STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

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 II

EXAMINER HEARING

BEFORE: DAVID R. CATANACH, Hearing Examiner

July 29th, 1998

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Division, DAVID R. CATANACH, Hearing Examiner, on Wednesday, July 29th, 1998 (Vol. II), 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

July 29th, 1998 (Volume II)
Examiner Hearing
CASE NO. 11,996

(Continued...)

WHITING/MARALEX WITNESSES:

BRUCE WILLIAMS (Engineer)

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E X H I B I T S

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A P P E A R A N C E S

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and
MICHAEL J. CONDON

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District Supervisor
Aztec District Office (District 3)
NMOCD

ERNIE BUSCH
Geologist
Aztec District Office (District 3)
NMOCD

* * *

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

EXAMINER CATANACH: Okay, we'll reconvene the hearing in this case, 11,996.

Just for the information of the audience, it looks like we'll probably go at least most of the day tomorrow with this case. We're going to try and finish up by tomorrow evening, so -- and not have to go into Friday, but -- We'll do our best to see what we can do about that.

Mr. Hall?

MR. HALL: At this time, Mr. Catanach, we call Paul Thompson.

PAUL C. THOMPSON,

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

DIRECT EXAMINATION

BY MR. HALL:

Q. For the record, state your name, please, sir.

A. Paul Thompson.

Q. Where do you live, how are you employed, and in what capacity?

A. I live at 5423 Foothills drive in Farmington, New Mexico, and I'm the President of Walsh Engineering and Production Corp.

Q. And have you previously testified before the

Division and had your credentials accepted as a matter of record?

A. Yes, I have.

Q. And what is your professional background?

A. I have a bachelor's of science in chemical engineering from New Mexico State University, I'm a registered professional petroleum engineer in the State of New Mexico, and I've been working in the San Juan Basin since 1979.

Q. And are you familiar with the wells and the lands that are the subject of the Pendragon/Edwards Application?

A. Yes, I am.

Q. Do you operate those wells?

A. I'm the contract pumper. Pendragon is the operator.

MR. HALL: All right. We'd tender Mr. Thompson as a qualified engineer.

EXAMINER CATANACH: Any objection?

MR. GALLEGOS: No objection.

EXAMINER CATANACH: Mr. Thompson is so qualified.

Q. (By Mr. Hall) Mr. Thompson, can you tell us something about the Chaco wells? When exactly did you assume responsibility as a pumper for the Chaco wells?

A. I can't say exactly. Keith Edwards purchased the wells, I believe, sometime -- He started purchasing the

wells in this area sometime in 1993. I don't remember the exact date of these particular wells.

Q. All right. After you were contacted to serve as pumper for these wells, how long was it from that point until the frac jobs were performed on the wells?

A. I can't say that either. I guess it wasn't a very long time from the time that Pendragon became involved in the situation until we frac'd the wells.

Q. All right. Are you aware that Whiting Petroleum and Maralex Resources have alleged that certain of the wells, the Chaco wells, were perforated directly into the main coalbody?

A. Yes. At the request of Pendragon, they asked me to pull the tubing in the wells and run a gamma-ray collar correlation log to confirm the location of the perforations.

Q. All right. Let's refer to what's been marked as Exhibit T1, if you could identify that, please, sir.

A. This would be the gamma-ray collar correlation log for the four wells, the Chaco 1, the 2-R, the 4 and the 5.

In all cases, we could pick up the perforations. They were as reported on the completion reports, the original completion reports filed by Merrion. Two of the wells that were frac'd through the existing perfs, we

didn't reperforate at all. And the 4 and 5 we reperforated in the same places where Merrion had, and our perfs show up exactly where they should be.

Q. Did you witness these casing collar surveys?

A. I witnessed three out of the four. My brother John witnessed the fourth one, and Mr. Chavez with the Aztec Office of the OCD witnessed all of them.

Q. All right. What date were they performed, approximately?

A. The first week in June.

Q. Mr. Thompson, let me hand you what's marked as Exhibit T2. Can you identify that, please, sir?

A. These are the four original completion reports filed by Merrion Oil and Gas on the -- Well, actually, I think there's six of them here, on the six Pendragon wells in question.

Q. And you've seen these reporting forms before, have you not?

A. Yes.

Q. And do all of those reporting forms, completion reports for the Pendragon/Edwards wells reflect that they are completed in the Pictured Cliffs formation?

A. Yes, they do.

Q. Can you give the Hearing Examiner a general idea of the condition of the Chaco wells when they were taken

over by Edwards and Pendragon?

A. Actually, they were in pretty bad shape. I think that the Merrion people had neglected the area, the best we could tell. We spent some time originally soaping and blowing the wells, getting them kind of cleaned up. It seemed to have some beneficial effects on the initial production. There was a lot of stuff we had to do: fix valves, separators that weren't working, et cetera.

Q. Do you operate a number of other Pictured Cliffs wells in the area?

A. In this area we operate -- my company operates about 45 Pictured Cliff wells and about 40 additional Fruitland Coal wells.

Q. All right. Overall in the Basin, can you estimate how many Pictured Cliffs wells you've operated?

A. I'm just guessing we operate probably 150 Pictured Cliff wells and probably 75 Fruitland Coal wells.

Q. All right. Based on your experience over the years operating Pictured Cliffs wells, can you say whether these Chaco -- Pendragon Chaco Pictured Cliffs wells are modeling as a typical Pictured Cliffs well?

A. Based on the lack of any substantial water production from these wells, qualitatively I'd say that they act more like a Pictured Cliff well than the Fruitland Coal wells in the area that make considerably more water.

Q. All right. By the way, are you familiar with the Whiting/Maralex coal wells that are involved in this proceeding?

A. I drilled most of those wells in 1992.

MR. HALL: That concludes our direct of Mr. Thompson.

Move the admission of T1 and T2.

EXAMINER CATANACH: Exhibits T1 and T2 will be admitted as evidence.

Mr. Gallegos?

CROSS-EXAMINATION

BY MR. GALLEGOS:

Q. What's substantial water production, Mr. Thompson, when you use that term?

A. You know, 30 to 70 barrels of water a day.

Q. It was your responsibility, from the time you took over these Pendragon wells, to record and report the water production; isn't that true?

A. Yes, sir.

Q. And the -- You're familiar with the Form C-115 of the Commission which, among other things, requires the reporting of the water production?

A. Yes, sir.

Q. Okay. There are, on the locations for the Pendragon wells, sizeable unlined pits, are there not?

A. In my opinion they're small unlined pits.

Q. Well, what are the dimensions of those pits?

A. I'd guess 10 by 10, 12 by 12, something like that.

Q. And the depth?

A. Four to five feet.

Q. Are those pits permitted for water disposal?

A. I believe they are.

Q. Did you or your pumpers measure or approximate the water production from the time you took over these wells?

A. Not really. You know, the way the wells are set up is, they flow a separator which dumps occasionally into an unlined pit. There's no real way to accurately gauge the water. You know, we had a foot or two of water in the pits, there didn't seem to be any huge amount of water. We felt like it was less than five barrels of water a day, and frankly we didn't take the time or go to the expense of trying to measure it.

Q. Let me show you what's marked as Exhibit 44. I represent to you that this is a charting of the reported water production on the Chaco wells.

Do you recall, Mr. Thompson -- does this -- Do you have any disagreement with this appearing to be what I represent it to be?

A. I don't have the pumper reports, so I can't say.

Q. Now, you will recall that in February of this year, 1998, officials of the NMOCD came out to do an inspection of these wells; is that true?

A. As part of our data-gathering procedure, we went to these and all -- a bunch of wells out there and collected gas samples and water samples and rates, yes, sir.

Q. And suddenly in February of 1998, there is reporting of water production on the Chaco 2-R, the Chaco 4, the Chaco 5.

MR. HALL: Mr. Examiner, let me state an objection at this point. I think it's inappropriate to examine the witness on an exhibit and data which the witness says he can't authenticate.

MR. GALLEGOS: Well, this is from your files, from the Pendragon files.

MR. HALL: We don't know that, is the problem. He said he can't verify that. This is something prepared by someone else. I mean, that's the problem, Mr. Examiner.

MR. CARROLL: Well, if he can't verify it, he can't verify it. To the best of his knowledge, he --

MR. HALL: He can testify to the best of his knowledge about water production.

MR. GALLEGOS: We'll tie this up. I represent

that we'll --

MR. CARROLL: Okay.

MR. GALLEGOS: -- tie it up with the witness who prepared it from their records.

EXAMINER CATANACH: All right.

MR. GALLEGOS: Okay.

Q. (By Mr. Gallegos) So water production started being reported this year --

A. Yes.

Q. -- is that correct?

And on wells like the Chaco 2-R, there was no water reported for the entire period of February, 1995, until February of 1998?

A. That's what it says here.

Q. Were those pits in existence, or was some work done on them also, when you found the Chaco wells in a state of neglect, as you've described it?

A. All the pits were there.

Q. What did you do to fix the wells? You made some reference to --

A. Well, we --

Q. -- broken valves and that sort of thing.

A. We had valves that we couldn't open, so it was hard to take pressures. We soaped and blew wells, tried to get the wellbore liquids out of there. You know, it's --

in all these wells that are 2 7/8 completions, most of them had 1-inch tubing, which is very difficult to lift water out of. So you have to work at it --

Q. And --

A. -- especially at the flow rates that the wells we're producing at. They're not going to lift any liquids.

Q. The wells were filled with liquid?

A. I -- Yeah, I think so.

Q. Okay. And that liquid would be water --

A. Yes.

Q. -- in the case of these wells? Okay.

No artificial lifts were attempted, plungers or anything of that sort, to lift those -- lift that water?

A. We tried after the frac job on the 2-R, and we still had a hard time getting it to unload, and we tried a piston on that well for a while and couldn't get it to unload, so we installed a compressor early on in that well.

Q. I didn't make it clear in my question. I'm talking about the situation before the frac jobs in 1995. The wells -- It was your perception that the wells were basically loaded up with water?

A. Yes.

Q. Correct? All right. And my question, then, is, in that period, which would be, let's say, sometime in 1993 until the stimulations in 1995, were any artificial means

attempted to lift the water from those wells?

A. Well, I'm sure you know you can't run a piston in one-inch tubing, so no.

Q. Okay. And no attempt to put in a larger tubing or install a pumping unit or anything of that sort?

A. No.

Q. Now, after the fracture stimulations were applied to the Chaco 1, the 4 and the 5, those wells then unloaded on their own?

A. Yes.

Q. The gas production unloaded the water --

A. Yes.

Q. -- from that point on? Okay.

Certainly before the fracture stimulations of 1995, you would have had some pressure readings, wouldn't you, you or your pumpers took some wellhead shut-in pressures?

A. I'd like to think so, yes.

Q. Okay, and were those recorded someplace?

A. They should be on the pumper reports.

Q. Okay. Were these wells basically shut in until the stimulations, Mr. Thompson?

A. No, I believe they were still on production, but it was pretty marginal.

Q. Okay. About how much were they making? Less

than five a day?

A. In that range.

Q. All right. Now, talk about what you were asked to do here. You are familiar -- I guess back in 1988 when Examiner Catanach heard the case concerning the creation of the Fruitland Coal Pool, Fruitland Formation Coal Pool, you attended those hearings, did you not?

A. I don't believe I did.

Q. Well, are you familiar with what the Commission's orders have been in regard to that pool and pools in the area, Fruitland sand pools, Pictured Cliff pools, that type of thing?

A. Basically, I think, yes.

Q. All right. So you are acquainted with the fact that geologically speaking, the Fruitland formation is composed of alternating layers of coal and sandstone?

MR. HALL: Mr. Examiner, I think this is getting far afield from direct. I would object.

EXAMINER CATANACH: What's -- Where are you headed, Mr. Gallegos?

MR. GALLEGOS: Well, we've talked about where he says these perforations are.

But you know, if we're going to have a problem on direct, there's a lot I want to ask Mr. Thompson, and we'll keep him here and ask him to stay and we'll recall him on

our case.

So we're either going to do it now or we're going to do it later.

EXAMINER CATANACH: Okay, we'll go ahead and allow it for now, see how far you go.

MR. GALLEGOS: That's --

THE WITNESS: Could you repeat the question? I'm sorry.

Q. (By Mr. Gallegos) You understand that the Fruitland formation is composed of alternating layers of coal, sandstone and shale?

A. The Fruitland formation, or the Fruitland Coal Pool?

Q. The Fruitland formation.

A. Yes.

Q. Fruitland formation.

A. Yes.

Q. All right. And if you've seen the cross-section in this area, you know that there are more than one coal layer?

A. Yes.

Q. There's an upper and a lower coal?

A. Yes.

Q. Okay. The perforations that you show on Exhibit T1 are -- or sets of the perforations are above the lower

coal?

A. Yes, there was a coal stringer on some of the wells below that.

Q. Okay. Those perforations, the upper perforations and it specified the wells, but -- that are above the lower coal are in the Fruitland sandstone; isn't that true?

A. No, I don't believe so. These perforations are as they were reported on the completion reports, and they're described as Pictured Cliffs wells in all cases.

Q. The completion reports, Exhibit T2, describes these as in the field and pool of the WAW Fruitland Pictured Cliffs.

A. Yes.

Q. All right. What do you understand the WAW Fruitland Pictured Cliffs to be?

A. Pretty much all the sands.

Q. Including the sands that are known as the Fruitland sands?

A. Yes, above the coals, that's correct.

Q. Okay, that's definitionally -- The Commission definition of the WAW Fruitland Pictured Cliffs is the Pictured Cliffs formation and the sandstone interval of the Fruitland formation. That's the definition of it, isn't it?

A. That's what I said, I think.

Q. All right. And so it's the Pictured Cliffs, and it's the Fruitland sandstone interval, correct?

A. Correct.

Q. And that's why it's known as the WAW Fruitland Pictured Cliffs?

A. Yes.

Q. All right. And the upper perfs, again, as we said, would be in -- above the lower coal and in the Fruitland sandstone?

A. You know, we've had testimony for all day yesterday --

Q. Well, I'm asking your -- what you --

A. -- and I don't --

Q. You've been --

A. In my opinion --

Q. -- out there since 1979 --

A. In my opinion --

Q. -- what you recognize --

A. -- Pictured Cliff.

Q. Pardon me?

A. In my opinion those are Pictured Cliff perfs. Standard industry practice calls those PC.

Q. You did the -- worked on the fracture stimulation designs with Western on the Chaco 4 and 5 wells?

A. Actually, Roland Blauer did most of the design

work on those two wells.

Q. Okay. Well, it has your name on --

A. I'm the --

Q. -- Walsh Engineering.

A. I'm the local contact.

Q. Yeah. And you were out there when the treatments were done --

A. Yes.

Q. -- is that right?

And the stimulation procedures or designs were provided to you before the work was done?

A. Yes.

Q. In fact, we saw from the evidence yesterday, I think they were dated May 5th on the Chaco 4 and 5, and the procedures were done on May 10th of 1995 on the Chaco 4 and 5? Does that comport with your recollection?

A. I normally get the procedures before the job so I can make, you know, plans for how much water is there.

Q. Yeah. And in every place on the design, and then on the post-treatment information, it is stated that the target formation is the Fruitland Coal; isn't that true?

A. That's true.

Q. Okay. And if that was a mistake, you did nothing to correct that, did you?

A. I didn't even notice it.

Q. Didn't even notice it?
A. Didn't even notice it.
Q. Okay. You also were responsible for the stimulation work that was done on the Lansdale Federal --
A. Yes, sir.
Q. -- which is in Section 7, offsetting the Chaco 2-R?
A. Yes.
Q. All right. And that's -- If you're not familiar with it, there's Exhibit N1 that's up on the wall behind you that shows the ownership of your clients, of Pendragon, in that southeast quarter of Section 7. Are you familiar with that?
A. Yes.
Q. And they purportedly have an ownership in that southeast quarter of the Fruitland and the Pictured Cliffs?
A. Yes.
Q. Okay, but that's on 160 acres, correct?
A. Correct.
Q. And you completed that well in the Fruitland formation; isn't that true?
A. We perforated the Fruitland Coals accidentally.
Q. Accidentally?
A. Yes. Those perforations have since been squeezed off.

MR. GALLEGOS: Here's a copy of Exhibit 44 and --

MR. CARROLL: Forty-one.

MR. GALLEGOS: Forty-one. I don't have the additional copies right now.

Q. (By Mr. Gallegos) There is a Walsh Engineering and Production workover and completion report dated December 19th, 1994. Do you find that?

A. Yes.

Q. The last sentence of the work summary says, quote, "Plan to perforate Fruitland Coal and..."

MR. CARROLL: Hold on.

MR. GALLEGOS: I'm sorry.

EXAMINER CATANACH: Where are you guys?

MR. CARROLL: What page are we on?

MR. CONDON: About the third or fourth page in. No, keep going.

THE WITNESS: Seventh page in.

MR. GALLEGOS: The next one -- that's the -- I'm sorry, Mr. Examiner, going a little fast.

Q. (By Mr. Gallegos) The last sentence of your report says, quote, "Plan to perforate Fruitland Coal and acidize 12/20/94." End quote.

A. Yes.

Q. You planned to do that?

A. Right.

Q. And the next page, on December 20, 1994, the third line of your work summary says, quote, "Perforated Fruitland Coal from 1042' to 1056' at 4 SPF." End quote. Correct?

A. Yes.

Q. That was work being done for Pendragon also?

A. That was actually Keith Edwards at the time.

Q. Keith Edwards, all right.

MR. CARROLL: We're miss- -- What was that last page?

THE WITNESS: It was the one right before the --

MR. GALLEGOS: -- right before -- They're in opposite order. In other words, the later date --

MR. CARROLL: Okay.

Q. (By Mr. Gallegos) Mr. Thompson, it's also common knowledge among operators in that southern part of the Basin that if you hydraulically fracture the Fruitland sand or the Pictured Cliffs sandstone, that you're going to break through into the coal formation; isn't that true?

MR. HALL: I'm going to object to that question. Are you asking him to assume that?

MR. GALLEGOS: No, I'm asking him what's common knowledge. He said this is what the operators commonly know, told us something about other formations --

THE WITNESS: I would say that's not true.

Q. (By Mr. Gallegos) Okay. So when Frank Chavez testified before this same Examiner as follows --

"A problem that's developed in developing the coal resources is that due to the nature of the shales that separate the coals and the sandstone, it is not uncommon for a hydraulic fracture initiated in the Fruitland Sand or the Pictured Cliffs sandstone, to break through the shale into a coal."

-- you disagree with that statement?

A. I do.

Q. Okay. If you notice there, Mr. Chavez -- You're acquainted with --

A. Yes.

Q. -- him, are you not?

Who is Frank Chavez?

A. He's the District Manager for the Aztec -- Oil and Gas Commission.

Q. And how long has he held that position?

A. As long as I've been around.

Q. Okay. At least since 1979, then?

A. Yes.

Q. You notice that he refers to the Fruitland sand or the Pictured Cliff sandstone as recognizing two

different formations?

A. Yes.

Q. Do you recognize that in this area there is a formation known as the Fruitland sand?

A. Some of the wells that were acquired from Merrion were perforated in the Fruitland sands. Those were above the coals.

Q. Okay. And you can't see on your Exhibit T1, you can't see a Fruitland sand; is that your testimony?

A. On this one with just a gamma-ray log, no, sir, I couldn't.

Q. Well, if there were -- What kind of log would you need? Neutron density?

A. Yeah, something like that.

Q. And you don't have that?

A. No, I don't.

Q. When you performed -- You were present when Western -- or I guess it -- someplace in there it became BJ, performed the fracture stimulations on the Chaco 1, the 2-R --

A. Yes, sir.

Q. -- and the 4 and the 5, correct? Okay.

And when that happened, after you do the -- after you complete the hydraulic fracture, then there's a period of time where you flow back the well, correct?

A. Correct.

Q. You're attempting to recover the frac fluid?

A. Right.

Q. Okay. And when the frac fluid was flowed back, there was visible evidence of coal fines in that frac fluid; isn't that right?

A. I can't recall that.

Q. Well, wasn't that stated by several people who were there on the location, that they saw that?

A. Who?

Q. Well, you were there. You just can't recall?

A. I can't recall that, no.

MR. GALLEGOS: I think that's all the questions. Thank you, Mr. Thompson.

REDIRECT EXAMINATION

BY MR. HALL:

Q. Mr. Thompson, just briefly -- Mr. Catanach -- Mr. Thompson, with respect to the Lansdale federal acreage, it's correct, is it not, Edwards and Pendragon own the coal rights for the 160 acres?

A. They did. If I could elaborate a little bit --

Q. Please.

A. -- the way I understand, we were kind of blowing and going. At the time this well came up, Keith just sent me procedures, said, Let's frac the coal here, make it a

dual -- or a commingle -- downhole commingle Pictured Cliff-Fruitland Coal completion.

We got as far as perforating the coal, and he realized that he didn't own the whole 320, he just owned the 160: Whoops. So we've since gone back in there and squeezed off those Fruitland Coal perfs.

At the time, the northeast quarter was a Navajo-allotted lease that wasn't -- it wasn't leased, so it wasn't like he could, you know, make a deal with the other quarter section and go ahead and complete the well as a nonstandard coal well.

Subsequently, the quarter section has been purchased by Coleman Oil and Gas.

Q. Let me ask you an additional question, see if I can refresh your recollection as to some dates with respect to when these properties were acquired.

Let me ask you to assume that the Chaco 1, 2-R, 4, 5, the 1-J and the 2-J were acquired about December of 1994.

And then also assume that the first fracs for those wells commenced in January of 1995 and were completed May or June of 1995. Does that comport with your recollection, that sequence of events?

A. Yeah, it seems like as soon as Pendragon got involved in these wells, which seemed to be late in the

year, you know, then we started right away on the 1 and 2-R.

Q. All right. There was no delay from the acquisition to the performance of the frac jobs?

A. Right.

Q. You're familiar with the industry practices in the Basin for reporting water outside the vulnerable area for wells of minimal water production, aren't you?

A. Well, I know it's probably not proper, but in cases where it's going through a separator to an unlined pit and there's no real good way to measure the water, if it's -- you know, if it's just not significant at all, I know a lot of people do not report any water.

Q. What physical installations would be required to capture and measure and report the water for Chaco wells?

A. You'd have to install a tank.

MR. HALL: That concludes my redirect.

RECROSS-EXAMINATION

BY MR. GALLEGOS:

Q. Mr. Thompson, on the -- back to this Lansdale that was completed in the Fruitland formation on 160 acres, you're saying it was just sort of an "Oops", the operator didn't know that it didn't own a 320?

A. That's what I understand, yes, sir.

Q. And you squeezed off those perforations?

A. Yes, sir.

Q. When?

A. Last week.

Q. Last week. That's July, 1995, so the perforations were done in December of 1994?

A. I don't have that --

Q. July, 1998, excuse me. You're talking about --

A. Yes.

Q. -- the last week in 1998. So it was producing from the Fruitland from, let's say, January of 1995 until last week in 1998?

A. The perforations were open. It was never fracture-treated, so there was probably negligible production from the Fruitland Coal.

Q. Well, did you --

A. There was no water production to speak of, and so it certainly wouldn't act like a Fruitland Coal completion.

Q. Well, there's no question it was perforated in the Fruitland; isn't that true?

A. That's true.

Q. All right. And on the C-115s, was the production of this well reported?

A. I believe so.

Q. And it was reported as being a WAW Fruitland sand PC well, wasn't it?

A. It was actually a Farmington WAW Fruitland sand, commingled.

Q. This is Exhibit 43. Do you recognize this as a C-115 report by Pendragon Energy Partners?

A. Yes.

Q. And do you see the first well reported there is the Lansdale Federal in Section 7 of 26 North, 12 West?

A. Yes.

Q. And it is listed as a WAW Fruitland sand PC gas well, is it not?

A. That's what it says.

Q. Okay, so that's what the Commission was being informed as to the nature of the well, the completion, right?

A. That's what it says, yes.

Q. But in fact, it was completed in the Fruitland Coal?

A. It was perforated in the Fruitland Coal.

Q. Did you file a sundry notice last week when you squeezed this well?

A. No, I haven't yet, no, sir.

Q. Speaking of ownership, you've sponsored Exhibit T2, and was the purpose of this to show that these perforations that are above the lower coal were placed there back in 1977, 1980, that era, when these wells, these

Chaco wells, were originally drilled and completed?

A. That shows the wells were listed as Pictured Cliff wells. Farther down in the producing interval, each one of these is listed as a PC well, and we were just confirming that the perforations as reported here in the Pictured Cliff are actually the case.

Q. Okay. The perforations that were made by Merrion back at original completion are the same perforations that exist today?

A. Yes, that's correct.

Q. Okay, and --

A. Same place.

Q. Same place.

And are you aware that when these wells were originally drilled in the late Seventies, that Merrion or the Merrion group owned in common all of the formations that we're discussing? The coal, sandstone, Pictured Cliffs, all the formations?

A. Yes.

MR. GALLEGOS: That's all.

EXAMINATION

BY EXAMINER CATANACH:

Q. Mr. Thompson, are the Chaco wells making more water now than they previously were, before they were frac'd?

A. Well, before they were frac'd, again, they all had 1-inch tubing in it. It's pretty hard to get fluid up 1-inch tubing, no matter what. And pretty much the first thing we did on all the wells was to pull the tubing and replace it with 1-1/2-inch tubing.

We did acid jobs, small acid jobs, on a couple of wells. Didn't see a tremendous improvement in the wells' productivity, so right away we went ahead and frac'd them. The wells are certainly making more water than they were, you know, prior to the stimulation, but it didn't seem to be anywhere near like a coal well.

The 2-R is the exception. We, even after the frac job, had a hard time keeping it unloaded. We tried plunger lift on it for a while and it just didn't have enough oomph to get it coming around, so we put a compressor on that well. And that well has always made more water than the other -- other wells.

Q. Is that even before the frac?

A. No, we didn't try anything, really, before the fracs.

Q. Do you know how much that well makes?

A. Volumewise? I'd say, you know, a couple hundred a day.

Q. Two hundred barrels of water a day?

A. No, 200 MCF. It makes like ten to twelve,

something like that, barrels of water a day.

Q. Is that the highest water producer?

A. Yes.

Q. You say you operate about 150 PC wells in the Basin?

A. Throughout the Basin, yes, sir.

Q. What's the typical range of water production in those PC wells?

A. Most of them make less than five barrels of water a day. In some areas they make a little condensate and fluid production. It's usually minimal.

Q. Is the water production from this 2-R, is that -- that's higher than the average, is that --

A. I think so. But in this case, you know, we've lowered the wellhead pressure considerably, more -- Until recently, all wells were flowing against the standard about 40-, 45-pound pipeline pressure, whereas this well was probably considerably less.

Recently we've installed compressors on other wells, and their water production has also increased.

Q. So that's typical behavior?

A. I think so, yeah.

Q. You can't really put an average on Fruitland Coal water production, can you? Or can you?

A. Well, it varies, you know, depending on how --

where it is on the dewatering deal. You know, they can start off at hundreds of barrels of water a day and come down to the 20- to 30-barrel-a-day range.

Q. After it's been dewatered, is there kind of a minimum amount that they still produce, or --

A. We've had wells -- Some of the early ones that we did for J.K. Edwards still make 20 barrels of water a day, pumping.

Q. Mr. Thompson, is it typical to fracture a PC well?

A. Yes.

Q. It is?

A. Yes.

Q. You've looked at the collar logs and you've satisfied yourself that -- The perforations have been displayed on other exhibits by the Applicant, on some of their geologic exhibits. Have you satisfied yourself that those were place correctly on those exhibits?

A. Yes.

Q. So in your opinion, there are no perforations -- the highest perforations are in what the Applicant is calling the upper PC interval --

A. Correct.

Q. -- in all of their wells?

A. In all their wells. There's no perforations in

the coal.

Q. No perforations in the coal.

And all of these perforations were existing in four of the wells?

A. Actually -- That's right. These are the four wells that were frac'd by Pendragon. The 1 and the 2-R we frac'd at existing perfs, didn't even reperforate.

On the 4 and 5 we reporforated at one shot per foot in the same interval that Merrion had previously perforated.

Q. Why was that done?

A. There was some thinking that, you know, you're frac'ing through perforations that might be scaled up and, you know, if you could get one good perf in that same interval, that you could start your frac easier.

EXAMINER CATANACH: Mr. Chavez?

EXAMINATION

BY MR. CHAVEZ:

Q. Mr. Thompson, in your work for Pendragon and J.K. Edwards, were you also responsible or made recommendations as to how these wells should be treated?

A. Right, I was in on part of the design work, yes, sir.

Q. In your experience with Pictured Cliffs wells, have you yourself designed frac jobs for Pictured Cliffs

wells and carried them out?

A. Sure.

Q. How did the frac jobs that you did on these wells, or this Application, compare to the frac jobs that you have designed?

A. Actually, I thought these were better.

At lower rates, which I was a little skeptical of at the start, we were able to get the jobs put away, except for on the 4, right near the end of the job, it screened out.

So I think we did better on these wells than I probably would have done, left to my own devices.

Q. So, say, left to your own devices, would you have gone at higher rates or maybe higher pressure?

A. I probably would have gone at a little higher rate, yes, sir.

MR. CHAVEZ: Thank you.

EXAMINER CATANACH: Are there any other questions of this witness from anybody?

MR. HALL: We --

MR. GALLEGOS: Just one follow-up -- Oh, I'm sorry.

MR. HALL: Go ahead.

MR. GALLEGOS: One follow-up to a question you asked, Mr. Examiner.

FURTHER EXAMINATION

BY MR. GALLEGOS:

Q. Concerning the dewatering of the Fruitland wells, Mr. Thompson, you were monitoring the Whiting wells as to the progress they were making in dewatering the wells in this area; isn't that true?

A. No, sir.

Q. Were your pumpers doing that?

A. No, sir.

Q. Checking those wells?

A. No.

Q. No attention was given to what was going on with the Whiting wells; is that your testimony?

A. That's right, we have plenty of things to do on our own well.

Q. Well, the wells that you started pumping in 1993, in the case of the 4 and 5, they literally are 200 feet from Whiting Fruitland wells; isn't that true?

A. Right, we have to drive by them. There's one right on the county road. I mean -- Yeah, I mean, we can see them, sure. Yeah.

Q. You stand at one well and you just -- the other one is just a one-minute walk over to --

A. Sure, yeah.

Q. -- the other well?

A. Yeah, they're in the same area.

Q. Okay. But you took no -- made no effort to see what their water production was or whether their gas volume was increasing or anything of that sort?

A. No.

Q. Okay, that's all.

EXAMINER CATANACH: Anything further of this witness?

If not, you may be excused.

MR. HALL: It might take a minute to set up exhibits for you.

(Thereupon, a recess was taken at 9:15 a.m.)

(The following proceedings had at 9:25 a.m.)

EXAMINER CATANACH: Okay, let's reconvene the hearing.

And Mr. Hall?

MR. HALL: At this time, Mr. Examiner, we call Jack McCartney to the stand.

JACK A. McCARTNEY,

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

DIRECT EXAMINATION

BY MR. HALL:

Q. For the record, state your name.

A. Jack A. McCartney.

Q. Mr. McCartney, where do you live, how are you employed and in what capacity?

A. I live in Lakewood, Colorado. I'm employed with McCartney Engineering, L.L.C., and I'm the manager of McCartney Engineering, L.L.C. It's a consulting petroleum engineering firm.

Q. All right, and you're a petroleum engineer?

A. Yes.

Q. Have you previously testified before this Division?

A. No.

Q. Why don't you give the Hearing Examiner a brief summary of your educational background and your work experience?

A. I received an undergraduate degree in petroleum engineering from Colorado School of Mines in 1965. I went to work in the industry for Kerr-McGee Corporation, later returned to Denver, worked for NCRA in Denver and at that time went to night school and received a master's of engineering in petroleum from Colorado School of Mines, and I believe that was 1972.

Shortly thereafter, I went to work for Scientific Software Corporation, which is a consulting organization in Denver, and then later transferred to Houston. I returned to Denver about 26 years ago and worked for Davis Oil

Company, which was active in the Rocky Mountain area, primarily in Wyoming, as reservoir engineer.

Then I started my own business about 25 years ago and have been consulting primarily with emphasis on reservoir engineering aspects and field studies and things of that nature.

Q. Have you previously testified before regulatory agencies and courts in other jurisdictions and had your credentials accepted as a matter of record?

A. Yes, I've testified in Utah, Colorado, Wyoming, North Dakota, Montana, Nebraska before oil and gas commissions or similar-type commissions in those jurisdictions.

Q. Are you familiar with the subject Application here and the lands and wells that are the subject of the Application?

A. Yes.

MR. HALL: At this point we'd tender Mr. McCartney as a qualified expert petroleum engineer.

EXAMINER CATANACH: Any objection?

MR. GALLEGOS: No objection.

EXAMINER CATANACH: Mr. McCartney is so qualified.

Q. (By Mr. Hall) Mr. McCartney, were you asked to perform a certain evaluation of the dispute before the

Division here today?

A. Yes.

Q. Why don't you explain exactly what you were asked to do?

A. Well, it was my understanding a controversy has arisen about the completions in the Pictured Cliffs sands, that were operated by Edwards and Associates and later operated by Pendragon Resources, and their effect on the production from nearby Fruitland Coal wells, whereby the concern was -- there was a concern that completions of the Pictured Cliffs wells might have invaded and, in fact, be producing gas from the Pictured -- or from the Fruitland Coal formation.

And that's basically the area that I've investigated, I guess you'd say.

Q. What evaluation methodologies did you utilize?

A. Well, I obviously looked at the performance characteristics of the PC wells and the Fruitland Coal wells. I looked at the pressure data that's available on the PC and what little pressure data I could find on the Fruitland Coal wells.

Looked at the logs and calculated volumetrics on some of the wells in question and performed a material-balance analysis using the available pressure data, of course decline-curve analysis based on the production

characteristics of the wells. And I did that for both the PC wells and for the Fruitland Coal wells.

Then I, of course, closely analyzed the performance of the wells, particularly those wells that are in close proximity of the wells that are completed in the Pictured Cliffs formation.

Q. Did you reach certain conclusions with respect to the issue of whether these Pictured Cliffs wells were interfering with the Fruitland Coal wells at all?

A. I can't see any direct evidence of interference with the production from the Whiting/Maralex Fruitland Coal wells by virtue of the PC production, neither in the performance aspects nor in the pressure aspects of the data that was made available to me.

Q. All right. Let's refer to Exhibit M1, if you would identify that, please, sir.

A. M1 is an exhibit I believe Al Nicol put up before the Commission, which merely shows the total production from the Whiting wells in this vicinity, which basically is Section 1 and Section 12 of Township 26 North, Range 13 West and Sections 6 and 7, and -- with respect to the coal wells -- 6 and 7 of 26 North, 12 West, and then with respect to the PC wells we bring in Section 18 of 26 North 12 West.

I overlaid basically the performance of the

Pendragon Pictured Cliffs wells on the same graph with the Whiting -- what's labeled as the Whiting wells, which is -- On this exhibit there are five wells included in the Whiting wells, and there are six wells included in the summary for the Pendragon wells.

And this production, for the most part, came from either *Dwight's Energydata* or from public-record reports that have been filed with the OCD.

The water production is also shown for the Whiting coal wells, and the wells -- the Whiting wells show overall typical -- very typical, maybe even classic, behavior as far as gas production going up, water production going down in a very consistent manner.

Then we see the Pendragon wells coming on production about the middle of 1995 and actually reaching a -- you know, maybe the peak rate, I'm not sure. It's close to the peak rate there in 1995.

And for the first, oh, about year and a half, there are five wells included -- or -- yeah, there's five wells included there. Actually, the 2-R well is probably included, but the 2-R well was producing virtually nothing until later in 1996.

There's a bump in the curve on the Pendragon wells about October of 1996. And as we go through the individual well performance we'll see that's when the 2-R

well was put on compression, and then it started producing much better under compression than what it could on its own.

I think Paul Thompson testified they couldn't get that well to unload for some time and then finally put it on compression and achieved some production from that well, and that caused that increase in the overall curve.

Recently, it's my understanding anyway that Maralex has put on -- or put compression on three of their wells. I believe the -- what I'll refer to as the 6-2 well, the Section-6 well, the 7-1 in Section 7, and the 12-1 in Section 12, all in -- it's my understanding, in either December, 1997, or -- one I think may have been January, 1998, and maybe one March, 1998, but very recently -- and have improved the production somewhat on some of their wells by virtue of the compression.

At the same time, the Pendragon wells declined in production, and so Pendragon put on compression the Chaco Number 1 in March of 1998, the Chaco Number 4 in April of 1998 and, as I mentioned before, the 2-R went on compression way back in about October of 1996.

So on this curve, as we -- at least my information is that three of the wells of Whiting are on compression and three of the wells of Pendragon are on compression.

Q. Let's refer to Exhibit M2, if you'd identify that, please, sir.

A. M2 is just a tabulation of primarily surface shut-in data, surface shut-in pressure data, on the Fruitland Coals, and they'll be kind of individually listed here. I think there's four or five of these graphs.

The Fruitland Coal -- The attempt here was to try to find or try to determine what the expected pressure in the Fruitland Coal was at the time the Pendragon wells were stimulated in early 1995.

The first graph is -- It's labeled "Pressure vs. Time, Chaco Number 1", and the Pictured Cliffs well shown there in the lower part of the curve, that little lighter line there, is Chaco Number 1 pressure data since 1995 forward, on this case.

And the Fruitland Coal data, I have not seen any pressure -- I haven't been provided any shut-in pressure data, *per se*, for the Fruitland Coal wells. It's my understanding at this point that there may not be any very significant record of shut-in data for the Fruitland Coal wells.

The two points that are shown on the Fruitland Coal map, one in, say, mid- to late 1994, a little over, you know, about 215, 220 pounds, that data came from a tabulation that was supplied through Counsel by Maralex

and/or Whiting, and it listed a whole series of pressures that appeared to be, for the most part, flowing casing pressures.

And then in 1994 there was a day or two where the pressures were a lot higher, considerably higher than what the flowing pressures were, and I made the assumption that the wells was probably shut in at that point in time. And so I used that pressure, which is a surface-casing pressure, for the purpose of this exhibit.

The same is true in August, September, some point in time there, in 1997, had what appeared to be flowing tubing -- or flowing casing pressures on the wells.

And then there was a point there where the pressures were considerably higher, and I assumed that that pressure was a shut-in pressure. I have no information of how much fluid was in the hole and what the actual bottomhole pressures would be that's related to these surface pressures.

So what we see here is just connecting points of what -- the two points that I had on the -- that look like they were shut-in pressures, on the Maralex data, and the measured pressures that are all, again, surface pressures for the most part in the -- the first one is the Chaco Number 1.

The reason I put the Chaco Number 1 and the 7-1

together is, those wells are in fairly -- Well, they're the closest wells together. The 7-1 is located up here in Section 7, and the Chaco 1 is located at about -- oh, almost a mile, not quite a mile, a short mile south of Number 7.

And from this analysis it appeared that had we communicated, or had Pendragon or Edwards communicated their frac, that we would have anticipated the pressures would have been a little closer together than what we see here.

The next one is the 1-J well. And the 1-J well, located in the southwestern portion of Section 1, is fairly close to the 1-2 well, the coal well. And what we see here is that the 1-J well's pressure has been pretty darn consistent all along.

This last pressure show here is the shut-in surface pressure that resulted from the shut-in of the wells by the municipal court here about a month ago, so that represents maybe three weeks or 24 days or something, shut-in period, on the well. So that point in 1998 is a very current point.

And as we'll see in the production graphs, the 1-J well is producing -- reportedly producing very, very minimal quantities of gas. In fact, it's questionable whether it's producing at all.

But what's interesting here is that we see a pressure of the 1-J well, essentially the same pressure from 1995 through current, alongside the pressure from the Chaco 1-2 well, the Number 2 well.

Also, I think we'll see on this that the pressure that we have back in 1995 on this particular well is lower than I think is observed on most of the other coal wells, in fact maybe all the other coal wells. Well, there's one other well that's fairly low, but -- But the coal pressure here is maybe -- maybe did have some water in the casing. I'm not sure that can be represented as a valid representation of the coal pressure at this location. It may be or it may not be. I just don't have adequate information.

Then on to the Chaco 2-J comparison. The Chaco 2-J sits really close. I understand through testimony it may be 200 feet away from the well in Section 1, the 1-1 coal well. Again, we see fairly high pressures in the 2-J well, and fairly consistent except for the first pressure, measured in 1998, and that was, I believe, measured in May of this year. And that was a bottomhole pressure bomb that was run in the well.

The problem I had with that is that virtually all the pressure represented by this point, or by the bomb, was water column in the well, adversely, no surface pressure.

And so I'm always concerned when -- I don't know whether the well was loaded from the surface to create that high column of water or whether that water entered through the formation and really represented true bottomhole.

So I asked them to basically swab down that well and run another pressure.

So they ran another pressure recently -- Actually, they didn't swab it down; they put a compressor over there and they sucked on with a compressor, and it unloaded for them, and so we ran another pressure on it, and it was 178 pounds, and I think it built to like 183 or 184 pounds during the shut-in, and I believe that's the pressure that's represented on this graph, is the pressure from that recent shut-in.

So I would disregard that higher pressure as being an anomalously anomalous pressure, probably not correct, which then again shows that the pressure had been very consistent in the 2-J well, sitting 200 feet away from the Number 1 coal well.

What's this mean? It mean two things.

One is, at the time they completed -- or back in 1985, of course, this well was never frac'd, or -- I should be careful to say "never frac'd"; it wasn't frac'd in 1985. Now, I have information here. I don't know -- I don't think this one was ever frac'd.

But anyway, one of my concerns initially, particularly initially was, because of the pressure profiles as explained by Roland Blauer, and actually because of Roland Blauer's explanation of the frac jobs and the likelihood that the fracs in the Fruitland Coal grew out of zone, I had concerns that the Fruitland Coal fracs themselves may have grown down as well as up, and you don't have to go down very far before you invade the Pictured Cliffs formation.

The concern was that if that happened, possibly two things could happen.

One, the fluids from the Fruitland Coal could invade the Pictured Cliffs formation, because we're showing here that we anticipate the pressure to be higher in the coal.

Or, number two, fluids from the Pictured Cliffs formation could be produced out of the Fruitland Coal wells, because they're on pump, they hopefully have fairly low bottomhole pressure. They bottomhole pressure of the coal wells is undoubtedly lower -- or I believe it would be lower than the shut-in pressures, the pressures of the PC formation. So you have that crossflow potential.

From analysis of this pressure and this well sitting 200 feet away, we don't see that. I don't see any evidence in this particular area of communication between

the two zones, or any material communication between the two zones. Had we seen that on the pressure analysis, we would have anticipated that we would have had a different pressure profile in the PC, in my opinion.

The next one is the 2-R well, and again the 2-R well sits fairly close to the Section 7 coal well. And the 2-R was frac'd back in 1985, early 1985, or that period of time.

And that series of pressures in there, in the 110- to 120-pound range, up until 1996, and then found another pressure right about the time they put this well on compression, and it was 150 pounds, and so I put that in the graph. And the testimony was that -- from Paul Thompson, that he couldn't unload this well.

So there's a good chance there's water in the hole here and that these earlier pressures may be erroneously low. So that may not be good data.

Then the last pressure shown in 1998 is the most recent shut-in pressure, and I think it was 68 or 69 pounds, surface shut-in pressure on this well.

And I believe that -- as I recall -- well, I'd better -- I don't know if I have that data with me, but -- Well, I won't comment on that. I was going to -- I may have to look up some additional data to comment. What I was going to say was that I believe that the casing

pressure and the tubing pressure was reading about the same, and I believe that to be the fact, but I'd better check the data. I think that's what the data will show. In fact, I believe that was an exhibit that Al Nicol put in, so I think it's in the record anyway.

The next graph is a combination showing the Chaco 4 and 5 wells, along with the Section 12-1 and the Section 6-2, and those wells are spaced a little further apart. We've got the -- I think we've got the Section 1 well and this well over here. I don't think I put the 13 In there. But anyway, here's the two wells in question, and these are the nearest -- These three are basically the nearest coal wells. So that was a comparison on this graph.

These wells are really something on the order of 2000 feet apart, the 4 and 5, from the nearest coal wells. I believe opposing counsel had indicated they were 200 feet apart with Paul Thompson, but that's incorrect on this case. He may have been thinking of the 2-J well.

Anyway, on this we show the fairly abnormally pressure for the 12-1 well. Again, I can't tell you whether that's a good pressure or not a good representation of the pressure there, but the 6-2 well is fairly consistent with several of the other wells.

All of these show that the expected pressure in the coal should have been about 200 pounds at the time

Pendragon completed their wells, and the data shows when Pendragon completed their wells, their wells were in the 150- to 160-pound range for the most part.

Again, the pressure profile on these wells, if we believe the 12-1 pressure is tracking fairly close to the 4 and 5 pressures, but the Number 2 well up there is tracking somewhat higher.

And then more recently we've got -- Let's see, I think the 12-1 well has -- I believe it was reported, a flowing pressure like -- It had a reported pressure just recently here when the companies agreed to share data and monitor each other's wells during the shut-in period.

I believe that shut-in pressure was 91 pounds. I shouldn't say shut-in pressure. The pressure on there appeared to be a flowing pressure. At least the well was producing. I believe it was 91 pounds, was the high pressure that was witnessed on that well, and -- Yeah, it's on the 15th of July. It shows production that day, but I believe the plant was down part of that day, so they may have been packing the line with their compressor or something.

But what is of interest there is that the flowing pressure on the nearest coal well there, or at least the 12-1 well, is at or above the shut-in pressures on these other wells, again indicating to me that there's no

significant pressure communication between the Fruitland Coal and the Pictured Cliffs sand.

I might go back to that first exhibit. When Pendragon brings their wells on production --

Q. Excuse me, you're referring to M1?

A. M1, yes. -- I would have anticipated that we'd have seen a significant change in the performance of the coal gas wells by virtue of this -- two things:

One, significant gas production from the PC wells, if they were sharing a common source of supply, we would have seen something.

Number two, I think we would have seen significant water production from those wells, which testimony has been that they didn't report water production, testimony has been that the pits were ten by ten by three or four feet deep or whatever, which doesn't take a whole lot of water to fill up the pit. It's my understanding that there's not very many times they hold a load of water out of those pits during this period of time. So the indications are that the water production was not very significant in the PC wells.

And we don't see a real change in slope of the production of water from the Fruitland Coal wells, which is another thing that I think I would have anticipated.

So the performance data, the pressure data, does

not show any significant communication between the two zones in this area.

Q. All right, let's turn to Exhibit M3, if you'd identify that, please, sir.

A. M3 is a series of three well logs, the Chaco Number 1, Chaco Number 4 and the Chaco Number 5, and what's shown on here is the induction log run by Birdwell -- the Birdwell company, logging company.

Obvious question is, is there sufficient -- Well, there's two questions:

Is there sufficient resource available to justify the production from the Fruitland sand formation?

The second question, is there sufficient resource available to justify the production from the Fruitland Coal formation?

This addresses the Fruitland sand issue, and what I show there is a log on the Chaco 1.

The top -- The portion colored yellow is what I'm referring to as a perforated zone. It's in the area of the primary producing zone in the Pictured Cliffs formation.

Then what I show there in green is what I'm calling the lower zone. Al Nicol may have called it upper zone, zone 2, zone 3 or some other nomenclature.

But basically I'm looking at what the gas saturation is in the Pictured Cliffs sand. And we found

that there is relatively a high gas saturation, good porosity, lower clay content in the zones that are customarily perforated in the area, or at least were perforated in these particular wells, and that the lower zone also contains gas. It contains higher water saturations, it contains higher clay content, and it's usually somewhat lower average porosity, at least in these particular instances. But it does show gas content on the order of 25, 30 percent gas saturation.

Now, if I were analyzing this log and recommending where I'd perforate and complete this well, I'd perforate and complete right where it was perforated and completed.

The lower zone looks like it may produce some gas and may produce some water. And it's my understanding that from -- you know, from the initial completions in the area that's exactly what happened: They completed this higher-resistivity zone, which was a higher gas saturation, lower water, and produced gas with smaller amounts, fairly small amounts of water, or in some cases maybe no water at all.

It's my understanding that operators were hesitant to frac their wells, particularly in the -- because of fear of the frac migrating down into the lower portion and loading the wells up with water.

And during certain periods of time back there --

and I don't have the data, but say early to mid-Eighties, gas prices plummeted, the ability to sell gas plummeted, certainly no incentive to produce a bunch of water for a little bit of gas.

So the zone is primarily not perforated in this immediate area. I think the High Roll Number 4 that Al Nicol referred to may have perforated a lower sand other than this, but I have not looked at that log.

Basically there's three logs there, it shows the log calculations.

And the fourth sheet of that exhibit shows the calculation of the gas in place. The gas-in-place calculation here, I just at the time used 320 acres to represent the volume, and I did that because I was representing, as we'll get through here, I was representing the coal wells on 320 acres also, and I thought it was for convenience to use the same area, although it's irrelative, we'll look at -- Basically it could be MCF per acre, instead of 320 acres. Or if you want to use 160s, just divide the numbers by two.

This shows volumes that I calculate for what I'm calling the perforated zone, volumes that I'm calculating for the lower zone, and then the total volumetric estimate of gas in place.

What I believe has happened out here, or very

well could have happened, is that we had a series of pressures that Mr. Nicols showed that indicated in the early 1980s, when they were reporting pressures to the State, some of those pressures got fairly low, in the 100-pound range. The wells wouldn't produce very well.

In the case of the wells that are the subject of this Application, it's my understanding that five of the six wells had 1-inch tubing and one of them had like 1-1/4-inch tubing, and it doesn't take very much water at all in 1-inch tubing to load up a well.

So if they had some water in the wellbore, that's one reason they wouldn't produce, because they could have been logged off with water. And I don't know whether the operator -- Merrion, I believe, operated these wells. I don't know the history of how they operated these wells, so I can't speak to that, but I do know that unless you pay a lot of attention to wells, soap them or else remove that water somehow, you can log them off.

And there's a possibility that a lot of those earlier pressures reported were also erroneous, they're all -- My understanding is that they're surface-pressure readings. If there's water in a wellbore, well, that has little to do with the bottomhole pressure. It may be an indicator, but it may not represent the reservoir bottomhole pressure.

Secondly, the comment was made by Mr. Chavez that at one of these prehearing meetings that if a well went down or if there was an opportunity to have the well shut in or if it loaded up, that was just a good opportunity -- I may be misquoting, but it's kind of a good opportunity to go take that shut-in pressure and supply it to the State, because the well is shut in anyway. And it may or may not be very representative of bottomhole because of potential water in the wellbore.

So it could be that the pressure in the reservoir, as it exists right now, is 150 pounds, and that's because those pressures were not all that accurate. It could be that we've seen some recharge from some other source.

I looked at recharge theory, I looked at -- initially looked at recharge from the fracs in the Pictured Cliffs wells -- I mean in the Fruitland wells. They did fracs, there's gas in there, it's higher pressure. If they communicated, did we have recharge? Well, pressure data disputes that.

Secondly, initially those wells were, I think, spudded right towards the end of 1992 to qualify for tax credits. They were completed -- Well, the frac reports would indicate that it looks like about four of the five were frac'd in August of 1993. We can see from their

performance graph that they didn't report production.

Or, let me put it another way. Well, that's erroneous, they did report a little bit of production. They didn't report much water production prior to about November of 1993, so I'm not sure that the water production on the front end of this is truly representative of the response of the coal.

If it was my operation -- and I would think Mickey would have the same view, or the Maralex people, that once you frac the well, you want to get it on pump, you want to keep the fluid moving, and you don't frac a well and leave it shut in two or three months before you start selling gas in the Fruitland Coal.

I don't know whether they produced the well in September and October. I kind of assume they did, because it would probably be prudent practice to do that.

But anyway, we may not have good early data on that formation.

The next series of exhibits are the individual performance curves for the Pictured Cliffs formations completions that are operated by Pendragon.

Q. For the record, you're referring to Exhibits M4?

A. Exhibit M4, correct, yes.

The Chaco Number 1, we see -- and I think it's true for most of these -- came on early in 1995, produced

fairly well there for about a year and a half, and then started to decline. Then just recently, the last three months of production there, ending in June of 1998, show an increase in production, and that's the result of putting them on compression. The drop in production prior to that, in February and March, may have been in part to increase line pressures, resulting from higher volumes from the Maralex wells that had gone on compression and backed these wells off somewhat.

I've also included on there an extrapolation of what I believe the remaining reserves -- or what will represent the future decline in production from this well, and this in part taken from the decline that started to be established in early 1997. And then we probably need to discount the latter part of 1997, early 1998, because of high line pressures, but that's my estimate of remaining reserves for that well.

Same goes through, you see the -- I just put the Chaco 1-J in there, that shows minimal production, the Chaco 2-J, minimal production.

The Chaco 2-R shows -- We've had a little bit of production in early 1995, we were having trouble unloading it, and then they put it on compression there, as I had mentioned, in 1996, and it's producing and it's also declining in production.

The Chaco Number 4 well came on fairly strong and immediately started to decline, and then more recently has shown in the early part of this year a significant decline, most likely line pressure. And then it was put on compression, and it did not recover to its prior rates with this compression. And so I've reflected that in my estimated remaining reserves.

Chaco Number 5 came on production the same time, and it's shown a significant decrease in production during 1998, and it is not on compression at this point in time.

The results of this show that -- that we've got listed on the last page of the exhibit, the cumulative production from these wells, in total they've produced about 1.6 BCF to date, and these numbers are current, I think, through the end of June, 1998.

The remaining reserves are reflected from our declines, and the ultimate recovery.

And then I've categorized the drainage areas, calculated by use of the volumetric estimates of gas in place on the perforated zone only, and then on the -- if we include the lower zone as a potential source of recharge.

It shows that we're on average draining 320 acres with these wells, which I believe I've only averaged the wells that have been frac'd here, and I did not have a log, porosity log, on the 2-R well, so I did not have a valid

means to determine the volumetrics on the 2-R. It has about -- Oh, I don't know, 18, 19 feet of pay or so.

So in a perforated zone, which is basically the log -- part of the log I had, it's relatively representative of the other wells, and it's not as good a well and not draining as good an area as those others.

But from this -- My conclusion from this is that even though they're good production, we have adequate resource in here, even in the perforated zone, and if we add in the potential for the lower zone to be contributing in some fashion, then we have plenty of resource in the Pictured Cliffs formations to account for what I think the ultimate recovery from these wells will be.

The next exhibit, which is M5, is an attempt to calculate the reserves pursuant to the material-balance method of P/Z curves. In some cases we get a -- appear to get a fairly consistent fit; in other cases the fit will not be so consistent.

The first one, Chaco Number 1, looks like a fairly consistent fit. The last point on this is this June 199- -- or actually July, 1998, point, indicating a potential for gas in place of 700,000 MCF.

The Chaco 1-J, we merely show the P/Z pressures there. There's no extrapolation there because at the current production rate it's producing below economic

limit. There are no economic reserves. There's virtually no data to extrapolate there anyway.

Same with the 2-J.

And then the 2-R, it's somewhat difficult to extrapolate the 2-R on material-balance method because the early time history does not look like it's representative. We had the 150 pounds, which is represented by that dot above the curve.

The only -- And I came back to 200 pounds, or a P/Z of 200, which may be a little pessimistic for this, and the reason for that was, there's a well completed over here in -- I think it's this well in Section 12, completed in about 1980, which is about the time this well was completed, I think. It had a reported pressure of 218 pounds, so I just took -- you know, used that as maybe an idea of what the original pressure was there. So I don't know how valid this particular curve is, because of the lack of good data.

Chaco Number 4, we have some early pressure declines. I'm not sure those are valid pressures. And those are all, say, prior to 198- -- you know, ending in the 1980s.

And then the -- It shows a designation in May, 1995, when the well was frac'd, and we have series of three pressures there, and those pressures Mr. Nicol may have

been -- Excuse me one minute. About three of those pressures -- Well, a couple of those pressures overlie each other.

The three pressures taken in there, in February, March and May, 1995, prior to the frac that were -- range from 140 to 147 pounds. And P/Z would be about 170 pounds. Then the -- After frac they had one that measured 153, and then later in 1995 one at 162. So a couple of those points are prior to frac, and one is after frac.

And then we have a series of points that fall above the curve. We did not see in this case, if we believe these pressures, that -- We didn't see a whole lot of declining pressure for a while. That is -- you know, brings to mind, is there some source that's helping recharge this formation somewhat.

And then we see the pressures drop off fairly dramatically here this last year, year and a half, and the production also follows that same decline. It appears what we might have is like either some minor water influx, or we have some slow migration of gas from the lower PC up into the upper PC.

And of course there is a possibility in some parts of the Basin there may be some minor, minor -- minor communication between the coal itself and the PC that has been -- you know, has been mentioned, anyway, as a

potential problem.

What I think this represents is, it's like a leaky faucet in my bathtub. If my bathtub is full and I'm draining the bathtub, I don't notice the volume of the leaky faucet. But if I leave the leaky faucet there for four or five days, well, my bathtub tends to slowly fill up. And then when I start draining my bathtub again, I don't notice the recharge is insufficient to keep up with me. So that may be what's happening in there.

Chaco Number 5 looks a little more consistent. The pressures, more recent pressures, may be a little more believable because this well has never demonstrated any water production outside of maybe a barrel-a-day-type production, so these pressures may be a little more valid, and they do line up fairly good on the P/Z curve.

The results of P/Z analysis and material-balance analysis showed on the last exhibit [*sic*], shown on the four wells that I did extrapolate, a total of gas in place 2.8 BCF, estimated recoverable gas 2.3 BCF. On average drainage area of 332 acres, if we account for only the producing zone. If we include the lower PC as a potential recharge source, then we're down to 198 acres.

It should also be noted that in most of these instances that -- in most instances it's -- the Pendragon wells are producing at this point the majority of gas from

the area, and that there's not very much other production going on in the PC in this area.

There's a couple wells that were recently completed that may compete with these wells. But basically these wells have the advantage of a very large area to draw the resource from, so the 320 acres of potential resource is, in my estimation, not out of line for the situation as it exists today.

In this area -- I have kind of rough numbers, if I can find them. In this five-section area, Section 1 and Section 12 of 26-13, and Sections 6, 7 and 18 in 26-12, there's been about 3.5 BCF produced, or a little less than 700,000 per section. My resource says that there should be somewheres in the range of 1, 1.5 BCF per section, so it appears that we have plenty of resource in the area, even though just the upper zone to account for the production that we're seeing.

The Exhibit M6 is when we get in talking about our coal gas performance. I constructed an isotherm curve of -- for use in -- for the purposes of determining a couple things.

Primarily, this curve is used to determine the recovery factor that we might anticipate if we have a desorption characteristic that's represented by a curve such as this.

And it also assists in what I'm calling my material-balance calculations in the Fruitland Coal and that I need a methodology to determine the gas content at a particular point in -- pressure point here.

What this is constructed on, this is constructed on, actually 110 standard cubic feet per ton, associated with about a 250-p.s.i.g. pressure.

Q. What's the basis of that gas-content figure, 110 standard cubic feet?

A. Well, there's -- Actually this 110 was -- Mickey O'Hare at Maralex said -- stated that's what he believed the gas content to be in the prehearing conference.

The earlier testimony yesterday from Mr. Nicol was -- showed the Lansdale Federal tests that were run, which average about 85 standard cubic feet per ton, which -- So what I did is, I used 110. And in this case I assumed that to be an *in situ* gas measurement, rather than an ash-free-type gas measurement. It's my understanding it was taken from a well -- and Mr. O'Hare can tell us if he wants -- in the Bisti area a little bit south of the current area, and it was taken with a pressurized core.

And the core -- analyzed the core and it had something on the order of 90 standard cubic feet per ton, my recollection, and -- but the core was leaking somewhat, so Mr. O'Hare -- and, you know, from his observation he

believed it really should have been about 110.

So that's where the number came from that -- used here. And it appears to be substantiated by the Lansdale Federal work that was done in this immediate area.

The important -- I don't know for sure what the downhole pressure is going to be. I used 25 p.s.i.g. as an average abandonment pressure over the 320 acres, or whatever the drainage area happens to be, which represents in this analysis 62.5 percent of the gas in place. And naturally take the initial gas saturation, or gas content, and the final gas content, and see what ratio that is of the total gas content, and that's how you calculate recovery factor.

The exhibit M7 just kind of outlines where we get our data. I believe the Commission is well aware of all -- where coal data comes from.

More important is the volumetric analysis that shows up on the bottom part of the page. I've taken the individual coal wells and calculated the thickness and the density of those coals and then used the 110 standard cubic feet per ton as an *in situ* gas measurement.

And that is actually a little different than -- You know, basically, if you had ash-free gas content you would use a little different approach in that you would use -- calculate the ash content in the coal. But if you don't

have the ash -- if you don't have -- If you have an *in situ* measurement, well, then, you don't calculate ash and coal; you use a density.

One minor problem is that if you use the same gas content, *in situ* gas content, for all coals, the dirtier, shalier coals tend to calculate higher gas in place, which is the reverse of what probably happens.

In one instance, it's my understanding that the 13 Section 1 Number 2 well is perforated in three upper coal benches. I calculate a total of 11 feet in that, and I calculated volumetrics on that. And those have a considerably higher density or -- measurement than the other coals, and so I used a 77-standard-cubic-feet-per-ton gas on that coal, rather than 110. I did reduce it because I thought it was poor-quality coal.

Also shown on there is the cumulative production from the coal wells, as of July 1st of this year, and based on the volumetric estimates on 320 acres -- all this is -- all those gas measurements are on 320-acre basis -- we see that the cumulative production is very high on -- quite high on a lot of these wells. One well that happens to be completed in both the basal -- what I call the basal coal and the upper coal stringers, is actually the poorest well of the bunch.

But in a couple instances the wells have already

appeared that they have drained more resource than what we think is available based on the volumetrics.

The next exhibit, M8, shows the performance of the coal gas wells.

The 6-2 well, showing typical coal-gas-type performance. The increase in production, 1988, has been enhanced, most likely, by the addition of compression. Still fairly -- you know, fairly typical coal-gas behavior.

In 1995, when the Chaco 4 and 5 were both put on production, we don't see any -- we still see -- you know, see a little -- we don't see any dramatic change in its pre- -- in its condition prior to those being put on, particularly in the water-production side.

Then the next exhibits, Section 7, Number 1 well, classic coal behavior. Nothing in this curve indicates to me that there is significant communication between the zones, or loss of resource in the coal formation itself. Very good well. Very good well, produced 820,000 MCF, best well of the Whiting wells.

Then the Section 1 Number 1 well, it's the furthest well up to the north, it's in close proximity of the 2-J well that's not producing. It's in close prox- -- well, the next nearest well is the 1-J, and it's not producing either. So it's unlikely there's any effect of any PC production on that well.

The 13 1 Number 2 well, this well was once completed in the upper coal stringers, and it has not been as good a well as the other wells.

And then the last one is the Section 12 well, Number 1, showing the effects of putting the compression on just recently.

The results of -- Also I should note, I guess, I've drawn an extrapolation of the potential future production from these wells. That is -- in some -- in -- Decline rates that I've used in this analysis range from -- I think there's one 14-percent, one 15-percent, and then for the most part 20-percent declines on these wells is what I used.

I think that will prove to be -- very well may prove to be a little bit conservative, particularly to the short time rate. I think these wells are going to continue to produce at their current rates for a while. They're still the peak time of their production, but they're getting -- It's a simplistic view and probably a conservative view of the volumetrics, but I needed some indication of what the potential ultimate reserves were here to fit within my volumetric estimate to see what kind of drainage these wells might represent.

The last page of that exhibit shows the cumulative production, the remaining reserves based on

those declines, the ultimate recovery, the recovery factor that is from that sorption isotherm of 62.1 percent, and then the estimated drainage radius based on all the data that went into the analysis there of the gas content and the recovery factor and the isotherm, the volumetrics and the actual performance.

And then my estimate of remaining performance shows that -- indicates that these wells range from 148 acres to as high as 816-acre drainage, average of 550 acres, which is quite large, quite large drainage, which means these wells look like they're producing extremely well for their -- and that -- and that there's no evidence that the resource from the Fruitland Coal is being drained by any other source.

The Exhibit M9 is a material-balance analysis. What I did here is, I used those surface shut-in pressures that were reported in roughly July 30th, 1997, that were reflective on those earlier graphs, and just assumed that those were representative of the formation pressure, and then went to that sorption isotherm and found out -- or looked on that to see what our gas content should be at those indicated shut-in pressures, gas content.

And then the percentage of reserves that would be produced is merely taking the initial gas content minus the current gas content as of July 30th, and that represents a

recovery factor. In this case, recovery factors would be represented in the -- you know, roughly 16 percent -- should have been produced that would account for the cumulative production from these wells.

Based on this analysis, it indicates that these wells are going to average a little over 2 BCF apiece, one well as high as 2.8 BCF. And then that relating into a drainage area again indicates extremely large drainage radiuses for the coal-gas wells.

An observation would be that if there's significant drainage of the gas resource from the coal formation, then why are these wells exhibiting such good performance and apparently are going to drain such a large area? You'd anticipate that it would be the opposite, that we would see that had these wells indicated that they were draining a smaller than average area, based on the performance of other wells or whatever, then we might suspect that some of the resource was being drained from the Fruitland Coal, but we don't see that.

The Exhibit M10 is -- Again, the first part of that exhibit is merely a normalization, in this case, of the five Fruitland wells in question, as opposed to the earlier one was just a total performance, and this represents the average of the five wells through just normalizing the production data.

Then the reason I did this is, I was wanting to see if these five wells were typical of the area, whether they were poorer than the area or whether they were better than the area.

So the Maralex -- Whiting/Maralex have 11 wells out there, coal wells. So what I did on the second page -- Actually, there's two pages to that first one. One is an overlay exactly the same as the first which shows the normalized performance of what I'm calling the five wells, which are the five wells in question here. And then the next one is the other Whiting six wells. And Al Nicol had referred to that in his production graph, and this is just a different way -- or my way of presenting the data.

And the overlay, if you wish to use it, shows that the five wells in question are performing about twice as good as the six wells that are not in question, that there's been no allegations of any communication or producing Fruitland gas out of PC wellbores that I'm aware of with -- in the areas of the other wells. And this indicates that the wells in question are just way better than the other Whiting wells.

The reason I use Whiting wells in this case is, same operator, maybe similar completion practices, operating practices, so I made that comparison.

Then the question arises, well, are those six

wells typical of the area, or are the five wells typical of the area?

So I did a bigger sorting. I took all the wells -- and I don't have a well count on this, but I believe this to be everything within two or three miles of the current production. A larger sorting of wells, excluding the five wells in question.

And we see that after three or four years that the average production in this larger sorted area is consistent with the five Whiting wells -- with -- I mean, the other six Whiting wells. And again, the average performance in the general area is only about half of what's represented by the performance of the five wells in question. And it really shows that the six other Whiting wells are performing in a fashion that is consistent with the other production in the area.

The Exhibit M11 is a tabulation of my conclusions.

Basically, the performance there is -- Performance of the PC wells just don't look like the performance of the coalbed wells. The coalbed wells look like coalbed wells, the PC wells do not look like coalbed wells. So there's no indication to me that there is vertical communication in the wellbores themselves, in the PC wellbores themselves.

By virtue of the tracer survey that was run on a PC well that shows the frac grew up to that first little shale and then it grew down into the lower PC sand intervals, it reinforces my -- you know, it kind of reinforces the opinion, I guess, that the PC wells are not producing from the Fruitland wells.

And it also is -- somewhat reinforces the potential for more consistent pressure support or, say, after-frac behavior of the Pictured Cliffs wells, in that I would have anticipated that the frac would have grown down into the lower PC intervals in the wells that Pendragon -- or Edwards frac'd. The reason is, they frac'd with about 36,000 pounds.

The example that was shown by Roland Blauer that showed clear evidence of downward growth of the frac into the lower PC was frac'd about 20,000 pounds. I don't recall what rate it was frac'd at, but it was a smaller volume, and so that has the opportunity to go back into the lower PC and act as some source of pressure support during the period, for a short period or a couple-year period, say, after the PC well had frac'd.

Then the performance of the Whiting wells, either look at them individually or look at them in total, did not indicate, in my opinion, any interference from the production of the PC wells. Pressure data shows that the

PC wells had lower pressure than the Fruitland Coal in early 1995, both prior to and after stimulation treatments.

There is a potential that the PC formation has seen some recharge. As I said earlier, it could be -- you know, we had the fracs -- I didn't quite explain myself on the fracs from the Fruitland Coal wells that may have invaded the PC formation. If they did, the initial production from the Fruitland Coal wells would have been primarily water production, and maybe that's why I mentioned when the wells were frac'd versus when they start producing a similar amount of gas, and I didn't have that water production.

They would have produced a significant amount of water production. The PC sand sits underneath the Fruitland Coal. If there's any communication, it would have been primarily water entering the Pictured Cliffs formation. That water, I don't think, would have invaded very far into the Pictured Cliffs formation before it basically created a -- you might say a water block in there.

In any event, if we would see communication of gas through the PC formation by virtue of the fracs in the coal wells, we should have seen a significant amount of water production before we saw any evidence of gas. The gas would have had to have pushed that water to the PC

wells in order to have the channel going -- of gas going into the PC formation and out the PC wells. I see no indication of that, and I think it's highly unlikely that the recharge is -- if there was recharge, that it's a result of the fracs into the coal formation by the -- by the Whiting wells.

A probable source of recharge, if you just look at the whole situation, is most likely the lower Pictured Cliffs sands may have some minor recharge. Particularly if you look at the gamma ray of the Pictured Cliffs sands, it's fairly uniform, you don't see very many breaks in the gamma ray.

There's gamma-ray -- neutron-density logs and the gamma rays on one of the exhibits Al Nicol had. Lansdale Federal is an exhibit, it's got gamma ray. Look at gamma ray there, it looks a lot different than induction log. Induction log would lead you to believe there's significant breaks in there. They may be tighter, lower-permeability stringers, but the gamma ray suggests that it's pretty massive-type formation.

Now, Pictured Cliffs cumulative production, and my estimates of ultimate recoveries are well supported by volumetric analysis. Yeah, we're draining more than 160s, but we're not draining 640s or 1000 acres or anything that's not -- can't be supported volumetrically,

particularly if we add in some resource, the lower PC resource.

Material-balance data is pretty close agreement to the decline-curve analysis. Decline-curve analysis on the Fruitland Coal wells indicate they may be draining a large area, and certainly do not indicate that there is a loss of reserves to an outside source, such as PC production.

Material balance also indicates that the wells draining very large area and again does not indicate a loss of resource to PC.

Performance of the Fruitland wells, Whiting wells, subject, as I mention there, are much greater than the average of the area.

The bottom is that the Pendragon Pictured Cliff wells are producing from their own common source of supply, the Pictured Cliffs formation, and the Whiting Fruitland Coalbed wells are not being produced -- or the coalbed methane reserves in the Whiting wells are not being produced from the Pendragon Pictured Cliff wells.

Q. Mr. McCartney, I believe you're aware that pursuant to application made by Maralex and Whiting to the District Court, the four Chaco wells that were frac'd were shut in by court order just about a month ago. You're aware of that?

A. Yes.

Q. Do you think -- Do you have an opinion whether there is maybe any likelihood of waste or damage that will result from that shut-in?

A. Yes, there's -- Well, there's obvious economic waste. The wells are sitting there still incurring some operating costs, compressor rentals, whatnot, pumper fees because of the monitoring of the wells, and there's no income from the wells. That's obvious.

My main concern is -- My main concern is that the wells do -- some of the wells, absent, say, the Chaco 5 -- Three of the four wells that were frac'd make some water. My main concern is that that water imbibes into the -- particularly the perforated -- what I'm calling perforated zone, what Al Nicol called the upper PC zone, the area of lower resistivity, that I envisualize has this fracture going out there.

If water invades into this fracture system and is allowed to imbibe into the formation matrix itself, it has certainly the ability to lower the relative permeability of the gas. And I've seen cases where -- That's exactly why you don't go out there and frac a well and leave it shut in.

You know, in case after case it will come back that you'll damage a well by frac'ing it and leaving it

shut in, and now those fluids imbibe back in the formation, create high water saturations in the matrix and create low relative permeability of the gas, you can't get that, there's not enough pressure to push that water back out, and the flow rates may come back to be significantly diminished than they were when we shut them in.

So that's a concern of mine, and we won't know, I guess, whether that, in fact, happens or not until these wells are producing again. But the longer they're shut in, the more the likelihood of that occurring.

Q. And likewise, Mr. McCartney, is there any justification for the continued shut-in of the four wells?

A. Not in anything I've seen. I see no evidence of direct communication between the two formations, and there's absolutely no reason in my mind that the wells shouldn't be on production and producing as they were before.

Q. If the four shut-in wells are restored to production, is there any likelihood of damage the Whiting/Maralex Fruitland Coal wells?

A. No.

Q. Mr. McCartney, were Exhibits M1 through M11 prepared by you or at your direction and control?

A. Yes.

MR. HALL: That concludes our direct of Mr.

McCartney.

We'd tender Exhibits M1 through M11.

EXAMINER CATANACH: Any objection?

MR. GALLEGOS: No objection.

EXAMINER CATANACH: Exhibits M1 through M11 will be admitted as evidence.

This is probably a good place to take a little break before we start, ten or fifteen minutes.

(Thereupon, a recess was taken at 10:43.m.)

(The following proceedings had at 11:07 a.m.)

EXAMINER CATANACH: Let's turn it over at this point to Mr. Gallegos.

CROSS-EXAMINATION

BY MR. GALLEGOS:

Q. Mr. McCartney, are you aware that the major companies in the San Juan Basin that are large owners and operators of Fruitland Coal wells have been taking the position, and particularly before this Commission, for years that shut-in of Fruitland Coal wells is harmful because of the water accumulation?

A. I'm not aware of what their thinking is, but that would be consistent with my feeling, yes.

Q. Okay. And so now you're telling us and telling this Commission that the same concept applies to Pictured Cliff wells, or at least to the Pendragon Pictured Cliff

wells; is that correct?

A. Yes, particular sand-formation wells may run a higher degree of risk. The coal wells, you may build up water, but they'll come back. You can pump that water, and you have to spend a little more money pumping water, but the gas production probably won't be irreparably damaged.

Sand operates different, and you could suffer damage with sand wells.

Q. Where is the water coming from? The very last questions, you were asked were you concerned about this. Where is the water coming from in the wells that -- Pendragon wells that were shut in at the end of June?

A. Well, it could be some water coming from the perforated interval itself, could be some water coming from the lower PC intervals.

Q. So you're not talking about water that's standing in the tubing when you shut in? You're not talking about that water?

A. It's the same water.

Q. Well, but I mean the water that you're concerned with is -- Are you talking just about the water that's *in situ* in the reservoir --

A. Well, the --

Q. -- or water --

A. That's where -- That's the source, potential

source of the water.

Q. In other words, are you talking about --

A. I mean --

Q. -- the water that's already coming from the rock, that's already there?

A. Well, it may be coming from a different rock. In this case it may be coming primarily from -- You know, there may be some water production from the lower PC interval or the -- what I'm calling the lower PC interval, that's not *in situ* water that's currently present in the perforated zone or the upper PC interval.

Q. But what is your -- What's your basis for your statement? I'm trying to find out if you're worried about water setting in the wellbore, in the tubing, or your water -- Are you telling us that you're worried about water that's in the formation, that's already naturally there?

A. Well, what I'm worried about is, if water is in the tubing, stays in the tubing, that's no concern. It can be blown out, pumped out, swabbed out, whatever.

My concern is that we sit there with the upper PC formation exhibiting water saturations, *in situ* water saturations. For a number, use 40 percent.

If additional water is introduced to that system and that water saturation imbibes into the formation and that water saturation goes up to 60 percent or 70 percent

or 80 percent, then the ability for the gas to flow from that upper PC is diminished considerably. That's my concern.

Q. Okay, well, let's try and understand this. Let's say that you're starting out with the -- The formation that's productive in the Pendragon wells has 40-percent water saturation.

A. Well, I -- Is that a hypothetical question or --

Q. Yeah, hypothetical question.

A. Hypothetically, okay.

Q. Okay. And then the well is shut in. So it has 40-percent water saturation, hypothetically. Now, how is it going to increase that? This is going to come from this lower PC?

A. That's a source, yes, could be. That's a possibility.

Q. Just a possibility?

A. Or -- Yeah, I don't know if we'd use "probability" in a legal sense, but there is a concern on my part that might occur.

Q. But you haven't done any study, you haven't quantified anything? It's just a concern?

A. No, I haven't -- We'll find out, hopefully, soon if that's a concern or not.

Q. And was your testimony that it gets worse with

time, or just your concern gets worse, or the water situation gets worse?

A. Well, if there's water in the formation and if there's water introduced into the fracture system, the longer it's in there, the more opportunity it has to imbibe. And the further it imbibes into the formation, the lower it reduces the permeability, and the damage increases, and my concern increases.

Q. On that, let's go back to some of your earlier testimony, where I believe you said there's not much water production in these PC wells. Wasn't that your testimony?

A. I haven't seen evidence of very much water production myself, and the -- the conversations with Paul Thompson, you know, his indication that he hasn't seen -- I haven't -- I haven't seen evidence of very much water production myself.

Q. Okay. Well, isn't one of your theses that there was a lot of water produced from the Whiting wells, and that's characteristic of a Fruitland Coal well, and there wasn't much water produced from the Pendragon wells, and that's characteristic of Pictured Cliff wells?

A. Yes.

Q. All right. Now, as far as the Whiting wells are concerned, you had reported data to go on concerning water production?

A. Yes.

Q. In fact, even with the reported data, you had some skepticism about whether it was true or not in two or three of the early months?

A. No, I'm not concerned, although there is potential for error in the reported data, no doubt. I'm not concerned about error in the reported data. My comment referred to data that probably, or very well possibly was not reported.

Q. Well, I think you said this may not be good early data. Wasn't that your testimony?

A. I guess you've got me confused. Are we talking about the Fruitland Coal early production or are we talking about pressure data?

Q. We're talking about water production --

A. Okay.

Q. -- from the Fruitland Coal --

A. Yeah --

Q. -- that you had the --

A. -- the early production data, which -- I'm not -- If they put the wells on production in August of 1993 and then they don't have any water -- or don't have any production reported for a couple months in there, and no significant water production, I'm wondering why not.

Q. Then you question that?

A. Well, yeah, I don't know whether it was reported or not, or if it -- I just would think they're out there pumping the wells.

Q. All right.

A. Maybe they're not. And I can't say one way or the other whether they are. I would be out there pumping those wells.

Q. Okay. All right, now, let's switch over and look at what information you have for water production on the Pendragon wells. Mr. McCartney, all you have is anecdotal statements by Mr. Thompson about something about pit size and not much water produced; isn't that right?

A. Oh, I have -- I've reviewed some of the pumper reports, and occasionally there will be a notation of water on there.

The State reports just recently reflect some water production?

Q. Just this year?

A. Just this year. And the testing that was done earlier this year indicated some water production on some of the Fruitland wells.

Q. Well, so basically the reports, whether they're verbal or on the pumper reports by Mr. Thompson and his crew, that's what you rely on?

A. Well, that's the information that I have reviewed

and that I have.

Q. Yeah, and you --

A. And I don't know if I -- Well, I guess I'd have to say I do not rely on that being the sole, absolute production from those wells.

Q. Okay, you don't take that as gospel?

A. Well, it depends on how religious we want to be, whether I take it as gospel. But if the pumper puts down 11 barrels a day, I assume that he had some basis for putting down 11 barrels a day. If he puts down no water production for a year and sometime during that year they set out their 150-barrel truck, and the vac truck sucks 150 barrels off the pit, maybe sometime during that year it produced 150 barrels, I don't know.

But anyway, I don't question -- you know, I don't have a tendency to question as much positive available data as I do data that is absent.

Q. I see. So you question the reported data to the State by Whiting, but you don't question the absence of data in the Pendragon wells? That's your position?

A. No, that's not what I said.

Q. In terms of water production, the Fruitland Coal wells of Whiting were on pumping units; isn't that right?

A. They reported -- It's my information they're pumping the wells, yes.

Q. Okay. The Pendragon wells did not have pumping units, do not have pumping units; isn't that true?

A. That is true.

Q. And do you know whether they have any other mechanical means for lifting the water?

A. Well, they get tubing in the hole and -- I mean, they don't have any artificial lift installed as far as plunger systems, bottomhole pumps, that type, no.

Q. Okay, so you're comparing what you think is water production from a set of wells that have artificial lifts, pumping units, and a set of wells that have no such facilities; isn't that right?

A. You could make a comparison on that, yes.

Q. You had some comment about the loading up due to the 1-inch tubing that was in the Pendragon wells?

A. Yes.

Q. Your conclusion was that these wells loaded up with water because of the small size of that tubing?

A. They would have the likelihood to do that, yes.

Q. So your advice, then, would have been to put a pumping unit on these Pendragon wells?

A. No.

Q. Don't you think if they put a pumping unit on, it would have increased their production?

A. I don't know. Probably not, probably. I'd have

to answer no on that.

Well, let me -- let me -- If you're referring to the time frame when Pendragon -- or Edwards/Pendragon, took over operations of these wells, I would have to say probably not.

Q. But it would have some other time frame, when they were originally drilled, if they put pumping units on?

A. Well, I don't have any information of water there. It didn't appear that it would make any difference back then.

Q. Now, isn't it a common practice of operators who are attempting to address buildup of liquids in their well casing to use smaller tubing size in order to gain lift?

A. Well, that works to a point. You can do that. You might refer to it as a velocity string. If you have sufficient bottomhole pressure and limited quantities of water, you can unload through smaller tubing.

Q. Okay. So here the tubing size -- the tubings were changed -- at least there was some report to you the tubings were changed from 1-inch to 1-1/2-inch on the Pendragon wells, or did I hear you correctly?

A. I think I heard that in testimony from Paul Thompson today. I believe they ran 1-1/2-inch tubing in there. I'm not exactly certain, but Mr. Thompson testified to that.

Q. And what do you know, if you know anything, about whether the wells still loaded up with water?

A. Well, they operated the wells in a fashion to try to avoid them loading up with water as best they could.

Q. And what was that fashion?

A. Well, they dropped soapsticks in there and soaped it to make the water column lighter, in order to help unload the wells.

Q. Let me ask you a few questions about some of your exhibits. Let's turn to your Exhibit 1, M1 to be specific. This exhibit is a comparison of production curves for the combined Whiting wells and the Pendragon wells?

A. Yes.

Q. And when we talk about the Whiting wells, we're talking about what you've identified as the five Whiting wells that are the subject of the investigation here?

A. Yes.

Q. Okay, and six Pendragon wells?

A. Yes.

Q. All right. Now, when I look at the curve -- Let's take a look at 1995. Do you see an indication in the latter part or mid part of 1995 of a decrease in the Whiting well, or at least a -- what I would say is a decrease in the rate of increase of the Whiting well's production?

A. You're referring to the latter part of 1995.

Q. Well, this looks like about the -- it looks like about the middle -- mid-1995.

A. Okay, I should note, if you'll allow me, that August production is not shown on the plot for the Whiting wells, because I had no information for that month, so that month is just omitted. It showed up as a zero production month on *Dwight's*, and I'm not --

Q. Well, look at the two points --

A. -- sure what it was, so that's just a --

Q. Okay --

A. -- deal, but --

Q. -- but look at June and July. There's definitely a decrease?

A. Yeah, June and July is -- you know, is lower than May; that is correct.

Q. Okay. And wouldn't you say -- In fact, you've drawn a couple of curves. You had an incline -- Oh, okay, you haven't drawn the curves.

But if you drew a curve for the period of time up to May of 1995, of the incline rate, and you drew a curve for the incline rate beginning with June and July of 1995, you would have significantly different curves, would you not?

A. Well, the exhibit on its face will show that May

and June of 1995 is low months, and I don't know what the problems was there, as far as -- very well could be mechanical or other problems. I don't know.

The wells showed an increasing -- you know, an appetite for increasing gas production and an appetite for decreasing water production, and there seems to be little change in the well, in my opinion, as -- after the Pendragon wells came on.

Q. Let me see if we can get back to my question. All right.

You take the production levels up through May of 1995, and you project that line, and then you take the production levels beginning with June and going on out through the last data points you have, and you have a significantly different incline curve; isn't that true?

A. No, it looks like the rate of incline is about the same. It shifts down there a little bit in May-June, and I don't -- you know, I don't -- you know, the character of the curve is not -- you know, there's no significant change. It depends on how you draw it.

You could draw through the months of March and May as flat production, and then you could draw the rest of the production on into 1996 as a fairly steeply inclining production. So...

Q. Looking on out into 1988, do you have any trouble

recognizing that the Whiting well production goes up significantly, and in that same period of time the Pendragon wells' production goes down?

A. That's correct.

Q. So there's a -- This would indicate to you, would it not, evidence of a direct relationship between increased production in the Whiting wells and decreased in the Pendragon wells?

A. I think the direct relationship would be an indirect result of the Whiting wells producing higher quantities of gas into a common pipeline, increasing the pressure in that pipeline, which then the Pendragon wells were not able to produce as much into that pipeline.

So I think it's a pipeline pressure situation, it's a physical situation on the surface with the pipeline.

Q. Well, if that's the case, Mr. McCartney, provide us the data that shows us the pipeline pressures, the gathering-line pressures.

A. Pardon?

Q. Let us -- Share with us the data that shows the gathering pressure increases that you say explains what would otherwise appear to be a direct correlation.

A. I don't have that data available to me right here. We can get that and provide it to you. Well, it may very well be if --

Q. Do you have the data?

A. I may have some limited data here with me in the room.

Q. How many wells are on that -- Strike the question.

You understand these wells are connected to El Paso Field Services' gathering system?

A. Yes, that's my understanding.

Q. Okay. How many wells are connected to that system --

A. I don't know.

Q. -- to that particular gathering system?

A. I don't know.

Q. Hundreds?

A. I don't know.

Q. But you're testifying five wells -- Actually it wasn't five. Three wells of Whiting go on compression, and that changes the line pressure in that gathering system?

A. It could.

Q. Well, if you have some data that shows those line pressures that -- after you leave the stand, we'd be pleased to see that.

A. I can see what I've got in there.

Q. Okay. Your series of Exhibits 2 are some comparisons of pressures between Pendragon wells and

certain nearby Whiting wells?

A. That's correct.

Q. Correct? And the time period that we're looking at is simply the post-frac time period of the Pendragon wells; is that true?

A. No, that's not true. There are some pressures indicated on here that were pre-frac pressures.

Q. Well --

A. But I think they're all 1995 pressures.

Q. And if they're --

A. Maybe --

Q. Excuse me.

A. -- I could check and see specifically, but I think they're all pressures that were in the vicinity of time when these wells were completed, 1995.

Q. When they were stimulated, either by acidization or hydraulic fracture or both, correct?

A. I'm not familiar with how many acid jobs were given to the wells and when the timing of that was, other than the January 30th one that was entered in testimony, but --

Q. Just what you've heard in the hearing room here today?

A. Yeah. But I believe these are all 1995-vintage wells, and some of them were prior to frac and some were

post-frac. I think the Chaco 1, the first one, I think all those are post-frac readings.

Q. Well, you said 1995-vintage wells. You mean 1995-or-later-vintage pressure readings?

A. Yeah, the pressures that were taken in those wells, 1995.

Q. All right. So first of all we understand that the curves drawn here for these pressure points have nothing to do with pressure readings that were taken back in the 1978-through-1983 time period? Those are not shown?

A. No, I -- Maybe you missed the point of the exhibit. The exhibit really is trying to estimate what the coal pressure was at the point of time that the Pictured Cliffs wells were completed and see if they match up. So the earlier period prior to completion of the coal wells would not help us there.

Q. All right, you're seeing how these pressures compare between the Fruitland Coal and the Pendragon wells during the period after the Pendragon wells were stimulated, either by acidization, fracture or both, correct?

A. Yes. During that period of time, they -- that is, in essence, what I was trying to do, it may be that there's all the pressures that were taken subsequent to the Whiting wells being completed, but I -- and it appears

that's the case. But anyway, that's basically what it is in 1995, pressure.

Q. All right. Now, let's talk about this, and assume -- assume for these questions that the Whiting wells are strictly producing from the Fruitland Coal and the Pendragon wells are strictly producing from the Pictured Cliffs, and explain to us the drive mechanisms for the gas production in each of those two formations.

A. Okay, they're both primarily pressure-depletion mechanisms. With respect to the coal production, the method by which the gas is liberated from the coal is much different than the method by which gas is liberated from sandstone. And we can go into that if you want to. That's a desorption-type mechanism, and so it's a different mechanism, but they're both dependent upon pressure depletion.

Q. But they are quite different drive mechanisms for the movement of the gas to the wellbore?

A. Well, the movement of the gas in the coal gas comes through the cleat system, into the fracture, into the wellbore, out the wellbore to the pipeline.

The movement of the gas in the sandstone goes from the sandstone, into the fracture system, into the wellbore, out the wellbore to the pipeline.

So if that is -- To me, that's similar. Maybe to

somebody else that's dissimilar, but that's the mechanism.

Q. Okay. Would the pressures of these wells, the two wells, in different formations, the pressure declines moving in tandem, be evidence of communication?

A. Not necessarily.

Q. What you have on the first Chaco 1 chart that you show basically reflects that, doesn't it?

A. Yeah, those are --

Q. Almost a strict parallel between the pressure decline in the Whiting well and in the Pendragon well?

A. Based on this data, that's a correct observation.

Q. Okay. But that doesn't indicate -- That's not evidence of communication?

A. No, that's not necessarily evidence of communication.

Q. What would be -- When you look at this, then, what would you expect to have seen that would have said there is communication?

A. Well, if the coal gas wells when they were frac'd immediately came up to the pressure -- I mean -- Let me back up.

When the Pictured Cliffs sand wells were frac'd, if they immediately exhibited the 200-plus-pound of the coal wells and then followed a similar-type decline, then that would be stronger information to me that there might

be communication.

Q. Okay, so it would be the in-tandem decline in pressure, but to be evidence to you of communication they would have to sort of lay on top of each other?

A. Well, I would think that they would be closer to each other. And, you know, they exhibit pressures out of the same reservoir, they should be relatively similar, just as the coal wells themselves are relatively similar to each other.

Q. And these seem to exhibit about a -- What? About a constant 30-pound difference in pressure?

A. Are you referring to just the Chaco Number 1?

Q. I'm still looking at Chaco Number 1 when I say "these", yes.

A. Excuse me, Counselor, I forgot your question. Thirty-pound --

Q. About a consistent 30-pound difference in pressure.

A. Oh, difference in pressure?

Q. Yes, the difference.

A. That's probably fairly close, yes, sir. Well, yes, that's about right.

Q. Now, aren't there available type curves for the pressure decline in a Pictured Cliff well in this area?

A. My answer is either no, or I don't understand the

question.

Q. Well, what I'm interested in is comparison of the pressure-over-time decline in the Pendragon well, as opposed to other wells that are acknowledged to be strictly Pictured Cliff wells.

A. Well, I think they'd be -- if they're different reservoirs, different forma- -- different reservoirs, different areas, different producing characteristics, the pressure decline is going to be different. I don't think you can type-curve pressure decline in the PC, *per se*.

Q. Well, in these two townships. I'm not talking about trying to do it all over the San Juan Basin but just in analogous wells, where there's no dispute, there's no question that this is a Pictured Cliff well producing only from the Pictured Cliffs. Did you investigate that?

A. I've looked at -- I have not in detail looked at all the Pictured Cliff wells in the region, no, so I can't testify as to what they look like, whether similar or dissimilar.

Or for that matter, whether they're analogous or not analogous to these wells.

Q. Okay. We'll come back to that question in a minute.

But just as we look at these pressure-versus-time plots in your Exhibit 2 and we flip over to the Chaco 4 and

5 wells, which were frac'd in May of 1995, we see a pressure increase in about May of 1995 with the Chaco wells coming up to a pressure that is basically the same as the Whiting 12-1 coal well. Am I correctly reading your chart, Mr. McCartney?

A. Well, the -- With respect to the Chaco Number 4 well, there are three pressure points in there that are pre-stimulation, pre-frac-treatment wells, and then one of them is post-frac, and it increased six pounds, and then the pressure measurements we have, say, in October of 1995, are on the order of 160 pounds, 162 pounds in Chaco 4, and 158 pounds in the Chaco 5, and that does intersect pretty close between -- on the curve of the 12-1 well, and still that 20- or 30-pound differential with the 6-2 well.

Q. But basically, the Chaco 4 and 5 line lay on the pressure line of the 12.1 Whiting well?

A. Well, the graphs there indicate that pressures -- if this extrapolation between these two surface shut-in -- or surface -- the two higher pressures on the flowing pressure data supplied, if those are valid pressures, then -- Well, let me put it this way: The curves come very close together at that point in time. Whether that's valid or not, we have no information to say it is.

Q. Well, aren't you drawing conclusions from --

A. Not just that well -- Well, the conclusion I draw

with that well is that the initial pressure in that well indicates that it's -- that it may be erroneous, because it's much lower than three of the other four wells.

Q. Which one are you talking about?

A. The 12-1 well. So I don't know whether that's good data, and that's what I said in my direct, I believe.

Q. And by the way, on the Chaco 4, that pressure point is taken after the well was acidized on January 30th of 1995, isn't it?

A. Yes, it was.

Q. And did you check the data that indicates that there was about a 50-pound increase in pressure of that well after the acidization?

A. From what to what, I guess I should ask?

Q. From the --

A. From prior -- five minutes before the acid to five minutes after, or five years before to --

Q. From the rig pressure reading on January 30, 1995, before the acidization, and from the point -- from a pressure that was taken on February 14, 1995, in the well file, that indicates that the pressure went from 119 to 170.

A. I have seen that 170 on that daily report. I don't recall seeing the other number. I don't doubt that there's another number there, but I don't recall that one.

I don't believe I've seen it.

Q. So anyway, what we see on the 4 and the 5 here, which, by the way, are located very close in geographical relationship to the Whiting 12-1 well, is -- and it -- is an exhibition of basically the same pressure, and the same pressure decline over time. Do you agree?

A. I don't agree with -- It appears that it's relative on what you think is close by. Those are about as far apart as any of the comparative wells there are in the analysis. They may be a couple thousand feet apart. They're not close by like the 2-J is to the Number 1 well in Section 1, not close by like the 2-R well is with the well in Section 7. But...

So these are the furthest-away parts, and the pressure readings may have been fairly consistent there. I mean -- Well, the graph shows Chaco 4 looks like it was pretty close to what the other two wells were in the middle of 1997.

Q. And in fact, the 6-2 well pressure is -- over time -- I mean, you only have two points there --

A. Unfortunately, I might add, yes.

Q. Only two points. So the second point that illustrates pressure in about mid-1997 reflects a difference of -- what? Maybe five to ten pounds from the coal well pressures?

A. It could be in that order of magnitude, yes.

Q. Okay. And all of these wells that we're looking at, Chaco 4, Chaco 5, the Whiting 6-2 and the 12-1 wells, are basically within what amount to a 40-acre -- 40-acre offsets?

A. Yeah, I think they're in contiguous 40-acre tracts. Well -- Close by. I'm not sure on this Number 1 whether it's, you know, in the northeast northeast or the southeast northeast. But in the 40-acre vicinity, yes.

Q. All right. Let me discuss with you now, Mr. McCartney, some of your work that you did concerning the gas in place in the Pictured Cliffs. Would if be correct if we would want to refer to your Exhibits M3 and M4 on that subject?

A. Yes. Well, not M4. M3 is -- addresses gas in place.

Q. Okay. Well, in M4 is Pictured Cliff performance, which I thought led to some of your conclusions about the amount of reserves that you think are attributable to the Pictured Cliffs?

A. Yes, but I thought your question had to do with recoverable reserves, not volumetrics, but --

Q. Well --

A. -- they're --

Q. I'm not very exact --

A. Proceed, yeah, okay.

Q. -- about these things, all right?

But looking at your Chaco -- You have a Chaco 1 and a Chaco 4 -- Well, actually I guess you have the 5 here. You have logs where you've colored certain zones. Do you have that?

A. Yes.

Q. Are you with me? Okay.

First of all, the perforated zone is colored in yellow, and are we to understand that you are attempting to illustrate from this log what is commonly referred to as the upper unit of the Pictured Cliffs and, in addition, what Mr. Nicol has named the upper Pictured Cliffs formation?

A. Well, it's just in the upper portion of the Pictured Cliffs sand, and I think Mr. Nicol had drawn a sketch of what he called upper Pictured Cliffs sand, or his nomenclature that he coined in -- as you stated. But I have not checked his exhibits either. These are the exact same footages as he referred to, but it's obvious it's in the upper portion of the sand.

Q. Okay, so the upper portion of the zone that's colored in yellow would be the sandstone that's above the lower coal formation?

A. No, not necessarily. I mean, some of these don't

have a lower -- The basal coal shows right above the perforated zone, and in some instances that maybe the only coal in the log. And in other cases there may be a coal into the Pictured Cliffs formation.

Q. What kind of log is this?

A. This is an induction electrical log.

Q. Not a neutron density?

A. No.

Q. Okay. What's the thickness of -- What do you consider to be the thickness of the perforated zones? Let's use that terminology.

A. For the Chaco Number 1, 24 feet.

Q. All right. And then, the lower zone is not perforated?

A. To my knowledge, it is not perforated.

Q. And are you aware that it is essentially universal practice in the Basin that operators do not perforate what you have designated here, colored in green and called the lower zone?

A. I would anticipate it's common practice that that zone is not perforated.

Q. Okay, why would you anticipate that?

A. Because it's not perforated in these wells subject to this analysis, and it exhibits low resistivity and low gas saturations, high water saturations, higher

clay content, and is probably not in itself commercially producible resource.

Q. Okay. But in your -- Unless I'm misreading this, in your calculation of the gas in place, you're attributing almost half of that gas ion place to that lower zone?

A. I've shown both. I've shown what's attributed to the perforated zone and then what's attributed to the addition of the lower zone. So both of them are in there.

Q. And the lower zone is almost equal, isn't it, in your calculations? 50-50? Roughly, I mean, not exact calculations.

A. No, it's -- the lower zone is somewhat -- Well, the lower zone has higher water saturations, lower gas saturations, but considerably more thickness than the upper zone, so it consists of a fairly large supply. Not as large a supply of gas resource, in any instance that I've looked at in these particular logs, as a perforate zone, but it is a fairly significant resource for gas.

Q. Well, in the Chaco 4, you're putting 819,000 MCF on the perforated zone and 760,000 MCF on the -- what you call the lower zone?

A. Yeah, the upper zone exhibits about 21 feet of pay, and the lower is 58 feet of pay, so that's the major difference, is the thickness.

Q. Okay. Well, what is the water saturation percent

of the lower zone in the Chaco 1 or in any of these?

A. Well, Chaco 1, the lower zone indicates an average of 67.01 percent.

Q. Okay. So if you open up that zone, are you going to make gas or are you going to make water?

A. Probably both.

Q. A lot of water?

A. I don't know how much water. That depends on the relative permeability to water.

Q. Well, maybe we can cut it short. Are you basically concluding that the gas in place in the Pictured Cliffs that's going to be a recoverable resource is the gas calculation you made for what you call the upper zone?

A. That's part of it.

Q. So you're -- Will you take the number as the entire 4.1 BCF or the 2.4 for only the perforated zones?

A. Well, the perforated zone, I think, is -- unless I -- The exhibit appears to me to be fairly clear. Perforated zone shows 2.493 in those three wells.

Q. Yes.

A. The lower zone calculates to be 1.69. Add those together, you get 4.18.

Q. Yes. And that's what you consider to be the reserves for the Pendragon well?

A. That's the resource available in the PC sand

there. I don't know if we're going to recover -- I don't know what our recovery factor is going to be on that lower zone. I do think it's contributing to the productivity of the well in some degree.

Q. How much?

A. I don't know. Some.

Q. Five percent?

A. I don't know.

Q. So then following that, we have your Exhibit M4, and what is the purpose of these curves?

A. Well, there's two purposes. One is to show the producing characteristics of the individual wells, and one to show the anticipated ultimate recovery of these so we can determine drainage radius exhibited by this performance.

Q. Okay. So in simple terms, the -- You're taking the production performance of the Pendragon wells to say what you believe is the gas that can be recovered from what you consider to be production in the Pictured Cliff formation?

A. Yes.

Q. All right. Now, if you assume with me, just assume for purposes of my question, if you assume for purposes of my question that the Pendragon wells are in communication with the Fruitland Coal formation and

producing gas from that formation, then your reserve study is reflecting production of gas from the coal; isn't that right?

A. So if I understand the question, if the question is that all the gas represented on these graphs is from the Fruitland Coal, then the gas produced is all from the Fruitland Coal?

Q. No, my question is if you assume there's a communication so the Pendragon wells are producing from the Fruitland Coal, not to the exclusion of some production from the Pictured Cliffs, what your curves are reflecting is, the production that's contributed to by the coal?

MR. HALL: Well, you know, I'm going to object at this point. I think that's inconsistent with prior testimony. He testified to the exhibit that it's reflective of Pictured Cliffs reserves, period.

MR. GALLEGOS: Well --

EXAMINER CATANACH: I think I would agree --

MR. GALLEGOS: -- I'm asking --

EXAMINER CATANACH: -- with Mr. Hall.

MR. GALLEGOS: -- a hypothetical -- Pardon me?

EXAMINER CATANACH: I think I would agree with Mr. Hall.

Q. (By Mr. Gallegos) Mr. McCartney, you understand there's a pretty serious question in this case as to where

the gas is coming from that's being produced from the Pendragon wells?

A. That's probably why we're here.

Q. Yes, sir. So when you take the production from the Pendragon wells and say this is -- this indicates the reserves to be recovered, you're talking about the gas that is in issue, whether it is coming from the Fruitland Coal or the Pictured Cliffs or both?

A. I'm talking in this exhibit about the gas that's being produced from the wells that are purported to be producing from the Pictured Cliffs sand.

Q. Because you assume -- your opinion or assumption is, that's where it's coming from?

A. That's what my study is all about, trying to determine that.

Q. And all I was asking you, if you assume for purposes of my question, if you assume that this gas or a portion of it is coming from the coal, then you're reflecting a recovery of reserves that includes Fruitland formation gas; isn't that right?

MR. HALL: Well, same objection, Mr. Examiner. Same question. He said it's reflective of Pictured Cliffs reserves.

EXAMINER CATANACH: I think it's clear what the exhibit is meant to state, Mr. Gallegos.

MR. GALLEGOS: Well, on his assumption of what it is, but I think I can -- All right, the -- stands as -- ruling.

Q. (By Mr. Gallegos) Mr. McCartney, in order to make some comparisons to the production of the Whiting wells, first of all you undertook to compare those Fruitland Coal wells to six other Whiting wells. That was one study that you did?

A. Yes.

Q. Okay. And that told you that the Whiting wells were good wells, the five wells in question are good wells?

A. Yes.

Q. Okay. Then you went a step farther, and you took the data from -- what? Forty additional wells, 40 coal wells in this area?

A. I'm not sure. I don't have that available, and I didn't plot it on the graph, which I apologize for.

But I don't know how many wells are in that sampling. Significantly more than five or six, yes, sir.

Q. Well, approximately how many?

A. I don't -- I'd be speculating.

Q. Okay. But anyway, a large study area?

A. A bigger study area than the five or so, that's right.

Q. And what that was meant to do was to do what is

often referred to as analogous well study?

A. Well, I wanted to see what -- Yes, I wanted to see what the other wells completed in the Fruitland Coal were doing in the area.

Q. Right, so you could compare the five Whiting wells in question with other wells that are completed and producing from the Fruitland Coal formation?

A. Yes.

Q. Okay. What I'd like to learn about, then, is studies you did to take the Pendragon wells, that are supposedly Pictured Cliff-formation-productive wells, and do a similar study so we could compare those to other Pictured Cliff-formation wells.

A. Okay. In looking at the area -- a broader area, say a township or two on either side of this -- I did not come across information that indicated that there were the same -- that there were analogous wells to this, you know, similar-type frac jobs, similar-type fluids, anything like that. Maybe, but I didn't research it to the detail to find out.

I did look at the magnitude of production of some other wells in the area to -- And there's some good PC wells out there. They may not have been stimulated, but they're good PC wells, produce a lot of gas.

Q. Well, let's -- Since we're addressing these, if

we're going to address a comparison of analogous Fruitland Coal wells, wouldn't it be logical, then, you would give us a study to compare these Pendragon Pictured Cliff wells to a group of other Pictured Cliff wells in the vicinity?

A. I think it would be appropriate to -- as you may have suggested, to compare these to analogous Pictured Cliff wells, but that's the key. I do have analogous coal wells. I don't have what I feel are analogous PC wells.

Q. Because what you're saying is, you can't find any PC wells in the area that are performing anything like these Pendragon wells; isn't that true?

A. I can find wells that are going to cum more than these. There's wells out there that are better than these are.

Q. If you get a group of Pictured Cliffs wells in this area, you're going -- what it would reflect is that these wells are producing a magnitude of 20, 30, 40 times what other Pictured Cliff wells are producing; isn't that right?

MR. HALL: Well, I'm going to object. It's calling for the witness to speculate about whatever group of Pictured Cliff wells Mr. Gallegos is talking about. We don't know that.

EXAMINER CATANACH: I'm going to allow that question.

THE WITNESS: Well, let me answer it this way: I have graphs on six Pictured Cliff wells in this exhibit. Each of those graphs shows that prior to stimulation the production from these wells was very minimal. And I think you'll find that in many of the surrounding wells, in many of the surrounding wells, they didn't produce very much PC gas, and that's the reason that this PC reservoir is not as depleted as Whiting would like to have believed it was.

So it's obvious from these exhibits that these wells are producing small quantities of gas, seldom over 10 MCF a day, average, on a monthly basis, and most of them considerably lower than that.

So when we fracture-stimulate these wells and we achieve flow rates of 250 MCF a day, that's magnitudes higher than what it was prior -- pre-stimulation. And in some instances it may be comparable to what these wells were IP'd at or initial production was.

But -- So if we do a whole series of wells that don't have stimulation treatments on them, particularly these type of stimulation treatments, then I wouldn't anticipate they'd look anything like these wells.

Q. (By Mr. Gallegos) Well, they wouldn't be analogous?

A. That's right.

Q. I'm suggesting to you that you could have done a

study of PC wells that were completed, without any question, being completed in the Pictured Cliff formation and that were fracture-stimulated with those completions. But you didn't do such a study, did you?

A. If they exist out there, I didn't. I didn't find them, and I didn't study them.

Q. So the bottom line is, there are no analogous wells to the Pendragon wells, Pictured Cliff formation, at least that you're able to bring forward?

A. Well, I think if you'll look up in Section 1 of 27 North, 12 West, you'll find four Pictured Cliffs wells there that have -- several of them have higher cum productions than any of these wells. So as far as significant good wells, those are better wells than these are.

Q. Are they fracture stimulated?

A. I don't have that information. I don't know if they were or were not.

Q. What wells are you referring to?

A. The ones in Section 1 of 27 North, 12 West.

Q. And you don't have the well names?

A. Not here at the stand, I don't. But they're all -- There are four wells in there, and they're all PC wells.

Q. Operated by who?

A. Dreyfus, maybe. I'd have to look, I'd have to look.

Q. All in Section 1 of 26 North, 13 West? Is that what you're saying?

A. That's what I --

MR. HALL: 27-12.

THE WITNESS: 27 North, 12 West is what I recall.

Q. (By Mr. Gallegos) I'm sorry, 27 North, 13 -- 12 West.

A. Yes, Section 1 of 27 North, 12 West.

Q. Yes, sir. Just a few questions, Mr. McCartney, about your gas content, gas-in-place studies on the coal wells. I think part of that work would be reflected in Exhibit M6; is that correct? Your isotherm?

A. Yes.

Q. Okay. Now, for your standard gas per ton, you used that noted authority, Mickey O'Hare, correct?

A. That's the number I used. That's a number that I heard in one of the pre-hearing conferences, yes.

Q. Okay. So you didn't -- I take it you don't challenge that, you think that's an acceptable number?

A. I haven't reviewed that data. It was higher than the 85, which I did have the data on, so it was the higher of the two numbers. I used the higher of the two.

Q. Okay. But the other factor that would play a

significant role in determining the gas content would be the shape of the curve; isn't that true?

A. No, the gas content is what the gas content is.

Q. Well, as far as recoverable?

A. Yes, sir, recoverable reserves would be a function of the shape of the curve.

Q. I didn't fashion my question very well. Okay. How did you determine the shape of the curve?

A. What this is, is, I took a GRI study in wells in the San Juan Basin up there, it has extensive work done on it by GRI and --

Q. That's the Gas Research Institute?

A. Yes. And -- It's one of their coal-site studies. And what I did was, in that study it's a much a richer gas area, higher gas content, so what I did is, I factored down the Langmere volumes and Langmere coefficients in a consistent manner until I matched up 110 standard cubic feet per ton with a pressure of 250 p.s.i.g.

And so the shape of the curve is similar to that coal-site study, and it's normalized down to those two values.

Q. Okay. The Gas Research Institute curve would have been derived from some kind of a core test --

A. Yeah --

Q. -- core data?

A. -- it's core data.

Q. Okay. But then in your opinion that would create too high a value to the curve?

A. Yeah, that gas contour is very high up there in the north -- you know, considerably north of here --

Q. Okay --

A. -- because, number one, the formation is much deeper, much higher pressure, has higher gas content.

Q. Okay, the help me. What did you use to bring it down?

A. Well, you have a Langmere volume and a Langmere pressure, that kind of formula that draws this type of relationship between gas content and pressure, and I took those, and I just started dividing those two numbers by a factor -- or multiplying times a factor, same thing -- until the curve came down to where it represented 110 standard cubic feet per ton, at a pressure of 250 pounds.

Q. Oh, so the key would be the 250 pounds, the pressure to bring -- to bend the curve down?

A. Well, if there's a key it's multiplying both coefficients times the same factor to maintain the shape of the curve but reduce it down into the magnitude that we're working with here.

Q. And the factor you used was what?

A. I don't recall what that factor was.

Q. Could you look in your papers, see if you find that?

A. I probably have it in my briefcase; I don't have it here. I don't believe I have it here in front of me. But I can get it for you. It's -- I mean, it's just a mathematical calculation.

Q. Okay, but you can get that for us?

A. Uh-huh.

Q. Okay. So what -- is there any -- The shape of this curve, then, has no direct relationship to the particular coals in the Whiting wells?

A. The shape of this curve was not derived from the coals in the Whiting wells. Obviously, it would be advantageous to have an isotherm analysis from the Whiting coals themselves, but I did not have that available to me, if such exists.

Q. Are you aware, Mr. McCartney, that there's core information on these coals by reason of the work done on the Lansdale Federal well, which is in Section 7? It's in the same section as --

A. Yes.

Q. -- two of the Chaco wells?

A. Yes.

Q. But you didn't use that?

A. No. It had a lower gas content, so I used the

higher.

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

REDIRECT EXAMINATION

BY MR. HALL:

Q. Mr. McCartney, referring back to your Exhibit M1, Mr. Gallegos was asking you about production decline for the Whiting and Pendragon wells that appear to have occurred mid-1995, do you know, doesn't that drop correspond with the time that the El Paso Chaco plant was off line?

A. I've heard that mentioned. I have no direct knowledge of when the plant was down. But there has been conversation that the plant was down during that period of time; that is correct.

MR. GALLEGOS: I move the answer be stricken. Pure speculation. There's not -- If we don't have some information that verifies that, it's meaningless.

MR. HALL: Mr. Examiner, we would ask that you take administrative notice of that fact, and we can supply you with documentation of that.

EXAMINER CATANACH: I will do that, take administrative notice, and you provide evidence to that effect if you can find it.

MR. HALL: We will do that.

Q. (By Mr. Hall) Similarly, Mr. McCartney, did the

other Whiting/Maralex wells, outside of the five subject area wells show a similar decline for that same period in 1995?

A. You know, I don't -- I did not look at that information on those wells, so I really can't answer that.

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

EXAMINER CATANACH: Okay, Mr. Hall, I've been corrected by our counsel that I can't take administrative notice of that because that's not in our records. But you will supply us --

MR. HALL: I offered to supply you with something to substantiate that.

EXAMINER CATANACH: Okay.

EXAMINATION

BY EXAMINER CATANACH:

Q. Mr. McCartney, what is the typical recovery for a Fruitland Coal well, recovery rates?

A. Well, it obviously depends on your abandonment pressure. In my analysis, I assumed an abandonment pressure of 25 pounds, primarily to be consistent with the coal, and that would give you an 83-percent recovery factor.

Q. I believe your testimony was that you thought there was some contribution from the lower PC into the

producing portion of the PC?

A. I believe it's likely, yes.

Q. What do you base that on?

A. Well, two main things:

The proximity of the sands and -- there -- that -- it looks like on -- particularly on the gamma-ray log, that's -- basically fairly consistent one body of sand there, with some occasional tight streaks in it, maybe occasional coal streak down there.

And plus the frac profile we saw in the well that Roland Blauer had, the PC wells in this general area. It was frac'd to 20,000 pounds, and it showed communication into the lower PC interval.

And even though the frac analysis does not indicate that we had any significant vertical growth in the zones, there is some likelihood in my opinion we could have had some vertical growth, particularly in that lower PC, and that it -- by virtue of the fracs we may have opened that up somewhat.

And in areas of -- you know, general areas, there may be some minor, minor recharge -- or I mean -- I shouldn't say minor, minor, but there's a -- some recharge from that bigger source down there just through some very low permeable rock that may have helped us a little bit.

Q. On your Exhibit Number 2, tell me again how the

pressures for the coal wells was determined and whether or not you believe they're accurate.

A. Would you allow me to go to my briefcase and --

Q. Sure.

A. -- get the actual data?

That doesn't appear to be a big help, since it doesn't appear I can find it. Maybe I left that someplace else.

What they supplied was a two- or three-page tabulation of --

Q. Let me stop you. This is data that was supplied to you by Maralex?

A. It was supplied through Counsel via fax, and it had a Maralex fax designation on the sheet, either Whiting or Maralex. I think it was Maralex. And what it had for -- oh, started maybe -- sometime in 1994, and it just said "pressures" and had days on one side and had the wells across the top, and then it had a whole series of pressure readings.

In the instance there were pressure readings, say, in the -- just for example, 60, 70, 80 pounds, coming down there. And then all at once there was a 220-pound reading. And then the next day or two it goes back to 60, 70 pounds. I had to make the assumption that that 200-pound reading must have been under shut-in conditions or

minimal-flow conditions.

And having no other source of data, I made the assumption that it appeared -- since it was so out of line with the other data, that -- the flowing data -- that it appeared that it was probably a shut-in pressure, a surface shut-in pressure.

And that's the source of both of those -- of that data.

I've just been handed a sheet, if you'd --

Q. What is it?

A. Basically, this is part of the fax that says Maralex Resources at the top. It has the days here. It starts, oh, about January, 1994, first reading, February 4th, 1994, and this goes to December of 1995.

For several months it shows no pressures reported, and then in some instances it shows -- For instance, the 26-12-7 Number 1 well starts off with -- and I'll just read, like in 1994. February of 1994, they had numbers of 30, 36, 38, 36. And then in August of 1994 it says 75. And then in September 13th, it says 215. Then later on in February of 1995 we go back to 68, 62, 59, and so forth.

And so it's my -- That's the number I used. And there were several of the same day that had high -- relatively, within a day or two of each other, that had the

high pressures, and I had to assume that those might be representative of surface shut-in pressures, and that's what was used.

Apparently somebody found my information. This is the tabulation that I referred to. And then in July 30th, 1997, we again had high pressures when we went from numbers in the 60s and 70s to, in the case of that same well, 140 pounds, and then back to 95, 87, 62, and on down.

So it appeared to me that most all of them were flowing casing pressures, and occasionally there was a shut-in and they'd catch a pressure when the well was shut in. And it's -- That was the data I had to work with.

Q. Did you, in fact, just choose to use two pressure points, or were there more --

A. Yeah, there were more -- There were a few more pressures, and they all fell below that line. Those were the end points, the beginning and the end points.

And those in between that were lower than that, particularly those that were lower than the end point, I had no confidence in those, because it could have had water -- Who knows? Maybe they weren't shut in or whatever.

But there's fairly sparse data with respect to what might be shut-in pressures

Q. Are you fairly confident of the beginning and end points, at least?

A. Well, those numbers are what reported here, and they do not appear to be in line with the flowing pressure, so they -- I would have to say it would be my opinion that the bottomhole shut-in pressure would most likely exceed these pressures, because I don't know the content of the water in the wellbore, et cetera, et cetera.

But even from this data the pressures are significantly higher than what I saw in the PC.

Q. If, in fact, your PC wells were -- did frac into the coal, would you expect that pressure to equalize very quickly?

A. Well, I think we'd expect a couple things. We expect to see a significant change in the performance of the coal wells themselves. We expect to see significant water production. And we would expect to see higher pressures, I think, than what we see.

And I think it would be fairly quick, to finally answer your question.

Q. So your evidence basically shows that in your opinion there is no communication?

A. I don't see any physical evidence of communication from the Fruitland Coal to the Pictured Cliffs, or vice versa.

Q. In prior testimony it's been suggested that there may have been some communication established by the Maralex

wells. Would that also show up as well?

A. Well, frankly, when I first started looking at this problem, that was my first suspicion, is that what event happened between 1984 where we had reported all these low pressures and 1995 when we're reporting somewhat higher pressures. You know, what event happened in there? Well, all these coal wells were frac'd, you know. And the coal had a higher pressure.

So the first inclination, we'd say, Well, we must be communicating, and maybe the coal is the source of the recharge. When you look at the pressures in the wells, and particularly wells in close proximity like the 2-J and the Number 1 well up there in Section 1 -- we've got a pair of these wells a couple hundred feet apart, and you see no evidence of communication in those wells.

If you don't see communication in those wells, where are you going to see it?

Well, go down to 2-R. The same thing there. I don't think you see any indication of communication there. And the 1-J and the Number 2 well in Section 1, again, the 1-J pressure hasn't hardly bobbled, and it doesn't even know that coal well exists.

So if we didn't see it in those instances, my conclusion based on that is, it didn't happen. Or if it did happen, water dumped into the PC, it created a --

basically a kind of water block or a decrease to permeability such, and the low pressures, that it never moved very far away from the wellbore, and we didn't see any appreciable communication even in the Maralex fracs.

Q. So that's what your data shows, that you don't believe that the Maralex wells are even communicated?

A. I think they're communicated, but I don't think there's any -- I mean, I -- Well, let me put it this way: I suspect that the Maralex wells may have frac'd down into the PC, but I don't see any material communication resulting from that frac into the PC.

It doesn't show up in the performance data that I can see, it doesn't show up in the pressure data that I see, and I don't see where the Fruitland Coal itself, because of the performance aspects, particularly in this area, that it has been subject to a loss of significant resource from the coal.

We have a hard enough time accounting from the coal itself, let alone losing that resource to an outside source such as the PC.

Q. Okay. On -- Still on Exhibit 2, on the Chaco 4 and 5 wells, I just want to make sure I understand the pressure points you have listed on that exhibit. The first three, the triangles are pre-frac?

A. Yes.

Q. Okay, the fourth point, which is just above the third point, is what?

A. It's post-frac, taken the same month, but one before frac, one after frac.

Q. And that's a very slight increase in pressure?

A. Yes.

Q. Do you know how soon after the post-frac that was taken?

A. I don't. Well, maybe I do. Let me look on my data. But I -- I think I just put down the month of the pressure, not the day of that pressure. So I don't have the day that pressure was read.

Q. I'm just wondering, shouldn't that pressure have come up fairly quickly on that point?

A. Yeah, I show -- I show -- well, 147 pounds there in March through May of 1995, both readings, and then another May of 1995 that I have a note, it says the second pressure was taken after the frac. But I don't know whether it was ten minutes or ten days.

Q. Okay. We did talk a little bit about the change in slope on your Exhibit Number 1, as far as the producing rates of the coal wells. There may have been some events that occurred in 1995 that affected that change in slope, if there is a change in slope?

A. Yes, that's -- through my conversation with

Pendragon personnel, that's what I understand, that there was some mechanical things going on there with respect to the plant.

Q. It looks also like there may be a change in slope in 1994 at some point, due to something else. Do you also detect that, or...

A. Well, in a sense it's an ever-changing slope, of course; it's just a matter of perception and degree. But there's a pretty significant wrap-up, as you observe there in the first -- oh, through July of 1994, the first, you know, four or five months there, and then it looks like there may have been some down time in there, and then it kicked back up again. So...

Q. You don't believe that change in slope in 1995 was a result of the Pendragon wells coming on?

A. No, I don't. Unfortunately, it doesn't look like my pressure data goes back that far, so I don't even have an indication on the pressure.

Q. Would you expect to see a pretty dramatic interference if, in fact, the Pendragon were having an effect on the coal wells?

A. Yes. Yeah, I think you would see interference in the magnitude of gas production and interference in particularly the water production.

Q. The five Maralex wells that you compare their

production or their performance to the six other wells in the area, are there any other factors that could contribute to the difference in that performance, that you looked at?

A. I'm not aware of any, but I didn't have specific pressure data or specific data on those other wells, except for their production histories. And that's one reason I compare them to a broader sampling, to see if it would be unfair to characterize those other six wells as typical if it turned out they were not typical-type production for the area.

So that's -- And I don't know, to tell you the truth, because I didn't examine the size fracs or any of the producing characteristics.

Q. All right, these PC wells, are they exhibiting, in your experience -- are they draining a larger well than a typical PC well in the Basin?

A. Yeah, a considerably larger area than what might consider it PC, typical PC wells. A typical PC well -- Well, I hate to typify them. They're all different, of course.

But for instance, one of these wells in question, we might see it came in at a fairly high rate and then establish a pretty consistent and fairly steep decline right off the bat.

And then in 1985-86, a lot of them were shut in.

Some of that was marketing conditions, I understand. And then after that you never did see very much production from them. If that is typical, well, then, these are, you know, a lot better than -- performance than those.

But, you know, as far as -- you know, this doesn't -- you know, my problem is, I don't have a -- you know, I don't have a whole lot of other wells right in the immediate area that have been frac'd in a similar fashion, et cetera, et cetera, to work from. Or at least I haven't investigated if there are out there.

In instances you'll find PC wells that hold a flat rate for a long, long time, and then plunge off pretty steeply on the end. I think that, you know, that we'll probably see those Section 1 wells show up, and they show a pretty flat decline for a long time, and then they drop off pretty radically. And in one or two cases it looks like they've done some work on it and kicked the production back up significantly too.

But they did not produce the magnitude ratewise, but they did produce the volume, better volumes than these wells. And that's why I don't think they were stimulated. I mean -- But they did hold that constant production for a long time.

Q. Is it the fracturing that you think is going to improve the drainage of these wells? Is that what makes

this area kind of special?

A. Well, I've noticed in some literature that talks about the area, it says the permeability ranges up to -- I think it said like 169 millidarcies or something like that in the PC, and the average was about 4 millidarcies.

We see in the Lansdale Federal's got, you know, excellent permeability there, and that type of rock would drain, depending upon what your abandonment pressure was, could easily drain 320, 640 acres with that type of reservoir rock.

Because of that, I think that these wells had damage. I think some damage -- you know, it came down. And I'm not real sure of the cause of damage. It's been testified maybe migrating clays.

But if at any point in time there they were allowed -- if that water was allowed to imbibe back in the formation, that -- you know, that's a concern of mine; it always has been.

But it's obvious that upon stimulation it revived these wells significantly, and they've done very well.

Q. On one of your exhibits -- and I don't recall which one it was; I thought it was a pressure exhibit. I can't seem to find it now. -- you actually used a pressure from an offset wells instead of the actual pressure --

A. Yeah, and I should -- Yeah. Well, after this, it

would be -- It was the 2-R well that didn't have a good front-end pressure on it, and the P/Z exhibit --

Q. Where is that?

A. Exhibit 5, page about 4 of Exhibit 5, something like that.

Q. Yeah, can you kind of go into that a little bit --

A. Yeah --

Q. -- the reasoning on that?

A. -- well, the first time I looked at this I said, Well, can't analyze the data because the data doesn't look good, doesn't look like it's good data. And had a matching pressure back there close to when it came on production of P/Z a little over 150 p.s.i.a., and that, at the time, just didn't look like it was sufficient. It probably should have been higher than that. It wasn't as high as any of those others.

Knowing we had some water in the well, couldn't unload the well, I didn't give any credence to those shut-in pressures there where it produced about 50,000 cubic feet of gas.

And then I had the shut-in pressure there -- I think it's 69 pounds or something -- that's the current July pressure, and could draw a line through all that -- you know, through the massive set of points there, but the

beginning point didn't seem right to me.

So I did notice that there was a well, and I think I testified it to be in Section 12, and I think it's actually down here in the southeast quarter of Section 13 of 26 North, 13 West. That is the well that had 218 pounds. It was drilled in 1970.

Since the wells I -- At the time I had in my head the wells were drilled relatively the same time period, so I thought that might be -- 200 pounds might be a -- you know, a better estimate of what the pressure might have been.

Frankly, in my first blush through there, I admitted this analysis because I didn't like the data. And then I added it back once I saw that 218 pounds. And I believe this last point is probably valid data, and the other points it's a little difficult to tell whether they're valid or not, or how valid they are.

EXAMINER CATANACH: Mr. Chavez?

EXAMINATION

BY MR. CHAVEZ:

Q. Mr. McCartney, did the methodology that you used to derive the desorption isotherm for the coals in this area -- is that a standard methodology that's used by the industry to try to fit a desorption curve to an area?

A. I don't think I would characterize that as

standard. What I was trying to do is get a representative shape of curves that intersected at the 110 cubic feet per ton and 250 pounds, that -- The shape of that curve could be -- you know, could be somewhat different.

And that's just kind of a typical shape of curve, primarily for the determination of a recovery factor, that's primarily a determination, and then of course the material balance. And obviously, the shape of that curve would affect both of those analyses somewhat.

Q. Did you find that the -- Did you compare the performance of the Whiting coal wells against that desorption isotherm to see how well it was performing against the -- that you had derived?

A. Yeah -- yes, in -- well, in performing -- Obviously they're performing way in excess of what one would expect.

And that's reflected in the apparent -- Well, the calculated drainage area of the wells is very massive, and -- so that means a couple things. It means that, in fact, they're draining a large area, or the gas content could be higher than what's stated.

Q. By using the -- If you could use the smaller cubic feet of gas per ton from the Lansdale 4, what would have been the conclusions you would have drawn from the performance of the Whiting wells against the curve, using

the lower feet per ton?

A. Well, it would have indicated that the drainage areas would have had to be larger to account for the production we see from the wells. So the lower the gas content, the larger the area it has to drain. And so if I would have used a lower area, it would have indicated that the drainage area was even in excess of what I put in these exhibits.

Q. Would the drainage of such a large area, as indicated by your curve you drew, indicate that there might be also a problem with the curve, more than the actual area that was being drained?

A. My inclination is that there may be more of a problem with the gas content than there is, necessarily, the shape of the curve, although we don't have -- We have a couple indications of gas content. The -- Mickey's indication and the 85 that's on that Lansdale Federal.

The shape of the curve we just don't know. They can vary. It could be more linear. If it becomes more linear, then it's more of a straight pressure-versus-cumulus-production type of behavior and would indicate -- in the material balance sense, it would indicate lower gas in -- lower drainage area, smaller drainage area, the more straight it gets, and the more curved it gets, the flatter it is, particularly on top, means that the drainage area

would have to be a lot larger.

So it does make a difference.

Q. Okay. If the Pendragon wells are producing a large amount of coal gas, would you anticipate that their production might indicate that they were working off a desorption isotherm also?

A. They should, certainly, certainly.

Q. Did you compare the performance of those wells against the desorption isotherm to see if there was any indication there?

A. Well, basically what you get in the desorption-type mechanism is, you get -- as you reduce the pressure, the production goes up for a period of time. And in the Chaco and the Pictured Cliffs wells, as you reduced the pressure, the production went down. So you don't get that same effect.

So because of the production tend in a downwards direction, my assumption was that that was not coming from a desorption-type of mechanism.

Q. In believing that there may be some contribution from that larger Pictured Cliffs -- I guess what was termed earlier, third shelf, or whatever, what type of mechanism are you saying or are you thinking is at work in saying that that lower Pictured Cliffs is contributing to production from the perforated intervals?

A. Well, originally we can agree that basically the Pictured -- the pressure in the lower portion of the Pictured Cliffs, what I'm calling lower portion there, the third bench or whatever it's called, was essentially the same as the upper Pictured Cliffs. It's all, you know, the same pressure gradient, maybe a pound or two more, but -- whatnot.

And then we have this higher-permeability upper Pictured Cliffs section sitting here -- and I assume it's higher permeability because it's lower gas saturated, say it's higher gas permeability for sure, lower water saturations.

It's acting as this pipeline, and it's feeding the production to the wells, so we've got this massive lower section sitting out here -- excuse me for using "massive" but a thicker section, that if there is some limited vertical communication because of its higher pressure and seeing this depletion in this upper zone, it could slowly, slowly feed into there.

And particularly if we'd frac into it, that would give it a better conduit, at least in the vicinity of the well, to contribute to the pressure support of the well.

One concern is, if you frac into it, wouldn't it make lots and lots if water? And I'm not sure about how much -- you know, what the permeability of the water is.

We've got a high clay content in some formations, like up in the Rockies in some of the J-sand formations, you get a massive J-sand formation that looks wet, you know, and you perforate a frac into it and it doesn't seem to make any difference. It just won't produce much water, it's so tight up in there.

So whether you frac into a lower interval and it should or should not produce massive quantities of water, I'm not too sure in this area. It appears, though, that it's sitting there as a -- You know, you have to weigh your options. What are your options, you know? Are you getting recharge from the coal, are you getting recharge from water and flux, are you getting recharge from this big old lower sand that you know has in it? I think we'll agree that it's got gas saturations in there that are highly mobile.

The logical conclusion might be that it's this lower sand that's contributing in some small fashion to help support this system.

And of course, there's always the possibility that all those pressures that were taken there weren't really valid pressures. Don't know, but -- That's the most obvious source I see that seems to fit the best with the puzzle about what's supporting this pressure.

Q. Without any -- Let's say the fractures were contained in the perforated intervals, based on the

evidence presented earlier. What -- Wouldn't the gas have to pass a pretty thick separation interval of clays to get into the perforated intervals?

A. Well, you look at the core that was -- Lansdale core, you know, and you see some clay filling in that lower part, but you don't see any shale sections in there. There is a -- In that particular one, there's a lower coal in there, but you don't see any shales in there.

And you look at the SP and you see all these -- you know, where the SP drops. That could be, they tell me, a function of permeability in the sands.

You look at the gamma ray, and the gamma ray is pretty consistent. You wouldn't see -- You don't see much separation in the sandbodies, looking at the gamma ray. So maybe there's better communication than what would be particularly indicated on the SP curve. I don't know.

And it doesn't have to be much when you're covering thousands of acres, you know. If it's very, very small permeability, over time, it will -- it could help you.

MR. CHAVEZ: Thank you.

EXAMINER CATANACH: Any other questions of this witness?

This witness may be excused.

I suggest we break for lunch at this point, try

and get back here at 2:00.

It looks like we're running behind schedule. I hope you all eat a good lunch because we're going to be here late tonight, I suspect, trying to catch up a little bit so we can get finished tomorrow, so -- I don't know, 7:00 or 8:00 maybe tonight.

MR. GALLEGOS: Mr. Examiner, could I inquire if Mr. Hall has satisfied himself as to the authenticity of the well files offered as Exhibits 37, 39 and 40?

MR. HALL: You know, we looked at those briefly, and it appears that it's a compilation of materials from Pendragon/Edwards well files, along with some materials from the BJ Services -- Correct me if I'm wrong --

MR. GALLEGOS: Which were produced --

MR. HALL: Yes --

MR. GALLEGOS: -- by you?

MR. HALL: -- and I don't have a problem with those.

There are some foreign materials in there as well. For instance, there's some notes from Rich Fromm. He's a Whiting employee. Did not come from us, so you might want to --

MR. GALLEGOS: Point that out to, is that -- what -- move the admission, if there's something in there that doesn't belong, but I don't believe it's pending --

MR. HALL: Yeah, otherwise I don't have any objection.

EXAMINER CATANACH: If there's no objection -- What are the numbers? 37 --

MR. GALLEGOS: 37, 39, 40.

EXAMINER CATANACH: 37, 39 --

MR. GALLEGOS: That's the Chaco 1, the Chaco 4 and the Chaco 5.

EXAMINER CATANACH: Exhibits 37, 39 and 40 will be admitted as evidence.

MR. GALLEGOS: Thank you.

(Thereupon, a recess was taken at 12:53 p.m.)

(The following proceedings had at 2:07 p.m.)

EXAMINER CATANACH: We might as well get started. Mr. Hall?

MR. HALL: At this time we call Ken Ancell.

KENNETH L. ANCELL,

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

DIRECT EXAMINATION

BY MR. HALL:

Q. For the record state your name, please, sir.

A. My name is Kenneth L. Ancell.

Q. Mr. Ancell, where do you live, by whom are you employed, and in what capacity?

A. I live in Houston, Texas, and I'm employed by the firm of Fairchild, Ancell and Wells, who I'm a -- of whom I'm a principal and -- whatever else I do, everything else I do.

Q. Okay. You've not previously testified before the Division, have you?

A. No, not in New Mexico.

Q. All right. Would you give the Hearing Examiner a very brief summary of your educational background and work experience?

A. Yes, I was graduated from Colorado School of Mines in 1964, with the degree of petroleum engineer.

My work experience has been -- I spent some time with what is now Exxon Production Research -- in those days it was called Jersey Production Research -- in Tulsa, Oklahoma.

Then I joined Panhandle Eastern Pipeline Company, where I was chief reservoir engineer in charge of all gas reserves and deliverability forecasts for the pipeline. My last three years in that endeavor, I was associated with a project team to build a coal gasification plant in Wyoming, and during that three years I was the liaison with the coal-mining company, which was really my first experience with coal.

In 1976 I left that company and joined a company

called Intercomp in Houston, which was a petroleum production engineering software firm, and my first assignment there was to spend one year studying how gas migrates -- is stored and migrates in coal seams. And out of that study was the first real coalbed methane simulator. And from that study we concluded that if you could find coal with the right properties you could produce commercial quantities of gas using conventional oilfield technologies.

We followed that with a project that I led in Alabama where we developed the first real commercial coalbed methane project -- it later became known as the Brookwood project -- and I drilled the first 30 wells in that project and left there in about the middle of 1982 to form our own company, Fairchild, Ancell and Wells.

Since that time I've been involved as a consultant, and the last eight to ten years I've been specializing in coalbed methane projects and probably spend 75 percent of my time evaluating coalbed methane reserves and designing coalbed methane development projects.

In that endeavor, I've been recruited to be a -- the distinguished lecturer for coalbed methane reserves for the Society of Petroleum Engineers and the senior technical advisor for the United Nations for their coalbed methane projects in China.

Q. Are you familiar with the lands and the wells

that are the subject of this Application?

A. Yes.

MR. HALL: I tender Mr. Ancell as a qualified expert petroleum engineer.

EXAMINER CATANACH: Any objections?

MR. GALLEGOS: No objection.

EXAMINER CATANACH: Mr. Ancell is so qualified.

Q. (By Mr. Hall) Mr. Ancell, let me start off -- You were asked to evaluate the coal reservoir involved here. What were you asked to do?

A. My charge in this endeavor was to look at the coalbed methane portion of the reservoir, the Fruitland Coal, if you will, and make an analysis, as it turns out -- it turned out to be not a very quantitative analysis -- of what we would expect, what should we expect if the Pictured Cliffs wells were actually fractured into the Fruitland Coal such that it was actually another -- I call it a take point, another well out of the Fruitland Coal reservoir.

Q. All right. When you did your analysis, did you use the traditional methods of analysis, analyzing reservoir properties, such as decline-curve analysis, material balance, et cetera?

A. Yes, my first reaction was to use a reservoir simulator to make actual quantitative calculations about this particular reservoir, and when I got into it I

discovered that we have hardly any real hard information that's been discussed here in the last two days, and I got very uncomfortable trying to fill in all the blanks that were there.

And so I arrived at a more generic analysis, if you will, that applies the theory and technology of coalbed methane recovery to this particular location.

Q. All right, why don't you refer to your exhibits and explain what you did.

A. Okay, I brought with me ten exhibits that -- and I need to preface all these with the fact that none of these -- none of the data I'm presenting in these ten exhibits came from this location. Some of it is actual data, and some of it is nothing more than cartoons that help describe what the coalbed methane process does and how we try to control it.

Exhibit KLA1 is nothing more than a -- describes the methane capacity of a coal, and its actually a measured curve that came from an Alabama coal. I choose this one because it is the most nonlinear isotherm that I know of.

The thing that sets coalbed methane apart from conventional gas reservoirs is the method by which the gas is stored.

In conventional reservoirs, the gas is stored either by the process of compression, in dry gas

reservoirs, or by the process of solution in associated gas reservoirs.

In coalbed methane, the gas is stored by the physical process by adsorption. And that process is highly nonlinear with pressure. It increases very rapidly, as you can see by the red line, at low pressures. And this is the reason that we have to operate coalbed methane reservoirs at low pressures in order to achieve significant recovery of the gas in place.

Q. What does the term "effective permeability" mean in conjunction with coalbed reservoirs?

A. The -- I'm going to say all, or in a more strict sense we must probably say almost all, coals have a permeability that is associated with what the coal miners historically have called cleat. It's a natural fracture system that forms during the coalification process, and it's a system of fractures that exist in the *in situ* coal seam.

And coal miners have recognized this for a hundred years and actually lay out their coal mines to take advantage of this because the coal will dig easier in one direction than in another, because this cleat system is not isotropic. In other words, it has preferential directions of fractures.

In a virgin basin, the gas is stored according to

the coalbed -- the methane capacity, the isotherm, if you will, the amount of gas that the coal -- the gas can hold, and it is determined by the hydrostatic pressure under which the coal exists.

And generally, that's a hydrostatic pressure. Sometimes it's overpressured, sometimes it's underpressured. But at equilibrium, under normal conditions, the coal will be -- the cleat of the coal, the permeability, the porosity, if you will, will be saturated with water, and the coal will be saturated with gas at the pressure, at its hydrostatic pressure.

Once that equilibrium is broken by producing a well, opening a mine, whatever, once that is broken and fluids begin to flow -- Fluid flows because there's a reduction in pressure someplace. In a well, we consider it a point source, and the pressure is lowered at some point, and the first thing that begins to flow is water. And as water flows, the pressure is reduced and gas begins to flow.

And in order to understand how that transition takes place between water flow and gas flow, we have to introduce the concept of relative permeability.

And KLA2 is a generic relative permeability -- a set of relative-permeability curves. The blue curve is the water curve, and the red curve is the gas curve.

At normal conditions, initially, the coal will be a hundred percent water-saturated, far -- on the far right. And the relative permeability to water will be one and the relative permeability to gas will be zero.

As we lower the pressure in the near vicinity of the wellbore, the gas begins to desorb from the coal particles, and it appears in this cleat system, in the porosity, if you will. That makes the saturation move from 1.0 to the left. And as we create a higher and higher gas saturation, we drive the water -- the relative permeability to water down, the relative permeability to gas up.

If you multiply this relative permeability by the absolute permeability of the rock, you get what we call the effective permeability to the flowing phase. And the effective permeability to water goes down, the effective permeability to gas goes up as the water saturation decreases.

Now, what happens when we do this in real life in a well? And KLA3 tries to depict this. The upper chart of this is a plot of pressure versus distance, both of them being unscaled.

And if you have a single well operating in one huge reservoir, in an infinite-acting reservoir, if you will, the -- at time T equals zero, the pressure is constant everywhere and represented by the horizontal black

line.

At time T equal one, we have begun to produce fluid from the well, and we begin to get a -- we call it an exponential pressure distribution away from the well. And that's represented by the curved line shown at time T equal one.

If we -- this well is all alone in a big reservoir and it has any significant permeability, at time T equal two, sometime later, the pressure profile around the well tends to stabilize very quickly, and we begin to produce fluids from farther and farther away from the well. What the reservoir is trying to do is go into what we call steady-state flow.

And if a reservoir ever actually achieved that, what would happen? The water production would begin to flow, and it would decline, the gas production would go through -- start at zero and would climb, and when we -- at each point, the coal would -- the gas in the coal would try to achieve equilibrium with the pressure at that particular location.

If we ever actually achieve steady-state flow, which means the pressure isn't changing anywhere, the gas rate would go up and go through a maximum, decline and go to zero. Water rate, or water production, would just continue a long, very slow decline.

And in fact, this has actually been demonstrated in some places where we have extremely high-permeability reservoirs and where the coal is being recharged. I had one client that produced a couple million barrels of water before he figured this out.

But what we try to do in the coalbed methane reservoir is to make this technology work for us. And so what we try to do is create no-flow boundaries within the reservoir. And we try to depict that in the lower portion of Figure 3.

We put the wells, now, on a regular pattern and begin to produce those wells. We get -- At time T equal one, we get essentially the same profile around the middle well that we had before at T equal one, but we've also created a similar one around the -- its neighbors. And at time T equal one, these begin to interfere with each other, so that you have a no-flow boundary occur at the -- at a location between the two wells.

And at time T equal two, we now have begun to lower the pressure between wells such that -- Put this into three dimensions, you can see that all of a sudden we're affecting a very much larger volume of coal with a pressure drop. And when that happens we begin to see the incline in gas rates.

And as a sidelight, you notice I have white hair.

And in 1977 I got most of these white hair trying to convince a set of PhD's that these gas rates would really go up.

KLA4 is a calculation. It's a calculation of a reservoir simulator. The only real comparison that this has with our project here is, it was developed for a 20-foot coal. That's about the only thing that's really similar. And this is for a single well in a very large reservoir, and it's what I'm talking about.

The solid curve is the gas production, the dashed curve is the water production. And you can see that the water production started up at about 240 barrels a day and declined to about 100 barrels a day and was on a long, long, slow decline.

The gas rate started at zero, went up to about a hundred and, say, forty MCF a day, and then started a very long, slow decline. In a high-permeability reservoir where we had very little drawdown, that curve can actually go to zero.

KLA5 is exactly the same -- is exactly the same -- in fact, the blue curves are exactly the same as KLA4. And in this case we have taken the same coal properties, same pressure, same gas isotherm, same everything, except we have put steel plates around a 320-acre well pattern. And you can see that it's exactly the

same until that pressure wave reaches the boundary -- reaches our boundary. And that happened at about 1000 or 1100 days in this case.

At that point, the gas-production curve started a long incline that lasted for about 3000 days, and the water curve saw the interference effects and began to decline.

My question -- The question that always bothers everyone is, does this really happen in real life? And I've searched all over the world looking for good examples of this phenomenon actually happening, and I haven't -- I don't have at my hand one that's exactly analogous to what we have here, but I did bring one that's from the northern portion of the San Juan Basin that is a group of wells that were drilled up in the Colorado portion.

And Well Number 1 was completed back in 1988 and produced for three years with essentially no wells completed around it. And I think there were some water production numbers missing from the first month or two, but this data straight out of *Dwight's* with -- and converted to barrels per day.

The gas production started low and increased to about 500 MCF a day and began a long, slow decline. And in fact, you can fit that decline with a hyperbolic decline curve, with a very high correlation coefficient, and I'll show you that in a minute.

The water went up and was on a long, slow decline also.

Enter the rush to beat the tax credit in 1991 and 1992, and Wells Number 2, 3 and 4 were completed.

Well 2 is a direct 320-acre offset to Well Number 1 and came on and started at low gas rates and got the -- and began to get the ramp-up of the gas production.

And Well 3 is very similar, started in late -- in mid-1991, and again shows the same thing with gas rates as high as about 1.5 million a day.

Well Number 4 is also a 320-acre offset, but it did not start production until 1993.

The KLA10 is the continued production from our Well Number 1. And what happened when it started to begin to get confined was that the gas rates turned over and started to decline and reached about 1 million cubic feet a day from about 200. So it had an increase in gas production rate of about five over about a three-year period.

And this is what we're trying to effect with out patterns in coalbed methane reservoirs. To point out the problems of trying to utilize conventional decline-curve techniques in coalbed methane wells, I told you that you could extrapolate the production from Well Number 1 using a hyperbolic decline curve, and if you did that at the end of

1991, you would get a reserve for that well of -- If I remember the numbers right, it's about 1.1 BCF.

Then just put your finger over the part at the end of 1992 and look at the data you would have had. And what most reservoir engineers would do is, they'd take that line and move it up to there, and they'd do the same at the end of 1993, 1994. And by 1994 and 1995, this particular well probably would be a reasonable candidate for extrapolating with the decline curve, but the number that we did back in 1991 probably would have been 400 to 500-percent wrong.

So we have to temper our analysis with the technology of what's going on in the reservoir.

Q. With respect to this case, have you developed any opinions about the separation of the Fruitland Coal reservoir and the Pictured Cliffs sandstone reservoir?

A. Yes, and what I'm going to try to do is present an analysis of what has happened. If you would open up to KLA5 at the same time we're talking about this.

And what changes the shape of this curve? The time from initial production to the time of interference depends on basically two things. One is the spacing, which we control, and two is the permeability of the reservoir. If it's a higher-permeability reservoir, it interferes faster. If it's a -- If the wells are closer together,

they interfere faster.

So what we try to do is optimize the shape of this curve by adjusting our spacing, among other things. That's one of the things that we can look at.

Now, if we turn -- And I'm going to use McCartney's exhibits to demonstrate what I'm talking about. If you turn to McCartney Exhibit 8 -- and I have to apologize at this point. The McCartney exhibits were updated for latest production late last week, and I did not update my charts, and what I discovered this morning, really, is that the McCartney exhibits left off some important data. And it was pointed out under cross-examination this morning that -- what had happened.

In the *Dwight's* data is a piece of information called days produced, and that was left off of the McCartney exhibits, whereas my old plots had that on, and the result could lead to some misunderstanding.

If we look at the first chart in McCartney Exhibit 8, you'll see a declining water production and a -- starting in early 1994, an increasing gas production that climbed to about 12,000 or 13,000 MCF per month and was reasonably flat for a while, and then kicked up and then had a significant increase in the last few months of 1998.

The data that I want to call to everyone's attention is, first of all, the basic data shows that there

were significant down times in the month of October, 1995, and you can see that on this plot in the gas curve. And all the wells that I looked at had that down time in it. It's about seven or eight, somewhere around seven or eight days, and I have to read off the chart because I don't have the hard data.

So October of 1995 is an anomalous month by approximately 20 to 25 percent.

The month of August was missing from our data. It just -- In *Dwight's* report it just shows up as zeroes.

In June and July there were two wells that experienced some down time. They were the two wells in Section 1 of 26-13.

If we look at the three wells that didn't experience any down time in June and July of 1995 -- and this first well is one of them -- you'll see that the gas production rate across the missing time -- which, incidentally, is all unfortunately -- I don't know why, but unfortunately the missing data is also about the time that the Pendragon wells began to produce after their frac jobs. You'll see that the trend through that period of time is very, very smooth, except for the down time in October and again in January.

The second of those charts is another well that did not show down time in June and July, but it showed down

time in October again, and you can see that if you eliminate the downtick in October, that again the curve is very smooth through the first few months of the Pendragon production.

The next one is one of the wells in Section 1, and you'll notice that starting in June and July, that gas production was significantly down, and the data I have where we have the producing days on there shows somewhere around 22 days in June and about 12 days in July.

The water curve on that particular well also shows that the water decline had a -- I call it a glitch. It had a shift, if you will, to the right, which indicates -- again indicates down time.

The next curve is also the second well in Section 1, and it shows the same thing, and its days produced also shows the same number of days down in June and July.

The last well is the well in 12, and it shows the same downturn in October, but possibly does show some sort of decline from July to September.

Now, if we look at those curves in light of where we are on my KLA5 chart, experience and extensive calculations have led me to conclude that if the interference wells are drilled during the period of time between the time that -- well, in this case, on KLA5, but if -- the equivalent time between, say, 100 days and 1000

days, or maybe even beyond that, maybe even 1200 days.

In the early part of the -- Before or in the early part of the interference effect, if an interference well is drilled in that period of time, what we would see is an inflection upward of the gas curve. And that's caused by the same thing that causes this curve to turn up. We're introducing a boundary in the reservoir.

Oh, the other thing that -- We're analyzing, really, five wells here. But these five wells are part of a much larger pattern. I've never counted the wells, but there's at least 25, maybe 35 wells, in this very area that are essentially drilled on a 320-acre spacing. I think there are some holes in there, but it's a pretty regularly spaced pattern of wells.

In 1977, I made the analysis that it required at least 16 wells in order to create these interference effects, and that's -- A square 16-well pattern is four wells completely surrounded on all sides.

Since then, I've upped that number to maybe 20 or 25 wells, depending on the spacing, because the closer the spacing, the fewer the number of wells you can get away with.

But this pattern is part -- or these five wells are part of a large pattern, and so you would expect them to begin to reach the -- what I call the ramp-up period at

some point in time, depending on how far the wells are apart and what the permeability is.

The other thing that happens, if you drill a well inside -- Let me go back and make one other point.

During the time that the blue -- on KLA5, that the blue curve, in other words, in the period of time that a well is producing in a large reservoir by itself, we are not changing the saturation very close to the well. Out here at 5000 days on this curve, we have hardly changed the saturation that flows to the wellbore, on the blue curve.

When we get to the red curve and we begin to put these no-flow boundaries in there, every barrel of water we produce creates a barrel of room for gas to desorb into. And when we -- That's when the gas saturation starts to go up. That's when we move to the left along the relative-permeability curve. The gas relative permeability goes up, and all of a sudden we have a big influx of gas into the well. And that's the situation we're trying to create in the coalbed methane process.

In this case, if you look at the average of these, which is M10, which is smooth for the five wells, it's very analogous to my Figure 5. If you'll notice, the gas rate climbs, begins to go through a curve -- through a flat period and then begins to ramp up starting in the third year. And by the end of 199- -- in this case, in the

fifth year, which is 1998, we're out on this ramp-up curve, and sometime out here it's going to turn over and then go back down.

Now, if the interference wells came on at the time that we were still acting infinite, we would have seen an increase in gas production at that time. If the wells were sometime after that period of time, we would have seen possibly a small increase, maybe nothing, and maybe a decrease. It depends on where you are in that and how fast the saturations are changing and all of the things that go into that calculation.

But regardless of what the gas curve does, the water curve has to go down. The water curve in the original well has to turn down, because again you're taking water out of a confined area, and every barrel of water that comes out goes to reducing the relative permeability to water and increasing the relative permeability to gas, and that's what we haven't seen.

If you look at M10, you'll see that, if anything, over the last three years, that curve has tended to flatten, it's tended to turn out rather than turn down, which is what you would predict off of KLA5.

And that leads me to believe that the Pendragon wells did not and have not interfered with the Fruitland wells.

There's one other point that we need to make with this data, and that is, the -- Probably the best way to look at that is on M1, which is simply a sum of all the wells involved.

When the Pendragon wells started producing in mid-1995, the Whiting wells were producing about 50,000 MCF per month or not quite 2 million a day, total [*sic*]. They were producing about 8000 or 9000 barrels of water a month, which is about 300 barrels a day.

If the Pendragon wells were actually completed in the coal reservoir, they would have been completed out in the area between wells where the water saturation is higher than it is at the well. So they would have been producing at a rate much higher than -- at a water-gas ratio, if you will, higher than what the Whiting wells were at that time.

And if you calculate the amount of water for, say, 30,000 or 35,000 per month, which is what the Pendragon wells were producing, the Pendragon wells should have been making somewhere in the neighborhood of 200 barrels of water a day.

At that point, there were only three wells producing, which would be somewhere in the neighborhood of 70 or 80 barrels on the average, and we can't find evidence that that kind of water ever came out of those wells on initial production.

Q. Mr. Ancell, you've testified there appears to be no effect on past production from the Pendragon Pictured Cliffs sandstone wells. By the same token, in your opinion will the ultimate recovery from the Whiting/Maralex Fruitland Coal reservoir wells be affected by the Pendragon Pictured Cliffs sandstone wells at all?

A. No, if they didn't -- if they didn't -- Unless they go in and do something to them. I guess if you went in and perforated the Fruitland Coal or something like that, you could affect the reserve. But as they're completed, I don't think that there will be any effect on the ultimate recovery of the Whiting wells.

Q. All right. Anything further you wish to add?

A. No, that covers the points I wanted to make.

Q. Mr. Ancell, in your opinion can the shut-in or curtailment of Pictured Cliffs wells be justified?

A. No.

Q. Mr. Ancell, were Exhibits KLA1 through 10 prepared by you or at your direction?

A. Yes, they were.

MR. HALL: We'd move the admission of Exhibits KLA1 through 10, and that concludes our direct of Mr. Ancell.

EXAMINER CATANACH: Any objection?

MR. GALLEGOS: No objection.

EXAMINER CATANACH: Exhibits K1 -- I'm sorry, was it -- KLA1 through 10 will be admitted as evidence.

Mr. Gallegos?

CROSS-EXAMINATION

BY MR. GALLEGOS:

Q. Mr. Ancell, you were examining the question of whether or not the Pictured Cliff wells by Pendragon had frac'd into the coal formation?

A. No, that isn't the question I was addressing.

Q. Okay, you did not address that question?

A. No.

Q. You just addressed the question looking at the characteristics of the Whiting wells producing from the Fruitland Coal formation?

A. No, that isn't just what I did either.

Q. Well, what was your assignment?

A. My assignment was, what would you expect to have happened if the Pendragon wells had frac'd into and actually produced from the Fruitland Coal?

Q. All right. And other than the slopes that you looked at on Mr. McCartney's exhibits that you mentioned, everything in this book has -- does not concern or does not reflect any of the wells in the subject area?

A. No, that's what I said to start with.

Q. Yeah, just trying to set the scene, if you don't

mind, with a few preliminary questions. Is that all right?

A. That's fine.

Q. Was your approach by your choice? This is the way you decided to approach --

A. Was it my choice? I don't understand.

Q. Well, I mean, was your assignment such that you were not to make any examination of the performance of the Pendragon Pictured Cliff wells themselves?

A. Well, that -- as far as -- As far as what? I don't understand.

Q. As far as their performance, as far -- You've taken a look at the Whiting coal wells, their performance?

A. Yes, okay.

Q. You -- I've heard nothing that indicates that you looked at, did a study, analyzed the performance of the Pendragon alleged Pictured Cliff wells.

A. I guess I left that out. The only thing I was going to say about that is, in looking at those -- at that set of data, the conclusion I would make is that the Whiting wells look like coal wells, and the Pendragon wells look like sandstone-reservoir wells.

Q. So you did look at --

A. Oh, yes, I --

Q. -- something to do with the Pen- --

A. Yeah, I had their production curves and all that.

Q. Oh, all right. So you were given the data, or you --

A. Oh, sure.

Q. -- obtained the data?

A. Yes.

Q. So, for example, you saw what the Pendragon wells did originally, what their production levels were when they were originally completed in the late 1970s or early 1980s?

A. Way long time, yes.

Q. Yes, sir.

A. Yes.

Q. So for example, you had the information that the Chaco Number 1, when originally completed, had produced at levels of about 70 a day, when a new well, and after the fracture stimulations produced over 300 a day?

A. Yes, I had that information.

Q. Okay. And you had the information that some of these Pendragon wells had been fracture-stimulated when originally completed, didn't you? Maybe the 2-J, if that will ring a bell, reminder?

A. There was some data that said that way a long time ago there were some very, very small frac jobs done, yes. I don't remember which well it was.

Q. Well, do you remember what the results were in terms of the production levels, into that Pictured Cliff

reservoir, when the well was first drilled and was fracture-stimulated?

A. I don't recall it offhand, no.

Q. It plays no part in your analysis that these wells originally produced at levels that are shown on these charts of 30, 40 a day, and after the fracture stimulation in 1995 were producing at levels of a quantum of 10 times or more, the original production levels?

A. Did that bother me, you say?

Q. Well, did it play any part in your analysis?

A. No, I can't say that it did play any part in my analysis.

Q. In attempting to understand some of your conclusions, I believe what -- one of the points that you were making was simply, first of all, the more water that is removed from the coal formation, the more gas that would be produced, over time?

A. Under certain circumstances that's true.

Q. Okay. And under what circumstances, typically, would that be the case?

A. Well, if you -- If you had the reservoir what I call under confinement -- in other words, you had these no-flow boundaries established -- then the more water you get out, the more -- the higher the gas saturation and the porosity has to be.

Q. And you achieved the no-flow boundaries by having more wells that are contributing to, in effect, the drainage of the water from the coal?

A. That's correct.

Q. Is that correct? So let me just try and understand what you're telling us.

My not-very-good artwork, what I'm trying to illustrate is four sections joining, and let's say that you have a coal well in the southwest of the southwest of this section and another coal well in the northeast of the northeast of this section, so the -- direct offsets, in effect, on 40s that are adjoining.

And these wells produce to the point over time where the water production has gone from initial 200 barrels to below 100 barrels a day, gas production has gone from zero to over 400, and pressure has dropped from, say, 250 to 175. And you've got a time period here of 20, 30 minutes over which that's happening. All right?

Now, if you add to the coal wells -- new wells into the coal -- and I'm going to put an "N" there at the stage that I've just described -- do you have the no-flow boundary condition present so that that would be reflected in the two new wells?

A. You haven't given me enough data to answer the question. If the only two wells were the original coal

wells, as you call them, these two --

Q. Okay.

A. -- then you certainly have not established the no-flow boundaries we're looking here.

Q. Oh, if you had more coal wells -- You understand you have 320-acre spacing for coal wells in --

A. Certainly.

Q. -- New Mexico? So you're not going to have a denser well pattern than that, at least legally; do you understand?

A. Yes, I understand.

Q. So if it needs -- if in these four sections you have that pattern established of coal wells, does that give you additional information sufficient to answer the question?

A. What you're -- I think what you said, and I'm not sure that you said it, is that the whole area is on 160s, and it just so happens -- or on 320s.

Q. Right.

A. And in other words, there would be another well in each of those four sections, two more wells in the two diagonals, the northwest one and the southeast one.

Q. Yes.

A. And then the new wells and the ones around it too, and so these two would be closer together, if --

closer together than the normal spacing.

Q. Yes, they would be, they would not be on a normal spacing. But the question is, what would you expect to see in terms of water production, gas production, in the new wells, directly offsetting --

A. These two?

Q. Yes, sir, the ones I put an "N" in.

MR. HALL: Can I ask a question for my clarification? Is this one section or four sections?

MR. GALLEGOS: These are four sections.

MR. HALL: Okay.

THE WITNESS: So the situation you described tells me that you're someplace -- if you look at my KLA5, that you're someplace down that -- someplace down that curve. I wish I hadn't put days on there and then made it unscaled so we wouldn't be looking at numbers. But someplace in there, if you're on that first section -- in other words, between, say, zero and -- well, you can't be at zero because you've already pulled it down some according to your hypothetical there. You're going to be close in to the place the ramp-up portion of the interference begins.

So if you had two new wells, that would accelerate that.

Q. (By Mr. Gallegos) And would that -- Does your

Well Number 3, which is under Tab 8, would that reflect what the expected water and gas production would be from the new wells?

A. Well, number one, Number 3 is not like what you just described to me.

Q. All right.

A. What you just described to me was that the whole area was drilled up on 320s. It pulled the pressure down from 250 to 175 when we did that. That's not what this is.

Q. All right.

A. When Well Number 3 came on here, it was like one of those wells had been producing for three years and nothing producing around it.

Q. And Number 3 would have been one of the new wells right next to --

A. Right.

Q. -- the one that had been producing --

A. Right, uh-huh.

Q. -- for three years and dewatering for that period of time?

A. Correct.

Q. And Number 3 would have been an offsetting new well?

A. Correct.

Q. Which would reflect --

A. But he probably had offsetting wells on the other side of him too, being drilled and started producing at the same time.

Q. To help contribute to the no-flow --

A. Exactly.

Q. -- circumstance?

A. Exactly.

Q. Okay. And what Number 3 would show would be --

A. That's why -- that's why -- Let me clarify here. That's why I apologize to start with, is that this example that I'm showing is not exactly analogous to what we have here, to what we have in this case, because in this case we had the entire pattern on production before the supposed new wells were completed.

Q. So you had a circumstance where dewatering had been accomplished?

A. It hadn't been accomplished; it was still producing.

Q. Well, it was underway?

A. It was underway.

Q. It was reducing the water --

A. Yes.

Q. -- production, increasing the gas flow, correct?

A. Correct.

Q. -- and had established or not established a no-

flow pattern, in your opinion?

A. It was close. Whether it had established it or not established it or whatever, it was -- the wells were beginning their ramp-up.

Q. And if I understand your testimony, what you're saying, then, is, the Pendragon wells were fracture-stimulated so that they were producing from the coal. It's your opinion that the Whiting wells would have reflected an increase in production?

A. I'm saying I don't know. You would have seen something happen, particularly to the water curve. The only thing that could happen to the water curve is, it would go down.

The gas curve, if it was -- At some point in time it could have gone up, which is like Wells 2, 3 and 4 in my example, or if it was out past the interference point it could actually go down.

Q. And where you see a ramp- -- I think you said you saw a ramp-up in the third year, at some point in time, in the Whiting well production, or --

A. Well, in the composite of the wells where everything is nice and smooth and all that sort of thing, I thought that the ramp-up portion would start about the third year.

Q. About -- that would be about -- I'm not sure what

you mean by "third year". What year and --

A. On M10, which is the normalization of all five wells.

Q. Okay, yeah, it's a zero time plot, so I don't know what year we're talking about.

A. Well, each well -- in this case, each well has advanced to time zero, and so it's not -- That window is somewhere -- late 1995, 1996, somewhere along in there.

Q. Do you recognize on this plot an effect of the -- three of the Whiting wells being put under compression?

A. I see an area in 1998 where it looks to me like the gas production took an increase that was caused by a lowering of the bottomhole pressure, which would be consistent with a compressor.

Q. That's a different point than the ramp-up point?

A. Yes, that's later.

Q. All right. On my copy, if you will, the plot we're talking about, will you just mark where you think you see the ramp-up and then label that?

A. I circled a little area there.

Q. All right, would you label it?

A. What do you --

Q. "Ramp-up".

A. -- want me to label it?

Q. "Ramp-up" seems logical.

A. I'll abbreviate that to "R.U.", how's that?

Q. And that phenomenon results from what?

A. Interference between wells.

Q. Interference between wells?

A. Yes.

Q. All right. So -- Just trying to reconcile this with a bit more of your testimony, which I thought was to the effect that you were of the school that in order to get interference you needed an accumulation of about 16 wells dewatering the reservoir, but you'd changed your thinking and now maybe it takes 20 or 25?

A. I mean, that varies with the properties of the coal and the spacing and the distance between wells, true.

Q. So you have that condition present in the area that we're --

A. Yes, sir.

Q. Concerned with?

A. (Nods)

Q. Of coal wells?

A. Yes.

MR. GALLEGOS: That -- your coal wells.

I think that's all the questions I have.

EXAMINATION

BY MR. CHAVEZ:

Q. Mr. Ancell, overall your testimony is that you

would expect to see some kind of a change, either decrease or increase, if the Pendragon wells were producing within the coal zone at the time that they started? I mean, you'd see that on the Whiting wells?

A. On the gas curves of the Whiting wells. I can't say whether they would increase or decrease because I'm not exactly sure where each individual well was in the cycle at the time the Pendragon wells came on.

But I can say for certain that they should have seen -- the Pendragon wells should have made significant volumes of water, and the Whiting wells should have seen a downturn in the volume of water they were producing. It would have to go down if they were interfering.

Q. In your analogous well from your example, was that from an area that might be considered to be overpressured area of the coal?

A. It's beyond -- It's farther north, I think, than what we traditionally have called that. Whether or not it's in the overpressured area, I can't testify to whether it is or it isn't, but I think it's on the -- It's at least on the north side of that if it's not beyond.

Q. Well, isn't that significant in the producing characteristics of a coal well, whether it's in the overpressured or underpressured area, whether you could use that as an analogy or not?

A. No, the same forces or the same process is going on.

MR. CHAVEZ: That's all.

EXAMINATION

BY EXAMINER CATANACH:

Q. Mr. Ancell, there was some events that took place in 1995 with regards to the Whiting wells, some down time and some, I guess, time when the wells were not on line. Could that have -- and the fracture, fracturing at least of certain wells took place during that time. Could that have masked any effect you would have normally seen on the Whiting wells, some of the stuff that happened?

A. I never thought of it in that context. But the two wells that experienced the down time during that period of time that caused the dip in June and July were the ones that were the farthest away from where the frac jobs happened.

What happened to the map that was up there? They were the wells in Section 1 -- or in Section 13 -- No, they were in Section 1. And the frac'd wells were this one and this one, and this one didn't start until late 1996. This one, this one and this one.

So you would have suspected to see -- I would have expected to see a bigger change in these three than in these two. And if you look at their data individually,

they're smooth across that period of time.

Q. Okay, the three wells, you're talking about the three Whiting wells, they --

A. Three Whiting wells, yes.

Q. They didn't have any -- There wasn't any other things going on during that period of time that would have masked --

A. Not that I could see.

Q. -- any effect?

And you did not see any effect?

A. No, I do not see any effect.

Q. Up or down?

A. Right.

Q. Was there any effect in terms of water production?

A. I couldn't tell. The water production is a little more -- is a little rougher than the gas production, but no, I could not tell anything. Certainly didn't see a dramatic change like you would calculate to happen.

Q. What kind of dramatic change in water production in the Pendragon wells would you expect if they had frac'd into the coal?

A. If they had frac'd into the coal? They would have to start out at producing water rates -- Because of the -- the condition of the reservoir -- you can tell, kind

of, where you are along the gas-water ratio by -- the relative-permeability curve, by water-gas ratio, converting it for the difference between gas flow and water flow, of course, and...

But the -- at the time the Pendragon wells started producing, they would be starting in a position in the reservoir where the relative permeability would be less favorable for gas production than the Whiting wells were. So they should have come on at something -- their water-gas ratio, higher than what the Whiting wells were at that time. And you would think -- And the rates were not as high as the Whiting wells, so they would not make quite as much water, but they would make a higher ratio, just simply because of their location in the reservoir. And that number would be somewhere in the range of 50 or 60 or 70 barrels of water a day per well, of the three wells that came on at that period of time, where the Whiting wells were maybe producing 70, 60 to 70.

And I guess to complete that statement, is that no one has come up with a way that that amount of water could be produced and not be seen.

EXAMINER CATANACH: Okay, I have nothing further.

FURTHER EXAMINATION

BY MR. GALLEGOS:

Q. If I -- on your last -- When you're talking about

the relative rates of water production, the Whiting wells and then Pendragon wells after they were frac'd, are you assuming that these wells, both groups of wells, have mechanical lifts to lift and remove the water?

A. No, it has nothing to do with that. What's coming out of -- what was coming out of the -- The water and the gas that come out of the Whiting wells were a function of the relative permeability distribution in the reservoir, which is a function of the saturation.

Q. Well, but there's going to be a difference in what water is produced at the surface, depending on whether the well is on a pumping unit or it's simply left to attempt to unload --

A. No, the thing that -- The thing that determines the amount of fluid that comes out is the bottomhole flowing pressure. Once it gets into the wellbore, the pump lifts it out, true. If you don't have a pump to lift it out, you have a higher bottomhole flowing pressure to lift the same amount of water --

Q. So --

A. -- and the Pendragon wells were lifting their water by themselves, so they probably had a higher bottomhole flowing pressure than the Whiting wells.

But my point is that the ratio of water to gas has to be higher in the Pendragon wells than the Whiting

wells. That's a reservoir phenomenon, not a wellbore phenomenon.

Q. That's not what I'm asking you about. I'm asking you about a produced-water phenomenon, because when you talk about producing water at 60 or 70 barrels a day, you're talking about water that comes to the surface and is expelled from the well.

A. Correct.

Q. All right? That's what I'm asking you about. You're not saying, are you, Mr. Ancell, that if the Whiting wells were producing 60 or 70 barrels a day with a pumping unit to lift and discharge that water, that the Pendragon wells with no pumping unit are going to produce the same quantity of water?

A. If they produced the amount of gas they did from the coal reservoir, they would have had to have produced that much water. That's what I'm saying.

Q. Okay, so it's a waste of time and money to even put a pumping unit on a well, then, because if you have that reservoir pressure and that quantity of gas, the water is just going to be lifted by the well pressure?

A. No, my conclusion then is that the gas in the Pendragon wells was not coming from the Fruitland.

Q. Oh, okay.

A. I haven't made a calculation as to whether or not

you could live with 300 barrels a day -- 300 MCF a day, could you lift 60 barrels of water a day in a 1-1/2-inch tubing. We don't know the answer to that question. I suspect that you probably could not.

Q. But your conclusion that the Pendragon well gas was not coming from the Fruitland is because these wells, you think, at least, there was not large quantities of water production reported? Isn't that right?

A. That's correct.

Q. All right. And I'm saying if the gas is coming from the Fruitland and producing water but there's no pump unit, no means of lifting that water, do you expect it nonetheless to produce just as much water at the surface as the Whiting wells on pumping units?

A. If you had a fixed bottomhole flowing pressure, that determines the amount of fluid that comes out of the reservoir. The saturation determines -- distribution determines what the ratio of water and gas are.

Once it gets into the wellbore, it can be pumped out or it can be flowed out.

If you can't flow it out, what happens? The water builds up in the reser- -- in the -- the water builds up in the wellbore, the bottomhole pressure comes up and the flow rate goes down. And if you can't get any water out, the well dies.

Q. Or you -- Or the well may be able to lift some water and make some gas?

A. Not for very long.

MR. GALLEGOS: That's all.

MR. HALL: That concludes our direct case, Mr. Examiner.

MR. GALLEGOS: Could we mark this exhibit as KLA11, please?

EXAMINER CATANACH: And that is -- What's that, Mr. Gallegos?

MR. GALLEGOS: That is the sheet from the McCartney exhibit which Mr. Ancell marked on the slope, the ramp-up time.

EXAMINER CATANACH: Okay. Let's take ten.

MR. GALLEGOS: For the record, then, I'm moving the admission of Exhibit KLA11.

MR. HALL: No objection.

EXAMINER CATANACH: Okay, Exhibit KLA11 will be admitted as evidence.

(Thereupon, a recess was taken at 3:20 p.m.)

(The following proceedings had at 3:35 p.m.)

EXAMINER CATANACH: Okay, let's turn it over to Mr. Gallegos.

MR. GALLEGOS: Thank you, Mr. Examiner.

We call Bruce Williams to the stand.

BRUCE WILLIAMS,

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. My name is Bruce Williams.

Q. Where do you live, Mr. Williams?

A. I live in Arvada, Colorado.

Q. By whom are you employed?

A. I'm employed by Whiting Petroleum Corporation.

Q. Would you tell the Examiner about your professional education?

A. Yes, sir, I have a bachelor of science in petroleum engineering from Montana Tech in 1971.

I worked for five years for Shell Oil Company. I worked for approximately 12 years for Petro Lewis Corporation. I was on my own doing consulting and property management for about four years. For the last nine years I've -- last eight years, I've worked for Whiting Petroleum Corporation, initially as a consultant for a year, and subsequent to that as an employee.

I have worked extensively in engineering and property management. Most of my experience has been in production and reservoir engineering, and I'm currently the

operations manager for Whiting Petroleum. I'm responsible for looking after all of the engineering and operations on behalf of the Whiting wells.

Q. Do the particular properties that we've been referring to as the Whiting coal wells in this area of concern fall under your responsibilities for supervision?

A. Yes, sir, they do.

Q. And do you have other duties as manager of operations for Whiting, other than what you've mentioned?

A. Yes, sir, I mean we're basically -- I'm basically responsible for supervising the engineering and field operations for some 400 wells that Whiting operates all over the country.

Q. In preparation for a District Court hearing that was held in June of this year and in preparation for this hearing, Mr. Williams, have you gathered data, analyzed that data and performed studies concerning the oil and gas properties that are the subject of this proceeding?

A. Yes, I have.

Q. Including the Whiting wells?

A. Yes, sir.

MR. GALLEGOS: We offer Mr. Williams as competent to give expert opinions in this case.

EXAMINER CATANACH: Any objection?

MR. HALL: One brief *voir dire*.

VOIR DIRE EXAMINATION

BY MR. HALL:

Q. With reference to the June 29th court hearing, isn't it true, Mr. Williams, that Judge Encinias did not allow you to render expert-opinion testimony for the reason you indicated you were not that familiar with the San Juan Basin-Fruitland Coal Pool?

A. I don't believe that's correct. I think on one particular question about coal reservoir engineering I said that I didn't know the answer, that I probably wasn't an expert on coal reservoir engineering, and didn't answer that question.

Q. In fact, you weren't permitted to answer the question; is that correct?

MR. GALLEGOS: Have you finished your *voir dire*?

MR. HALL: I'm waiting for the answer.

THE WITNESS: My recollection is that I voluntarily didn't answer the question and stated that I wasn't qualified to answer that question because I didn't have the expertise. That's my recollection.

Q. (By Mr. Hall) Well, isn't it more accurate to say that Judge Encinias sustained an objection and you weren't permitted to answer the question?

A. I don't recall that.

MR. HALL: All right, no objection. I'll

stipulate to qualifications, provided it be accorded the appropriate weight under those circumstances.

EXAMINER CATANACH: What does that mean?

MR. CONDON: Lawyerspeak.

EXAMINER CATANACH: The witness is so qualified.

DIRECT EXAMINATION (Resumed)

BY MR. GALLEGOS:

Q. Have you performed investigation into the question of whether the Pendragon Chaco wells are producing gas from the Fruitland Coal formation owned by Whiting and Maralex in the subject area?

A. Yes, I have.

Q. What data sources -- Generally speaking, what data sources have you relied on, Mr. Williams?

A. We relied on publicly available production data from *Dwight's* and PI, as well as production data provided by Pendragon. We relied on pressure data that is publicly available that was provided to the NMOCD during the early years of the wells' production history. We relied on the data that was provided to us on the wells by Pendragon that contains daily production and pressure data on the wells. We relied on gas analysis data that was gathered from Pendragon, from El Paso Natural Gas, and data that Whiting had in its files. We relied on Whiting production data on the coal wells, and Maralex.

Q. Okay. May I ask you, as we go through your testimony, to assist the Examiner as you're giving certain information on your studies as to the sources of your data --

A. Yes, sir.

Q. -- without my asking you each time to do so?

A. Yes, sir.

Q. All right. And are you prepared to speak to and sponsor Exhibits 17 through 31?

A. Yes, sir.

Q. Okay. Were those exhibits prepared by you, or prepared by you in conjunction with other engineering employees at Whiting?

A. Yes, sir.

Q. All right. Now, in attempting to answer the question of whether or not the Pendragon wells have invaded the coal formation belonging to Whiting and Maralex, did you approach that question from several different directions or by different studies?

A. We did. We looked at the production performance of the Chaco wells. We looked at the pressure performance of the Chaco wells. We looked for evidence of production- or pressure-interference between the Chaco wells and the Whiting wells. We also looked at gas-analysis data and the trends of gas-analysis data to dry and draw some

conclusions.

Q. I'm sorry, that was -- did you also -- Maybe you said this, I -- little interruption.

Did you also compare production and pressures of the Whiting and Pendragon wells during and after this recent period of -- recent shut-in period?

A. Yes, sir, we did. I included that in my comment about looking for the interference effects.

Q. All right. When you prepared -- or when you performed the gas-production history studies, the Chaco wells, both production before and after the hydraulic fracture, did you come to a conclusion?

A. Yes, sir, I did.

Q. And what's that conclusion?

A. I came to the conclusion that the production from the Pendragon wells could not be coming from the Pictured Cliffs formation, and it is undoubtedly coming from the Fruitland Coal.

Q. All right. Let's address that's study first, if we might, then, and would you display and explain the exhibits that you used in making the gas production history?

A. Yes, sir.

Q. And Mr. Williams, although we've gotten pretty familiar with the wells, I think when we speak of these

wells, if you would use maybe Exhibit 9 to help the Examiner to point out exactly where the wells are.

A. Yes, sir, the Chaco Number 1 well is located in the northwest quarter of Section 18, 12 West -- 26 North, 12 West.

And Exhibit 17 is a production history of that well with the data gathered from *Dwight's* and from data supplied by Pendragon. It's basically -- We basically took six-month averages of the production data from the initial production of the well, through May of 1998.

And you can see that the well initially came on at a production rate of approximately 80 MCF per day, declined over a period of time until it was down less than 10 MCF per day in 1984 and 1985, produced virtually nothing up until the time that the well was frac'd in January of 1995, at which time the production immediately following the frac jumped to 250 MCF per day and increased up in excess of 300 MCF per day.

Q. Okay. And to what point in time have you brought your production information?

A. That's through May of 1998.

Q. Okay. Could you proceed through the exhibits that illustrate this study?

A. Same source of data for the Chaco 2-R. Again, the well came in at approximately 68 MCF per day, declined

pretty rapidly, continued to produce until 1995. At that time it was frac'd, in early 1995.

And we heard testimony from the Pendragon witnesses about the fact that the well had difficulty unloading, and it has finally started to unload in the last half of 1996 and 1997. And we're now seeing a production rate that's not quite twice what the initial production rate was on the well.

Again, the same sources -- I'm sorry, I didn't point out the Chaco 2-R. Chaco 2-R is located in the southwest quarter of Section 7.

Chaco 4 well is located in the northwest quarter of Section 7. It had initial production rates as high in its life as 200 MCF per day, again declined until 1986-87, produced at virtually no rate. And then following the frac in May of 1995, the production on the well jumped to in excess of 400 MCF per day. So more than double what its initial production had ever been upon completion.

The Chaco 5 is located a 40-acre diagonal away from the Chaco 4 in the southeast quarter of Section 1, Township 26 North, 13 West.

Again, the same shape of production curve and initial production level just under 200 MCF per day, declining pretty rapidly. Stimulated and achieved production rates -- Stimulated in May of 1995 and achieved

production rates in excess of 350 MCF per day.

Q. Okay. Let me interrupt you and ask you, as you speak to the Chaco 4 and 5, are those wells direct offsets to your Whiting wells 6-2 and 12-1?

A. Yes, sir, they are. If you'll look at Exhibit 9, the 6-2 is located in the southeast -- or southwest quarter of Section 6, 26-12. The 12-1 well is located in the northeast quarter of Section 12, 26-13. Amazingly like the configuration of wells that you drew with the last witness.

Q. Approximately when were the 6-2 and the 12-1 completed and put on production?

A. They were completed and put on production in mid-1993, I believe.

Q. And what was their production profile in regard to gas and water initially?

A. They initially produced a sufficient volume of water and an insufficient volume of gas that Maralex was forced to buy propane to run the pumping units in order to get the wells to produce.

Q. And by 1995 -- Let's say by the beginning of 1995, can you tell us what the production -- both the water and gas production profiles were of those wells?

A. I don't recall it off the top of my head, but I've got the data available.

Yes, sir, the 12-1 well in January of 1995 made

13,600 MCF of gas and 2022 barrels of water.

The 6-2 well in January of 1995 made 13,078 MCF of gas and 3726 barrels of water.

Q. So at that point, January of 1995, did Whiting consider that it was successfully -- had successfully dewatered or was accomplishing dewatering of these wells, achieving the rates of production that it had expected?

A. Well, I guess I would answer that in hindsight we think that Maralex was successfully dewatering the wells and achieving the rates of production that they might have expected, but Whiting didn't really acquire their interest in these wells until October of 1995. And so -- I don't know what the position was at January of 1995.

Q. Go ahead with the production histories that you have.

A. Yeah, then the next production history is that of the Chaco Limited 1-J well, which is offset to our 1-2 well, located in the southwest quarter of Section 1, 26-13.

I guess I've got these backwards, but...

The Chaco 1-J well was and continues to be a stinker. Its initial production rate, it looks like, was about 11 MCF per day. There wasn't much room for decline, and therefore there wasn't -- the well was not stimulated by fracture treating, although the well was acidized in January of 1995. You can see virtually no effect from that

acid treatment, and the well produces today at less than 10 MCF per day.

Q. Do you have any information, reported information, concerning the water production for that well?

A. My recollection is that that well does not produce water, to the best of my knowledge.

Q. All right.

A. The Chaco Limited 2-J is located offset our 1-1 well in the northeast quarter of Section 1.

Again, it was a little better well. On completion it came in at about 33 MCF per day, but declined again. It has not been fracture-stimulated. And despite the apparent repressuring that we've heard about in the Pictured Cliff reservoir, that repressuring is not apparent in its production characteristics.

That's all of the production data.

Q. All right. Do you have an exhibit that reflects the total production --

A. Yes, sir, I --

Q. -- volumes?

A. -- I do.

Q. What exhibit number is that?

A. That's Exhibit Number 23. What this exhibit represents is the cumulative production for each of the frac'd Chaco wells prior to their frac job, and then the

cumulative production as of 5-31, 1998.

You can see in the case of the Chaco 1, it had made 103 million cubic feet. As of the end May it had made about 378,000 cubic feet. So since the frac job that well has produced about 2.75 times what it ever produced in the 18 years prior to the frac.

The Chaco 2-R well is similar, although as we noted on the curve it didn't really start to respond until last year. But the production prior to the frac was about 49,000 barrels of production. The cumulative production at the end of May was 99 -- I said barrels. 49,000 MCF.

The cumulative production at the end of May was 99,000 MCF. So it's made as much since the fracture treatment as it made prior to the fracture treatment.

Q. There may be a little mathematical error in the addition of the two volumes on the Chaco 2-R. Would you -- Oh, no, you're subtracting, I'm sorry. Go ahead.

A. The Chaco 4 had produced 202 million cubic feet of gas before it was fracture-treated in May of 1995. As of the end of May it had produced 591 million cubic feet, and the difference being the production since the frac, 389 million cubic feet.

The same on the Chaco 5, a similar sort of a number. It had produced about 145 million before the frac. It has produced as of the end of May 508 million. And so

the difference in production since the frac is about 363 million cubic feet. Or about 2.3 times what it had produced prior to the frac.

In total, these wells since they've been fractured have produced a little over a BCF of gas. The cumulative production on these wells before they were fracture-treated was 498 million cubic of gas. So they've produced about twice as much since they were fracture-treated in 1995 as they did in the first 17 years of their life.

Q. And what is the conclusion you draw from this particular accumulation of data?

A. I guess the conclusion that I would draw from all of the production data, including this production data, is that this isn't PC production, in my opinion, in this is Fruitland Coal production.

Q. Now, you've heard the testimony that by the fracture stimulations that were applied in 1995 some sort of skin damage or other phenomena was overcome so that these wells were able to increase production at these volumes. Do you have an opinion in regard to the validity of that hypothesis?

A. Yes, sir, I think that if what we were doing was overcoming damage, we would see production increases on these wells of five, ten, maybe in extraordinary

circumstances twenty times what their original -- what their prestimulation production is.

But in my experience, when you start seeing production increases that are 200 and 300 and 400 and 500 times prestimulation production rates, you're talking about recompletion, you're not talking about stimulation.

Q. Now, even in the event that there is some sort of so-called skin damage or interference, in the case of wells of this sort, is there an examination of the pressure that can be made that will answer questions of whether that exists or not?

A. Yes, sir, there are.

Q. And did the next study that you did involve an examination of the relative pressures in these wells during the -- before and after the fracture stimulations?

A. Yes, sir.

Q. What conclusion did you draw from your pressure studies?

A. Again, I drew the conclusion that these wells are no longer producing from the Pictured Cliffs formation exclusively, that they are connected to some other formation that had some higher pressure. My belief is that that's the Fruitland Coal.

Q. Okay. And do you have Exhibits 24 through 27 that illustrate that data?

A. Yes, sir.

Q. All right. Would you go through those, please?

A. I will.

We've seen quite a bit of pressure data, and maybe the first thing to do is to try and explain how I gathered shut-in pressure data.

Mr. McCartney was correct, we don't have a lot of shut-in pressure data on the coal wells. But what we did -- and you'll notice on this first Exhibit 24, which is an exhibit showing wellhead shut-in pressures on the fractured Chaco wells and the five Whiting coal wells, that a lot of these data points line up on the same date.

And the reason we picked those data points is that we went through and we identified periods of time when the Chaco plant was shut down and wells were shut in for an extended period of time, six or eight days. Most of that identification actually came from the Thompson daily production reports on the wells.

Maybe if I can use an example, in Exhibit Number 37, which is the well file of data that we received from Pendragon on the Chaco wells, under the second tab called "Production Data", this is kind of in a reverse chronological order, so the most recent stuff that we had available is on top and the later stuff goes back.

But if you go back about 20 pages in that, for

instance, to the July, 1997, Thompson report --

Q. These are pumper reports?

A. These are pumper reports. And so what you've got, you've got some combinations of -- So basically you can see that at -- Did you find where I'm at, Mr. Hall?

MR. HALL: Let's see, July, 1997?

THE WITNESS: July, 1997. This is just an example. But you can see that basically the well was closed in. This happened to be -- In this particular case, the notation doesn't show a Chaco plant shut in, but in fact all of the wells were closed in, as well as the Whiting wells being closed in.

So the last pressure point that you see here, it all lines up. This is a July, 1997, pressure point taken on all of the wells after they had been shut in for a period of about six or seven days.

And so -- And it is a wellhead shut-in pressure, it's a casing shut-in pressure, because that's the only data we have available. We don't have bottomhole pressure data available at all on the coal wells. We saw a little bit of pressure data that Mr. Nicol introduced on two of the Chaco wells yesterday that was just recently taken.

But anyway, that's the source of our shut-in data, and in every case --

Q. (By Mr. Gallegos) Mr. Williams, before you go

into explaining what is shown by this exhibit, it will help with the record and just understanding if you'll kind of explain the code and the color coding.

A. Yes, sir. The circles on Exhibit 24 are the Chaco wells. The triangles are the coal wells. And then each of the circles and/or triangles has been given a different color, so -- and the color code is shown on the chart so that you can see specifically which wells it is that we're dealing with.

Q. All right. That having been said, would you go ahead and explain what is revealed by the --

A. Yes, sir.

Q. -- the charting of these pressures?

A. Yes, sir. Basically, we just -- We plotted all of these pressures, because I think it's important to look at all of these pressures in perspective.

I mean, we saw some plots that Mr. McCartney had done this afternoon where -- or this morning, where he showed pressure points. And then he discounted all this earlier data because nobody that was operating a well between 1977 and 1983 knew how to take shut-in pressures on wells. And obviously the data wasn't good.

But obviously the data has been being accepted by the NMOCD for years, and so we assume that probably that data is pretty good. And in fact, it starts to make sense.

This is not unlike the exhibit that Mr. Nicol presented, which I think was -- maybe his Exhibit N15, just sorted a little differently and a little different group of wells.

But anyway, you can see that this pressure declined on these wells. And, in fact, all of the wells kind of were grouped together until they started to get some spread in them toward the last couple of pressure points in 1981 and 1983.

Q. And you're talking about the Chaco well?

A. Yes, sir.

Q. All right.

A. Yes, sir. Of course, the coal wells weren't drilled until 1993.

And then we've got a hiatus of data in here that we've all recognized. And we don't know what happened between here and here to cause these pressures that were someplace in the 97- to 135-pound range on the Chaco wells to increase to 150 pounds and beyond over here in 1995, which is the source of this data.

The earliest that I had any of these pumper reports from Pendragon in the data that they supplied to us was January of 1995. And so I don't know -- But Mr. Nicol had the same split of data in his presentation.

So we don't know whether this continued to

decline and then took a quantum jump. We don't know whether this stayed flat and took a jump, when that jump took place. We don't know that.

Q. Do you have any wellhead shut-in pressures on the Chaco wells in what I'm going to call the later period, the 1990s period, that predates some sort of stimulation being applied to those wells?

A. There are no data points on this graph that predate stimulation of the Chaco wells. I guess I --

Q. Predate the 1995 stimulations?

A. That's correct.

Q. Okay.

A. I'm sorry. Yeah, let me rephrase what I said.

None of the points after 1983 on the Chaco wells reflect a prestimulation pressure. All of these were following either an acid job or a frac treatment.

I guess I draw your attention to Exhibit 39, which is the Chaco 4 well file, and if I can find this there are some -- Okay, under the final tab, which is called "Completion File", about four or five pages in, there's a Walsh Engineering workover and completion report, and that report is dated January 30th, 1995, okay?

Okay, this is when they moved on this well, on the Chaco Number 4 well, prior to doing an acid job on the well. And the rig crew reported a shut-in casing pressure

of 119 p.s.i. at that point in time, which would be approximately a level where I'm pointing on the graph and there's not a point.

Again, that didn't fall under my selection of data points because I didn't know how long the well had been shut in or anything else.

That is the only reflection we've been able to find in any of these well files that show a prestimulation shut-in casing pressure. But the pressure at that point in time was 119 p.s.i. shut-in casing pressure reported by the rig crew.

The last data point that we had from the C-122-A -- is that the correct report, the deliverability reports?

Q. Yeah.

A. -- was 97 p.s.i., so that would suggest that there had been about a 22-pound increase in that reservoir, if this is a valid shut-in casing pressure point, over about a 12-year period.

Interestingly enough, staying with the same exhibit, and going back up to the front where we find the production information and thumbing back to just before the log file, maybe 10 or 15 sheets in front, we find that same pumper report, the Walsh Engineering daily production report for this well for February of 1995.

Again, shut-in casing pressure of 119 pounds when the rig crew got on the well. They acidized the well, and the pressure reported on both the 24th of February and the 28th of February is 140 p.s.i., which I think is one of the pressures that Mr. Nicol referred to.

And as you flip forward in time, you can see some 147-pound pressure points in March of 1995, in April of 1995 and in early May of 1995, prior to the stimulation of this well.

So I don't know what the pressure was before the stimulation of that well, but that 119 pounds is the only data point that we've got.

Q. Let me ask you this as you're working through this exhibit: If sandstone wells such as these had accumulation of fines or so-called skin damage so that gas production levels had dropped off, what would be the circumstance in regard to shut-in wellhead pressure on such a well?

A. The damage or the accumulation of fines or anything that causes damage, as long as there is some communication to the reservoir, regardless of how damaged, you will eventually see the true reservoir pressure.

The damage doesn't affect the pressure. It may affect the rate of pressure buildup, but it does not affect what the reservoir pressure is.

Q. All right, go ahead. What does this exhibit show?

A. Okay, this exhibit shows some data points from the Fruitland Coal wells before the 1995 stimulations that were in the range of 210 to 230 p.s.i.

By the time we get down -- And one point which I think Mr. McCartney had pointed out, of less than 200 p.s.i. on the 12-1 well, until the time that we get down in the range where we start to see Chaco well pressure data again -- and basically I guess I would say there is a grouping within about 20 or 30 pounds of Chaco well and coal well shut-in pressure data.

Q. Following the frac -- Following the stimulations of the Chaco well?

A. Yes, sir. You know, I think you look at that grouping of pressure and you are pretty hard-pressed -- Again, knowing what it is, that it's a wellhead shut-in pressure, you're pretty hard-pressed to say that's not pretty similar pressure data.

Q. In fact, some of the pressure points between the Chaco wells and the Whiting wells fall almost on each other?

A. Yeah, literally the symbols overlap on the exhibit.

Q. All right. Is there anything else that you

wanted to point out on that exhibit?

A. Not on that one, no, sir.

Q. All right. Would you go to Exhibit 25?

A. We saw some pressure data this morning that Mr. McCartney presented, and he tended to pick and choose which points he wanted to honor and didn't have a firm reason for not honoring other points.

What this and the next two exhibits are, is a plot of all of the shut-in pressure points, wellhead shut-in pressure points we have, the blue points being the pre-frac points, with the last point being July 5th, 1983.

Q. This is on the Chaco Number 1?

A. This is on the Chaco Number 1 well. And then the first red point being a post-frac point on 3-14-95.

And so I just grouped those things together, and instead of ignoring any of that data I just told the computer to go ahead and put a least-squares-fit line through that group of pressure points.

And in fact, as we're well aware, and I'm sure you're aware, Mr. Examiner, one of the traditional ways of trying to look at gas reserves in a depletion gas reservoir is to look at a pressure P/Z-versus-cum production.

Well, this isn't exactly P/Z -- it's wellhead shut-in pressure -- but it's against cum production. And basically by the time you get down to a zero casing

pressure, you would anticipate that that would define approximately the gas in place on the well. And when you got down to some sort of an abandonment pressure, maybe 25 pounds or something like that, that would define approximately what the recoverable reserves are from that well.

Q. Which by this chart would be approximately --

A. Approximately 220 million cubic feet. And I recognize that there may be some scatter in this data, maybe that isn't the best fit, maybe you slide it a little bit to honor some of the other points later.

But the bottom line is that probably you've got some sort of a gas in place or a -- The size reservoir that this well is seeing in the Pictured Cliffs is 200 to 300 million cubic feet.

Q. Could you go back at this point to the production history on the Chaco Number 1 so we can compare what's happened in terms of volume of gas produced from that well --

A. Yes, sir.

Q. -- before the fracs and after?

A. Again, this is Exhibit 17, and basically the last data point that we had was here in 1983 where the well was producing -- had gotten down to a point where it was producing between 5 and 10 MCF per day.

Q. Okay, if we would look at Exhibit 23 that shows the total, the cums before and up to date, after --

A. Oh, yeah, okay.

Q. What you've got -- Yeah, you can just leave it where it can been.

EXAMINER CATANACH: Let me flip to it in my book.

THE WITNESS: Yeah, essentially at the time that this well was recompleted it was here at 102 million cubic feet of gas.

Q. (By Mr. Gallegos) All right.

A. Or -- I said recompleted. At the time that the well was stimulated it was here at 102 million cubic feet of gas.

Q. And if the recoverable reserves, which you estimated may be 175 million, since the frac -- fracture treatment on the well, it's produced --

A. Two hundred --

Q. -- in excess of 275?

A. -- seventy-five. Yes, sir. Yeah, absolutely. It's...

And so then -- These are the shut-in pressure datas. The red squares on this curve and on the next two curves are the shut-in pressure data that we've seen determined as I mentioned, finding those periods where we had an extended shut-in period and then recording wellhead

shut-in pressure.

And again, they line up -- This is a computer-generated fit of those points, but they line up in a pretty good scatter around this line, again honoring all of the data points, post frac. And you've got a pretty dramatic change in the size of reservoir that this well is seeing. This is not seeing the same reservoir.

If we had seen a recharge of the same reservoir, and this pressure had miraculously gone from here at 135 pounds up to 170 pounds within the same reservoir, you would expect to see a parallel line to the blue line, coming down here giving you some increased production, because that's the same container that you're dealing with. But in fact, the container here changes very significantly.

Q. Do you have another similar pressure --

A. Yes, sir, I've got some more.

Q. -- comparison? Okay.

A. This is the same kind of a curve on Chaco 4, again showing pre-frac pressure data in blue, the last pressure point being the C-122-A, 7-5 of 1983, and then showing a post-frac pressure data in red, the earliest point being 5-22-95. And this well was frac'd, if I recall correctly, on the 10th of May, 1995.

And again, this last pressure point -- I should have pointed that out on the Chaco 1 as well. This last

pressure point on the Chaco Number 4 is the shut-in pressure that these wells achieved, and I just happened to pick the pressure on the 13th of July, after the wells had been shut in for 13 days, and we'll talk a little bit about why I chose that date in a minute.

But again, it shows virtually the same thing. The container size, based on the original depletion of pressure from the Pictured Cliff reservoir, defining a container size of 200 to 300 million cubic feet and a significantly larger container size, indicating that you're not in the same reservoir you were in before.

Q. And has that well, since the fracture stimulation, produced 389 million?

A. Yes, sir, it's produced about 1.9 -- or .9 time what it had previously. I'm sorry, 1.9 times what it had previously.

Q. Were you going to explain now the July pressure point, or do you want to --

A. We'll talk about that with a later exhibit.

Q. Okay. All right, go ahead. This is Exhibit 27?

A. This is Exhibit 27, which is basically exactly the same data, on the Chaco Number 5, the blue points being the pre-frac pressure data reported on C-122 and C-122-A, and the red points being the post-frac data.

The latest data that we had on this well was a

1980 C-122-A. We didn't have any later point than that. Again, the post-frac data shows an increase in the pressure and a dramatic change in the slope of that curve, shut-in pressure against cum production.

Q. And is your conclusion likewise in that well that that's seeing a totally different reservoir?

A. It's connected to something different than it was connected to previously.

Q. All right. What other information do you have regarding your study concerning the wellhead shut-in pressures on these Chaco wells before and after the hydraulic fractures or other stimulations were applied?

A. That's really it, relative to that.

Q. Okay. And does that information confirm your conclusion that the gas that's being produced from the Pendragon wells is coming from the Fruitland formation reservoir --

A. Absolutely.

Q. -- rather than the Pictured Cliff reservoir?

A. Absolutely.

Q. All right. I think the next study you did, then, involved the gas analysis, BTU content and dryness index on this area?

A. Yes, sir.

Q. All right, before --

A. Yes, sir --

Q. Before you get into the exhibits that illustrate this study, tell us what your data was and why you were using this particular approach.

A. We basically had gas analyses from 40 wells that -- and it represented about 221 data points, going back to 1977, 1978, up through 1998, on wells within the general area. They weren't all within the four-section area that we've discussing here, or the five-section area that we've been discussing, but they were basically within these two townships.

And we had that data -- Again, our sources were data that we had, data from El Paso, data that Pendragon had presented to us.

We only utilized -- This is not unlike the same data that Mr. Nicol presented in his Exhibit Number N19, but not all of the points overlap. We only used the points where we had a full gas analysis and could really look at it and say, yes, this is correct data. If we had a point where it was just a BTU data point or something like that, we just didn't use that because we weren't sure it was reliable data.

So a lot of the wells overlap the wells that Mr. Nicol presented, but not all of them do. And we've got some data points in ours, including some Pendragon-operated

wells that Mr. Nicol chose not to put in his exhibit, for whatever reason, so --

Q. Okay, if you'd address Exhibit 28 and explain what it shows?

A. Exhibit 28 shows from -- I guess -- Back here from 1977 through 1998, it shows the BTUs -- and these have all been corrected so that they are at a constant pressure base -- but it shows the BTUs on all the wells and all these samples that we have, the 221 samples.

The red triangles are wells that are described as in the WAW Fruitland Pictured Cliffs or the -- whatever field, Fruitland Pictured Cliffs Pool. We make no interpretation about this data at all. These data points are all the same.

The green squares are Fruitland Coal points.

And there are about five blue triangles on here that -- I can only see four, and I think the fifth one sits down here -- that are mixed wells, wells that either are commingled or -- well, wells that are commingled; there's not an "either". Wells that are registered with the Commission as being commingled.

And so what this data shows is that basically you have a gathering of points in the Pictured Cliffs that fall above a 1050 BTU, with only three exceptions, in -- I don't recall the number of data points, but again I can tell you

that.

Q. Did you say 221?

A. Yeah, but I'm trying to look at the pre-1993 points. We kind of -- Yeah, basically we had 73 of these points, all of which were -- well -- Yeah, 73 points before January of 1993, and 68 points subsequent to -- No. I'm sorry. Okay, 143 total Pictured Cliff -- Fruitland Pictured Cliff reservoir points. And before 1993 we had 73 of them, subsequent to 1993, 70 of them.

Anyway, of the 70 points prior to 1993, we had a total of four of them that fell below 1050 BTU.

And then all of a sudden we see -- At about the same time we start seeing some coal production develop and some coal analyses being included in here, we start to see a number of these points that fall -- that historically had fallen in here at above 1050. A number of the points start to fall below 1050.

You can see that the coal points, with a few notable exceptions, are grouped in the 1000 or maybe 950 to 1050 range, and there are four or five points outside of that range, but all the rest of the coal points are in there. The mixed points, two of them, on commingled wells, two of them are high, three of them are low.

But we start to see that, in fact, there's a drop in points that just coincidentally occurs when you start to

get coal development.

And so, you know, being an engineer, I don't necessarily believe in all these coincidences, you know, these recharges of reservoirs and changes in BTUs. I mean, I start to see all these coincidences and they all point the same direction.

And so we started to try and investigate that a little further, and that's the next exhibit here, Number 29. And what 29 represents is about nine plots of different wells. And we plotted two parameters on here.

We plotted the BTU content, which is the same parameter that is shown on this BTU-as-a-function-of-zone-and-date graph and is blue line on all of these curves.

And then we plotted what is referred to as a dryness index. And what a dryness index is, is a ratio of the methane percentage to the total hydrocarbon percentage. So this is how much of the total hydrocarbon stream is methane.

Q. So if it were 100 percent, you'd be saying that all of the stream is with methane?

A. Yes, sir.

Q. All right.

A. And so the first three wells that we've got are the first -- Yeah, the first four wells that I guess we show are coal wells. And we show those plotted in time

from 1994 through 1998. And you can see a consistency of the dryness index and a consistency of the BTU in that low range.

The first is a combination of the 6-2 and 7-1, which until about two years ago went through a common data point, so we had just a common sample for them, and then we've just gone ahead and combined their samples in total on there because of that fact.

Q. Well, do you mean it went through a common delivery point --

A. Common delivery point.

Q. CPD [*sic*]?

A. Yes, sir.

Q. Okay. Is there an explanation for the one -- oh, January, I guess, 1998, blip in the data there?

A. No, sir. I'm not sure it's a good data point --

Q. Okay.

A. -- but we showed it.

Q. All right --

A. I mean, it certainly is not consistent with all of the other data on this graph.

Q. All right. But just to read this, one would read these two wells where they're delivered as having a BTU content that generally was around 1025 --

A. Yes, sir.

Q. -- and a dryness index of about --

A. -- 97 percent.

Q. -- 97 percent? All right.

A. Yes, sir.

Q. Go ahead.

A. Okay, the next graph in here is the same kind of data on another coal well at the Federal 1-2 CDP. And again, this -- There are four coal wells that come into this point, and this represents the composite of those four coal wells.

Again, the same consistency, a BTU content that is less than 1025 and a dryness index in excess of 97 percent.

The next curve in this series is the Gallegos Federal 12-1 well, and again the same consistency of data over time, BTU of less than 1025 in general, and a dryness index in excess of 97 percent.

And finally, the Federal 14-1, again another coal well, outside this narrow area that we've been talking about, but again it's got a little higher BTU. It gets as high as 1033, but basically a dryness of 97 percent and above.

So the coal data is pretty consistent.

The next graph in this series is the well that was -- the Pendragon Hard Deal 2-J.

Q. Why did you --

A. This was picked because it was a mixed well.

Q. "Mixed well" meaning what?

A. That they perforated the coal and frac'd it along with the PC, and it is now a commingled well.

Q. Okay.

A. And they did that in 12-5 of 1994. And you can see there's one real funny-looking data point there about January of 1991 that, you know, you can believe or not believe, or just say of all these data points you get a few strange-looking ones.

A fair consistency of data there, although again following 1994 and that commingling with the coal, we do see, in the next few data points, a drop in BTU and an increase in dryness index to where it gets above 95 percent.

Q. Say again, when was it in 1994 that the commingling --

A. It was in December 5th of 1994.

Q. Okay. Okay, go ahead.

A. Okay, the next well is another Pendragon well where they recompleted from the PC to the coal in 1990. I think maybe the recompletion was done prior to Pendragon owning it. But anyway, the well was recompleted. It's now operated by Pendragon. The well was recompleted in 1990.

Again, we've got a lot of data points back in the pre-recompletion period where the well was a PC well, in the 1100 BTU with a dryness index between 90 and 95 percent.

Then we don't have much data on this well until we get out here to 1994. And again, this is data we gathered from Pendragon; that's why we have it. And as a result you see that the BTU dropped so that the last several data points here have been, you know, below the 1050, like we had seen on the Whiting coal wells, the dryness index in excess of 95 percent.

The next wells are some of the wells in question that we are concerned about and we believe are draining the Fruitland Coal.

The Chaco 1 well, again, the data points were pretty consistently above 1100 BTU, as a PC well. And then this well was frac'd in January of 1995. The first three points following the frac showed that it still had a fairly high BTU. And then a pretty abrupt change in the BTU and dryness index that occurred in 1996, early 1997 on that well.

Again, not knock-your-socks-off conclusive data, but there's darn sure a discontinuity that has occurred here that looks just like the discontinuities we see in wells recompleted to the coal.

We see the same sort of a thing in the Chaco 4. We had only one data point way back in 1977, and then no additional data points until 1988. Again, it was frac'd in May of 1995. The first data point following that frac was -- still showed a fairly BTU, and then we see again a pretty abrupt discontinuity, a big drop in BTU on that well, with the exception of one extraneous data point in there.

Q. And an increase in the dryness?

A. Yes, sir. Yeah, those go hand in hand.

And then the Chaco 5 data is very similar. Again, we see a pretty dramatic drop in BTU, in -- actually occurred in 1994 here, and an increase in the dryness index. The frac on the well occurred in May of 1995.

So again, this data -- Again, you've got an extraneous data point out there that looks funny and inconsistent with other data around it. Whether it's a good data point or not, I don't know.

Q. Apart from that data point, is this well essentially -- the Chaco 5, essentially showing the same BTU content and dryness index --

A. Absolutely.

Q. -- by now as the Whiting wells?

A. Absolutely.

Q. Anything else you did in your study of the gas

analysis?

A. No, sir.

Q. Okay. And did this study and the data that you found and you've illustrated in these exhibits support your conclusion that the gas being produced from the Pendragon well is coming from the Fruitland Coal formation?

A. In my mind, it definitely does.

Q. All right. Your next study, I believe, Mr. Williams, was a comparison of production and pressures of the Whiting wells and the Pendragon wells during and after various shut-in periods; is that correct?

A. Yes, sir, it was. And even before that -- I mean, I guess I would go even broader than that. It was trying to look for examples of interference and changes in our wells and/or the Chaco wells that related to one another, you know.

And I guess maybe the first thing I'd like to do is to talk about Exhibit Number 56, which is at the back of this book. And we saw this curve from -- as M1 from Mr. McCartney this morning, in another incarnation, and I just -- I looked at that curve this morning, and I drew two lines on it, which you almost thought were Mr. McCartney's lines and asked him about.

But clearly, you had a slope, a rate of increase of these five wells that was taking place in the period

from mid-1994 through mid-1995. And I didn't try to connect every data point to account for every minute of downtime on this thing, but it certainly looked like a trend to me.

And then all of a sudden I started looking at data points that fall in September, November, December of 1995, January, February, March, April, May, June, July, August, September of 1996, and I see a pretty dramatic change there.

Now, Mr. McCartney couldn't see that, and Mr. Ancell couldn't see that, but that appears pretty obvious to me, and that's the sort of thing that we were looking at.

I guess I could say that we could look at the same sort of a thing in Mr. McCartney's Exhibit M8 and look at the last curve in M8, which happens to be the 12-1 well, and we see an increasing trend of production that began in 1994 and continues through the middle --

Q. Just a second, Mr. Williams, let the Examiner get with you on this.

A. I'm sorry.

EXAMINER CATANACH: I've got it.

THE WITNESS: Okay. So we were seeing an increasing trend of production. And then all of a sudden this thing had no increase any longer, there was a

discontinuity which has been explained as being shut-in time, and that may very well be the case, but there is no increase any longer, there is something that resembles --

Q. (By Mr. Gallegos) After the shut-in -- After the supposed shut-in time?

A. Yes, sir. Again, ignoring the August point, ignore the October point, look at the points in September and November and December and January and February and March, and then it looks like there's another shut-in point in July or something there.

But the bottom line is that it doesn't take a very broad pencil to draw two trends on that which indicates interference.

Q. Now --

A. So --

Q. Excuse me. Now, if memory serves, didn't Mr. Nicols have some sort of pressure comparisons in his presentation? I thought he had an exhibit, supposedly pressure comparisons. Do you recall that?

A. I guess I'm not recalling which exhibit you're referring to. We'll --

Q. I'll try and get it and refer you to it.

A. Okay.

Q. Go ahead, then, with your studies.

A. Okay. So I guess those are the kind of things

that we looked for. And the problem that you have, we don't have a definitive expectation of how long every one of these wells is going to climb and at what rate every one of these wells is going to climb. Unfortunately, the science isn't that good, particularly when we don't have, you know, core data and core analysis on all of these wells.

So again, I can't predict that -- I can't absolutely say that this change in the 12-1, for instance, is totally unrelated to anything that the Chaco wells occur -- you know, had happening to them.

But the point I can make is that this, along with every other piece of data that we've seen, all points in the same direction. Something changed in those wells, something changed in our well. That's evidence of interference, in my mind.

Q. Okay.

A. So...

Q. Let's go ahead, then. Do you have some other exhibits, some exhibits you did that reflects your pressure --

A. I do --

Q. -- studies?

A. -- and I guess the next exhibit that I'd refer to is Exhibit 31. And Exhibit 31 is pressure data on the

Chaco wells that were shut in under the Court injunction, and these wells were shut in on September 30th.

Q. June 30th.

A. I'm sorry, June 30th.

And our pumper has been going out on a daily basis -- and I think in most cases it's been in conjunction with the Walsh Engineering pumper -- and gathering data points on the shut-in pressures on these wells.

And you can see that the data points that were gathered on the 8th of July, the 10th of July and the 13th of July were constant on all of these wells. Essentially, they had been shut in 13 days, and the pressure had built up and was pretty stable.

I think the data that Mr. Nicol presented in -- I don't know which exhibit it was. Maybe N16?

Q. I think so, I think it was 16.

A. -- you know, confirms this.

Something happened on the 14th, and basically the Chaco plant got shut in for a two-day shut-in, and the Whiting wells dramatically lowered their production rate, and we'll see that in the next exhibit.

But the bottom line is, upon the Whiting wells getting shut in, for all intents and purposes, the wells we didn't shut the casing valve and absolutely shut the wells in, which again in hindsight maybe was unfortunate, but the

wells continued to produce against a packed line and produce up to a point where they could produce no more, and we'll see a dramatic drop in their production rate.

We saw an increase in the pressure on every one of the Chaco wells. It is most pronounced on Chaco 4 and Chaco 5, but we saw it on Chaco 1 and the Chaco 2-R as well.

The wells were shut in for two days, the Whiting wells were shut in for two days and brought back on production, and we see a decrease in the pressure, in the shut-in casing pressures, on the Chaco wells.

Okay, the production continued from the Whiting wells until the 23rd of July, and then there was about a 2-1/2-day Chaco plant shutdown, and again the same situation occurred. The wells produced basically into a packed line at reduced rates.

Q. The --

A. The Whiting wells.

But you can see an increase in pressure on all of the Chaco wells. And when the Whiting wells went back on production, you see a decrease in the Chaco Number 5, you see a decrease in the Chaco Number 4, you don't quite see the decrease.

Now, we've got a couple of more days of data that didn't make this exhibit, but the same thing is happening.

The wells have been on, the pressure dropped, we had a little dip the day before yesterday, and the wells went off and the pressure went up.

Now, if these wells are in the PC, then nothing that goes on with the Whiting coal wells ought to have any impact on the shut-in casing pressure of these wells. These wells ought to be flat as a fritter. They're shut in. But in fact, we're seeing a direct --

Q. If they're in the Pictured Cliff --

A. If they're in the Pictured Cliffs, there should be no effect whatsoever. But there is an effect of pressures increasing when our wells go down, pressures decreasing when our wells come back up. And that is occurring, and that ought not to occur if these are PC wells.

Q. Does that say to you that there's communication?

A. Absolutely, absolutely.

The next exhibit we probably want to look at is really the previous exhibit in the book, Exhibit Number 30. And again, same situation. If these wells are in different reservoirs and the Chaco wells are truly in the Pictured Cliffs reservoir, then Whiting should see no effect of the shut-in of those Chaco wells on the production in our wells.

Well, we can kind of flip through these curves,

and again, unfortunately, it's pretty difficult to see because of these periods of shut-in on some of these wells, but others it's pretty obvious.

The 12-1 is an example of a well that is on compression, and the compressor has been up and down, and we have not been able to keep it running, and so the production data on this well is very erratic. But it appears that the peaks, certainly later in the month, are significantly higher than any of the peaks that we had seen in June, prior to the shut-in of the Chaco wells.

The next well is the 1-1, and you can see that prior to the Chaco wells being shut in, it was producing about 370 MCF per day. Subsequent to the Chaco wells being shut in, it jumped almost immediately to 390 MCF per day. And again, we had the shut-in that occurred on the 14th-15th, and again that shut-in that occurred on the 23rd, 24th and part of the 25th, that you can see on here.

The same thing occurred on the 1 Number 2 well. It was producing at about 165 MCF per day. Following the shut-in of the Chaco wells, the production almost immediately jumped over to 190 MCF per day, and every time it's been back on, it's been in that same range.

Q. It looks like up to 200?

A. Yes, sir. Yeah, I'm sorry, you're right.

The Chaco 6-2 well had been producing in the

range of about seven hundred and --

Q. I think you mean the Whiting 6-2?

A. I'm sorry, yeah, you're correct. The Whiting 6-2 well had been producing in the range of 760 MCF per day prior to the shut-in. The Chaco wells were shut in, and within a ten-day period, the well was producing over 800 MCF per day, and that production has continued to increase.

The Chaco 7-1 exhibits exactly the same characteristics. That well had been producing less than 700 MCF per day. The production jumped almost immediately, was declining as it had been previously, had gotten almost to the point, 13 days into the month, that it had been prior to the shut-in, and the each time it's come back on production, it's come back on at a higher rate.

This should not occur if those wells are in separate reservoirs. The shut-in of the Chaco wells should have no effect on the production of the Whiting wells if the Whiting wells and the Chaco wells are in separate reservoirs.

This data conclusively leads me to believe that they are not in separate reservoirs. We are seeing pressure communication, we are seeing production communication, without a doubt.

Q. Let me ask you if you have examined data and given consideration to the subject of whether or not the

fracture stimulations applied to the Whiting wells invaded the Pictured Cliff formation. Have you considered that?

A. I looked at that. I haven't seen anything, other than Mr. Blauer's testimony, that would suggest that that occurred.

Q. Okay. What does the evidence indicate to you concerning whether the fractures created in stimulating the Whiting wells extended into the Pictured Cliff formation?

A. I can see no evidence from the production on the Pictured Cliff wells in the period between when Whiting and Maralex stimulated these wells in 1993 and put them on production, you can see no indication in the production of these wells, you can see no indication in the pressure on these wells.

All of the pressure increases that we observed, we observed as occurring following a Pendragon/Edwards stimulation of some kind, and there is just not anything that suggests that the Whiting/Maralex wells were affecting the Chaco wells at all, or associated with the Chaco wells in any way prior to the stimulation of the Chaco wells.

MR. GALLEGOS: I move the admission of Exhibits 17 through 31 and Exhibit 56, and pass the witness for cross-examination.

THE WITNESS: Mr. Gallegos?

MR. GALLEGOS: Oh, I'm sorry.

THE WITNESS: Could I make more comment?

MR. GALLEGOS: Yes.

THE WITNESS: You asked me about a comment Mr. Nicol made about pressure. I think it ought to be --

Q. (By Mr. Gallegos) That was Exhibit N16, I think, did you find that?

A. Yes, sir. Yeah, Exhibit N16 is a compilation of a lot of pressure data from different sources, but I think Mr. Nicol relied on a Walsh engineering and production report where they are tracking the pressures and the production on the Whiting wells during this period of shut-in subsequent to the June 30th injunction.

Both Mr. Nicol and Mr. McCartney referred to the fact that the Whiting wells were producing at flowing pressures in excess of the shut-in pressures of the Chaco wells, and they both referred to the date of the 15th of July.

And as we pointed out on Exhibit -- whatever it is here, Exhibit 30, that's the day the Chaco plant was shut in. And so these wells -- That isn't a flowing pressure on these wells.

Yes, the wells may have flowed some gas in the intervening time period, in the intervening 24 hours, in trying to -- in packing the line, but they would have been decreasing flow rates over time, and in fact what we're

seeing is close to a shut-in pressure on these wells because they have now packed the line. The Whiting pressure in this particular case is in excess of what they recorded as the line pressure.

And so I guess I just think that the record ought to be made clear that both Mr. Nicol and Mr. McCartney picked a single point out of all of these points when these wells were shut in.

And in fact, Mr. Nicol referred to the flowing pressure of the 6-2 well and the 7-1 well, both wells of which are on compression. And had they been flowing, the flowing pressure would have been two to seven pounds; it wouldn't have been 60 to 80 pounds.

And so I think the record needs to be set clear that the choice of the date for picking that data point was very convenient for them but, in fact, it does not really reflect the producing condition of these wells. The producing condition of the wells is reflected on the data when the wells are producing, not when they're shut in, not when the Chaco plant is shut in, not when the compressors are shut down.

Q. Okay. Was there anything else, Mr. Williams?

A. No, sir.

MR. GALLEGOS: All right. Once again, Exhibits 17 through 31 and Exhibit 56.

EXAMINER CATANACH: Any objection?

MR. HALL: No objection.

EXAMINER CATANACH: Exhibits 17 through 31 and 56 will be admitted as evidence.

Let's take a break here before you start, Mr. Hall. Five, ten minutes.

(Thereupon, a recess was taken at 5:00 p.m.)

(The following proceedings had at 5:18 p.m.)

EXAMINER CATANACH: All right, let's reconvene the hearing and turn it over to Mr. Hall.

CROSS-EXAMINATION

BY MR. HALL:

Q. Mr. Williams, I want to ask you about your Exhibit 23, right here.

As I understood your testimony on direct, Mr. Williams, looking at your volume reporting pre- and post-frac, what was striking to you, as I understand it, was that post-frac production rates were some seven-tenths, sometimes twentyfold higher than you would have expected. Is that an accurate characterization of what you said?

A. Yes, sir. It doesn't relate to this exhibit; it relates to the individual production well exhibits. But that's correct.

Q. Wouldn't it be more meaningful if you were to compare the production increases over the IP rates from the

initial completion of the wells, the Chaco wells?

A. Not in my mind. No, the pre-frac production data represents the condition at the time that the frac took place. The IP production data represents a total set of different conditions, as the pressure points show, totally different set of conditions.

Q. All right. Well, as I understood, your numbers are basically production numbers, then, at those points in time, post-initial-completion, pre-frac, post-frac, correct?

A. That's correct. On Exhibits -- whatever they are.

Q. You tell me what they are.

A. Seventeen through 20 are the entire production history of these wells that show the initial production levels, the production levels prior to frac, the production levels following frac and since that time. It's the entire production history of the well. I think it's the first time it's been presented today.

Q. All right. Do you have the IP for the Chaco Number 1 from 1977, 1978, whenever it was?

A. Yes, sir, referencing Exhibit 37 in the section called "Completion File", there's a USGS form -- I don't see the name of the form on here -- 9-330. It says that the initial production rate on the Chaco Number 1 on

3-23-1977 was 342 MCF per day.

Q. Now, do you know what the average production rate immediately post frac was for the Chaco 1?

A. Well, referring to the same exhibit, front section, second section, which is called "Production Data", going to the Walsh Engineering reports, the first production data that is reported in the data that we have shows a production rate on the 20th of March of 71 MCF per day, on the 21st 188, on the 22nd 188, on the 23rd 190, and so forth.

MR. GALLEGOS: What year?

THE WITNESS: This is 1995, I'm sorry. There is no production data between when the well was fracture-treated at the end of January and the first of March -- and the 20th of March.

MR. GALLEGOS: Excuse me.

Q. (By Mr. Hall) On Exhibit 23, the large chart here, let's turn to that. On your production volumes post-frac, can you say which proportion of that is attributable to Fruitland Coal production and how much to Pictured Cliff sandstone production? Can you say?

A. My opinion is that the preponderance of it is attributable to Fruitland Coal production, and I guess I'd be more specific and say in excess of 90 percent of it is attributable to Fruitland Coal production.

Q. What's the basis of that, Mr. Williams?

A. Well, I guess we need to look at each individual well, Mr. Hall, but if -- Well, let's look at the Chaco Number 4 as an example.

If this well was producing -- call it 5 MCF per day, prior to this -- we can go back and look at the actual data in the book if you'd like.

If I were to say you're going to get fivefolds of increase of 10 MCF a day -- fracture treatment in the Pictured Cliffs, and that would be a good fracture treatment by most standards, and this number is 425 MCF per day, and maybe 50 over 425 or something like that, that maybe is one-eighth. Maybe that would say 12 percent of the production.

I mean, you can go through that kind of an exercise on every one of these wells and get about the same number.

Q. All right. As I understand it, your assumption is that 90 percent of the post-frac production volumes are attributable to Fruitland Coal reservoir gas or based largely, production volume quantities.

A. Well, that's one way of analyzing it. We will present witnesses later in this case that will talk about their opinion, and they're probably more qualified than I am to talk about it. But that's one way of approximating

it.

Q. Let's turn to Exhibit 24. Can you -- Mr. Williams, on your pre-frac pressure points -- we're on the left side of the chart -- do you know whether at that point in time for those wells there was a water load in the wells?

A. No, sir.

Q. You do not know?

A. That's correct.

Q. Do you know whether after an acid job or a frac job they would have been able to unload any water column?

A. No, sir.

Q. Didn't you say earlier in your testimony that you didn't believe the acid jobs performed on two of the Chaco wells were effective?

A. Yes, sir. The data suggests that the acid jobs performed on all of the Chaco wells that had acid jobs performed on them were not effective in increasing production rates.

I don't know how effective they may have been in communicating with extraneous pressures, but they were not effective in increasing production rates.

Q. All right. Can you show us when some of those acid jobs were performed on the time line here?

A. Well, a little difficult, but virtually the acid

jobs -- Let me get some notes.

Okay. The acid job on the Chaco Number 4 -- and you pick out the Chaco Number 4 -- was done on 1-30-95. This pressure point at 147 p.s.i. that is represented here is like a March, 1995, point, so it's a little hard to be much more specific than that.

The acid job on the Chaco Number 2-J -- Well, the Chaco 2-J is not on here.

The Chaco 1, was it acidized --

Q. Why isn't the 2-J on there?

A. Because it was not fracture-treated.

Q. But you picked up both acid treatments and frac treatments, did you not?

A. I showed the pressure points from the four Chaco wells that were fracture-treated and that we believe are communicating with the Fruitland Coal.

Q. Exhibit 24 doesn't have the 1998 post-shut-in-period data on it, but you didn't have that available, did you not? You showed it on Exhibit 31. Is there any reason why you didn't show it here?

A. I didn't show it there because I prepared this large exhibit before I had that data. We can -- If you'd like, we can try and mark the points on there.

What I'm trying to do is find the raw data that went behind them, so I'm not picking them off of the curve.

Okay, let's try and -- March, 1996, to November, 1998. July, 1998, is probably somewhere in here.

The Chaco 1 -- which I'll represent in red and I'll show a red X up here -- The Chaco 1 pressure point on the 13th was 97 p.s.i.

The Chaco 2-R, which I'll represent with a green X, that pressure point on the 13th is 66 p.s.i.

The Chaco 4, which I'll represent with a black X, is 83 p.s.i.

And the Chaco 5, which I'll represent with a blue X, is 100 p.s.i. even.

Q. Is the reason that the Chaco 1-J and Chaco 2-J are reflected on this exhibit because you couldn't show any correlation between the acid jobs on those wells and the wellhead shut-in pressure?

A. No, sir.

Q. Tell me why they aren't reflected on there.

A. Because I chose to plot the four wells that we believe are communicating with the coal.

Q. All right, so you don't believe the 1-J and 2-J are communicating with the coal?

A. I don't believe they are draining the coal. There may be pressure communication, but there is not production communication.

Q. So may we dismiss those wells from the lawsuit?

A. You'll have to talk to my attorney about that.

Q. Let's turn to -- Back on Exhibit 24, Mr. Williams, the shut-in pressure for your 2-R is quite a bit lower than your flowing pressure, correct?

A. Than the flowing pressure for the 2-R? I'm sorry.

Q. Than your flowing pressures for your coal wells.

A. I guess I don't think that is a universally correct statement. The flowing pressures on the 6-2, the 7-1 and the 12-1, when the compressors are running, which is the normal circumstance, are about five to seven pounds.

Q. What about the 13-1 Number 1?

A. The 1 Number 1, flowing pressure is about 70 pounds, 75 pounds. I mean, it varies from day to day. It flows against the line.

Q. Uh-huh.

A. The 1 Number 2 flowing pressure is 65 to 70 pounds, and it varies and flows against the line.

Q. Okay, how about the 12-7 Number 1?

A. The 7 Number 1 is a compressed well, and when it is flowing and the compressor is running, it's five to seven p.s.i., is the flowing pressure.

Q. All right. It's the closest well to the 2-R, is it not?

A. That's correct.

Q. And if you can look in your records there, can you tell me what the casing pressure was on July 15th.

A. The casing pressure recorded here is 74 p.s.i.

Q. And it was flowing, wasn't it?

A. No, sir, not at the point in time that that pressure was recovered. It had flowed in the preceding 24-hour period, but essentially, as I tried to explain, the well was flowing against the line pack. The production that you're seeing for that day is a 24-hour period for the prior day, and the pressure that you're seeing is an instantaneous pressure reading.

Q. Production reported for the 14th was how much?

A. 308 MCF -- Or, I'm sorry, for the 14th, 131 MCF, I'm sorry.

Q. Okay, so that would be attributable to the casing reading on the 15th, if there's one day behind, as I understand it?

A. That's correct.

Q. And then, so what is the volume reported on the 16th?

A. The volume reported on the 16th is 506.

Q. So that's production really attributable to the 15th?

A. That's correct.

Q. And that's when you show your casing pressure,

74?

A. Well, the casing pressure was 74 when the well was shut in. When they came back out on the morning of the 16th, the casing pressure was 17. And in fact, you can see to the right-hand side that the compressor was running that day, and the suction pressure on it was 14 p.s.i.

Q. Let's turn to Exhibit 25. Now, earlier, as I understand your testimony, Chaco 1 produced about 102,000 pre-frac, and that's shown on your Exhibit 23?

A. That's correct.

Q. If I understand you correctly, you suggest that at the frac point, anyway, PC reserves were basically depleted; is that your contention?

A. I don't believe I said that PC reserves were depleted at the frac point. I don't think I ever made that statement.

Q. Is that your contention, though?

A. No. I mean, the data clearly indicates that the pressure was a hundred pounds less at the frac point, or at the point where that 100 million cubic feet would have been produced, than it was originally. So there is some depletion in the PC.

Q. So what should the abandonment pressure be at that point, that produced those volumes?

A. I guess I'm not sure I understand that question.

Q. At the point of the frac, as I understand, Whiting and Maralex's contention is that Chaco Number 1, anyway, was bare economic limits; fair to say?

A. Absolutely.

Q. At that point, if we were to abandon Chaco Number 1, as of the frac date, your pressure would have been what? 130 pounds?

A. Well, again, I don't know what the pre- -- Well, I do know what the pre-frac, I don't know what the pre-acidizing pressure was on this well. Maybe I don't -- I can't recall, was Chaco 1 acidized? I don't think it was.

So I don't know what the pre-frac pressure was on this well. The early part of the data would suggest that the pressure, if the well didn't communicate with something else, was on the order of magnitude of 125 to 130 p.s.i. I don't know what it was because there is no data, no one gathered that piece of data.

So if that well was abandoned before frac, I guess I would say that the pressure would be possibly someplace between 125 and 130, and the after-frac measured pressure. I mean, we just don't know that.

Q. All right. What does that -- You know, taking your suggested assumption, abandonment pressure, 125, 130, what does that tell you about the remaining reserves that could have been produced, assuming abandonment occurred at

that point?

A. It suggests to me that you couldn't have produced those reserves at an economic rate and that economic probably dictated abandonment, rather than reservoir conditions.

Q. All right. So at that point, had you looked at the reservoir pressure, do you believe it would have been prudent to restimulate the well at that point?

A. I guess without this being my wells, it's hard for me to say what would have been prudent or what would not have been prudent.

Q. Your series of exhibits like this for the Chaco 1, Exhibit 25; Chaco 4, Exhibit 26; Chaco 5, Exhibit 27 -- when you created these exhibits, accumulated data for that time period, if you can tell me, initial phase, how many wells were interfering with the Chaco 1, 4 and 5 from, say, 1977 to 1984?

A. I don't know whether any wells were interfering with them. I don't have the ability to tell that.

Q. You didn't take that into consideration?

A. I just reported the data as it was reported.

Q. I see. Do you know generally whether there are now fewer wells, PC wells, competing with the Chaco 1, 4 and 5 than there were in the initial phases of the Seventies?

A. I guess -- Can I borrow back Exhibit 9? Mr. Hall, in looking at Exhibit 9, I see one, two, three, four, five plugged-and-abandoned symbols in that four-section area where Chaco Number 4 is. So I see four plugged-and-abandoned symbols. I see two additional wells that weren't there at the time.

So I guess I would say that maybe the answer to your question is that there are three fewer drainage points in a two-section area that involves the Chaco 4, which would be the same two-section area involving the Chaco 5. Now versus then, I just don't -- I don't have specific data about when every one of these wells was plugged and abandoned.

Q. Did you also create pressure-over-cum-production curves for your coal wells?

A. I did.

Q. What did they look like?

A. Pretty similar to what Mr. McCartney reported. I don't have them here with me. But I mean, essentially we had two or three data points. They had a slope that was not unlike the slope that we're seeing with the red points.

Q. Would you say they were identical, close to identical?

A. No, I can't.

Q. Similar anyway?

A. I think they were similar, but I don't have them here to compare.

Q. Were there any changes in the slope for the coal wells?

A. No, sir, not when you've only got two points. You can't get a change in the slope.

And in the case where there were three, I mean, I essentially -- I did the same thing I did here. I let the computer fit the points.

Q. Okay. Now, when you prepared your curves on your coal wells -- We're talking about the five coal wells that were the subject of your initial application before the OCD and in the District Court lawsuit?

A. That's correct.

Q. Did you also do that on your other six coal wells --

A. No, I didn't.

Q. -- outside that area?

Any reason why you didn't?

A. No, sir, I had no need to. I had no reason to.

A P/Z plot on a coal well is not particularly meaningful. As Mr. Ancell explained, you've got different physics going with the coal production as it desorbs from the coal -- or with the gas production as it desorbs from the coal and as it produces through the cleats.

And again, I guess I'll offer the same statement that, you know, I'm not an expert reservoir engineer on the coal. But I do know that you can't use a P/Z plot to forecast coal reserves.

Q. All right. And the same thing could be said for PC P/Z plots: They don't give you an overall picture of the entirety of the PC reservoir, do they?

A. I disagree with that. I think that generally the PC is considered a depletion-drive reservoir, and that's probably the textbook example for using P/Z plots to forecast reserves.

Q. And that's true in a high-permeability reservoir?

A. That's true. We use them all the time in the Gulf Coast.

Q. You say we can't use P/Z plots for coal reservoirs, in this case, anyway, but you are saying in essence that Pendragon is producing coal reserves?

A. Right, and I didn't use the P/Z plot to predict reserves. I used the wellhead-shut-in-pressure-versus-cumulative-production plot to show that something changed after these wells were frac'd. I didn't say that I was using it to predict reserves.

Q. Isn't it possible that because of the frac that the wells were looking at a larger reservoir, draining a larger area?

A. They would have to be draining a five-to-ten-times larger area than they were pre-frac, to experience that sort of a change in the slope.

Q. Let's look at Exhibit 28. That's your BTU plot. Can you identify which well these BTU values were taken from?

A. All 40 of them.

Q. No, just give me a general area. That was my question, I didn't know how many were involved.

A. Well, I think I testified that there were 40 wells that represent that plot. And those wells generally are in Section -- or in Township 26 North, 12 West, and 26 North, 13 West. They are all within those two townships.

Q. All right, appreciate that.

A. I can list the sections, if you'd like.

Q. You participated in the public meetings before the OCD District Office in Aztec regarding this perceived problem, did you not?

A. Yes, I did.

Q. And during that process, didn't the group attempt to evaluate BTU analyses to determine whether there was communication?

A. I don't think you could characterize it that way. I don't think the group tried to evaluate any data. I think two sides presented opposing views of data, and I

don't think that there was any group dynamic associated with a group trying to evaluate data.

Q. Well, wasn't it the general consensus, though, that BTU analyses were meaningless for determining this issue of communication?

A. It was clearly the general consensus among the Pendragon personnel that BTU analysis was not meaningful in attempting to do this. It was clearly not the conclusion among the Whiting/Maralex personnel that BTU analysis was meaningless.

Q. The BTU data you present here today, is that the same that you presented in Aztec?

A. I think there is probably more data here than presented in Aztec. And this plot, in this format, was never presented in Aztec. It represents all of the points we had in Aztec, plus some. It is organized differently than anything was ever presented at Aztec.

Q. Were there BTU data from wells presented in Aztec that are not portrayed here today?

A. Not to the best of my knowledge.

Q. Talk to you about your post-frac BTU data points, if you'll look at this on the right side of the chart -- Well, actually going back as far as January, 1992, to January of 1998, that's where you start to show Fruitland Coal BTU data points on there, correct?

A. That's correct.

Q. What are the upper and lower ranges of those BTU data points?

A. The lower point is about 975 BTU; the upper point is about 1145 BTU.

Q. Now, that's a pretty broad range to extract any meaning from, isn't it, Mr. Williams?

A. Well, that's -- If all you were looking at was raw data, you might conclude that, Mr. Hall.

I think that's why it's presented so that you can see, in fact, that there is a large -- I'll use a technical word -- clumping of the data on the coal wells in the 1000 to 1050. That's not to say there aren't exceptions, but there is a large clumping of that data in that range. And I don't think that it's difficult to look at that data and make some sense out of it.

Q. Well, isn't there likewise some similar clumping for some of the PC BTU data points in, say, January, 1996, through January, 1998?

A. There is far less clumping of the PC data points during that period -- and that's one of the points we were trying to make.

Let me just find -- I've got a -- maybe a summary of that here that I -- when I was trying -- I had it earlier, when I was trying to refer to the number of points

in each grouping and so forth.

Q. And similarly, isn't it --

A. Yeah --

Q. Go ahead.

A. I'm sorry. Let me just point out -- prior to -- I mean, I'm not a statistician; I'm not going to try and baffle anybody with statistics, okay?

But prior to January, 1993, if you look at the PC points in here, there were 73 points or about half of the total PC points were before 1993 and half of them were after 1993.

Before 1993, the average of the PC points, just the arithmetic average -- take all the number of points, add them all together, divide by the number of points -- was about 1104 BTU. Okay? And there was a deviation around that. The average deviation above or below that was about 28 points.

So you know, if you took the average of the things that weren't at 1104, you know, you had -- you went from 1128 to 1072, something like that, I mean, that's where the average points would all fit in.

Subsequent to 1993, that average on 70 points -- again, almost as many points as pre- -- that average dropped from 1104 down to 1061. So again, after coal development in this area, the PC points dropped from 1104

to 1061 on average.

But you ask about the clumping of the data points. The deviation was not a -- The standard deviation from that number was now like 40 or 47. So we were talking about 1061 plus 47, or 1108, to -- down to 10- -- whatever that would be, 1014. You know.

So there's much less clumping of the data post-1993. And I mean, that's the point -- and the clumping that appears obvious is right down here, which is kind of right in the coal data, and that's why we tried to show some specific examples of that.

Q. That's largely a function of time. You did not have any coal BTU data points prior to 1993; that's why they're all there, right?

A. No. No, I'm talking about the clumping of the PC points that are down in the same area as the coal points. There weren't PC points back here, down in this area, with one, two, three exceptions -- four.

Q. Well, at the same time as your clump, there was still quite a wide range of data points for Pictured Cliffs gas; is that accurate?

A. Yes.

Q. What this is, is nothing more than raw BTU data points at points of time, correct?

A. That's correct.

Q. This exhibit -- And you did not account for any other factors that may affect BTU at any given point in time. For instance, you didn't take into consideration shut-ins, whether a plant was shut down, line pressure variations, variations in reservoir pressures at any given point in time. You didn't account for that in this, did you?

A. None of this data accounts for that, no, sir. It is just -- it is -- Unlike some of the data we saw presented this morning that is just specific selected data, this is all of the data that we had.

Q. All right. So this wouldn't attempt to explain some of the phase changes that affect the production of liquids through a reservoir, as Mr. Blauer testified to?

A. I disagree with Mr. Blauer, but no, it doesn't attempt to do that.

Q. All right. Look at your gas-analysis trend for Chaco Number 5.

A. That's Exhibit 29, and Chaco Number 5 is the last curve in the group.

Q. Right, thank you.

Look at your BTU line there, and if you look at, oh, about February of 1994, the blue line, there is quite a drop then, correct?

A. That's correct.

Q. Similarly, if you look at your dryness index at that same point of time, there is quite a big jump, correct?

A. That's correct.

Q. Yet when was the frac --

A. That point happens to be April of 1994.

Q. All right.

A. It's on the left-hand side.

Q. When was the frac job done on the Chaco Number 5?

A. The frac job was done in May of 1995.

Q. All right, so you can't correlate, this analysis anyway, a change in the BTU trend or the dryness trend to the frac?

A. Well, no, but I can offer another suggested reason for that.

At the time that Thompson moved on this well to perform a frac in January of 1995, they found a casing leak in the well and had to repair that casing leak before the well recompleted. I don't know that that casing leak wasn't in effect and that this well was communicated with the Fruitland Coal back at that point in time.

I -- You know, I mean that's a possible explanation.

Q. Let's look at Exhibit 31.

A. Okay, there's no big version.

Q. Shut-in casing pressure for the Chaco wells. And this is summer of 1998 shut-in?

A. That's correct.

Q. Why are these data points on here every third day and not daily points?

A. Because that is the data that was reported to us by our pumper.

Q. All right. Don't you really need wellhead pressures to interpret this data?

A. This is a wellhead pressure. It is the shut-in casing pressure of these wells.

Q. I'm sorry.

The conclusions you drew from this data were that there was some communication between the Chaco wells and the Fruitland Coal wells?

A. Absolutely.

Q. And you didn't attempt to take into consideration any other factors in reaching that conclusion, did you? In other words, you didn't account for variations in line pressures?

A. Line pressure has nothing to do with the shut-in well. Line pressure -- These wells are shut in, they are not connected to the line. They valve is closed, they are not seeing line pressure. This is the shut-in casing pressure of these wells. There is nothing that should

affect that, except something in the reservoir.

Q. Well, at the same time, if the Chaco wells are shut in, doesn't that allow you to produce additional volumes from the coal gas wells into the line?

A. Well, it did, because the coal gas production came up when the Chaco wells were shut in. That's the point I tried to make with Exhibit 30.

I mean, the fact of the matter is, Mr. Hall, I don't think any of this would matter of these wells weren't connected. But the data suggests that they are connected. I think the data is unequivocal in that regard.

Q. If you look at daily production -- this is Exhibit 30 I'm referring to, the daily production for the 13-12 Number 1 -- you show production came down on July 26th, July 27th?

A. Yes, sir.

Q. Why did it do that? If this well is no longer competing with the Chaco wells against the line?

A. Look at another piece of data. I don't have -- What my assumption is, is that the compressor went down. I don't have the data right here in front of me to answer that.

Q. Okay, so you don't know for sure?

A. (Nods)

Q. Let's look at the 13-1 Number 1, also Exhibit 30.

Production reported, 1st of June, is around what? 400?

A. No, sir, the production on the 1st of June was about 375.

Q. Well, it's averaging for the time reported there around 400 --

A. No, sir.

Q. -- or 397?

A. I don't think it's averaging 400. I mean, it looks like we've got about -- We've got maybe about 15 days at 400 and 15 days at 350 to 375, so that doesn't average to 400.

Q. If you look at the period from, say, early June through, say, June 29th, it's producing less on June 29th -- June 27th, June 29th, immediately before the Chaco well shut in --

A. That's correct.

Q. -- than it was early part of June?

A. That's correct.

Q. Then after that point in time, after the shut-in, it showed production above that pre-shut-in production volume of -- what? 375? It showed greater production only -- what? Three times after that, correct?

A. Yeah, essentially all the time that it was on, it showed greater production.

Q. Well, post-shut-in production averaged less than

what it was producing in May; isn't that correct?

A. Do you have the May production? I'm sorry, I don't have it.

Q. Let's say June, early June. Well, let me give you the production for May. Just assume this is the May production. It was 12,335, an average daily production of 397.

A. Okay.

Q. It's pretty close to what the start of the chart reads, correct?

A. Yes, sir.

Q. Why wasn't it producing higher after the shut-in than before?

A. It was producing higher after the shut-in than before. The production had declined in mid-June, and the well was producing about 365 MCF before the shut-in. After the shut-in, it is producing about 395 MCF.

I mean, we can probably go back to January, Mr. Hall, and see what it was producing then and compare it to now. I mean, the important thing to look at is, what is the data immediately before and immediately after the shut-in? That's the point in time that we're interested in.

Q. What --

A. Not May --

Q. I'm sorry, were you finished?

A. Yes, sir.

Q. If you look at the period of time, say, between June 17th to about June 25th, June 27th, that production drop there, was that attributable to a compressor problem?

A. No, sir, this well isn't on compressor.

Q. Is it attributable to a line problem? Can you explain --

A. Not that I'm aware of.

Q. -- the falloff?

A. It's attributable to well performance.

Q. Why didn't that decline continue after June 25th?

A. Because the Chaco wells were shut in, is one reason.

Q. Let's talk about the possibility that the Maralex fracs on the coal wells may have escaped out of zone and discuss that briefly.

Do you agree that it's possible that the Maralex fracs could have escaped out of the zone?

A. Yes, sir.

Q. Do you agree that it's possible that they could have penetrated into the Pictured Cliffs sandstone?

A. That's possible.

Q. In fact, you were present when your expert engineer, Mr. Robinson, testified in District Court the other day, and he likewise testified that he thought it was

possible the Maralex fracs could have escaped out of zone?

A. I'll let you ask Mr. Robinson that question.

Q. Well, I'm asking you if you were present, you were --

A. I was present, yes, sir.

Q. And you don't disagree with his assessment of that possibility, I assume?

A. That's correct.

Q. You indicated that Whiting acquired its interests in the subject coal wells in the summer of 1995, August of 1995?

A. I believe the closing date was October of 1995. I'm not sure what the effective date of the acquisition was, but the closing date was about October of 1995. I think that's when we became record operator.

Q. All right. When was this deal brought to Whiting? Do you know?

A. No, sir.

Q. You've been in this business for some time. Are you familiar with the processes that companies go through when they look at acquiring properties?

A. Yes, sir.

Q. And you're familiar with the due-diligence investigation process, then?

A. Yes, sir.

Q. Do you know what due diligence was undertaken by Whiting to investigate these particular properties before they were acquired?

A. No, sir.

Q. Who would know that?

A. Probably people in our acquisition department.

Q. Would that be Miss Beyl?

A. No, she's not in acquisitions. I would -- If you need a name, I would suggest maybe Jay Fera or John Hazlitt. Jay is our manager of acquisitions, John is our vice president of land.

Q. Do you know whether it was disclosed to Whiting that there was a possibility that -- or an allegation anyway, that the Pendragon/Edwards fracture-stimulation jobs may have created a problem in the coal?

A. No, I don't know that.

Q. Do you know if it was disclosed to Whiting whether there was a concern that the upper set of perforations in the Pendragon/Edwards wells were above what Maralex, anyway, contended was the base of the Fruitland?

A. No, I don't know that.

MR. HALL: I have nothing further, Mr. Catanach.

EXAMINATION

BY EXAMINER CATANACH:

Q. Mr. Williams, if -- You've looked at the data for

the Pendragon wells. I believe you went into it briefly. If, in fact, the Maralex wells had frac'd out of zone, would you have expected to see an increase in pressure or production from the wells at that time in 1993?

A. I don't know the answer to that. I think maybe not immediately.

Again, at the time that the frac took place there wasn't mobile gas in the reservoir. You know, I think I've testified that we had to produce -- Maralex, before Whiting owned an interest, had to produce the wells for an extended period of time before they even had enough gas to run the pumping units.

So whether you would see an immediate effect, my guess is maybe not. I just don't know.

Q. On that production plot of the 13-1 Number 1 --

A. Yes, sir.

Q. -- I had a question about -- you have what looks like a similar drop in production, and then an increase in production on or about June 3rd. Do you have any explanation for that behavior there?

A. No, I don't. I noticed that the 12-1 had some down time that day. All of these wells look like that maybe there was some down time on the 3rd of June, and whether that was a line problem or a plant problem or something, I don't know. But that's consistent with all

five of the wells. It's less pronounced in the 1 Number 2, but it's present in all the rest on that date.

Q. Are you saying the -- What may have been down that date?

A. Maybe the Chaco plant went down for a period of time. Maybe there was a sharp increase in line pressure. I just don't know.

Q. Is there any way to track that, to try and find out if something occurred that day?

A. We can go back and see if the pumper has something in his log book or something. It wasn't on the data that was supplied to us, but we can go back and look at that.

Q. As far as the daily production rates on these wells, why did you choose to begin on June 1st, as opposed to maybe an earlier time?

A. Well, I just was kind of looking for a before and after, and these wells -- they're either inclining or declining, and it just seemed to make some sense to pick an arbitrary -- I knew that we were having a hearing the 28th. You know, I figured I'd have a month of data before, a month of data after. I mean, we can -- Again, we can gather and plot the daily data from 1995 if you'd like to see it.

Q. I'm thinking maybe 1998 data, daily production

data --

A. Okay.

Q. -- might be helpful in recognizing trends.

You testified that you had some information, you didn't verify it, but there may have been a casing in the Chaco Well Number 5?

A. There was a casing leak in the Chaco Well Number 5 that was discovered in January of 1995, and I think I commented that it -- that there's a possibility that that -- you know, that that could have been the reason. It might have existed before then, and they just found it at that point.

It should be in the -- Under "Completion File" in Exhibit Number 40, there is a workover report dated -- well, the first one is dated January 31st, and it says that that, Frac'd existing perfs through 2-7/8 tubing, establishing circulation through the bradenhead. Shut down and released back pressure. Black water is flowing from the bradenhead. Released the frac crew and shut well in.

And then there are subsequent reports from February 2nd up through February -- I guess February 8th is the last data in the report where they describe the repair of that casing leak. They actually -- This is one of the wells, I believe, with 2-7/8 tubing used as casing. They actually unscrewed the tubing, came out and went back in

and screwed it back together again, is how they repaired the casing.

Q. So do you believe that there may have been some communication at that point with another type of gas or another gas from a different formation?

A. There might well have been.

Q. Could it have been coal?

A. Yes, sir.

Q. On your BTU data, the composite of the 40 wells, can you offer an explanation of why the BTU content of the PC wells began to fall in 1993?

A. I really don't know. The fall is coincidental with the development of the coal. Whether the coal communicated with the PC, whether the PC communicated with the coal, I just don't know. But the fall is coincidental with the development of the coal.

Q. Do you think that was a result of communication?

A. It's possible, yes, sir. And I guess it's our -- It's our allegation, obviously, later in time that it's a result of communication resulting from the fracs of the PC in some of those wells.

Q. But your wells were drilled in 1993?

A. Yes, sir.

Q. You apparently don't agree with Pendragon's assertion that the BTU data cannot be used?

A. I guess my opinion is that the BTU data by itself is not unequivocal, but the BTU data, when combined with the production data, when combined with the pressure data, when combined with the obvious evidence of interference since the Chaco wells have been shut in -- I think it's just another -- I don't want to use the word "nail in the coffin", but it's another strong piece of data that suggests that these wells are not producing PC gas any longer, or not -- or that a large portion of the gas that they are producing is not PC gas, but in fact coal gas.

Q. Do you subscribe to their theory or their assertion that there are other factors that could change the BTU content of a gas stream?

A. I think there are other factors. Some of the ones that were offered, I don't think, are correct.

For instance, I don't think, when Mr. Blauer said -- you know, showed a bunch of single-component phase curves that show that, in fact, you're condensing, if you will, propanes and butanes in the reservoir, I don't think that's factual. And in fact, I think the way it would work under his assertion, as you lower the pressure, you would expect more of those things to go into the gaseous phase, and you would expect to see a BTU increase if, in fact, what he was saying is true.

But I don't think you can take single-component

phase diagrams and characterize a mixture. You know, I think that there are a lot of, you know, equation-of-state software and that sort of stuff that's used to do just that sort of thing. I mean, people that run gas-processing plants do it all the time.

Q. Exhibit Number 56, am I correct that is a composite of the five Whiting wells, the production curve?

A. That's correct. That was what Mr. McCartney presented as M1 this morning, and the only difference between M1 and 56 is the addition of the two trend lines.

Q. In your experience with coal wells, do you -- When coal wells are inclining like this, do you generally see a change in slope?

A. We have observed in our coal wells a gradual bending over of the slope. We haven't observed in most of our wells, particularly outside this area, we haven't observed sharp changes. I mean, the 12-1 is an exception to that, the 6-2 is an exception to that. But by and large, we tend to see a gradual turning of that.

Q. Does Maralex operate any PC wells in this area?

A. Yes, sir.

Q. In this specific area?

A. Well, I think -- I think within three or four miles. I mean, not right in this six-section area, or each of the sections around it, but I think two or three miles

away they operate some wells for themselves or someone else.

Q. Are you familiar with the behavior of these PC wells?

A. No, sir.

EXAMINER CATANACH: Frank?

EXAMINATION

BY MR. CHAVEZ:

Q. Mr. Williams, looking at your Exhibit Number 25 on your P/Z plot for your Chaco 1 --

A. Yes, sir.

Q. -- you said you let the computer draw the line. Now, you told the computer which section to draw lines for; is that how you did that?

A. That's correct. I basically input -- I basically input pre-frac and post-frac data as a separate range, and I just asked it to put a trend line on a least-squares fit through the pre-frac data and through the post-frac data.

Q. So whenever --

MR. GALLEGOS: Excuse me, Mr. Examiner, but the question presumed that this was a P/Z plot, and I think maybe --

MR. CHAVEZ: I'm sorry.

MR. GALLEGOS: -- that was a misstatement.

THE WITNESS: I'm sorry?

Q. (By Mr. Chavez) Yes, I'm talking about your Exhibit 25.

Whenever you -- If you were to pick any other point for any other reason, wouldn't the computer also draw least squares through those points also?

A. Yes, sir.

Q. So in effect any time you pick end points for plotting for the computer, it will draw a line through that point, or from the beginning to the end of that point, and would reflect a different curve for the points after that, wouldn't it?

A. Yes, sir. If I understand your question, if I asked the computer to draw a least-squares fit through all of these points, it would draw a line.

But the line that you'd see, I think, wouldn't connect with very many of the points. You'd have a lot of scatter. You'd have a Mr.-McCartney-looking line, where you had kind of points that just fell way off the line. And it just made some sense to me that we had some data that was consistent with before and after the thing was frac'd, to try and break it out into those two pieces.

Q. Well, isn't that consistency induced because the computer itself, whenever you ask it to draw a line between points, draws a line that makes sense, using the parameters within the application itself?

Well, let me give you an example. If you were to draw -- ask the computer to draw a line for the first 25 MMCF production, you'd have only two points?

A. Yes, sir.

Q. And where would that line be as you --

A. It would connect -- it would probably -- I mean, again, I'm -- we're speculating about what the computer would do, but it would probably connect someplace between those two points. I mean, it wouldn't go anywhere.

Q. If you were to pick any other two points -- Let's say, for example, if you started, let's say, at a point for anything after 25, it wouldn't use the first points at the top of the curve, would it, at the top of the graph?

A. That's correct. So --

Q. And you'd anticipate --

A. It uses whatever points you specify. If you specify two points, what you get is a line between two points. That's the least-squared fit between two points.

Q. So you could choose any points you want, then, to -- as long as you have it begin at any point where you think -- Well, let me just -- I'm going to get a little wild here.

Let's say there was an earthquake in Afghanistan at about 200,000, and you say, Well, did the earthquake in Afghanistan affect this? And you say you wanted to plot

from the beginning to that point, and one from afterwards. Would there be a change in the curve?

A. Yes, sir.

Q. Well, would that have any relationship to the earthquake in Afghanistan?

A. No, sir.

Q. In looking at the cumulative production on that curve, taking your blue line, post frac, if we take that to 25 pounds and assume a 25-pound abandonment pressure by projecting that curve --

A. There was a --

Q. Would that co- -- Beg pardon?

A. Are we talking about the red-line post frac?

Q. The blue line -- I'm sorry, pre-frac.

A. Oh, pre-frac.

Q. And project that to, say, 25 pounds. Would that give a realistic figure as to how much cumulative gas would have been produced based on any other calculations you've done on the Pictured Cliffs in that area?

A. I guess I'm -- That would indicate that this well would produce something just under 200 million cubic feet. Okay?

Like Mr. McCartney and Mr. Nicol, I did back-of-the-envelope calculations of -- No, it wasn't Mr. McCartney; it was Mr. Blauer and Mr. Nicol.

I did back-of-the-envelope calculations about volumetrics, and my volumetrics on 160-acre spacing -- I made the assumption of 160-acre spacing, I did the log calculations, I did the calculation assuming about a 250-pound initial pressure, and I calculated that gas in place was about 200 to 300 million cubic feet on all three of these wells that I've got this kind of plot on. So those numbers kind of matched that, but I didn't look for that match. I only did that calculation after I had these numbers. I didn't look for the match.

Q. So in a sense, then, your back-of-the-envelope calculations, to you, validated the pre-frac curve?

A. Yes, sir.

Q. When we look at the gas analyses that you presented, as we go through the analysis for the Chaco Number 1, that's your Exhibit Number 29.

A. Okay.

Q. Now, given that this well was fractured in 1995, does the first gas analysis after the fracture indicate that it was producing Fruitland Coal gas at that time?

A. Well --

Q. Or Pictured Cliffs?

A. The first analysis indicates it was producing gas with an 1104 BTU and a dryness index of about 92. That is more characteristic of what we have seen for the PC wells

than it is for the Fruitland Coal.

Q. Then over a year later, what do you show as a gas characteristic there?

A. Well, it depends on what period of time over a year later. We show a data point at 10-1-96 that gas producing was 1202 BTU. We show a data point at 3-20-97 that shows it was 1027.

Q. Okay, so if we go as -- you know, using the issue of the anomalies and everything, do you accept that last gas analysis before, say, January, 1997, as a valid analysis? It kind of jumps up to 1200 BTUs.

A. No, the -- Before January, 1997.

Q. It looks like it's October, 1996.

A. Okay, October, 1996?

Q. Yes.

A. Yeah, again, I didn't offer an opinion about the quality of any of these analysis. I reported them, Mr. Chavez.

Q. Well, could you offer an opinion on the quality of these analyses?

A. Let me find that point. I can tell you who analyzed it --

Q. Well, it's --

A. -- and -- I mean, it just -- I can't -- Just looking at the point, I can't make that judgment.

Q. Okay. Well, you don't have to go that far. I just thought you might have an opinion based on your knowledge of gas analysis in this area.

A. That was an analysis done by El Paso on 10-1-96. Again, I --

Q. At that point, given that analysis, would this well have been making 90 percent gas from the Fruitland Coal?

A. If this is the only piece of data you looked at, the answer would be no.

Q. If we turn back to your Exhibit Number 25, could you somehow draw a relationship of point out where the cumulative production was or might have been in October, 1997, on that curve?

A. Let me see if I've got monthly production data for that well up here. What was the date?

Q. October, 1997.

A. Cumulative production was 344 million cubic feet at the end of October.

Q. Okay, so if you look on your Exhibit 25 for the Chaco 1 --

A. Yes, sir.

Q. -- could you point out that place on the curve?

A. It's about right there.

Q. Okay. At that point the gas analysis shows 1200

BTU gas?

A. That's correct. Again, that's a single point.

Q. I understand.

When you look at -- You said you did some P/Z analysis that -- Oh, you didn't say that?

A. No, I -- If I said P/Z, I misspoke. I haven't done any P/Z analysis here. I've only looked at wellhead shut-in pressures against cumulative production.

Q. Have you compared these types of cumulative production over wellhead pressures in sandstone reservoirs to the same type of performance in coal reservoirs?

A. I compared the pressure data that we have in our coal wells with these data, and our coal wells have a slope very similar to the slope -- and again, it's defined by two or three points at the most of shut-in pressure, and they have a slope that is very similar to the slope of the red line that is the post-frac.

I don't have that data with me, so I can't tell you, you know, one slope is this and the other slope is that. I just don't have that data. But they were similar, is my recollection.

Q. Would that be important in determining whether or not a well might be producing in the same reservoir as the coal well?

A. It would be an indication, kind of like Mr.

Gallegos tried to point out this morning, you know, when Mr. McCartney showed pressures that appeared to be declining in lockstep, on a parallel track. I think it's an indication of communication. I don't say it's unequivocal.

Q. In doing -- looking at your gas samples and analysis, did you review any of the literature concerning comparing gas analyses and samples between Fruitland Coal and PC?

A. Yes, sir, we did.

Q. Was there any conclusions you could -- you drew from that literature that helped you to analyze the samples?

A. Well, that's -- It was in some of that literature, and I don't recall the specific name or the author of the paper, but it was in some of that literature that I think they talked about the dryness index as being a pretty good differentiator between coal and Pictured Cliffs.

Some of the literature pointed out, as Mr. Nicol testified, that you can't use just gas analysis across a Basinwide area in determining the source of gas. That paper did not say you can't use it on a local basis, or a localized basis, to try to make that distinction.

Q. We look at your Exhibit Number -- I guess it's

55, the shut-in pressures on the Chaco wells?

A. Thirty-one.

Q. Thirty-one, I'm sorry. Yes.

To you, these shut-in pressures indicate that there's pressure communication between the Fruitland Coal and the Pictured Cliffs; is that correct?

A. It indicates that there is pressure communication between the Chaco wells and the Whiting Fruitland Coal wells.

Q. Okay. Earlier you had mentioned that -- When you're talking about short-term increases of production from the Whiting wells, after the Chaco wells were shut in, did you examine whether or not the -- because the -- that gas was no longer going into laterals in that area, whether the line pressure had dropped, it caused a short-term increase in production from the Whiting wells?

A. I looked at a few. I didn't have, every day, line-pressure data. I looked at a few points in June and a few data points in July, and they appeared to be within three or four pounds of each other.

Q. Would the pressure being the same, even though there's less gas going into the laterals from some wells indicate that other wells are making up the difference to keep the pressure up?

A. Not in my mind, no, sir.

Q. Just a final note here.

Are you familiar with coal gas analyses using a P/Z' or P/Z* plot that's been derived by studies done by Meridian and others?

A. No, sir, I'm not.

MR. CHAVEZ: Thank you.

EXAMINER CATANACH: Just a couple more.

FURTHER EXAMINATION

BY EXAMINER CATANACH:

Q. On your Exhibit Number 31, your pressures start on July 8th?

A. Yes, sir.

Q. But you actually said that these wells were shut in for 13 days prior to any increase in pressure?

A. No -- Yes, sir. The wells were shut in June 30th, is my understanding.

Q. Okay.

A. The first pressure point that we had was July 8th.

Mr. Nicol, in Exhibit 16, is it, has more data than that. The data basically shows the same thing.

Q. You wouldn't expect these reservoir pressures or shut-in casing pressures to build normally after shut-in?

A. I think they were built. I mean, these wells have been shut in for 13 days, and the pressures for the

last five of those days were constant. I think that they were built.

Mr. Nicol and Mr. McCartney have testified that this is a high-permeability reservoir.

Q. If these were just PC wells and not in communication with anything, would you normally expect them to build in the PC?

A. Probably, they'd be pretty close to buildup, yes, sir.

Q. But you wouldn't expect to see the differences that you're seeing in these?

A. Oh, absolutely not. I mean even if you were to assume that they weren't built up and you saw increases, then you wouldn't see it turn around and go the other way. I mean, it just can't be.

EXAMINER CATANACH: Okay, I have nothing further of this witness.

Is there anything further?

MR. HALL: Briefly, Mr. Catanach.

FURTHER EXAMINATION

BY MR. HALL:

Q. Mr. Williams, you testified briefly about some of the workover reports on the Chaco Number 5. It's in your Exhibit 40. You don't need to turn to that. I'll just read to you what you read from the workover report about

the repair to the holes and the 2-7/8, and they were found from below 843 to above 651. Do you recall that?

A. I do.

Q. Where is the main coalbody, the Chaco Number 5?

A. I need to look at -- somebody's exhibit, I don't recall. But I mean it's --

Q. It's --

MR. CONDON: This one.

THE WITNESS: Yeah, that will be fine.

What Mr. Ayers defines as the B coal looks like it's between 1141 and 1161.

Q. (By Mr. Hall) Substantially below the holes in the casing, then?

A. Yes, sir.

Q. And you also testified briefly, you had done your own back-of-the-envelope calculations for volumetrics and a little log analysis on the Chaco Number 1. Let me ask you, what were your assumptions with regard to reservoir for that well?

A. Let me see if I have that. I didn't throw mine away.

I'm sorry, I don't have it with me.

Q. Okay, did you also do those on the other Chaco wells?

A. I did it on the Chaco 4 and the Chaco 5 as well.

Q. Could you find those and provide those to us? Would you mind doing that?

A. I can do that.

Q. Let me just ask you, maybe you can recall. What assumption did you make about porosity?

A. I calculated the porosity. I didn't make any assumptions. I calculated porosity from the logs. It was -- it seems like 20 to 23 percent is kind of my recollection, but again that's all on the same sheet of paper, and I'll provide it to you.

Q. All right, saturation, water saturation, can you recall --

A. Again, I calculated water saturation. I think I calculated a water saturation that was probably 55 to 60 percent. My water saturation, if I recall correctly, was significantly higher than that calculated by Mr. McCartney.

Q. Okay, how about clay content?

A. I didn't go into that. You don't worry about clay content on a back-of-the-envelope calculation.

Q. Did your thickness include that section which has been called the third bench or the lower bench?

A. No, sir, it did not.

Q. Why not?

A. Because I calculated that to be 87-percent water saturation, and there's no gas that will flow in that sort

of situation.

MR. HALL: All right, that's all I have.

MR. GALLEGOS: I have nothing further.

EXAMINER CATANACH: Anything further of this witness?

If not, he may be excused.

I don't think we're going to make it to another one.

MR. CONDON: No. We've done four today. That's pretty -- We've got three left.

EXAMINER CATANACH: And you will assure me that we will finish tomorrow?

MR. CONDON: If you're willing to go this late, I assure you we'll finish tomorrow.

EXAMINER CATANACH: We may go through lunch if this keeps up.

All right. Well, let's start at 8:00, I was going to suggest that. We'll start at 8:00 and depending on how quickly we're going we may, in fact, go through lunch, so you might bring a snack.

(Thereupon, evening recess was taken at 6:55 p.m.)

* * *

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. _____, heard by me on _____ 19 ____.

_____, Examiner
Oil Conservation Division

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 Division 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 August 20th, 1998.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1998