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- New Mexico Oil Conservation Commission
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  Case #12888 Testimony:
  1. Hawkins, Bill, Regulatory Affairs Engineer, BP America, pp. 41-64
  2. Balmer, Jeff Ph.D., Senior Staff Reservoir Engineer, Burlington Resources, pp. 221-279
  3. Kump, Gary, Engineer, Devon Energy, pp. 174-198
  4. Dinh, Vu, Reservoir Engineer, BP America, pp. 280-294

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION FOR THE PURPOSE OF CONSIDERING:

APPLICATION OF THE FRUITLAND COALBED METHANE STUDY COMMITTEE FOR POOL ABOLISHMENT AND EXPANSION AND TO AMEND RULES 4 AND 7 OF THE SPECIAL RULES AND REGULATIONS FOR THE BASIN-FRUITLAND COAL GAS POOL FOR PURPOSES OF AMENDING WELL DENSITY REQUIREMENTS FOR COALBED METHANE WELLS, RIO ARRIBA, SAN JUAN, MCKINLEY AND SANDOVAL COUNTIES, NEW MEXICO

CASE NO. 12,888

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Oil Conservation Division

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING (Volume I, Tuesday, June 3rd, 2003)

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

June 3rd-4th, 2003

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Commission, LORI WROTENBERY, Chairman, on Tuesday and Wednesday, June 3rd and 4th, 2003, at the New Mexico Energy, Minerals and Natural Resources Department, 1220 South Saint Francis Drive, Room 102, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

* * *

First, last, any time.

CHAIRMAN WROTENBERY: Commissioners, are you ready to get started with the testimony?

COMMISSIONER BAILEY: Let's do it.

CHAIRMAN WROTENBERY: Okay, let's go then.

MR. CARR: May it please the Commission, I believe you have an exhibit book that was delivered last week on behalf of Burlington, BP and ChevronTexaco, and we'll work through that exhibit book in order.

Our first witness is Bill Hawkins. Mr. Hawkins is with BP. He will testify about the work and the recommendations of the industry/OCD Study Committee. He's going to explain to you the reasons behind the proposed -- or the existing actual boundary between the low-productivity area and the high-productivity area. He's going to then provide an overview of what we believe are the appropriate recommended regulatory changes for this pool.

BILL HAWKINS,

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

DIRECT EXAMINATION

BY MR. CARR:

Q. Would you state your name for the record, please?

A. Yes, Bill Hawkins.

Q. Mr. Hawkins, where do you reside?
A. In Golden, Colorado.
Q. By whom are you employed?
A. BP America Production Company.
Q. And what is your position with BP America Production Company?
A. I'm a petroleum engineer with BP. I'm responsible for regulatory affairs in Colorado and New Mexico.
Q. Could you summarize for the Commission your educational background?
A. Yes, I have a bachelor of science in petroleum engineering from Texas Tech University in 1972 and a master of engineering from Texas Tech in 1974.
Q. Would you review your employment history?
A. Since 1974 I've been employed by Amoco and now BP, through a merger, as petroleum engineer.
Q. At all times have you held engineering positions?
A. Yes.
Q. Are you in charge of regulatory affairs for the San Juan Basin?
A. Yes, I am.
Q. And in the exhibit book behind Tab 1, is there a copy of your résumé and then a summary of the testimony you're going to be providing here today?

A. Yes, there is.

Q. Were you an engineering witness providing testimony in the Colorado case where infill development was approved for that pool on the Colorado side of the line?

A. Yes, I was.

Q. And you also testified before this Division last year?

A. Yes, I did.

Q. Are you a member of the Division's Fruitland Coalbed Methane Study Committee?

A. Yes, I am.

Q. Have you participated in all aspects of that work since its first meeting in August of 1999?

A. I have.

Q. Are you familiar with the Application filed in this case on behalf of that Committee?

A. I am.

Q. And are you familiar with the Basin Fruitland Coalbed Pool and the rules that govern development of that resource?

A. I am.

MR. CARR: We tender Mr. Hawkins as an expert witness in petroleum engineering.

CHAIRMAN WROTENBERY: Let me ask one question first. I don't believe we have a copy of Mr. Hawkins' résumé in our books. I don't know if that was available in the court reporter's copy.

MR. CARR: The copy of the book that I received has that. I will provide copies of the résumé and summary following Mr. Hawkins' presentation, if you'd like.

CHAIRMAN WROTENBERY: Okay, that sounds fine.

Any objection? Then we find that Mr. Hawkins is qualified to testify as an expert.

Q. (By Mr. Carr) Would you summarize for the Commission the purpose of your testimony?

A. I'd like to review the work that the Study Committee did and basically summarize the recommendations from the Committee. I'll testify about the boundary between the high-productivity area and the low-productivity area. I'll also go over the recommended notice procedure inside the high-productivity area and provide a regulatory summary of the Committee's recommendation.

Q. Let's start with the work of the Committee, and I'd ask you to turn to the page and slide that -- I guess what we're going to start with, Mr. Hawkins, are certain slides that are in the back of the material behind Tab 1, and they're about the last five or six pages there, entitled Supplementary Introduction Exhibits. Would you just identify those, please?

A. I'm going to scoot to those on the projector. We have five pages of a summary of the Study Committee's or the Coalbed Methane Committee's work since 1999 through 2003. And although I won't go through each notation on these, I'd like to point out some of the key events that occurred over the course of that study.

Q. These are actually the exhibits that were presented last summer at the hearing in Farmington by Mr. Hayden of the OCD; is that not correct?

A. That's correct. The first four slides were presented by Steve Hayden, and then the last slide is just an update for the latest meetings.

Q. Why don't you now at this time summarize for the Commission the work of the Study Committee?

A. Well, just to kind of briefly go through this, the Committee was convened in August of 1999, and the primary purpose the Committee was convened was to look at infill drilling in the Fruitland Coal. The Oil and Gas Commission in Colorado had just approved a fieldwide infill spacing hearing in Colorado in the Fruitland Coal, and certainly there was interest by the NMOCD and the BLM and other industry to take a look at the Fruitland Coal in New Mexico.

We met on a number of occasions. I think one of the most important initial meetings occurred in August of 2000 when Burlington presented some of the study they had for their 28-and-6 Unit, and they indicated that the Fruitland Coal appears to behave like a multi-layer reservoir and indicated to importance of starting to look at individual pressures in the different layers in the Fruitland Coal.

Move ahead to the next slide, we continued to have some meetings, and in January of 2001 we set up a group to define the boundary between the high-rate portion of the pool and the low-rate portion of the pool, and that eventually became named the high-productivity area and the low-productivity area. The initial boundary was preliminary, just based on input from a number of companies, but without the benefit of additional studies.

Following that, each of the companies on the Committee began to do some individual studies and present those to the Committee for consideration.

If we move to the next slide, in May of 2001 Burlington presented a case to the NMOCD to pilot-test the low-productivity area. And following that, in August of 2001, we began to look at the high-productivity area. And based on some of the presentations by BP and others that we wanted to allow infill drilling in the high-productivity area and considered an administrative procedure where notice would be given to offset operators.

If we move ahead, in April, 2002, the Committee met again and finalized the high-productivity area as a single continuous area that encompassed wells that produced at greater than 2 million cubic feet a day as the highest average rate from those wells. And you can see that on the board, off just to the right here, we've got -- that black boundary is the boundary that the Committee drew.

Following that, we had the hearing for Fruitland infill in July of 2002 and received an order in October approving infill in the low-productivity area but denying infill in the high-productivity area, basically remanding back to the Committee for further study the high-productivity area.

Two final meetings following that. In November, Burlington and Devon presented layer pressure data from nine wells inside the high-productivity area, showing the individual coalbeds, some being partially drained, some not being drained at all. And in February the Committee reviewed the study of those pressures and considered the alternatives in the high-productivity area. And the majority vote on the Committee was to allow -- to keep the high-productivity-area boundary with an administrative procedure for notice inside the high-productivity area and allow infill with that notice.

Q. And as of February, 2003, the Committee was unanimously in favor of the recommendation that's before the Commission here today?

A. Well, we are all in favor of this -- in support of this recommendation now. I think in February, 2003, there was still maybe some controversy from ConocoPhillips. But subsequent to their study they have concurred with the Committee's recommendation.

Q. Let's now look at the boundary, and let's go back to the first part of the material included behind Tab 1. I'd ask you to go to the slide that's entitled "Fruitland Coal HPA Infill - HPA Boundary" and review that for the Commission.

A. This is a slide that's going to summarize a little bit about the purpose of the boundary and how it fits into the coal reservoir.

As I stated, the Committee's approach was to find a single, continuous boundary that would encompass the high-rate wells. We chose the 2-million-a-day rate based on some of the preliminary studies that BP had done, indicating that those wells were -- that less than that rate, the wells were clearly draining less than 200 acres. Above that rate, there were some of our studies indicating wells draining larger areas than that.

But once we got to put a line, a best-fit line, on the map, about 2 million a day was about the only line we could fit that was a single, continuous boundary to encompass those high-rate wells.

The line was not intended to separate the pool into an area where infill is needed versus an area where infill is not needed. We all recognize that there were areas inside this boundary where infill wells were going to be needed to prevent waste.

Just to give you an idea of the complexity of the reservoir, even though we've drawn this as a single continuous boundary, there are about 75 wells inside the boundary that actually had a maximum rate less than 2 million a day, and there are about a hundred wells on the outside of the boundary, in what we've determined now as the low-productivity area, that had higher rates just above 2 million a day.

So it's not a perfect line, but it's a best-fit line to encompass those higher-rate wells in the reservoir. And our studies, what we'll show you today is that the majority of the spacing units inside the high-productivity area will benefit from infill development and recovering incremental recovery.

Q. All right, let's now go to the plat that is based on the highest average daily rate, which is the next slide. What does it show?

A. This is a map of the Fruitland Coal wells, contoured on highest average daily rate, and this was the map that we used to actually select the boundary in the Committee. The yellow line is the -- or encompasses the wells that are at 2 million a day. The blue are wells that are producing between 1 and 2. And then inside the high-productivity --

COMMISSIONER LEE: Can I ask a question?

THE WITNESS: Yes.

COMMISSIONER LEE: Is this rate the initial rate or the current rate or --

THE WITNESS: It's the highest average annual daily rate.

COMMISSIONER LEE: At -- ?

THE WITNESS: For the life of the well.

COMMISSIONER LEE: For the life of the well. Thank you.

THE WITNESS: So it's the peak rate that the well made. It's annualized and averaged --

COMMISSIONER LEE: -- after you dewater it?

THE WITNESS: Right. Inside the boundary you also see some pink and purple colors, and those are areas inside the high-productivity area where the wells are producing at much higher rates. The pink shows wells making more than 4 million a day, and the purple shows wells making more than 5 million a day for their highest peak rates.

I think the point that I would make here is that you can see inside the boundary there are quite a few areas where we still have wells that are producing much less than the best wells in the pool. And that was our indication that those are the areas that are most likely going to need to be infill drilled.

Subsequent to that, we've looked at the layer pressure information, which I think is going to demonstrate that a large number, if not most of those wells that are even in the pink and purple, will still benefit from infill development.

Q. (By Mr. Carr) All right, let's move to your next slide, and I'd ask you to discuss with the Commission the waste concerns.

A. Approval of infill development in the high-productivity area will prevent waste and allow significant incremental recovery to be recovered from wells -- the infill wells drilled there. The industry estimates, all of our company's studies, indicate incremental recovery will range somewhere from 240 BCF to 640 BCF inside the high-productivity area.

To put that in -- Just to show that that's a conservative estimate, the USGS has recently completed a study of undiscovered resources, and in their study they have identified in the Fruitland Coal fairway a potential for 4 TCF of undiscovered resource in the fairway. That would be both in Colorado and New Mexico. And I think if we look at the map on the board, the brightly -- yellow and orange colors, you can see that the majority of that fairway lies in New Mexico.

In addition to this, the BLM's resource management plan currently provides for wells to be drilled on 160-acre density in New Mexico. So I think -- We have a regulatory scheme in place to allow these wells to be drilled, and there is a recognition that in order for those wells to be drilled, significant recovery would need to be recovered by those wells.

Q. Let's go to the next exhibit. I'd ask you to review for the Commission the relationship between the high-productivity area and the established producing units in that area.

A. Okay. We're going to take a look now at some of the details of what needs to be accomplished in the regulatory scheme or rules to govern the Fruitland Coal Pool, and the first thing I would look at is the boundary for the high-productivity area and, as shown on this slide, the federal units that are in place. And you can see from the different cross-hachured areas the part of the pool that lies inside federal units. About two-thirds of the area in the high-productivity area is covered by federal units.

And one of the benefits that we have inside a federal unit is that the ownership inside the participating areas in there is common and prevents the potential for correlative rights to be violated.

There's about one-third of the area that's shown in white that is what we call drillblock acreage, where each spacing unit has different ownership from the spacing units adjacent. And there is, you know, more opportunity for -- or potential for violation of correlative rights, and more need for -- potential need for notice to those parties for infill drilling in this high-productivity area.

Q. All right, let's go to the next slide, and let's review the well-location issues.

A. We tried to show on this slide the different occasions you might have for drilling wells, both in the federal unit that's shown in the dark outline and in the drillblocks, which are -- in this case they're shown inside of the federal unit, but they're not part of the participating area, and if you were outside of the federal unit it would be treated in the very same way.

And in fact, this slide was shown to the Division at the hearing back in July of 2002, and the recommendations on the setbacks from this slide were approved in the Division's order.

The recommended setback is 660 feet from the boundary of the spacing unit, when you're in a drillblock acreage, 660 feet from the boundary of the unit that is all inside a participating area, and also a 660-foot setback from any individual tracts that are either noncommitted or partially committed to the unit. So we're trying to keep the 660-foot buffer or 660-foot setback from any areas where the ownership is not common.

There's also a 10-foot setback from the -- that's not shown, and that's from the internal subdivisions inside the spacing unit, quarter-section boundaries.

Q. Mr. Hawkins, the Study Committee is recommending that there be a special notice procedure or a special procedure that will apply to operators who are proposing to drill --

A. Yes.

Q. -- in the infill area.

A. Yes.

Q. And would you now go to -- Before we go to the next slide, when I look at this spacing isn't what is being proposed here -- it was not only adopted by the Division, but it is identical to what is required for the Mesaverde and the Dakota formations; isn't that correct?

A. Yes, it is.

Q. Okay. And now, let's go from this and let's review for the Commission those notice procedures that we have been discussing in the high-productivity area.

A. Okay. We've got two slides here on the notice and protection of correlative rights. First is that notice of infill inside the high-productivity area will protect correlative rights of affected parties similar to a nonstandard location procedure. This will allow the operators to drill their wells efficiently when there is no objection from the offset operator. When the offset operator is concerned about correlative rights, they have the opportunity protest, which can initiate a hearing to determine justification for the well.

I have a slide -- the next slide is designed to show a little more detail about how the notice would work, similar to a nonstandard location procedure. In this example, the operator in -- it looks like Section 8 -- is proposing to drill an infill well in the southeast quarter -- Let's see, I've got -- you can see, right here. And we've named that operator Operator A, with a 100-percent working interest. And we're just going to show the example of which spacing units would receive notice.

The spacing units that would receive notice would be these that are designated in yellow. Those are the spacing units that are adjacent to or cornering the quarter section where the proposed infill well is proposed to be drilled.

And then on the right-hand side of the slide we've listed a little excerpt that comes out of Rule 1207 for affected parties for nonstandard locations, and we think that is the same type of language that should be used for the Fruitland Coal, that the notice to those affected parties should primarily be to the Division-designated operator of the spacing unit.

And there are a couple of nuances where the notice might be different than just to the operator. One would be if there is no operator, then the notice would go to the lessee of record, or the mineral owners if there are no lessees, and that would be the example in the north half of Section 9, cornering the drilled quarter for the proposed infill well.

The other nuances would be that if the operator is the same as the proposed infill well and the ownership is not identical, then the notice would go to the rest of the working interest owners in the adjacent spacing unit. And for instance that would be, in the south half of 9, here's the proposed infill well, Operator A 100 percent. In the south half of 9, Operator A is the same operator but only controls 50 percent of the working interest, so notice would have to go to the other 50-percent working interest in that spacing unit.

And finally you would have the situation where you're inside a federal unit or in a drillblock acreage where you have the same operator with the same ownership. The operator -- or ownership, is identical. No notice would be required for Operator A with 100 percent versus here Operator A with 100 percent.

And this is basically the same procedure that's set up for an exception location or a nonstandard location in the Division's Rules today.

Q. All right. Let's now review the regulatory impacts of the infill development on Fruitland Coal in the high-productivity area. Refer to the next slide, please.

A. Okay. An order approving infill drilling in the high-productivity area with our recommended administrative process will provide operators a cost- and time-efficient way to carry out our drilling programs for infill wells.

If we don't have that and we are left with what is in the current order, an NMOCD hearing would be required for each well inside the high-productivity area. There are 400 wells inside the high-productivity area. At an estimated cost of a hearing of up to $10,000 a well, it could add up to $4 million in additional regulatory costs to get approval for infill in the high-productivity area.

COMMISSIONER LEE: So 10M is the $10,000?

THE WITNESS: 10,000.

COMMISSIONER LEE: Is that an engineering term?

THE WITNESS: It's not million. 2 M's is a million.

COMMISSIONER LEE: That's only for gas, not dollars.

THE WITNESS: Do you like K, 10K?

COMMISSIONER LEE: Yes.

THE WITNESS: We'll change it to 10K.

MR. CARR: I helped him with these exhibits.

THE WITNESS: Requiring a hearing on each infill well would add years of additional time for the NMOCD and industry to get approval for infill drilling in the high-productivity area, which would be very inefficient use of our time and money, both for industry and the NMOCD.

Q. (By Mr. Carr) Mr. Hawkins, let's now go to your last slide, and I'd ask you to summarize for the Commission the proposed regulatory requirements that you're advocating here today.

A. First and foremost, NMOCD approval of infill in the high-productivity area will prevent waste and will allow significant incremental reserves to be recovered. We know that -- Our studies all show different estimates, but those estimates all are in the order of several hundred to 500 BCF of gas that would not be recovered if infill wells are not drilled.

The notice procedure that we're recommending will protect the correlative rights of all of the parties inside the high-productivity area, very similar to the nonstandard location process.

And the administrative approach that we are recommending for APDs will provide an efficient procedure for the NMOCD and for industry to infill the high-productivity area.

And lastly, I would point out that the well-location rules that we're using similar to the Mesaverde and Dakota Pools will provide many opportunities for industry to use the existing wellbores or well pads, roads and other facilities, so that we can minimize the potential surface disturbance for infilling.

Q. Now, Mr. Hawkins, you've reviewed the regulatory changes and requirements that have been proposed by the Study Committee?

A. Yes, I have.

Q. Will additional witnesses be testifying as to the geological and engineering data that supports the changes that you have just summarized?

A. Yes.

Q. And those witnesses will be testifying later here today?

A. Yes.

Q. Were the exhibits contained behind Tab A in the exhibit book prepared by you, or have you reviewed them and can you testify as to their accuracy?

A. Yes, they were prepared by me or reviewed by me.

MR. CARR: May it please the Commission, at this time we would move the admission of Mr. Hawkins' exhibits, which are each of the documents contained behind Tab A in the exhibit book.

CHAIRMAN WROTENBERY: Any objection? Then the exhibits behind Tab 1 --

MR. CARR: -- Tab 1 --

CHAIRMAN WROTENBERY: -- will be admitted.

MR. CARR: -- M, K, 1, A... And that concludes my direct examination of Mr. Hawkins.

CHAIRMAN WROTENBERY: Okay, thank you. Did anybody else have any questions of Mr. Hawkins? Commissioners?

EXAMINATION

BY COMMISSIONER BAILEY:

Q. Has every 320-acre spacing unit within the high-productivity area been drilled and completed in the Fruitland?

A. I believe all but possibly one have been drilled.

COMMISSIONER BAILEY: Okay.

CHAIRMAN WROTENBERY: Commissioner Lee?

EXAMINATION

BY COMMISSIONER LEE:

Q. You already dewater it on the other parts of it. Do you think this infill drilling is -- economically, is even better for the exploration well?

A. For the first well?

Q. Yes.

A. What we've seen in Colorado, where we have done infill, is that there has been no negative impact on those original wells. And in many cases there has been continued incline on the first well that was drilled.

So yes, I could say that I think there would be some potential benefit, particularly in the low-productivity area, where there's still dewatering needed.

Q. Right now, in this area, you have a lot of Pictured Cliff, 80 acres. Can you utilize those wellbores?

A. Well, the Pictured Cliffs are on 160s right now, but they're being piloted for 80-acre. I don't know that -- You know, I think there are many opportunities where we could use the Pictured Cliffs well or one of the deeper wells.

Inside the high-productivity area there are still some concerns over how we will complete wells, whether they would need to be perf'd and frac'd, where you could use an existing wellbore, or whether they would need to be cavitated, in which case you would have to drill a new wellbore. But there's always the potential to drill even a new wellbore from an existing pad. So I think operators would look at those as potential solutions.

Q. How many of the Pictured Cliff wells in this area increase their productivity after 30 years?

A. I'm sorry, I don't understand that.

Q. I heard a lot of Pictured Cliff wells in this area increase a lot of productivity. What I'm saying is, a lot of companies steal the Fruitland Coal gas from the Pictured Cliff completions. Do you have any idea about that?

A. I don't have any way to analyze that.

Q. Yeah. The Pictured Cliff is right under the Fruitland Coal.

A. Right.

Q. I think a common practice right now is, I don't have 160 acres, but I use the Pictured Cliff as a -- and penetrate into the Fruitland Coal and get the coal gas out. Is that true? Do you understand?

A. I understand your question.

Q. Is that a BP operation?

A. That is never our intent. I don't think any operator intends to try to complete into the Fruitland Coal through a Pictured Cliff --

Q. Are you sure?

A. -- perforation. Yes.

Q. I thought this is common practice.

A. Common practice?

Q. Yeah, the BLM told me that all the Pictured Cliff, up to 30 years, they recharge, and all the productivity increase.

Well, anyway, I think this is 160, my opinion, although we're going to these four days' hearing, but I think 160 -- I support it, because people have already done it. So -- in reality. So can I go home now?

(Laughter)

MR. CARR: If I can go with you.

CHAIRMAN WROTENBERY: You're in it too.

EXAMINATION

BY CHAIRMAN WROTENBERY:

Q. Mr. Hawkins, it sounds like you're familiar with the spacing rules in the Fruitland Coal in Colorado.

A. Yes.

Q. Could you summarize those for us, please?

A. It's very similar to New Mexico, it's spaced on 320 acres. The setbacks are slightly different, we use a 990 setback in Colorado.

In 1999 -- Well, prior to 1999, there were a number of areas that were piloted for infill in Colorado, and in 1999 a large hearing was held to approve infill drilling.

In 1999 industry didn't ask for infill in the high-productivity area in Colorado. At that point in time we did not have layer pressure data to look at, so we didn't even include it in our application. But it does use a boundary similar to the New Mexico Commission or what we're proposing. There's a 3-million-a-day boundary that was used in Colorado instead of a 2, and I have made a recommendation to our company to get together with other operators and take a look at the high-productivity area in Colorado for potential for infill there.

Q. Thank you. And could you explain how the USGS defines undiscovered resources?

A. You know, I don't know exactly what -- how they define undiscovered, but -- well, I really can't give you a -- We might have somebody that can tell you that.

CHAIRMAN WROTENBERY: Okay, I was just trying to put that estimate of 4 TCF in context.

Any further questions? Anything else of Mr. Hawkins, then?

MR. CARR: That concludes my presentation of this witness.

CHAIRMAN WROTENBERY: Thank you very much for your testimony, Mr. Hawkins.

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION FOR THE PURPOSE OF CONSIDERING:

APPLICATION OF THE FRUITLAND COALBED METHANE STUDY COMMITTEE FOR POOL ABOLISHMENT AND EXPANSION AND TO AMEND RULES 4 AND 7 OF THE SPECIAL RULES AND REGULATIONS FOR THE BASIN-FRUITLAND COAL GAS POOL FOR PURPOSES OF AMENDING WELL DENSITY REQUIREMENTS FOR COALBED METHANE WELLS, RIO ARRIBA, SAN JUAN, MCKINLEY AND SANDOVAL COUNTIES, NEW MEXICO

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REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING (Volume II, Wednesday, June 4th, 2003)

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

June 3rd-4th, 2003

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Commission, LORI WROTENBERY, Chairman, on Tuesday and Wednesday, June 3rd and 4th, 2003, at the New Mexico Energy, Minerals and Natural Resources Department, 1220 South Saint Francis Drive, Room 102, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

* * *

away from any and all of these slides that I've presented today is the variability that I've seen within the HPA in the fairway. Whether we're looking more at a regional level, at the gas-in-place map or at specific examples off the cross-section, we are going to be challenged with the present wells that we have to retrieve the gas that's in formation.

So it is my opinion that we need additional wells to help recover that gas.

MR. KELLAHIN: That concludes our presentation of Mr. Pippin.

We move the introduction of his exhibits behind Exhibit Tab 11.

CHAIRMAN WROTENBERY: The exhibits behind Tab 11 are admitted into evidence.

Questions?

Thank you very much, Mr. Pippin.

THE WITNESS: Thank you.

MR. KELLAHIN: Members of the Commission, Dr. Balmer's presentation for the high-productivity area is behind Exhibit Tab 12, and that's where we'll start. And then when we talk about the low-productivity area, we'll move to Exhibit Tab 14.

Dr. Balmer, are you a baseball fan?

DR. BALMER: Yes, I am.

MR. KELLAHIN: You're batting cleaner?

DR. BALMER: I feel good about it. Cubs are in first place, feel pretty good. It's June.

JEFF BALMER,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Please state your name and occupation?

A. My name is Jeff Balmer, I'm a reservoir engineer for Burlington Resources.

Q. Summarize your education.

A. I have a bachelor's of petroleum engineering from the University of Missouri in Rolla, awarded in 1988. Through a series of different jobs I came back and was awarded a master's degree in environmental and planning engineering, also from the University of Missouri in Rolla, in 1993. And then subsequent to some additional work, I came back and received a doctoral degree in petroleum engineering from the same university in 1998.

Q. Summarize for us your experience as a petroleum engineer in the Fruitland Coal gas.

A. I have two years, almost to the day, of experience, primarily in the high-productivity area, as a reservoir engineer in the Fruitland Coal.

Q. The reservoir engineer that presented the engineering study of the low-productivity last summer was not you?

A. That is correct.

Q. That was -- ?

A. Dr. Clarkson.

Q. -- Dr. Clarkson. And he's now residing in Canada, I believe?

A. Uh-huh, with a very pregnant wife. So he's essentially retained in Canada for the duration of the hearing.

Q. Have you talked to Mr. Clarkson?

A. Yes, I have.

Q. Have you reviewed his testimony that he presented before Examiner Stogner?

A. Yes, I have.

Q. Have you made yourself informed as to the reservoir engineering components of the low-productivity area?

A. Yes, I have. In addition to that, I was utilizing a consulting position to help put some of those slides together, primarily done by Mr. Thibodeaux and Mr. Clarkson, however I did have a hand in reviewing those slides prior to the original testimony last July.

MR. KELLAHIN: We tender Dr. Balmer as an expert petroleum engineer.

CHAIRMAN WROTENBERY: And we accept his qualifications.

Q. (By Mr. Kellahin) Let's start with the high-productivity area, Dr. Balmer, and I'm going to let you start, give us some idea where you're going, and let's go.

A. As an engineer I think it's important, in my mind anyhow, to try to visualize what we're talking about. To that extent, after the introduction of a recovery-factor map that Eddie -- or excuse me, Mr. Pippin and myself prepared, I have somewhat of a cartoon description of what I view as the -- what we're facing relative to the stranded gas in the reservoir.

After a description of that I'll introduce the layered pressure testing data that we have performed, discuss a little bit about the methodology behind that, and then more detail, some of the conclusions that we've been able to derive from that.

Towards the conclusion of my presentation, I'll discuss three different methodologies for estimating unique recovery in the high-productivity area, and then have a very brief summary at the end of it.

Q. Let's do it.

A. Okay. This first slide just gives you a basic outline of what I had pretty much just said, introduce the recovery factor map, discuss more or less on a cartoon basis what the stranded gas -- how that will exist in the reservoir under current 320-acre development, discuss layered pressure testing, both kind of in an overall description and then in detail, introduce different methodologies for recovery estimates, and then summarize with a concluding slide.

I'd like to start out with a summary for the reservoir engineering data and kind of start at the end and then go through the middle of it subsequent to this. The important thing is that new data is available since the July, 2002, hearing.

We were charged specifically with coming back after the original hearing and investigating and gathering data in the high-productivity area in New Mexico, and I think both Burlington and Devon and ConocoPhillips have done a good of going back and doing that. So I feel like the original requirements set out in the ruling were followed.

One of the very important things to remember -- and this has been a theme that you've heard several times throughout this from several of the presenters, is that even with a small pressure reduction you're still able to liberate large quantities of gas through infill drilling. The high-productivity area is a very unique area. There's a lot of gas in place in there. We're of the opinion that we'll be able to get more than just small amounts of pressure reduction, that even if you get just a small amount you can still liberate a lot of gas.

Q. Stop right there, Dr. Balmer. Yesterday Dr. Lee asked a question with regards to this issue, and I told him we'd have the answer.

A. Yes.

Q. Let's go back and understand the question.

A. I believe the question that Dr. Lee posed was the effect -- if you infill drill, how would that actually lower the abandonment pressure overall in the reservoir? We have heard a significant amount of testimony that indicates that there are lateral discontinuities in the coal, particularly in the high-productivity area -- or specifically, I should say, in the high-productivity area.

I think the answer to that would be, if you have discontinuous coals and you drill an infill well, your abandonment pressure at your parent-well location may not be that affected. That's on the assumption that none of the coals are intersecting each other or in communication with each other.

However, going with the discontinuity theme, if you're able to effectively lower the abandonment pressure in an area away from the parent well for -- perhaps in an infill-well location, the overall average of the abandonment pressure for that zone would be lowered, therefore liberating increased amounts of gas.

COMMISSIONER LEE: You're telling me -- That's not what you presented yesterday. But what I see is this. If you have an infill drilling, you are accelerating speed to go to the abandonment pressure.

THE WITNESS: You also do that, yes, in addition to recovering unique reserves, yes.

COMMISSIONER LEE: Right, okay.

THE WITNESS: Your overall field life will be reduced.

COMMISSIONER LEE: But abandonment pressure is set by the operator, abandonment pressure is not set by the operation.

THE WITNESS: That is correct.

COMMISSIONER LEE: Okay.

THE WITNESS: And again, going with the theme of discontinuities, if you look at a pressure distribution over time, which we'll see here, you'll -- it will better demonstrate where those higher-pressure areas or higher-gas-concentration areas will be located in your reservoir under current development.

COMMISSIONER LEE: So you're thinking about is a one tank and two tanks, with a valley in between the --

THE WITNESS: That is correct, there is a -- and it's all interrelated. I've drew a reasonably simplistic cartoon approach to it. However, making the assumption that they are intertwined, I believe that that will be a reasonably good explanation for what we're discussing.

COMMISSIONER LEE: Okay, I'm happy.

MR. KELLAHIN: If you're happy, I'm happy.

THE WITNESS: I'm very happy.

Q. (By Mr. Kellahin) Let's go.

A. The -- Really, the conclusions from this testimony will be that the reservoir and geological data indicate that significant amounts of gas are still left in place under current development. My approximations, rounded, are that between 300 and 600 BCF of incremental gas will be recovered due to drilling down to 160 acres in the high-productivity area of the New Mexico Fruitland Coal.

This recovery-factor map was developed with the assistance of Mr. Pippin and taken from his original-gas-in-place map that he's shown. Without going into intimate detail on this particular map, the primary items that I'm trying to demonstrate here are that there is a high degree of variability throughout this reservoir.

To set up a little bit about what this map is showing is, the yellow colors and larger circles are representative of higher recovery factors. The reddish colors and smaller circles are representative of significantly smaller recovery factors. These just are Burlington-operated well, they do not contain any other operator information.

A couple of things to point out here, and this was indicated before. Clearly in the high-productivity area, if you look, the majority of the larger circles are shown in the high-productivity area, and there's no disputing that. However, there are significant amounts of large circles or high recovery factors outside the high-productivity area in the northern sections of 32 and 6 and 32 and 7, just outside some of the 30-and-6 areas, and then to the southern portion of the HPA outline.

Also, it's important to note that inside the high-productivity area -- perhaps a good example is the 30-and-6 area, which is arguably one of the most prolific, if not the most prolific, developments in the high-productivity area -- you still find instances of low recovery factors within the high-productivity area.

Q. Don't leave that just yet, Dr. Balmer. When I look at that map, I'm looking at recovery factors as opposed to drainage circles?

A. That is correct. They're -- In general, you can equate the size of the circle to an enhanced drainage acreage or drainage area. However, there's difficulties associated with that particular methodology, as has been described, and perhaps a flaw in the original hearing, in that if you are trying to assess a drainage area based on a single pressure or a single -- a composite layered system, there's inherent problems with that, based on the variability that we'll demonstrate with the layered pressure testing.

Q. Take your laser pointer and show us an example where it appears that you've got what might be interpreted to be drainage circles that overlap each other and therefore are in competition.

A. Well, a good example is here in the 30-and-6 area, in here, and in these locations right here where, as has been testified by Mr. Kump, there potentially will be areas in layers, and admittedly so, that the drainage areas or drainage radius in those layers will have some overlap, if that's possible.

I think if you look at it from a more -- step back from a physical standpoint, once you reach some type of interference the physical overlapping generally cannot occur. You're either -- that molecule of gas is being pulled one way or another way. But this does demonstrate that, you know, in some areas, in some layers, the drainage areas could conceptually overlap.

Q. Please continue.

A. This is kind of, again, me stepping back and trying to make things a little bit simplistic. And I'll follow this up with the cartoon that I've alluded to.

Really what we're charged with, or as a reservoir engineer for this project, how can we recover gas through infill drilling? I mean, what's the purpose, what are we really after?

And just sort of to repeat the theme that gas is recovered by any reduction in reservoir pressure. If you're able to liberate any amount of gas, it comes through a reduction in pressure.

Even in perfectly zones, additional gas is recovered, because as you move farther away from that well, your pressure will increase the farther you are away from the take point or from that well. And it's clear that the Fruitland Coal is not homogeneous, so even with -- even in a simplistic everything is perfectly talking to each other, you're still going to recover additional gas.

The third point is that gas is recovered in zones that are not effectively intersected by zones [*sic*]. And this is a good example to think back to what Mr. Pippin and Mr. Reitz had indicated in prior testimony, that maybe 50 percent of those zones are only intersected by a single 320-acre well, so you have a pinchout that occurs prior to intersecting the other well. And again, that will be better demonstrated in the next slide.

And then also in addition to this, gas is recovered in zones that are not intersected by any wells. So if you have an isolated zone -- and Mr. Fassett showed some extremely good examples of this where we have a significant portion of zones that are just floating out there, that potentially have not been intersected by an existing 320-acre well, and some of the pressure testing that -- in particular, one example that Devon has shown where they have two zones in a single well that are essentially at virgin pressure in the high-productivity area, that's a good example of a zone that has not been intersected effectively by a 320-acre well.

Here's my take, or my trial at some animation here. Again, as an engineer if I can draw a picture and help myself understand it, it seems to make more sense to me. The points that I had made on the previous slide are now shown graphically here. Starting with the -- We have really four points I'd like to make on here.

The top zone is an example of an isolated zone. The deep red color indicates high gas concentration. This is an example of how the reservoir would be in original conditions. We've just discovered the Fruitland Coal, we begin to develop it on a 320-acre spacing, and these are the types of things that we'll see.

I'd like to repeat that these are very interrelated. This is a simplistic view of it, but again I think it's representative of what we'll find when we begin to investigate a little bit deeper.

The top zone is an example of an isolated zone. It's a zone that is not currently intersected by any 320-acre wells. The middle zone is a zone that is not effectively intersected by wells on current spacing. That would be considered in geologic terms a pinchout. You see it on one well, you follow it along the cross-section and it is not apparent in the well next to it.

The bottom zone -- And this is generally what people conceptually think about when they think about the Fruitland Coal, is a very thick zone that contributes a lot of gas to the productivity area. These are the zones that when you take a single surface pressure, you might see at 100 pounds or 150 pounds, something like that. It masks the complexity of it in there.

And I've tried to associate a minor degree of complexity by introducing these permeability restrictions or baffles, as Mr. Thibodeaux had presented prior evidence.

These are a variety of things. It could be zones of very low permeability, it could be a small stream or creek bed that had gone through that essentially eliminated the coal section, it could be some of the faulting that was demonstrated before. There's a lot of -- a variety of things that could be introduced in here. But in general purposes, for this description, it's called a permeability restriction.

The way that this develops -- and if you could continue to watch the screen so I get credit for my animation here -- the stranded at abandonment conditions will look something like this. And again, you know, semantics would dictate what exactly the colors should be at these different areas. But starting with the top zone again, under current development at abandonment conditions you really haven't produced any gas from that isolated zone.

Again referring to the Devon testimony, their original reservoir pressure was roughly 1642 pounds. The current pressure in those zones was 1450 pounds. To me, based upon my reservoir engineering analysis, those are isolated zones. Those are not -- they are not intersected by a 320-acre well.

The middle zone is an example of a pinchout where, near the 320-acre well that intersects that zone you do have reasonably good depletion. As you move farther away, towards the other -- towards the left-hand side of the screen where that zone is pinched out, you get subsequently higher and higher pressure and appropriately higher and higher gas concentration.

The bottom zone, if you can kind of think of that in two different ways. If you eliminate the permeability restrictions where you have gas stranded or stuck behind those areas and just concentrate on the thick zone that spreads across there, again near each of the 320-acre wells, at that take point, you have very good depletion, you will be able to lower the reservoir pressure reasonably well in those areas.

However, as you move towards the middle -- in this case it's very concentric, so your infill well would lay in a spot in the middle of that -- you still have a higher degree of gas concentration in the middle, simply because your pressure at the well and your pressure at the infill location will be different, so you have higher gas concentrations in the middle.

The permeability restrictions again -- it arbitrarily put in four there -- are just areas where you have trapped gas. The gas is unable to flow effectively, due to either a faulting condition or a permeability baffle, an area of lower permeability. Something is restricting that gas to flow there.

So again on a pictorial example, this is where we are under current development.

If you spot an infill well, this will demonstrate what the effect of this infill well would be. You can drill this infill well. And again, this is drilled right in the middle, and once we hit new abandonment conditions with 160-acre development, this is again clearly just a pictorial representation of what will happen. But you have the opportunity to develop the stranded gas that's in there. I'm not suggesting that you'll receive every single molecule of gas that's available to be taken out of there, as this example perhaps demonstrates, but your opportunity to intersect a gas that will not be produced on 320-acre spacing is certainly enhanced.

Q. On this slide, Dr. Balmer, the infill well as to the middle zone, is some of that gas attributable to rate acceleration?

A. Some of it will be, yes.

Q. But then you would also get gas that you would otherwise not produce by the parent well?

A. That is correct.

Q. Have you gone through a study to determine how much of the gas is recoverable?

A. Yes, I have.

Q. Let's do that.

A. Okay. This is an equation that you've seen several times prior to this, originally introduced by Dr.

Close. And really, I just wanted to put this up here to set the stage for the next slide, which will be what I have termed an incremental isotherm, where I'm going to demonstrate how small amounts of pressure reduction can liberate large amounts of gas.

This is a simple pressure reduction, and -- I've termed it an incremental isotherm -- and it generally applies -- if you think of it conceptually, if you have a very thick, continuous zone -- in this case I've assumed that you have a 50-foot-thick zone. And what I'm trying to demonstrate is, if you drop the reservoir pressure, on average, through infill drilling, by just one pound, just one p.s.i. -- in this particular example I'll show you from 100 pounds to 99 pounds, how much gas will be liberated with simply a 1-p.s.i. drop in reservoir pressure.

And this is a good reason why we continue to work with our field personnel, to try to optimize pumping units and compression at the surface, because every pound of pressure drop you get, that you can translate to downhole conditions, liberates a significant amount of gas.

And here if you enter the graph from the bottom -- and this is again approximately from 100 to 99 p.s.i., and then you read over to the left -- dropping the pressure from 100 p.s.i. to 99 p.s.i. releases 28 million standard cubic feet of gas. That's in a perfectly laterally continuous 50-foot-thick zone, with only a single 1-p.s.i. pressure drop, you'll liberate that amount of gas. And clearly our -- my engineering judgment would tell me that that's an extreme minimum, and your opportunity to decrease reservoir pressure in all the zones would be significantly higher than just the 1 p.s.i.

Q. Let's transition into the layered pressure study.

A. Okay. This slide just essentially sets the stage for the types of wells that we tested and why those wells, we feel, are representative of the high-productivity area.

We utilized two different types of wells for the testing, both wells that were candidates for plug and abandonment from prior formations or essentially wells of opportunity where we had the chance to come in and, instead of plug it, we could do some data-gathering on those wells. And in addition, we utilized four existing pressure-observation wells that we had in the Fruitland Coal.

Essentially the tests consisted of isolating those individual zones on each layer and taking pressure measurements. We utilized temporary gauges with the plug-and-abandonment candidates and permanent gauges in the POWs.

Much to my chagrin, sometimes those temporary gauges were left in there for up to 30 days. I really wish that we didn't have to absorb the cost of having those gauges in there for that long a period of time, but I'm very confident that the readings that we got from those gauges were pretty good pressures. They flattened out, generally, after -- oh, sometimes in a matter of days, and we just didn't have the opportunity to go in there and pull those gauges out, although we continued to pay for them.

The locations of the test are widely dispersed across the high-productivity area, and it's difficult to see.

If I could direct your attention to the map up here, there is -- We have four tests that were done in the 30-and-6 area. These are the green circles on this map. Devon had data that was in the NEBU Unit, which goes through here. Burlington also had the Seymour 2A, which Mr. Pippin showed a cross-section for. The 32-and-9 67A, which is again a very prolific area.

And then we had three data points that were in the Ute wells in Colorado. However, these wells were in very prolific areas, 10 to 15 BCF or more of EUR, estimated ultimate recovery, for those areas. And as any geologist here would attest to, the Fruitland Coal knows no state boundary line. So we felt that the evidence from these Ute wells in Colorado could be utilized as high-productivity-area exhibits for the New Mexico Fruitland Coal.

The locations of the tests varied in the proximity to the parent wells. So we had a few tests that were very, very close to parent wells, we had some tests that were more or less in infill-well locations. Utilizing the nine Burlington wells, we had about six that you could say, plus or minus, were in infill locations, and I had that cutoff of it had to be greater than 1500 feet from the parent well. Utilizing all three Devon wells, however, we had -- they were all in, plus or minus, infill-well locations.

So there was a sampling of nine possible infill locations, including the three Devon wells, that I've culled out and we'll talk about somewhat separately with respect to some data analysis that I've performed.

The cost of the pressure tests -- and this is a gross basis -- was $675,000. I'm not sure how the red K on my slide got translated to a black M on the hard copies, but that's --

(Laughter)

COMMISSIONER LEE: You're almost my favorite --

(Laughter)

COMMISSIONER LEE: Oh, you have a second one of my students there.

THE WITNESS: Yeah, okay, I can understand that.

Again, just a small slide to repeat what Mr. Pippin had demonstrated before. These are the infill well locations. One thing that I would like to note that needs to be changed, is the Devon well -- in the uppermost well labeled the 400 is actually in the low-productivity area. That was incorrectly drawn on this particular map and should be -- it's actually located just outside the line, that's correct.

It's interesting to note, to step back -- and I'm not trying to discuss too much on Devon's data, but if you recall back to their testimony, of all the wells that had the most similar pressures, the well that was in the, quote unquote, low-productivity area actually had the most similar pressures, indicating that the differential depletion that we are touting was seen to a lesser degree in a low-productivity area than the high-productivity area. Just, again, somewhat of a data observation.

The two wells that they had in the high-productivity area actually showed a greater degree of differential depletion, and I'll talk to that a little bit more in detail with the Burlington wells here in the next couple slides.

Again, kind of -- somewhat starting with the end and then working backwards, the conclusions of the layered pressure testing are that the coal is really not being drained efficiently.

It's vertically heterogeneous or variable in quality.

That the prior testimony that was introduced in the original hearing that a single layer pressure test -- or a single test at surface could be effectively utilized to describe all the layers is really probably not a good approach to have.

And that we do see differential depletion is occurring.

One of the thoughts originally that we had is, maybe it's just these -- we're going to get some 1-foot-thick zones or 2-foot-thick zones that are not depleted. Well, as you'll see, and as the Devon data suggested also, there's significant thick layers out here that are not depleted. You take a 10-foot-thick layer that's at 800 or 900 pounds of pressure, and there's a lot of gas in there that's going to remain in place under current spacing.

The other thing that was somewhat surprising and was brought up in some of the committee meetings was, well, let's not confuse original or gas in place with recoverable reserves, and if you're after these thin 1-foot or 2-foot-thick layers, why would we believe that those wells -- those thin zones, could be productive? And I'll demonstrate in some specific testimony that we have examples of 2-foot-thick layers or 1-foot-thick layers that are very well depleted and are obviously very highly permeable and can effectively produce the gas that they have.

I'll take a minute to kind of set this slide, and we can discuss it in brief detail or go over it in as much detail as you would like. But the points on the previous slide are listed off to the right-hand side, and those are the things that I'd like to have everybody keep in mind as I'm discussing some of these specific items on here.

What this columnar examples is, represents five wells that we had layered pressure testing on in the high-productivity area. And then the subsequent slide is this exact same slide, describing in specifics the four wells that were taken in 30-and-6. So you're going to see two slides that are essentially the same format from each other.

The first column introduces the well name.

The second column is labeled the distance to the offset well. And Mr. Pippin did an analysis of the nearest offset well to the layered-pressure-testing well that was completed in that was completed in that zone. So we didn't want to say, hey, we've got a well right here, it's got this layer in it but it's not completed. That's not really fair for analysis. It has to be a zone that has the opportunity to be produced in some of the offset wells.

The third column is a net thickness, which was taken from the density logs.

The fourth column is a measured pressure, or what we actually saw from the gauges that we had in the hole.

And the last column is what I've labeled the percent recovered, which is the percent to date, when that pressure was taken, of how much depletion has occurred at that point in time, utilizing that pressure.

You've probably heard the prior testimony on modified material balance, how that can be utilized to essentially -- at a given pressure and a given recovery factor, you can either use -- excuse me, at a given pressure or a given production, cumulative production to date, you can use one to calculate the other.

In this case, utilizing a pressure I could calculate an estimated recovery to date at that point in time and then back out a percent recovery to date.

A couple things that I'd like to demonstrate here.

If you look at the first well, the Seymour 2A, there's three zones that I'd like to point out. The top two zones, one at 10-foot thickness and one at 7-foot thickness, and then the bottom zone at 21 feet thick, are at, you know, an average of roughly 650 pounds. The recovery percent in those areas, if you average it out, is probably about 25 percent. That's 38 feet of coal in that well that's essentially very, very poorly depleted. That's a good example of an area where we'd probably jump on the opportunity to drill an infill well and try to deplete some of those coals.

COMMISSIONER BAILEY: When was that well completed in the Fruitland?

THE WITNESS: The Seymour 2A was actually not a Fruitland Coal well. It was a P- -- It was a Mesaverde original well. It's probably 25 to 30 years old. I'm not sure, this might be possibly what you're asking. We ensure through bond logs, through cement bond logs, that we are not getting communication behind pipe, which is a very important consideration, so that essentially the data that you're taking is truly isolated and that you're not having communication behind pipe in those zones.

COMMISSIONER BAILEY: No, my question more goes to the fact that Burlington in its previous incarnations as Meridian and El Paso had quite a bit of learning on how best to drill and complete the Fruitland Coal wells --

THE WITNESS: Uh-huh.

COMMISSIONER BAILEY: -- from open-hole to -- and cavitation --

THE WITNESS: Uh-huh.

COMMISSIONER BAILEY: -- to cased hole. So those previous techniques may have an effect on the recovery factor for a well that was completed 30 years ago?

THE WITNESS: I understand. That's a very good question, very appropriate. I believe the answer to that would be, the surrounding wells in that area were cavity-completed with the best technology that we have available to produce those wells. The -- speaking of the offset wells. Those have been on production for approximately 15 years, and therefore if you translate over to the Seymour Number 2A it has essentially -- the layers that intersect the Seymour 2A have been effectively, to the best of our ability, stimulated in the actual producing wells that are offset to the Seymour.

The next well that I'd like to call your attention to is the middle well, the UTE 17 POW. That is a Colorado well in the high-productivity area. The very bottom zone is approximately 1 foot thick, based upon the log that we had available, and that's at a measured pressure of 105 pounds, which, based upon my calculations, shows a 78-percent recovery at that point.

This demonstrates that the thin layers can be productive. I'm not saying that every single 1-foot-thick or 2-foot-thick zone that you'll encounter will be able to be so prolific that in 15 years you'll get 80 percent of the gas out. However, I'm saying that statistically there's a very valid opportunity for that to occur.

The last one that I'd like to point out is the UTE POW Number 1, which is the last zone. Here at essentially an infill-well location you have a 6-foot-thick zone that's still at 1100 pounds pressure. At that calculation, it's only about 10-percent depleted.

One thing to point out is that these numbers, if you utilize the percent-recovered or percent-depleted numbers from the Burlington data here, they won't match up one to one if you utilize the same information and how Devon had done it.

The methodology is identical, however the Langmuir parameters, in particular the Langmuir pressure that we had utilized in a dispersed basis for all of the Fruitland Coal, are different than the Langmuir pressures that Devon had utilized in specific to the NEBU Unit. Their data was NEBU-specific, and our data is more or less specific to the entire high-productivity area. It's just a -- in case you go back and try to, you know, one off, how come Devon's data or their recovery percents are slightly different than the information demonstrated by Burlington? That's the reason behind it. I think they're both relevant assumptions.

Without going into infinite detail, the testing results are continued here, again repeating that the 36-and-6 area is an extremely prolific area, shows the same things that we have -- had done before. You've got some -- They're vertically heterogeneous, you've got differential depletion occurring, the coal is not being drained efficiently, you have thick zones that are at higher pressures, and that your thin layers can be productive.

Just one item that I'd point out. The very bottom well, the 36-and-6 POW Number 2, has a 7-foot-thick zone that's still at 1155 pounds. My calculation shows that that well is only 9-percent depleted in that layer. And if you think about how much gas is contained in a 7-foot-thick zone, it's several BCF of gas, just in that zone.

So if all you did -- I'm not suggesting this would happen, but if that's the only zone that you were able to get, you can still regard large amounts of incremental gas.

The other item possibly to demonstrate here is, you've seen several examples of very thick zones, 40 foot thick, 30 foot thick. Those were lumped together because we were not able to mechanically isolate some of those zones in the later pressure testing. There's a certain, oh, push and shove, when it comes to the drilling department being able to stick six separate bridge plugs and gauges in the wells, so you're somewhat limited by your ability to put the gauges in and get them out.

In addition, based upon some of the completion techniques in these existing wells, some of those layers are broken up. You have some separation between those layers, but you're not able to mechanically put a bridge plug and gauges in between them to isolate them.

Potentially the rambling, what I'm saying, in a short version, is that you have shown up here maybe a 40-foot-thick section that's broken up into a variety of different coal packages that in all likelihood what we're demonstrating here is the lowest pressure for all those zone. We're representing it as a single pressure for those zones, but in all likelihood the zones that are not able to be mechanically isolated, some of those zones would be at higher pressure than what we're demonstrating here.

Q. (By Mr. Kellahin) You mentioned in your introduction that there were multiple methods for estimating recoveries.

A. Yes, there are.

Q. Can you take us through some of the choices?

A. Certainly. I'd like to present three methodologies for incremental recovery in the high-productivity area.

The first one is just data management, and I think as an engineer the first thing that you need to do when you obtain data is just kind of sit back and think about it a little bit, make some observations on the data without trying to do a lot of in-depth, high-level engineering analysis on it. If you don't have a good idea of what's going on just by getting a feel for the data, I think you may be biasing yourself. So that was the original approach.

The second approach is what's termed a modified material balance, which is a proven technique that you can utilize of pressure and cumulative recovery to date to estimate what your future conditions will be, if you're able to lower pressure through time.

The last and perhaps less technical but possibly the most appropriate recovery-estimate method is what I've termed reservoir description, and it goes back to that cartoon that I indicated before. And essentially what I'm trying to do is call out those four different areas -- an isolated zone, a zone that's not effectively intersected or intersected by only one well and then pinches out, a homogeneous zone that's laterally continuous, and a zone or areas of permeability restriction -- and try to assign some incremental recoveries to each of those four different things that we're faced with and then essentially sum them and kind of see where you land at that point.

Q. Okay.

A. The first methodology that I'd like to introduce is again called the data management method. And given the fact that utilizing the Devon data, hopefully with their permission -- I believe Gary gave me his permission, Mr. Kump -- we're -- If you look at the 12 layer tests that we have, about nine of them are in approximate infill locations. If you look at that data, eight of those nine wells -- and that's 89 percent -- have at least one zone that's less than 35-percent depleted. And you can make that cutoff in several different ways, but I think this is potentially one of the more compelling areas.

If you look at each of those individual wells, of those eight wells, and you added up all of the thickness that has less -- depleted less than 35 percent, you come up with 142 feet of coal. If you divide that by nine you get approximately 16 feet of nondepleted coal in every well.

So essentially what this methodology is suggesting is that if you go out and drill an infill well, you're going to intersect 16 feet of coal that has an average recovery factor of less than 23 percent. If you do a thickness-weighted average, those zones have less than 23 percent of recovery factor to date, and that's after about 15 years of production.

If you --

CHAIRMAN WROTENBERY: Sorry about that.

THE WITNESS: That's all right, thank you. I needed the break.

If you can match the recovery factor to date -- and this is not the estimated ultimate recovery, this is just, you know, if you can get 23 percent more gas out of just this zone, these 142 feet or 16 feet per well, you'll make a total of about 10.6 BCF of gas, which is a rough equivalent of 1.2 BCF of gas per well or 1200 million standard cubic feet of gas per well. That's going on the assumption that your recovery, once upon drilling -- or your life upon drilling the infill well will be about 15 years, which is about how much production we've had to date.

Taking the fact that there's approximately 400 infill well locations in the high-productivity area, just simple math of 400 wells and 1.2 BCF of gas per well, just from these zones alone you could conceptually make 480 BCF of gas, just from these zones.

The second methodology, or excuse me, the second portion of the data management method just looks at these isolated zones. And I think this in particular is a very, very conservative estimate, but again I'm not trying to bias myself other than speaking strictly to the data that we had gathered from these wells, and that -- this in particular is one of the Devon wells, is one of the nine wells that -- or plus or minus an infill location, has at least one zone that's not depleted. I think Mr. Kump's testimony indicated that those zones were at 2-percent depletion, which is essentially nothing. If you divide -- and that was a 5-foot-thick section and a 7-foot-thick section, for a total of 12.

If you divide that out and you assume, you know, 1 1/3 feet of coal -- and normally I wouldn't go to that type of detail and take that somewhat leap of faith, but we've got 12 feet and we've got nine wells, so it's 1 1/3 feet of coal.

If you make that assumption that that isolated zone is at 160 acres -- you're going to find zones that are larger than that, you'll find some zones that are smaller -- but if you assume that it's 160 acres and then you apply a 50-percent recovery factor to this coal section, that you would come up with an incremental recovery on a 12-foot coal of 1 BCF total, or divided by nine would give you about 100 million standard cubic feet per well.

And then translating that, if you get 100 million per well, you've got four wells, you'd get an additional 40 BCF from these wells alone -- excuse me, from these zones alone.

And although this is somewhat of a qualitative look at it, I think it's important again to repeat that when you gather data the first thing that you should do is take a look at it and just see what types of things stick out, without trying to apply, oh, very, very detailed, singular-answer recovery factors or analysis in here. And this was kind of a step back and see what we have.

In summary, the data management method of unique recovery, just in these zones, would give you approximately a half of a TCF incremental recovery.

Q. (By Mr. Kellahin) Let's move to the modified material balance presentation.

A. This is a more complicated approach to describing this. However, I've tried to again develop it in kind of a stepwise approach so that it's more or less understandable.

First of all, just to introduce, material balance is a proven pressure- and production-based method for predicting future conditions. Essentially you match what's going on now, and then based upon what you think is going to occur in the future, you can estimate how much recovery you'll get or where your abandonment pressure will be.

And I've quoted an extremely good paper written by two gentlemen, "A Practical Approach to Coalbed Methane Reserve Prediction Using Modified Material Balance Technique", and it's widely used across the industry for recovery techniques -- excuse me, for recovery estimations.

And without potentially looking at the slide, really what I did was, I looked at the offset wells to the layer pressure testing, and I tried to build a Frankenstein well.

If I took -- if I did thickness-weighted average properties of thickness, density and these Langmuir parameters, gas content in particular, what does the average offset well look like to these layered pressure tests? And that was the basis for this analysis.

I utilized 46 wells to perform this analysis over the 12 wells and came out with an estimated ultimate recovery of 11.5 BCF. If you look at -- and Devon again was very good about submitting very timely data and information, both on the pressure and on their decline curve analysis for their recovery estimates on their offset wells. So we had a very good population of wells surrounding our layered pressure tests.

Once that is done and you have this -- oh, I call it a Frankenstein well, it's probably not a very technically correct term, you can impose -- based upon the EUR of that well you can back-calculate what pressure you are at abandonment conditions. And this will become apparent in the next two slides.

Here's the well as it looks. On average, for the average offset well in here, taking the layered pressure test wells, averaging their properties, you're going to have an average of about 60 foot of coal. It's broken up into different layers, but in this approach they're combined to a single layer. Your gas in place is approximately 20 BCF and your density is 1.5 grams per cc.

Those are the types of properties, the thickness, your density and your gas content, are the properties that go into calculating the original gas in place, again via the same equation that you've seen in prior testimony.

And this is where it gets a little bit complicated, but again it's a very appropriate approach. Potentially answering a question that I'm sure Dr. Lee is going to pose to me, this is an approach where you're consolidating all of the layers into a single layer. So in that particular methodology it is somewhat flawed.

However, I would suggest that doing a weighted average of each of the layers reduces the amount of uncertainty that you have when making a composite layer. Essentially we have separate pressures, separate densities, separate gas contents from each of these layers, and those are all averaged to build this one composite model.

In addition to that, I have built more complicated models than this single-layer model. However, it's very difficult to describe a two- or three- or four-layer modified material balance on a single slide. And the problem with that is, the more layers that you break up, the less that you're able to come to a unique solution.

There are ways to get around that, but if you have four different layers and you're trying to make an assumption of pressure reduction in this layer and pressure reduction in that layer and how much gas has been produced from this layer or that layer, it becomes infinitely more confusing to describe, and you do not come up with a unique solution.

In this particular example, by simplifying it in what I feel is a reasonable approach to a single composite system, you are able to introduce a unique solution, again buying into the assumptions that were made.

All that being said, what you do with this graph is that I've introduced -- my apologies -- that the average well, average offset well will produce about 11.5 BCF at its abandonment conditions.

If you read over to the left -- and you have to do this equation of P over P plus Langmuir pressure to back out what the actual pressure would be -- based upon this, the average abandonment pressure in a 60-foot thick layer would be 248 pounds. That's the summation of all those layers put together. Clearly what you'll have is some zones at lower pressure, some zones at much higher pressure. But on average, your average abandonment pressure on a thickness-weighted basis would be 248 pounds.

Taking this, again, at 248 pounds, the starting point --

COMMISSIONER LEE: Will you go back to -- So how you decide that 11 is your abandonment?

THE WITNESS: That was on decline curve analysis of the 46 offset wells to the layered pressure testing wells. If you took an average of the --

COMMISSIONER LEE: Decline curve analysis, you are going to -- Decline curve analysis, then, you point at what? Decline curve analysis you are going to point at the time, right?

THE WITNESS: It's a rate-time, that's correct.

COMMISSIONER LEE: It's a rate-time. So what's the rate of your cutoff rate?

THE WITNESS: The Burlington wells utilized a 72-MCF-a-day cutoff rate. So essentially you're giving it about as much gas as you can. That's -- As you've indicated before, that's an operational consideration, kind of a break-even point for having a pumping unit or compressor or -- you know, you go much below that and you can't justify producing that well.

COMMISSIONER LEE: Okay.

THE WITNESS: But there's a very little -- very small amount of reserves that you'll recover below 72 MCF a day.

COMMISSIONER LEE: Do you have the wells -- 10 instead of 72 in the area?

THE WITNESS: Could you repeat that, please?

COMMISSIONER LEE: You say 72, right?

THE WITNESS: 72 --

COMMISSIONER LEE: So it's --

THE WITNESS: -- MCF a day.

COMMISSIONER LEE: -- your company's decision?

THE WITNESS: That's correct.

COMMISSIONER LEE: Thank you.

THE WITNESS: The way that this graph works here -- and if you show from this modified material balance, you begin at a pressure of 248 pounds, how much incremental gas could we get out of this 60-foot-thick zone if we lower the abandonment pressure? So as the blue curve will indicate, it starts at 248 pounds. So if you don't reduce the pressure, you read over to the left and you do not get any gas.

Every p.s.i. of pressure reduction that you're able to lower, if you read over to the left, that will indicate the amount of gas that you will produce through infill drilling.

In this particular example, what I've indicated is a 25-percent reduction from 248 to 186 pounds, and again this is a -- your layers that are at 120 pounds at abandonment will now be reduced, you know, 68 pounds. However, your wells at 320-acre spacing that are, say, 1000 pounds at abandonment, if you infill drill those, they may drop from 100) to 500 or 300 or something, and there's no single way to approximate that. But on a gross basis, if you look at it -- if you're able to reduce the abandonment pressure 25 percent from 186 pounds -- or excuse me, from 248 pounds to 186 pounds, you make about 1.5 BCF of incremental gas per well.

The final methodology, and one that again helps me kind of visualize what's going on here, is going to be repeated by introducing this cartoon. It's the recovery estimate method called the reservoir description, and it will essentially walk you through each of the individual components that we have, an isolated zone, an ineffectively intersected zone, a thick homogeneous zone, and what types of permeability restrictions that we may encounter in the reservoir.

And this is again, I'll repeat, somewhat of a simplistic view. But you know, if you apply reasonable estimates to these recoveries what you'll find is, when you add them all it still comes out with a very big number.

I've tried to indicate a schematic at the bottom portion of each of these slides so that you can kind of reiterate what part of that cartoon I'm speaking to.

In this case what we're talking about is a laterally continuous thick zone that's perfectly homogeneous. This does not actually truthfully exist in the reservoir, but clearly this would be a significantly conservative estimate if you made these assumptions.

If a 10-p.s.i. drop in average reservoir pressure is achievable in these prolific zones, that would result in the liberation of 260 million standard cubic feet per well. And as Mr. Kump had indicated on his material balance, it went from approximately 110 to 90 pounds reduction in pressure, or a 20-p.s.i. drop. This suggests, as an example, that a 10-pound drop in average reservoir pressure is achievable in these prolific zones.

Moving up the well to a permeability restriction -- and again I would suggest that this is a conservative estimate, that potentially 10-percent of net pay is restricted just over an extent of 160 acres. So if you have a 50-foot-thick zone, five feet of coal is restricted on 160 acres. That has an OGIP, 5 foot thick at 160 acres, of 800 million standard cubic feet of gas. If you're able to intersect that effectively and get a recovery factor of 50 percent, you make another 400 million standard cubic feet of gas just from those zones that are essentially restricted in there. And those restrictions, to repeat, can be a faulting, permeability restrictions or baffles, you know, by creeks or streams or something that a geologist would probably be much more efficient in describing.

This ineffective spacing, taken directly from the testimony of Mr. Pippin where he approximated that 50 percent of the high-productivity wells will have a zone that intersects only one 320-acre well. He introduced testimony that those thicknesses are generally between 2 feet and 10 feet, taking an average of 6 feet and then backing up to my modified material balance and making the assumption that at abandonment this average reservoir pressure is 248 pounds.

If you can reduce it to 186 pounds it gives you a little bit more gas, not much. But again, you know, this zone has been intersected by an existing well. It's reasonably good permeability. And, you know, you can't expect to get a ton more gas out because it's essentially pinching out just on the other side of your infill well. However, you do get incremental gas.

And the last one is essentially a repetition of what was shown previously where you have -- one of your nine wells has an isolated zone, and without going through the detail, in summary you'll come out with an additional 100 million standard cubic feet of gas from these types of zones.

Would you like me to proceed to the summary slides, Mr. Kellahin?

Q. (By Mr. Kellahin) Let's do that, and then I would suggest we could take a short break and then finish up with the low-productivity area.

A. This is a summary of the last method that I indicated. And again, the cartoons located to the right of the numerics will indicate specifically what zone I'm talking about. But in summary, when you add up all these together, you're coming to the conclusion that about 800 million standard cubic feet of gas can be recovered on a per-well basis throughout the high-productivity area.

Moving to the final numeric summary, if you look at the three different methodologies that were employed, the modified material balance, the data management and the reservoir description, in the middle column on a per-well basis it indicates the amount of gas that you'll be able to recover, incremental gas. And on the right-hand, the rightmost column suggests the total amount of gas that you would be able to recover in the high-productivity area through infill drilling.

The summary is plus or minus half of a TCF, in my estimation.

The final conclusions are things that I've been discussing. We do have new data and analysis that has been performed since the July, 2002, hearing. The data, I feel, is very transferable across the high-productivity area.

We've incorporated both Burlington data and Devon data throughout that, and I've introduced three methodologies to predict additional recovery.

The summary is really that under current development we're not adequately draining the reserves in the high-productivity area of the coal. And again, just to repeat my summary of approximately 300 to 600 BCF of incremental gas will be recovered in the New Mexico portion of the Fruitland Coal through infill drilling.

MR. KELLAHIN: Can we take a break?

CHAIRMAN WROTENBERY: Sounds good. Let's take about a -- We'll break till 25 of.

(Thereupon, a recess was taken at 10:20 a.m.)

(The following proceedings had at 10:35 a.m.)

CHAIRMAN WROTENBERY: Okay, we can go on again.

Q. (By Mr. Kellahin) Dr. Balmer, let's make a transition now and have you give us a short summary of the study work that Burlington conducted in the low-productivity area. You have a PowerPoint presentation that we can observe, and the hard copies of that presentation are behind Exhibit Tab 14.

A. That is correct.

Q. Some of this has got a little geologic data involved in it, and so I'm going to let you be a geologist for a few minutes.

A. Okay.
Q. But if you get uncomfortable with that, I want you to recognize that Mr. Thibodeaux has not left for Hawaii yet.
(Laughter)
Q. While he's physically here, mentally he may be gone, so with some degree of caution we'll defer those questions to him.
A. It won't be the last time he'll bail me out, that's for sure.
Q. Let's go.
A. Okay. I'd like to just give you a brief summary of the low-productivity area. There's been a large amount of testimony previously introduced in the July of 2002 hearing. The remainder of that testimony can be seen behind Exhibit Tab 16. What I'm going to introduce is just essentially a summary that will highlight the primary points that Burlington would like to make, that lead to the conclusion that infill drilling is required in the low-productivity area.
As Mr. Thibodeaux had previously testified, the low-productivity-area pilot testing was performed in areas that were specifically chosen to encompass all nine of the genetic coal packages that he was able to map.
Approximately 7500 digital density logs were

utilized to create a coverage of over 100 townships, so we really feel like we have a very good geologic understanding, at least from those points, in a regional setting.

The pilot wells were drilled in areas that were comprised of low-productivity areas, medium-productivity areas and high-productivity areas, relative to the overall low-productivity area. That might sound kind of confusing, so -- It is to me. Let me step back.

The low rates is perhaps a better -- low-rate, medium-rate and high-rate is probably a better description. And essentially what we tried to do with the five wells that are indicated again, if I could direct your attention to the map here, the Davis well, the low-productivity-area well, the Turner well, the Huerfano, the 28-and-6 and the 28-and-5, and as you can see from this cumulative recovery map, they are representative of the different quality of wells that we have in these areas. The lighter -- light blue colors indicating a poorer area of recovery, the areas in the LPA that go more towards the green and then into the pink are representative of the more prolific low-productivity-area wells.

It's important to note that when I go through these -- primarily the layered pressure tests that we've taken on isolated zones, that there's a significant amount of those zones that are at or near original reservoir pressure, indicating that depletion has not occurred in those locations.

And essentially what that does is, it confirms the analysis that we've done on comparing the decline curve analysis from a large subset of wells, close to 1300 wells, dividing that by the original gas-in-place calculation and coming to the calculated estimate that only 18 percent of the gas that's in place is going to be effectively recovered in the low-productivity area, which means 82 percent of the gas in place will remain in the low-productivity area under current spacing -- excuse me, under current density.

It's a very brief presentation. I'll talk a little bit about, you know, introducing the end first, and then coming back with original-gas-in-place and recovery-factor calculations, discussing in brief detail the layered pressure test results from the pilot program, and then I'll finish with essentially the same summary and conclusions.

Repeating once again that there's a lot more information behind Exhibit Tab 16, but the conclusions of all the work are clear that the current well density in the UPE portion of the pool -- Burlington terminology is "underpressured portion/overpressured portion" -- in this particular case, the current well density in the low-productivity area of the pool results in inadequate recovery.

The pilot wells demonstrate that inadequate drainage is occurring in some or all of the coal layers, and we feel that the pilot well results are transferable to the LPA, or the UPE in this case.

Similar to what Mr. Hall had indicated with ConocoPhillips' position in the high-productivity area, Burlington Resources was very much that way in the low-productivity area at the inception of the Committee meetings. We were not predisposed to say that clearly we need to drill up infill wells in the low-productivity area. We felt compelled to study it and reach our own conclusions, and the work that I'd like to present are a summary or an aggregate of what those -- that work and what those conclusions will be.

There's several maps that I'd like to demonstrate some geology on. This is just a total thickness isopach. On the left-hand side you'll see a type well that we utilized to demonstrate the different coal packages that we have available. The total thickness is obviously a summation of all the zones and what we would consider net pay.

The five infill wells or the pilot areas are located in the dark red squares on the isopach map and once again indicate that we do have areas that have thicker coals, medium-thickness, and lower-thickness coals.

The next slide is a demonstration of the Fruitland Coal original gas in place. A couple of identifying points: The thick red line that goes horizontally across the upper portion of the map is the defining line between the Colorado and New Mexico states.

The dark red line that essentially comprises the high-productivity area is what we had considered the original overpressured coal or underpressured coal boundary. We wanted to clearly demonstrate that Burlington's intent was to study the underpressured coal or reasonably if not very much lower-productivity production in the Fruitland Coal.

COMMISSIONER BAILEY: Could I have clarification? Greater than 10 BCF per -- square mile, per 320, per what?

THE WITNESS: That would be per well. Is that correct, Steve?

MR. THIBODEAUX: Per well.

THE WITNESS: Per well.

COMMISSIONER BAILEY: Thank you.

THE WITNESS: Uh-huh. What my next slide demonstrates is the current 320-acre recover factor, and this is based on a population of wells that we performed decline curve analysis on in conjunction with Mr.

Thibodeaux's assessment of original gas in place, repeating again that we had 7500 digitized logs across this area, which is an extremely large population that he was able to acquire over -- really diligent attention over a number of years to acquire that information.

This slide does demonstrate that we have representatively sampled the recovery factors by our infill wells. Again, the upper left well, the Davis well, very low recovery factor. The Huerfano, getting into the darker green areas, could be over 70-percent recovery factor for that particular area.

This is a summary slide that I alluded to prior to this. If you look at the existing well population that we have performed estimated ultimate recovery calculations on and assume that those wells are -- you know, we are drilling on 320-acre development, that only 18 percent of the original gas in place will be recovered under current development of 320-acre drilling. The flip side of that is, of course, that 82 percent of that gas is still left in place.

Shifting gears a little bit, the remaining -- I have 11 more slides. Five of them look exactly like this. In this particular case, this well is the Davis 505S, S designating that it's an infill well, that shows the layered pressure tests that we have taken in the wells, and that -- This demonstrates that the drainage is inadequate in some or all of the coal layers.

There's some extrapolation, of course, that we could perform on these, that shows if your original pressure was 1000 pounds and you're at 950 pounds, that you depleted the well at that location by 2 percent or something like that. But that testimony was given prior to these particular slides, both by Mr. Kump and myself, and so without trying to cloud the slides with too much infinite detail, I'd just like to point out that you can clearly see in this particular example that the current pressures or the pressure that we found at the infill well is very, very close to what the original well had on its original completion.

This particular well, the Davis 505S, again it's in a very poor, or reasonably poor area. But this infill well is only located 900 feet away from the parent well, so it's approximately one-third of the distance from where you would put the normal infill well. And yet even at a very close proximity, there's very little depletion that's occurring at this point in time, at that location.

We've demonstrated, you know, some of these items on cross-section, and without going into infinite detail it just reiterates the points. Each of the five infill wells that I will demonstrate pressure tests on also have an associated cross-section that Mr. Thibodeaux has put together and provided.

Without going into a lot of discussion, although I'm sure that Mr. Thibodeaux would be happy to discuss them further, it just reiterates the points that we have a very complex system out here, that we have zones that are thick, that thin out, that disappear, that are inconsistent and laterally discontinuous. The pressures clearly represent what's going on in the reservoir.

The remaining slides are simply a repeat of what you've seen before. In this case, the San Juan 28-and-5 Unit, 201 infill well which is located in the rightmost well on the poster board that we have, again indicate that the pressures that we have measured are at, near or sometimes slightly above what we had calculated for the original pressures in those zones, indicating that essentially very, very little depletion has occurred at the infill well location.

The next slide is just a cross-section, and unless there's any definitive questions on this, I'm just going to continue to put them in as exhibits and then not discuss them in any detail.

The Turner Federal 210S layered pressure test, as you know in the real world, everything doesn't work out perfectly like you'd like it to be, and by gosh, if we weren't able to go in and get this pressure on that uppermost zone. We tried it -- we attempted it twice and just were not able to -- It's either a bad pressure, or you're getting an incredible amount of drainage from that point. But in all fairness, it is a data point that needs to be shown. I personally don't think that it's very relevant in the fact that it's one data point out of probably 15 to 20 zones that consistently show the same thing. However, in all fairness -- It never works out as perfectly as you would expect it to.

The Turner Federal does demonstrate again that the layered pressure tests that were taken at the infill well locations do show very, very little depletion occurring at that location.

Another cross-section through the Turner infill area.

And then we move to the 28-and-6, which is a medium level, and here you do see some depletion in some of these zones. However, if you refer back to some of the material that was presented on a modified material balance, how much gas has resided in these areas at low pressures, even with some depletion occurring, and still have significant amounts of gas left in place.

A subsequent cross-section to the 28-and-6 area.

And then the final well, the Huerfano Unit 258S, which is in the more prolific zones where you would expect that you would have significantly more difference with depletion occurring. This indicates that in the middle zone that was tested, that you do have depletion that has occurred over time.

In this example, I went back -- and perhaps it's appropriate now to look at this cross-section. The top zone in the Huerfanito 258S comprises about 27 feet of coal package. And if you step back again to the actual layered pressure test, the top zone which is not depleted very well is 27 feet thick. The middle zone, which has some depletion that's occurred, is only 9 feet thick. So that you have, you know, essentially a 3-to-1 ratio of gas in place that is not depleted, versus a well that -- layer that is depleted, repeating again that this is one of the most -- more prolific areas that we have.

So if you're taking a look at saying, you know, the Huerfano unit is in a very prolific area, perhaps infill drilling is not required in this area, it is required, even in the more prolific areas of the low-productivity coal.

And in a short summary, the current well density in the UPE portion of the pool results in inadequate recovery.

The pilot wells demonstrate that there's inadequate drainage in some or all of the coal layers.

And we do feel that the pilot well results are transferable across the low-productivity area in the UPE.

MR. KELLAHIN: Madame Chairman, that concludes Dr. Balmer's presentation.

We would move the introduction of the displays behind Exhibit 12 and 14.

CHAIRMAN WROTENBERY: Okay, the exhibits behind Tabs 12 and 14 are admitted into evidence.

I would just like to make sure I can pull all of this information together --

THE WITNESS: Okay.

CHAIRMAN WROTENBERY: -- on the engineering side, and you have to bear with me.

THE WITNESS: Certainly.

CHAIRMAN WROTENBERY: I don't have any training in engineering. Well, I did take a couple of reservoir engineering courses, but I have forgotten most of what I learned.

EXAMINATION

BY CHAIRMAN WROTENBERY:

Q. When you did your recovery estimate using the material balance method --

A. Uh-huh.

Q. -- what did you use for the gas content? How did you get that information?

A. That's a very appropriate question. The gas content was calculated on a correlation between density and gas content that you can develop. As Dr. Close had indicated in prior testimony, you can get an extremely good estimate of gas content versus density, and it's a very linear correlation in that.

So what we were able to do was gather through time -- this is not recent, but over time we've developed a data set that has a number of density measurements and gas-content measurements on that same density and developed a straight-line correlation that allowed us to utilize a log-derived density from the layered pressure tests and calculate through a single graph a gas content from that density.

Q. Okay, so Dr. Close has provided a plot from Drinkard's Wash in Utah.

A. That's correct.

Q. What you're telling me is, you had something similar --

A. Exactly the same.

Q. -- for the San Juan Basin?

A. That is correct.

Q. Okay. And you got the density information off of the logs --

A. Yes.

Q. -- and then used that information with that plot --

A. That is correct.

Q. -- to get the gas content --

A. Yes.

Q. -- and plugged that into your equation?

A. That's correct.

Q. Is that basically -- We've seen several maps showing original gas in place across the Basin.

A. Uh-huh.

Q. Was that methodology used in developing all of those --

A. The --

Q. -- maps, or were there different approaches taken --

A. That --

Q. -- for different maps?

A. That is a very good question. There are different ways to calculate original gas in place. Burlington has several different methodologies that can be used to calculate that. The methodology that we are currently discussing is a methodology to do that.

Another methodology would be to take, oh, canister data, which is essentially a gas-content data for different areas, and then try to associate that. We have a large population of gas or canister data. We've taken cuttings, again very similar or identical to the gas-content discussion that Dr. Close had suggested in his desorption discussion, and translated that across more on a -- oh, a regional contouring level across the high-productivity area, and then backed into that calculation of 1359.7 times the area, times thickness, times the gas content at that point.

So there are different ways to calculate gas in place.

Q. Okay, for example, the map of original gas in place that you've included under Tab 14 --

A. Uh-huh.

Q. -- how was that one developed?

A. Could I refer that question to Mr. Thibodeaux, please, because he did that development?

CHAIRMAN WROTENBERY: Sure, that sounds good. Mr. Thibodeaux.

MR. THIBODEAUX: We used the --

MR. KELLAHIN: Go up to the stand so she can hear you.

MR. THIBODEAUX: We used the former methodology that was just -- the first methodology discussed by Mr. Balmer, where we had a density of the gas content correlation that we derived from a number of different data points across the Basin, and we plugged that in for SCF per ton. And we used that number times the thickness of all my isopach maps, layered and aggregate, along with pressure data to assume -- to figure out what our bottomhole pressures were, and used that data to come up with the gas in place.

CHAIRMAN WROTENBERY: Okay, that helps. Thank you very much.

Do you have any questions?

COMMISSIONER BAILEY: (Shakes head)

CHAIRMAN WROTENBERY: Okay. Then I think we can excuse you. Thank you very much for your testimony, Dr. Balmer.

MR. CARR: May it please the Commission, at this time we call Vu Dinh. Mr. Dinh is a reservoir engineer, and he is the last witness in the BP/Burlington/Chevron-Texaco portion of the case.

For the last day and a half we have been telling you what we believe will happen if you authorize infill drilling in the Basin Fruitland Coal Gas Pool. Mr. Dinh is going to review with you results that have been obtained on the Colorado side of the line immediately adjoining New Mexico where infill drilling was previously approved. And we're going to show you that the results that are being

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION FOR THE PURPOSE OF CONSIDERING:)

APPLICATION OF THE FRUITLAND COALBED METHANE STUDY COMMITTEE FOR POOL ABOLISHMENT AND EXPANSION AND TO AMEND RULES 4 AND 7 OF THE SPECIAL RULES AND REGULATIONS FOR THE BASIN-FRUITLAND COAL GAS POOL FOR PURPOSES OF AMENDING WELL DENSITY REQUIREMENTS FOR COALBED METHANE WELLS, RIO ARRIBA, SAN JUAN, MCKINLEY AND SANDOVAL COUNTIES, NEW MEXICO)

CASE NO. 12,888

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING (Volume I, Tuesday, June 3rd, 2003)

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

June 3rd-4th, 2003

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Commission, LORI WROTENBERY, Chairman, on Tuesday and Wednesday, June 3rd and 4th, 2003, at the New Mexico Energy, Minerals and Natural Resources Department, 1220 South Saint Francis Drive, Room 102, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

* * *

A. Gary provided the zonal pressure data, and I did all the correlations.

Q. Summarize for us what you've concluded from your work.

A. Well, I would conclude there's a great deal of lateral and vertical facies changes going on out here over a very small area, even between 1500 feet between wells, you can't really -- you're aliasing the information, you can't really tell what's going on there. There's a lot of faulting and fracturing that you'll never see with this well density.

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

We move the introduction of the exhibits he's presented behind Exhibit Tab Number 9.

CHAIRMAN WROTENBERY: Okay, the Exhibits behind Tab 9 are admitted into evidence.

Thank you for your testimony, Mr. Reitz.

THE WITNESS: Thank you.

GARY KUMP,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Kump, would you please state your name and occupation?

A. Gary Kump, I'm a petroleum engineer with Devon Energy.

Q. Mr. Kump, where do you reside?

A. I reside in Edmond, Oklahoma.

Q. Have you testified before the Division on prior occasions?

A. Yes, on one occasion.

Q. Summarize for us your education.

A. I have a bachelor of science degree from Montana School of Mines, 1969.

Q. Summarize for us your employment experience.

A. I have over 30 years' experience in the industry, primarily in reservoir engineering. I've worked for Shell Oil Company, Marathon, BHP Petroleum and Devon Energy.

Q. Did Devon participate with the industry Committee in its study of well density in the Fruitland Coal Gas Pool?

A. Yes, we did.

Q. What was your participation in the effort by Devon to determine appropriate well density in the Northeast Blanco Unit?

A. We gathered pressure data in the individual pressure-observation wells, as Dale has alluded to, to see how effectively the individual coal seams were being drained.

Q. Is the work we're about to see your work?

A. Yes, it is.

Q. Do the displays we're about to see represent your displays?

A. Yes.

MR. KELLAHIN: We tender Mr. Krump as an expert petroleum engineer.

THE WITNESS: Kump.

CHAIRMAN WROTENBERY: We accept Mr. Kump's --

MR. KELLAHIN: Kump?

THE WITNESS: Yes.

CHAIRMAN WROTENBERY: -- qualifications.

MR. KELLAHIN: I'll get it right yet.

THE WITNESS: Okay.

Q. (By Mr. Kellahin) Let's turn to the first slide and have you take us through your presentation.

A. This first map is a map of the NEBU Unit. Dale has already shown you where the unit is located. The unit outline is shown in red on the map. There are 120 Fruitland Coal wells producing from the unit. It's located primarily in Townships 30 North, 7 West, and 31 North, 7 West.

Cumulative production from 120 Fruitland Coal wells is about 950 BCF to date, and it's currently making

140 million cubic feet of gas per day.

Q. What was the purpose of the pressure-observation wells? What were you trying to understand?

A. In the past we've taken composite pressures where we've dipped in to some of the producers and our pressure-observation wells, to get what the current pressure is in the reservoir.

And we realize there may be different pressures in each individual coal seam, so we took three of our pressure-observation wells that are located some distance from existing producers and measured individual coal-seam pressures in each of those three wells.

Q. As a reservoir engineer, if you're taking that consolidated pressure does it matter?

A. Yes, it does.

Q. How is that different than taking the layered pressure information?

A. We will show some of that data a little bit later, but if you use the composite pressure you'll overestimate the amount of drainage and you'll overestimate the amount of drainage area, which has been done in the past and was done in some of the work in the last hearing.

Q. If you were to lump the pressures together in a well that its neighbor you have pressure on, did a drainage calculation, it's likely that that calculation will show a drainage pattern that overlaps?

A. Correct.

Q. And does it actually overlap?

A. No.

Q. Why not?

A. As we'll show, there are -- differential depletion is occurring in individual coal seams.

Q. Okay.

A. In one coal seam it could overlap. It could have one seam, if it's connected to the adjacent well and has high productivity, high permeability, it could overlap for that particular seam. But if you tie all the seams together, the gas in place, generally you'll see that you're not draining 320 acres for all the seams.

Q. Take us through what you've done.

A. If we turn to the second exhibit, this is the isotherm, similar to the one that Mr. Close showed on his presentation. This is the isotherm that represents the gas content of the coals in NEBU.

If you look on the right-hand side of the graph, you'll see a vertical black line. That represents the original pressure of the coals in NEBU, 1642 pounds. Where that black line crosses the isotherm is the original gas content at virgin conditions. That's 593 SCF per ton. That number, 593 SCF per ton, was used in some gas-in-place calculations I'll show a little later, and this isotherm data was used to construct the next exhibit.

Q. All right, sir.

A. This next exhibit is just an alternate way of showing the isotherm data where on the X axis I'm showing gas recovery as a percent of original gas in place, on the Y axis is reservoir pressure. And as you can see from the shape of the curve, this is far from being linear, as Mr. Close has already shown.

As an example, if you look at the first horizontal line to the left, where it says 50-percent pressure depletion, that's the point where you've taken the original reservoir pressure from 1642 pounds down to about 820 pounds, 50-percent depletion. And yet you go over to your isotherm, you see you've only made 13 percent of your gas, 13 percent of the gas has been liberated from the coal.

This is during the period of dewatering where the pressure falls rapidly because you're producing water, primarily, and water is not very compressible, so the pressure drops rapidly, even though you've produced very little gas.

If you go to the lower horizontal line, you'll see that you have to reduce your original reservoir pressure by 87 percent, down to about 215 pounds, before you liberate 50 percent of the gas out of the coal, so that you've reduced the pressure by 1400 pounds to get the first 50 percent of the gas out of the coal, 215 pounds is holding the remaining 50 percent of the gas from desorbing from the coal.

As Mr. Close said, you have to reduce pressures very low in a coalbed methane reservoir to get a high recovery of gas.

Q. Do small pressure reductions matter?

A. They do in the low-pressure range. You can see the red curve is becoming asymptotic to the X axis. So the very small decreases in pressure may give you significant increases in gas recovery.

Q. Can you set up a comparison for us so we can understand how a conventional reservoir might perform, and contrast that to what we see in the coal gas?

A. Yes, I'll show that on my next exhibit.

This shows how the depletion process differs in a conventional gas versus a coalbed methane gas reservoir. The red curve is the same as the curve on the prior exhibit. The blue curve represents the conventional gas reservoir, such as the Mesaverde or the Pictured Cliffs or Dakota. Very similar to what Mr. Close showed. It is almost linear, the conventional gas, whereas we already spoke about the red curve as being far from linear.

Is you reduce the pressure by 50 percent again in the CBM reservoir, you only liberate 13 percent of the gas. In a conventional reservoir, you would have liberated 56 percent of your gas in place.

By the time you've depleted your pressure to 87 percent of the original pressure, again 50 percent of the gas would be produced from the coalbed methane, whereas 89 percent of the gas has already been produced from the conventional reservoir.

So it's very much more important to reduce pressures to a minimum in the coalbed methane reservoir at low pressures than it is in the conventional reservoirs, totally different process.

Q. Can you describe for us the various ways Devon has attempted to obtain a pressure reduction in the unit?

A. Yes, I'll show that on my next exhibit. This exhibit shows the production history of the deposit, 102 producing wells, Fruitland Coal-producing wells at NEBU. Early on we went through the dewatering stage, we see gas production inclining. We reached the maximum rate of 300 million cubic feet a day in 1994, and then the unit went on a decline. It declined to about 170 cubic feet of gas per day by mid-1994.

At that point Devon recognized the need to reduce working pressures, to increase rate and maximize recovery.

So we implemented a program aimed at doing that.

Among the things we did, as shown in the box on the exhibit, we doubled the gathering capacity of our gathering system to reduce friction pressure, thereby reducing wellhead pressures.

We added compression to our central delivery points. There are four central delivery points in the field, again to reduce wellhead pressure.

We added wellhead compressors to all 102 wells in the field, to where we are now producing each well at a wellhead pressure of 5 to 10 p.s.i.

And finally, we installed pumping units on about three-quarters of the wells in the unit to keep any water head off the coals, minimize any pressure on the coals.

As a result of that work, you can see production increased over the next two and a half years from 170 million cubic feet of gas per day to about 265 million cubic feet of gas per day. At that point it went on another natural decline.

If you extrapolate those two declines you see on the exhibit, you'll see that we added -- there's a text box there -- we've added 351 BCF of additional reserves by doing that work of lowering working pressures on all the wells. We did that by lowering the abandonment pressure.

You can see on the curves, the lowermost decline projection abandonment pressure would have been about 280 pounds, had we not done that work. After doing that work, we have reduced our abandonment pressure upon depletion to about 150 pounds for all the wells in the unit, on average.

Q. Mr. Kump, how can Devon further reduce that abandonment pressure in the unit?

A. I think we've done all we can do with the existing infrastructure. The only other way we have to attempt to increase production, increase reserves and prevent waste would be to infill drill the field.

COMMISSIONER LEE: Can I ask a question?

MR. KELLAHIN: Yes, sir.

COMMISSIONER LEE: This whole thing is reduced to 320 acres to 160. Then for that purpose, what's -- what you want to imply here? Do you understand my question?

THE WITNESS: Well, I'm showing that reducing pressure does significantly increase reserves, and we did that initially by --

COMMISSIONER LEE: Yeah, I know what you're showing there. But what is going to relate it to 320 acres and 160 acres?

MR. KELLAHIN: Dr. Lee, we're just about to do that for you.

COMMISSIONER LEE: Okay.

THE WITNESS: Yeah.

Q. (By Mr. Kellahin) So this pressure reduction and the reserve adds are attributable to more efficient things that you've done within the unit, except for adding the infill wells?

A. Correct.

Q. When we look at the analysis of the additional infill well, are you simply accelerating the recovery rate of existing reserves, or are you adding new reserves to your unit?

A. I think the next several exhibits will show that production performance data, pressure data, we'll see that the coal seams are being differentially depleted and that we are leaving reserves behind in some of the coal seams with the existing spacing.

Q. So increasing the density will afford the opportunity to increase the ultimate recover from the pool?

A. Yes.

Q. Let's see how you've done that.

A. My next exhibit shows the 75 wells -- and I should -- Let me back up just one second to our map. I failed to note that part of the unit falls in the LPA area, part of the unit falls in the high-productivity area. The yellow portion is the portion that falls in the low-productivity area. It's about 25 percent of the unit. And the portion of the unit that's in white within the unit boundary, 75 percent falls in the high-pressure area.

And also while we're here, point out three pressure-observation wells we will be talking about later. Up in the northeast portion of the field, that's Well Number 400. That's one of the observation wells we took individual seam pressures in.

And the other two are located in the high-productivity area, in the central part of the unit, Wells 404 and 211. Those are also two wells that we took individual seam pressures in that we'll talk about in later exhibits.

So looking at the 75 wells that are located in the high-productivity area of the field, each of those dots on this exhibit represents one of those wells. If you pick a dot and read to the left, to the Y axis, it will tell you the recovery factor I've projected for that particular well.

And the recovery factor is calculated by the equation shown there where I've taken the estimated ultimate recovery, which I've calculated by decline analysis for each well, divided that by the amount of gas in place on 320 acres around that well. So it's a recovery on the 320 acres around each particular well.

Now, this is the high-productivity area of the field, and you suspect that this would be the area that's most homogeneous, would have the best connectivity, the -- more consistency throughout the wells in this area. If everything was perfect, if the permeability was the same, you had very good connectivity, the recovery factor should be very similar for all these wells, and it should be somewhat of a horizontal line.

The fact that you're seeing recovery factors varying from 20 percent to 140 is a manifestation of the heterogeneity that was described in the geological testimony.

If you take the total EUR of all the 75 wells and divide it by the gas in place for those 75 wells, you'll get an average ultimate recovery for the wells in the high-productivity area of NEBU, 68 percent. That means we're leaving 32 percent of the gas in place behind with existing wells, even though we've optimized the infrastructure of the field to maximize recovery.

Q. Mr. Kump, describe for us your method for determining the gas in place.

A. I use the same equation that Mr. Close showed in his testimony, just a volumetric equation.

Q. Let's go to the next slide, and let's look at the individual pressure-observation wells.

A. This is the first of the three wells in which we took individual seam pressure data. What you're looking at is the gamma-ray density neutron log. The coals are shown in the shaded -- in this particular exhibit, the red-shaded area are the coals.

In the depth track are shown perforations, so you can see we have four sets of perforations, four seams we've perforated in this observation well.

On the left-hand side of the log you'll see the pressure that was measured when each of these zones was isolated.

Now this particular well does not tell us a whole lot about reservoir heterogeneity or differential depletion, for several reasons. First of all, there are only four perforated zones. The bottom two zones could not be isolated because of mechanical reasons, so the pressure you see there is a composite pressure. 268 pounds is the pressure that was measured with both of those lower two zones open. One of those zones could be high pressure, one low pressure. I mean, you just don't know. So that does not tell you a whole lot there about reservoir heterogeneity, looking at those two lowermost coal seams.

So we only have two data points in this particular well. They are somewhat similar in pressure, 194 pounds -- it was just slightly building, probably would have reached a little bit higher than 194 pounds, but not much higher -- and 259 pounds.

On the right you'll see, based on the isotherm I've shown earlier, what depletion you see at this well. Now, this is not a producer, this is an observation well, but what you see at this location in the reservoir as far as depletion of that seam.

I should point out, this well is about 1500 feet from the nearest coal producer, which is only a little bit more than halfway to the point where you would drill an infill. An infill would be about 2640 feet. So only about a little more than 50 percent of that distance. This is the type of depletion you're seeing.

Q. The small box on the lower right has information. Why is that important to us?

A. Again, this particular well is in the low-productivity area, but it's right on the border of the high-productivity area. Those are the four offsetting producers around this pressure-observation well, and the heterogeneity of these wells can be seen by the cumulative production. All of these wells have been producing about the same amount of time -- 11, 12 years -- and yet the cumulative production varies from .8 of a BCF to 13.5 BCF. Very heterogeneous recoveries from offset wells.

Q. Please continue.

A. If we go to the second observation well, this is in the high-productivity area. We have five individual coal seams that are perforated. We were able to measure pressure in all five of these coal seams. Again, this well is about 1500 feet from the nearest coal producer also.

In this well we can see -- I'm sorry that's washed out, some of these numbers have washed out; they were all in red at one time. But the pressure data, you can see, varies from 140 p.s.i. to 770 p.s.i. in the thick coal at the bottom of the section. And you can see recovery varies from 15 percent in that lowermost coal to 72 percent in the second coal down.

Again, the wells surrounding this particular pressure observation well have been producing 11 or 12 years. This is only 1500 feet away from the closest of those wells, and that particular zone you've only depleted 15 percent of the gas in place. Very inefficient drainage of that seam and several others, particularly the thinnermost zone at the top. It has only recovered 20 percent.

Q. Describe for us the box on the upper right.

A. There are three pressures shown in that box. The first is just the average of the pressures you'll see on the left-hand side of the exhibit. That's -- You might suspect, well, what are the average pressure of all these zones? If you just take an average, you get 366 pounds.

If you give more weight to the thicker zones --

that's the second pressure noted there -- you get an average pressure, thickness-weighted average pressure, of 371 pounds, very similar.

The third pressure is a composite pressure. Three months prior to gathering this data, we dipped into this well, and all our pressure-observation wells, which we do annually, and took a pressure when all these zones are exposed, and that pressure was 219 pounds. So you can see the composite pressure is lower than an average pressure or a thickness-weighted pressure.

Q. And what would that cause you to do?

A. Well, in the past what we did and many of the other companies did, and some of the testimony in the prior hearing used composite pressures. They're lower than the average pressure, so you would overestimate drainage and overestimate drainage area by using a composite pressure.

Q. Please continue.

A. And finally again, to show the heterogeneity of the production of nearby wells, again, this is in the high-productivity area, the four nearest offset have produced anywhere from 2.7 BCF to 10.8 BCF. Not very consistent, showing again there's some heterogeneity.

The final of the three observation wells in which we took individual seam pressures is NEBU 211 pressure observation well. And again, that's in the high-productivity area and in the central portion of the unit. This particular well is about 2500 feet from the nearest coal producer, so it's at a location where you would potentially put 160-acre infill location. It is the farthest away from any of the producers that we've shown, and it has the most heterogeneity, or shows the most pressure -- differential pressure depletion, of the three wells.

We show a pressure in this particular well from 152 pounds, the middle coal seam on the log, to near virgin pressure, about 1486 pounds in the lowermost coal that's about six feet thick.

And you can see at this location only 2 percent of the gas has been produced from this zone by the offset producers, very inefficient drainage. Several other zones at this location have given up only about 30 percent, 25 percent of the gas in place, after 12 -- 11 to 12 years of production of the offset coal producers.

Q. Do you have a slide that you can go to, to give us your opinion concerning whether we're increasing ultimate recovery or simply accelerating the recovery of existing reserves?

A. Did you want me to talk about those text boxes or --

Q. It's a repetition of what you've already said.

A. It's a repetition.

Q. You get the same conclusion?

A. Yes.

Okay, this exhibit, again, is the same -- the red curve is the same as we've seen on the earlier exhibit that I've shown, gas recovery versus reservoir pressure. The red cross-hached area shows the current condition of the field -- not of the field, but this is the high-pressure -- high-productivity area, excuse me. We have made 797 BCF or 51 percent of the gas in place in the high-productivity area of NEBU. That correlates to a current pressure average in the high-productivity area of about 215 pounds.

If you look at the blue cross-hached area, that's the ultimate projection for those 75 wells, projected that we will recover 1077 BCF, or that 68 percent that I showed earlier, for the 75 wells in the high-productivity area. That would get you down to a pressure of about 110 pounds.

So the existing wells on 320-acre spacing recover all that are under the -- that's cross-hached.

Because of the complexity of this reservoir, it's very difficult to say how much additional recovery you would get from infill drilling. But if we assume that we could reduce pressure by only 20 more p.s.i. -- and that's that small sliver you see at the very bottom; it's not cross-hached -- because that red curve becomes asymptotic, only 20 pounds of additional pressure reduction would increase your recovery to 1155 BCF or an additional 78 BCF of gas just in the high-productivity area of NEBU. That would leave you with an ultimate recovery of 73 percent, which is not unreasonable in the high-productivity area.

Q. Let's turn to the conclusion slide and have you give us your conclusion.

A. A summary of my testimony. First of all, a major portion of the coalbed methane gas recovery occurs at low pressures. That was also stated by Mr. Close.

Devon has done everything we possibly can at this point to reduce the wellhead pressures of our existing wells in an attempt to maximize that recovery, and yet on 320-acre spacing we're going to leave 32 percent of the original gas in place behind, even with the optimization.

Geological correlations, production performance and pressure data have shown that additional gas can be recovered by infill drilling because of the heterogeneity of the reservoir.

The geological testimony has shown that 30 percent, or 30 to 50 percent, of the coal seams in NEBU are not connected.

The erratic recoveries we've shown also demonstrate the heterogeneity of the reservoir.

And finally, the pressure data measured shows differential depletion is occurring and the individual coal seams are not being efficiently drained.

Finally, infill drilling in the heterogeneous Fruitland Coal seams will enhance recovery efficiency, recover additional reserves and will prevent waste.

A small 20-p.s.i. reduction in just the high-productivity area of NEBU would recover an additional 78 BCF of coalbed methane gas.

MR. KELLAHIN: Madame Chair, that concludes my examination of Mr. Kump.

We move the introduction of his exhibits behind Exhibit Tab Number 10.

CHAIRMAN WROTENBERY: Okay, the exhibits behind Tab Number 10 are admitted into evidence.

Dr. Lee?

EXAMINATION

BY COMMISSIONER LEE:

Q. The individual reservoir, the abandonment, if you put a compressor there, what is the abandonment pressure?

A. If we go back to --

Q. No, don't go back to that, talk to me.

A. Well, I've shown in here, the exhibit, the average --

Q. You see --

A. -- will be 150 p.s.i. across the unit.

Q. Right. You see, the infill drilling will lower down your abandonment pressure. Who decided the abandonment pressure?

A. Well, 150 p.s.i. was calculated. That's the current abandonment pressure of the existing wells.

Q. Right, so you have the infill drilling that can lower that down?

A. That -- Because of the complexity, there's no way to calculate exactly how much pressure --

Q. But your argument is this: The infill drilling will lower down the abandonment; is that right?

A. Yes, because as I've shown earlier, many of the zones are not being efficiently drained. In one case --

Q. Suppose I have a well. I put a compressor, I suck it all out. Is abandonment pressure -- If you put an infill drilling, I suck the same thing, the pressure will be different?

A. It will be lower, because you're not effectively draining all the individual seams with the existing wells. You've got the heterogeneity, they're not well connected, you've got the faulting, like was shown in the earlier testimony.

Q. Oh, then we're talking about -- You are talking about this 160 is connected?

A. Hundred --

Q. This 320, they're all connected?
A. I'm sorry, I don't understand the question.
Q. If you have infill drilling, you are going to affect the other wells.
A. There will be --
Q. That's violating the --
A. There undoubtedly will be some acceleration. But the ultimate point is, you're going to recover additional reserves, and significant additional reserves, by infill drilling.
Q. Okay, but my argument is this: My argument is, this is so complicated, in some cases they may be connected to other cases, but for the most cases they don't connected to other cases. Then we need an infill drilling?
A. Correct.
Q. That's my suggestion, that's not your suggestion.
A. I thought that's what I was showing. I'm sorry if I didn't do it very well.
COMMISSIONER LEE: Well, anyway, it's pretty late. All right, thank you very much
THE WITNESS: Okay.

EXAMINATION

BY CHAIRMAN WROTENBERY:

Q. Mr. Kump, I had one question too. You had indicated that the gas content at initial original reservoir pressure was 593 standard cubic feet --

A. Yes.

Q. -- per ton? Where did that figure come from?

A. That's based on material balance, what I did on the total unit. For three years in a row, 1998, 1999 and 2000, we took approximately 25 of our producing wells and our pressure-observation wells and took pressures on each of those wells and plotted those on a map to a -- contoured those. Then I planimetered those contours within the unit boundary to get an average pressure at that point in time for each year.

Q. Okay.

A. Each of those three points I put on a material balance --

Q. Uh-huh.

A. -- which was shown earlier, a material-balance-type projection, to calculate gas in place, which was over 2 TCF -- this is the total unit now --

Q. Uh-huh.

A. -- and the slope of that curve gives you *in situ* Langmuir volume, which is used in your volumetric equation.

Q. Okay.

A. So it's *in situ*, it's not measured from cores; it's actual *in situ* data, measured from production performance.

CHAIRMAN WROTENBERY: Okay, thank you.

Any other questions?

Thank you very much for your testimony, Mr. Kump.

THE WITNESS: Thank you.

MR. KELLAHIN: May we have a short break so I can figure out what happens next?

CHAIRMAN WROTENBERY: Sounds good. Take about a five- or 10-minute break here.

(Thereupon, a recess was taken at 4:16 p.m.)

(The following proceedings had at 4:20 p.m.)

CHAIRMAN WROTENBERY: Okay, we'll go back on the record.

We've talked with counsel, and it appears that this would be a good stopping point for today. We will start back up at 9:00 a.m. tomorrow morning, and we hope to finish up tomorrow.

Thank you all very much.

(Thereupon, evening recess was taken at 4:21 p.m.)

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STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION FOR THE PURPOSE OF CONSIDERING:

APPLICATION OF THE FRUITLAND COALBED METHANE STUDY COMMITTEE FOR POOL ABOLISHMENT AND EXPANSION AND TO AMEND RULES 4 AND 7 OF THE SPECIAL RULES AND REGULATIONS FOR THE BASIN-FRUITLAND COAL GAS POOL FOR PURPOSES OF AMENDING WELL DENSITY REQUIREMENTS FOR COALBED METHANE WELLS, RIO ARRIBA, SAN JUAN, MCKINLEY AND SANDOVAL COUNTIES, NEW MEXICO

CASE NO. 12,888

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Oil Conservation Division

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING (Volume II, Wednesday, June 4th, 2003)

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

June 3rd-4th, 2003

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Commission, LORI WROTENBERY, Chairman, on Tuesday and Wednesday, June 3rd and 4th, 2003, at the New Mexico Energy, Minerals and Natural Resources Department, 1220 South Saint Francis Drive, Room 102, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

* * *

obtained are consistent with what we have been telling you will happen, and we believe his testimony will show that what will be obtained through infill drilling is not rate acceleration but, in fact, principally the production of incremental reserves.

CHAIRMAN WROTENBERY: Thank you.

VU DINH,

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

DIRECT EXAMINATION

BY MR. CARR:

Q. Would you state your name for the record, please?

A. My name is Vu Dinh.

Q. Mr. Dinh, where do you reside?

A. I reside in Fulshear, Texas.

Q. By whom are you employed?

A. BP America, Inc.

Q. And what is your position with BP America, Inc.?

A. I'm the reservoir engineer responsible for the San Juan Coal.

Q. Could you summarize your educational background for the Commission, please?

A. Yes, I have a bachelor degree in petroleum engineering in 1984 from Colorado School of Mines, and I also have a master in petroleum engineering from University of Texas at Austin in 1993.

Q. Could you review your employment history?

A. Yes, I have -- since graduation from the School of Mines have been working continuously with first of all ARCO and then Vastar, and subsequently BP, so I have approximately 19 years of experience.

Q. Did you testify as a reservoir engineer in the case in which infill drilling was approved in the State of Colorado in this particular reservoir?

A. Yes, I did.

Q. And you testified last summer in the hearing before Examiner Stogner?

A. Yes, I did.

Q. Have you made an engineering study of the Basin-Fruitland Coal Gas Pool?

A. Yes, I did.

Q. And are you prepared to share the results of that work with the New Mexico Oil Conservation Commission?

A. Yes.

MR. CARR: We tender Mr. Dinh as an expert witness in reservoir engineering.

CHAIRMAN WROTENBERY: And we accept Mr. Dinh's qualifications.

Q. (By Mr. Carr) Mr. Dinh, let's refer to the second page, I believe it is, in the tab -- behind Tab 13.

The top is entitled Colorado Infill Drilling Results. And as we start, before we go into this, could you show the Commission on the map exactly the area we're talking about?

A. Right. First of all, I'd like to point out the border between Colorado and New Mexico. The area I'm going to concentrate in is about a 20-section, right adjacent to the New Mexico border. So the data that we gather through the infill program here is directly applicable to what's going on to the south.

Q. And it extends into an area that would be comparable to the low-productivity, as well as the high-productivity area?

A. That's right, I will discuss the data that we gathered in the, quote, low-productivity area and also some in the high-productivity area also.

Q. And then as we move from that, you're going to present some material balance information on a couple of pairs of wells; is that right?

A. That is correct.

Q. And where are they located on this map?

A. They're located approximately right in this area here, just opposite of the high-productivity line in New Mexico.

Q. Close to the large orange dot on the --

A. That is correct, yes.

Q. All right. Let's go to this first slide, Colorado Infill Drilling Results. Would you review this for the Commission, please?

A. Yes. My intention is to present the actual data from the Colorado side. And I want to point out, the most important thing is that we did not see any detrimental interference with the parent well due to infill and that we were able -- we encountered a lot higher reservoir pressure at the infill well than at the parent well, which indicated that the parent well was not able to adequately recover reserves in the 320-acre unit.

And then I will show two -- or actually four material balance plots -- that would indicate that the infill gas reserves are mostly incremental, not rate acceleration, and then I expect to see similar infill results in New Mexico.

Q. Let's go to the next slide, Colorado/New Mexico Border Infill Coal Results.

A. What this graph shows is a time plot of production. The top red line here is the production from the 36 parent wells, and they were started in January of 1988. And then in the middle of 1998 we started the infill program, and we finished drilling 28 infill wells in about the middle of 1999.

What I'd like to point out is, one thing you need to look at is the trend of the parent well prior to the infill drilling which started in Colorado. Right after infill started what you see is, you don't see any detrimental effect, meaning the production didn't drop sharply as you produced more gas. In fact, what you're actually seeing is that the parent well response actually inclined higher once the infill was started.

One explanation for this was that what we're looking at is probably a beneficial interference in the sense that by putting in new infill wells, you help dewater the whole area and thus enable the gas to be recovered at a higher rate at the parent well.

So the next question is, is there any way that we can tell on this rate-time plot here whether all this production from the infill wells is incremental or purely rate acceleration, because on the rate plot here it's very hard to tell.

So to do that we need to examine some other data, for example, pressure data, that we gather.

Q. Let's go to the --

COMMISSIONER LEE: Can I ask you a question?

THE WITNESS: Yes.

COMMISSIONER LEE: Don't you think it's apparently -- they finish the dewatering process at the same time?

THE WITNESS: That is true. What we observe from Colorado is that the infill well initial rate is approximately two-thirds of what the parent well is. What's also interesting is that what we observe is that the infill well water rate normally comes in at the same rate as the parent well. So in answering your question, yes, it looks like there is interference in water production.

Now, keep in mind what Dr. Close was saying before, that all you need to do is produce just a little bit of water to really depressurize the pressure, the reservoir pressure. And that's probably what happened here, is that additional water production helped -- looks like it improved the production from the parent well.

Did I answer your question, sir?

COMMISSIONER LEE: (Nods)

THE WITNESS: Thank you.

Q. (By Mr. Carr) All right, let's go to the next slide, the Infill and Parent Well Initial Pressure information.

A. Now, you have heard testimony for the last two days about pressure, particularly layered pressure and composite pressure. What I'm showing here is not layered pressure. The only data we have gathered is composite data, pressure data. So keep that in mind.

But one thing I'd like to point out is, on the average, when you look at the sample wells right next to New Mexico, what you observe is that the infill pressure here is significantly higher than the parent well pressure at the same time. What that is saying is that the parent well is not being able to effectively draw down the reservoir pressure, hence not adequately recover gas from the 320-acre spacing unit.

The other thing I'd like to point out is that you can see a lot of pressure differential here. For example, in this well here the infill well practically came in at the original reservoir pressure. And then as -- This well is located in the low-productivity area, I'll show in the next map. But there are some wells, as you get closer to the high-productivity area, you start seeing pressure that is lower than the original reservoir pressure.

So to make this clear what I'd like to do is proceed to the next exhibit.

Q. Okay, let's go the Drainage Area vs. Highest Rate map.

A. All right, first of all I'd like to point out a couple things on this map here. This purple dashed line here is the Colorado-New Mexico border. What's outlined in green here is the current high-productivity-area line in New Mexico.

What is shown up here is the drainage -- ultimate drainage area for each of these wells as calculated from the modified material balance calculation.

Also overlaid on this map is the contour map of rates. So this blue, light blue right here, that's about a million cubic feet a day. Then the light yellow is 2 million, the dark yellow here is 3 million a day. So you practically can bring this high-productivity line up here into Colorado, following that border between the yellow and the dark yellow.

The other thing that I'd like to point out is that when you look at the drainage area here, what is highlighted is any drainage area that is greater -- or less than 320 acre, is highlighted in green. So the red circle here would show a drainage area of about 320 acres.

When you look at the low-productivity area over here where rate is less than a million a day, what you see is a drainage area as calculated from material balance, shows that most of these wells here are producing at less than 160-acre spacing. In fact, most of them are around 100 acres.

This corresponds to the pressure that we gather at the infill well. When you have low drainage area here, you would encounter higher reservoir pressure at the infill well. As you get closer to the fairway what you encounter as the drainage area is getting bigger, the pressure that you encounter at the infill well is now less than the original reservoir pressure.

Q. Now, you're going to present material-balance information on two pairs of wells?

A. Yes, sir.

Q. Where are those wells located on this map?

A. What I'd like to do is answer the most crucial question of this hearing, is, can you get incremental reserves out of high-productivity area? And what I'd like to do is show you data from four wells located right at that spot, Section 21 and 20.

Q. Okay, let's go to the first material balance plot, the material balance plot for the South Ute Well 21-2. That's in Section 21 of 32-9, right?

A. Yes. What I'd like to do is take some time to introduce to some of you who might not be familiar with a typical modified material balance plot, also known as a P/Z*. What we're plotting here is basically a pressure decline -- pressure function, reservoir pressure function, versus cumulative production on the X axis.

Now, we have seen testimony from Mr. Kump that he actually shows the reservoir pressure being curved as a function of the -- because of the Langmuir isotherm. What we have done here is modify the Z term here to account for that. So when we plot it up, you will see a linear trend between pressure decline versus cumulative gas production.

Now, once you get a linear forecast here, what you can do is extrapolate it out to an abandonment pressure. At this point, say it's 75 p.s.i. Now, you can read down and you can see that this well here, when you abandon the reservoir, we should recover about 3 -- close to 3 BCF of reserves.

Now, the question is, how can we tell whether that 3 -- nearly 3 BCF of reserves is going to be incremental or purely rate acceleration?

A couple points to keep in mind. When this well was drilled in March of 1999 we encountered an original pressure of 970 p.s.i.

Let's go to -- take a look at the parent well, offsetting this well.

Q. Now what you have here is, you have a material balance plot on the infill well; is that correct?

A. That is correct, yes.

Q. And that's where you have shown 3 BCF recovered by the well, and now what you're going to do is look at the parent well to see if, in fact, that 3 BCF is incremental or just a rate acceleration?

A. We're going to use the same kind of plot and see whether that 3 BCF that we're going to recover from this well, did we steal it from the parent well.

Q. All right.
A. Okay?
Q. Let's go to the next plot.
A. This is the material balance plot for the parent well in the same section, Section 21. What is shown here is shown here is, once again -- first of all, similar to the other plot, what's shown in this red line right here is the gas rate per month. So this well actually peaked -- the peak rate is about 5 million cubic feet a day. Definitely a high-productivity well.
And one thing to notice is that right here at April of 1999, this is when we drilled the infill well -- I'm sorry, March of 1999, right here.
One thing to note is that there is no deviation from the trend at all before and after the infill well was drilled in March of 1999. The well depletes on the same slope.
So what I'm saying is, the 3 BCF that you're going to recover from the infill well was not impacting this parent well at all. So the only conclusion, logical conclusion you can come up with is, all that 3 BCF is incremental reserves. We're not stealing gas from the parent well.
Q. Let's go to the next plot.
A. Same situation. This is the infill well in

Section 20 of 32-9. Once again, this well was drilled in December of 1999, and based on the pressure, production trend here, we can see that this well is going to recover approximately 3.5 BCF of gas at 75 p.s.i. abandonment pressure.

One thing to notice, when this well was first drilled, the reservoir pressure that was actually encountered was 531 p.s.i. So it is probably a third of what the original pressure is.

Based on this low reservoir pressure here, you would expect to see that this well probably has a large component of rate acceleration, because surely something has depleted pressure here, and it's got to be from the parent well.

So I'd like to go ahead and proceed to the parent well.

Q. Fine, go to the next material balance plot.

A. Once again, this is the material balance plot for the parent well. And what you see is, in approximately the same time that the infill well was drilled, which is in December of 1999, in April of 1999 we did obtain a reservoir pressure. Once again what you see is, there is no change in the production trend prior to when the infill well was drilled and after. What that's saying is, you are not -- that infill well is not stealing gas from the parent well, because if it does what you would see is a change in slope after the well was drilled.

Q. Let's go to the last exhibit in your material, the Infill Reserves vs. the Offset Gas Rate.

A. What I'm going to attempt to do right now is try to use the Colorado data and apply it to the New Mexico data. What's plotted here on the left side, on this graph, scatter plot, is basically -- on the X axis here, I'm plotting the offset gas rate from the parent well. And what's plotted on the Y axis is the ultimate infill recovery from the infill well.

What I'd like to do is point your attention to this area from, say, higher than 2 million a day, because that area there would qualify as a high-productivity area. Even in this -- I don't have a lot of data in the high-productivity area, but just from this sampling here it goes anywhere from 2 BCF to as high as 6 BCF. What I'd like to do is just use a very conservative estimate. For the high-productivity area you can expect, at minimum, 2 BCF incremental reserves per well.

Now, based on our drainage area calculations using composite data -- and you have testimony before how that could be misleading if you don't have the layered pressure data -- but still what we expect is, based on Colorado data, anything above, say, 4 to 5 million cubic feet a day, the well generally recover the 320-acre spacing.

So to apply the data to the New Mexico side, this is the distribution of the well rate in the high-productivity area in New Mexico. And what you see is about, oh, 50 percent of those wells produced less than 4 million a day. So the way I'm using the data is, there's approximately 400 wells in the high-productivity area. I assume that about 50 of those would require infill drilling, or about 194 wells. And at 2 BCF per well that gives me a conservative estimate as the potential price of infill drilling in the high-productivity area in New Mexico to be about 388 BCF.

Q. Could you review the conclusions that you've reached from your study of the reservoir?

A. Based on my conclusion, based on the data that I gathered from Colorado, what is shown is that infill drilling will have a beneficial effect on parent wells. Most of the well do require an additional well in the 320-acre spacing to adequately recover the reserve underground.

Q. And even though the numbers could change, depending on the type of pressure information that you might be using and the type of data you have, is it fair to say that there is no doubt about the conclusion, and that is that there are substantial incremental reserves to be recovered in the high-productivity area in New Mexico through infill drilling?

A. That is correct.

Q. Were the exhibits behind Tab 13 prepared by you?

A. Yes.

MR. CARR: At this time I'd move the admission into evidence of Mr. Dinh's exhibits, which are located behind Tab 13 in the exhibit book.

CHAIRMAN WROTENBERY: The exhibits behind Tab 13 are admitted into evidence.

MR. CARR: That concludes my direct examination of this witness.

CHAIRMAN WROTENBERY: Questions?

COMMISSIONER LEE: (Shakes head)

CHAIRMAN WROTENBERY: Thank you very much, Mr. Dinh.

THE WITNESS: Thank you.

MR. CARR: May it please the Commission, and on behalf of Mr. Kellahin, I'm prepared to pass this table to Mr. Hall.

CHAIRMAN WROTENBERY: Let me ask you one quick question. There was a Tab 15 with some supplemental exhibits in it. Did we -- I don't recall doing that.

DR. BALMER: Those are some supplemental exhibits that I had for the high-productivity area, the reservoir