what we might call the physics of how the gas would flow if you have those fracture conditions?

A. Yes, there's an Exhibit BR-26, and what it shows, very simple two-well scenario. The well on the left-hand side would represent a Pictured Cliffs completion, the well on the right-hand side would represent a Fruitland Coal completion.

If you look at the left-hand side, the gray area is supposed to represent a fracture that's extended up through the coal. Same thing on the right-hand side, the gray area represents a fracture that's extended down into the Pictured Cliffs.

Anytime the Pictured Cliffs wells are producing, they're able to flow Fruitland Coal gas because, a), the Pictured Cliffs is not producing much, it's basically depleted, and they're able to draw their flowing bottomhole pressure, which is represented by the P_{wf}, draw that down, creating a pressure sink that would allow crossflow of the Fruitland Coal gas and water.

Over on the right-hand side we look at one of the Fruitland Coal completions, and only at the point where the flowing bottomhole pressure on a Whiting well is less than the Pictured Cliffs reservoir pressure would you get crossflow. Any point above that, you don't get any crossflow, or no Pictured Cliffs gas moves up through the Whiting wells, and they're going to continue to produce predominantly Fruitland Coal gas and water, because that's where the path of least resistance is.

I've got some other examples that show in the Fruitland Coal you're going to have a much wider fracture, and of course you've got several hundred millidarcies, compared to maybe 25 or 50 for the Pictured Cliffs, the path of least resistance for all the Fruitland Coal gas is into the Whiting wells.

Q. Okay. Now, Mr. Robinson, let's say it's July, 1998, and we draw a line across this wellbore over here on the left because we're shutting in the Chaco wells. Then what happens?

A. In terms of --

Q. Well --

A. -- anything?

Q. -- will it change anything?

A. The pressure in the Fruitland is still higher than the Pictured Cliffs, so gas continues to cross-flow down into the Pictured Cliffs from the Fruitland, and it will continue to do so until it pressurizes the Pictured Cliffs to the same level as the Fruitland Coal. I mean, you're basically taking gas from one tank and filling another tank, and it's going to continue to do that until those pressures become equal.

But now --

Q. Okay, I was going to say, but now, now here in the summer of 1999, we've really been pulling on that coal formation, pulling that pressure down, and --

A. Whiting is probably just producing gas that they injected into the Picture Cliffs for, you know, the previous year, and whatever crossflow prior to that. I don't know how much it is, but I mean if they've been injecting gas all this time, for a while all they're going to produce is produce the gas they injected, back into the Pictured Cliffs.

Q. Okay. Now, I want to ask you, you alluded to the 200-millidarcy value for the permeability of the coal and mentioned injection tests. Can you tell the Commission more about what that test is? And we've already heard that there were actually two tests taken --

A. Right.

Q. -- in order for you to get your information? Can you discuss that?

A. Yes. After pulling a few teeth and twisting a few arms we decided to go out and conduct the test. As Mr. O'Hare described last night, there were some mechanical problems on the first test where they didn't shut the valves correctly, and it appeared that there was a possible leak somewhere in the system. The pressure data that we got was very abnormal during the early part of the test, and so we didn't feel comfortable with the analysis, so we convinced Whiting to go back and re-do the test and sort of re-plumb and re-plan their field operations so that we'd get better data.

We went ahead and analyzed the tests. I don't have it here with me. Again, I didn't feel comfortable with it. We actually got a higher permeability on that test than we did on the second test, so -- I mean, the numbers were probably okay, but I felt more comfortable with the second test where we got 200 millidarcies.

We did, just to draw a little picture of it, we actually -- what I want to call an injection falloff test. It's been referred to as slug test. That's a different kind of test, actually.

But if you look at a plot of pressure versus time, we started injecting gas -- and by the way, that was into the Gallegos Federal 26-13 Number 1-1. It's up here in the northeast quarter of Section 1.

And the reason I picked that well is that that seemed to be the only well that everybody could agree on that wasn't communicated with the Pictured Cliffs. And so I said, Okay, let's go perform a test on a well we know we're going to measure the permeability of the coal.

So we started injecting gas, and the pressure in the well would start increasing. You inject gas for a little while, you quit injecting gas, at that point the pressure starts to decline. It's called a pressure injection falloff test. And we can take these data and analyze them and calculate permeability.

It's a real simple concept, because if a well can flow 600 or 700 MCF a day at a certain type of pressure, let's inject 600 or 700 MCF a day and measure that pressure. And so we're really -- We're reproducing the production of the well kind of backwards.

So we measure the pressure. And somebody asked, well, why did you choose 700 MCF a day? That was based on the actual production rate on the well. And I wanted, you know, kind of -- things to be on an even keel. So that was the purpose of the rate selection.

And we took that data, we analyzed it, had one of our engineers who's an expert in coalbed methane reservoir evaluation look at the data, I looked at the data, we analyzed it with five different reservoir models. We looked at the injection part, we looked at the falloff part, and we got a permeability in all cases ranging from 180 millidarcies to 250, something like that, within that range. Very consistent analysis.

I've got the analysis with me. In fact, I've got everything with me. I don't want to be accused of trying to hide anything from anybody anymore, so I'll be glad to share those results with the Commission and anybody else.

Q. Okay, Mr. Robinson, let's turn to your fracture-simulation studies and those that were done by Dr. Conway.

First of all, I notice that when he selected a coal well to do, he selected the 6 Number 2, and you selected the 6 Number 2. Did you choose the 6 Number 2 for a particular reason?

A. Well, the reason I chose it is because it was right in the heart of that area that seems to be the real area of conflict. You've got the Chaco 4 and 5, you've got the 6-2 and the 12-1. I mean, there's that sweet spot that everybody's been talking about. And so I said, Well, let's look at the 6-2, that's right there.

You know, I didn't choose it because Dr. Conway did or anybody told me to. You know, it just was -- It was right there in that area everybody seemed to be interested in.

Q. Right around the Chaco 4 and the 5, which have shown remarkable production increases? The hot spot, so to speak?

A. The sweet spot --

Q. Okay.

A. -- I believe people have been calling it.

Q. Now, did you notice that the Chaco well that Dr. Conway selected to use to examine the fracture stimulations on those wells was the 2-R?

A. Yes, I did.

Q. And are you -- And you're aware, are you not, that the 2-R, of the four wells fracture-stimulated, is the only one that does not have perforations up in the Fruitland sand, it is only perforated down in the main Pictured Cliffs?

A. Yes, I'm aware of that.

Q. And it's not in the sweet-spot area, is it?

A. It's not, no.

Q. Okay. My copies of this are kind of messy, but I'm going to hand you Exhibit C-7, which was his first study on the Chaco 2-R.

And then C-23 we saw today, where he changed the Poisson's ratio.

C-13 is his first study on the 6 Number 2 coal well where the fracture was contained, couldn't get it to go out of the zone.

And then C-16 is where the 6 Number 2 goes out of zone because it changes various properties at 750 feet.

Do you remember those various studies?

A. Yes, I do.

Q. All right. Now, let's start out, let me ask you, Dr. Conway used a stress in the coal of 1.1 p.s.i. per foot, and he assumed a Poisson's ratio of .05 for the coal.

A. .5.

Q. .5, 0.5, I'm sorry.

A. Yes.

Q. Are those stress values correct?

A. No, I don't believe they're correct at all.

Q. Okay. What would have been the correct values to have used?

A. Well, as stated earlier, based on information that I've been able to find in the literature and actual measurements that my company has done, you know, the stress in the coals typically is on the order of .9 p.s.i. per foot, occasionally pushing up to 1.0 p.s.i. per foot.

There's no reason to believe the stress in the coals can be represented by a Young's modulus of .5. That's the maximum theoretical value possible.

And I know why Dr. Conway did it, and that's okay. He had to use that high of a stress to be able to reproduce the pressures in his match. And the reason is, he can't model all the physical things that are going on when you're fracturing a coal. There are so many different mechanisms at work there, there's not a single model that can do it all. So you adjust certain parameters to be able to achieve the pressures that you're looking for.

And, you know, that's what I think he did, and that's okay, but 1.15-p.s.i.-per-foot stress in the coal is not possible. It's more like .9- to .95-p.s.i.-per-foot stress gradient.

Q. Do you recall that at various places in Dr. Conway's testimony he referred to papers by Ian Palmer and also, I think, some Palmer and Johnson papers?

A. Yes, I do.

Q. And does that literature have a considerable amount of information on the stress values, Young's modulus, Poisson's ratio, for the particular rock formation we're interested in?

A. Yes. In fact, Ian Palmer and both Johnson go to great lengths of expense and study to determine the properties in the coal and the shale and the sandstone. And the values that we used were those same values that they reported in the literature.

Granted, those formations were deeper. And I'm not going to sit here and argue about Young's modulus, whether it decreases with depth or anything like that. That's not really at issue. You have a large contrast in Young's modulus, which is nothing more than a measure of the stiffness of the rock. And that contrast can be -- I mean, Palmer cited a factor of 10, regardless of depth. So I used that same ratio, a factor of 10. Dr. Conway used a factor of 5. Doesn't really matter.

What really matters is what's the real stress in the coal, and can that fluid, when it gets there, open up those cleats and inject fluid and proppant? And all it has to do to inject that fluid is overcome a stress of .9 p.s.i. per foot.

You've already seen Dr. Conway's numbers. My numbers are in my report, I think, on page -- Let's see. I don't have my report with me, unfortunately. I think it might be page 6, there's a table of the fracture gradients, and they're all, with the exception of the Chaco 1, in excess of .9. And the Chaco 1 is .85, so it's pretty close, and I'll arm-wrestle over whether or not that's enough to get some fluid.

Again, Mr. Cox said the fractures are already open, and they are. They're already open. So you don't have to really overcome the stress to even inject the fluid and proppant. But you get more in there, of course, when you do.

Q. Even if Dr. Conway wanted to use the 2-R as his experiment, even though that has the perforations only down in the Pictured Cliffs, if he had honored the rock properties set forth in the Palmer papers, what would have happened to his fracture on the Chaco -- on that Chaco well?

A. Well, I think he would have shown that it grew through the coal. But, you know, there's another knob on the tensile strength between the two different formations and the shear slippage that occurs at that coal/shale interface -- you know, I think he described it in one of his exhibits -- that will allow that slippage to occur when you go from one rock to a different rock. You know, if you allow that to occur it might not grow through the coal. But -- I think it would, but that's just my opinion.

Q. Well, let me ask you to just assume that -- leave the properties the way you had it, and you've got a fracture running along the -- right along the base of the coal, crossing all those cleats for --

A. -- 500 feet.

Q. -- 500 -- well, or longer, I guess it was, wasn't it? 350 in each direction?

A. Well, his initial analysis on 2-R showed about 250 feet --

Q. All right, five --

A. -- half-length, which would be 500 feet from tip to tip.

Q. Okay, 500 feet. Describe what would happen in terms of fluid from that fracture treatment moving up into the coal and what would happen as to whether or not that would open a pathway for pressure and gas to flow from the coal into the sandstone.

A. Well, as I said, you've got -- Let's see if I can draw this now. Look at a three-dimensional picture of the bottom of the coal. This the coal here, and you're kind of looking at the bottom of it.

So we've got this fracture now that's growing, and of course the coal has open cleats -- some of them are closed, some of them are open. They have to be, they're full of water.

Now you've got a fracture growing up and intersecting those coals. As I said before, it's going to inject proppant and fluid into that cleat, and as long as it's in excess of .9 p.s.i. it will inflate that fracture open even more and inject more and more proppant.

So what happens then -- Let's look at a more two-dimensional view. Here you have the coal, and whatever's in between that and the PC, you've got this fracture butted up right up next to it, growing down here. It's about a half inch to .6 inches wide. You've got fluid flow going up.

The reason Dr. Conway's model doesn't calculate very much proppant in the top is because there's no fluid flow. It can't flow up, because it doesn't take into account all the fluid and proppant flowing up into the coal.

So now when you do that, you get a lot more proppant up here. You create a conductive path for the Fruitland Coal gas to flow down into the Pictured Cliffs.

Q. Mr. Robinson, I asked Dr. Conway if he thought there was such a big stress differential so that the coal was a stress barrier with this fracture going up to it, would there be a likelihood that the fracture, meeting such a barrier, would go horizontal, what I'd say become a T. Are you familiar with that --

A. Yes.

Q. -- kind of geometry occurring?

A. Oh, sure, yes. It can happen in coals, it's been observed -- I wouldn't say many times, but certainly enough times to have people studying the phenomenon that causes the creation of the T-fracture, basically, when a fracture grows up vertically and then starts growing horizontally along a plane, and the same phenomenon at the bed interface, that same shear slippage and the plastic properties of the coal that cause that shear slippage are the same ones that cause the T-fractures, you know, in a simplistic point of view.

It's more complicated than that, but if you're going to have shear slippage, then there's a good chance you might have a T-fracture. And so now you've got not just a half-inch-wide crack intersecting these natural cleats, you actually have a horizontal fracture that might cover tens of thousands of square feet of coal surface.

Q. Okay. Now, our clients like Dr. Conway's C-13 better than your work. That was what I think, if I got the exhibit right, where he couldn't force the fracture out of the coal. He had to make some big changes.

But your fracture simulation that you showed us, which was your Exhibit BR-12, does show a growth out into the Pictured Cliffs. Do you have an explanation for why that difference, or is that just a difference between the GOHFER and FRACPRO?

A. There's some fundamental differences between GOHFER and FRACPRO, no question about it. You know, FRACPRO won't model the shear slippage that occurs at the bed boundary like GOHFER can, although you can fake it into doing that. I did it this weekend, you know, and as a result I was able to get a fracture to stay contained in the coal, just like Dr. Conway's Exhibit C-13.

So you can twist a few knobs and trick your models into doing certain things. I increased fracture toughness in the layers above and below, which is essentially the same as his shear strength.

So, you know -- But I didn't do that, and I kept the properties the same as I had used for the Chaco wells. And as a result of the high pressure that exists in the frac jobs -- and by "high..." -- I had to model four fractures to get the pressure that high. And I didn't feel uncomfortable doing that at all because, if you read the literature, you get multiple fractures in almost every coal frac, almost every one. So it took four fractures to model the pressure.

Q. I'm glad you brought that up. There was considerable discussion, I guess mostly by Dr. Conway, about what high fracture gradients are necessary to propagate fractures in the coal. Is that because you're not growing a single fracture as you do in your conventional reservoirs?

A. Exactly. I mean, in most coal reservoirs -- and you can always find an exception to everything, you know, you can always pull up an article, well, look what this guy wrote. But in most coal reservoirs, everything that I've seen, the fractures look kind of like my BR-14, where you have -- Imagine yourself in the wellbore, sort of looking out into the coal, and you're seeing these multiple fractures propped open with proppant. There could be parts of the coal where you get the horizontal component occurring.

This is what this part down here at the base, this is what we would call the T-fracture. It can happen at the top or bottom, but it's most likely to happen at the top for a fracture in the coal.

So you get these multiple fractures occurring. And, you know, that's really what will generally happen. That's why it's so complex to try and model this type of behavior, there's just so many different mechanisms occurring.

Q. Just one other item of Dr. Conway's testimony I want to ask you about, and that is that -- he said it some way that -- this way, that only skeptics don't believe that tracer surveys detect fracture-height growth.

A. Right.

Q. Are you a skeptic?

A. No, my opinions on gamma-ray tracer logs and temperature logs was formed long before I was doing any fracture-modeling with 3-D models. And that's the extent of his comment, was that you're skeptical because the tracer log doesn't match your fracture model, and so I don't want to believe the tracer log.

Well, when I went to work for Holditch in 1979, I wanted to be one of the best stimulation engineers I could possibly be. I was going to work for, basically, a legend at the time. So I read all of the literature I could find on fracture-stimulation.

And there were two guys who were sort of turning our industry upside-down at that time by the name of Ken

Nolte and Mike Smith. They had published a series of articles about that time, so I studied their work very diligently, as did the rest of the industry.

And I don't know if I have it or not but back in 1981, before we even did fracture-modeling, Dr. Nolte said that gamma-ray and temperature logs will always give you an optimistic estimate of fracture containment, and be careful with them because they will be misleading. That was 1981 and 1982.

And ever since then, I have been skeptical. I adopt the philosophy that Dr. Palmer said in his paper, and that is, if I've got a well and I've got these different zones here, different layers, and let's say I go in here, I perforate and frac that zone right there.

All right, now I inject radioactive material and then I run one of these gamma-ray temperature logs. If that temperature log or that gamma-ray log says there's radioactive material, then I believe that's the height. I feel comfortable saying I think the fracture exists at that depth.

But if I don't see gamma-ray material at that point, say here, I don't know whether the fracture is there or not, and I can't say for sure. That's the exact philosophy of Dr. Nolte and Dr. Palmer. And if they're skeptics, then I guess I am.

MR. GALLEGOS: Madame Chairman, I think everybody's fading out at this time, except Mr. Robinson.

(Laughter)

MR. GALLEGOS: And I've got a whole different area to go into, so would this be a good time to fill up the fuel tank?

CHAIRMAN WROTENBERY: I think it will be a good time to call it a night.

MR. HALL: May we be provided with the data Mr. Robinson said he'd brought with him?

CHAIRMAN WROTENBERY: Is this the data on the inject- --

MR. HALL: On the injection falloff test, yes.

MR. GALLEGOS: We gave you that.

MR. HALL: The analysis as well.

MR. GALLEGOS: Analysis?

THE WITNESS: Sure.

CHAIRMAN WROTENBERY: We've got several things pending. I think we've still got some water-analysis information --

THE WITNESS: Which one do you want?

CHAIRMAN WROTENBERY: -- that was requested. We can --

MR. HALL: I've got two tests --

CHAIRMAN WROTENBERY: We can -- Do you want to do that now or in the morning?

(Off the record)

THE WITNESS: Okay, there's one analysis of the injection part.

CHAIRMAN WROTENBERY: Can the rest of us go? Do we need to wait to work this out?

Okay, we'll start back up at 8:30 in the morning. Dress will be casual. Any other questions?

MR. GALLEGOS: Can we start about six?

CHAIRMAN WROTENBERY: 6:00 a.m.?

MR. GALLEGOS: Sure.

MR. CONDON: Could we just have an idea -- I mean, Mr. Hall has made reference to the fact that he wants to call rebuttal witnesses. Could we have some idea of what he contemplates in terms of that rebuttal?

MR. HALL: Well, I intend to rebut some of the comments your witnesses have made.

MR. CONDON: Well, who are you going to call?

MR. HALL: More than one of my experts and two additional fact witnesses to rebut some --

MR. GALLEGOS: Do you mind telling us --

MR. CONDON: You can't tell us who the experts are going to be?

MR. HALL: I haven't decided. I don't want to say all of them at this point. I suspect we'll have Dr.

Conway, Mr. McCartney, Mr. Nicol, Mr. Whitehead.

MR. CONDON: Well, are we going to have an opportunity for re-rebuttal then?

MR. HALL: No, I mean, that's not provided for under Rule 40, that's not done.

MR. GALLEGOS: Well, except that we have the circumstance here, the prefiled testimony. So you had an opportunity for rebuttal on your case, just as we have had on our case, and I think we should have a real limit on that, especially the way this keeps going on and on.

MR. HALL: I think we should follow the protocol under Rule 40. We're on your case now. We get rebuttal after that.

MR. GALLEGOS: Well, there's such a thing as surrebuttal, then.

MR. HALL: We can go on forever and ever.

MR. GALLEGOS: Yeah, if you keep calling your witnesses back.

MR. CONDON: I mean, Pendragon did have the advantage of -- I mean, our theory has been consistent throughout the case, so it's the same, essentially the same case, with some additional facts, that we put on in 1998. We're dealing for the first time here with the new theory.

MR. HALL: Surrebuttal is not appropriate.

MR. CONDON: Sure it is.

CHAIRMAN WROTENBERY: I mean, we did talk about this early in the hearing, that we set it up so that Mr. Hall would have a chance for rebuttal after the close of the Pendragon case.

Let's go through that in the morning and see where we stand.

See you at 8:30. Thank you.

(Thereupon, evening recess was taken at 7:15 p.m.)

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CERTIFICATE OF REPORTER

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Commission was reported by me; that I transcribed my notes; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

WITNESS MY HAND AND SEAL September 20th, 1999.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 2002