STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:	)	
APPLICATION OF McKAY OIL CORPORATION TO AMEND THE SPECIAL RULES AND REGULATIONS FOR THE WEST PECOS SLOPE-ABO GAS POOL, CHAVES COUNTY, NEW MEXICO	)	CASE NO. 13,976

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: DAVID K. BROOKS, Jr., Hearing Examiner
WILLIAM V. JONES, Jr., Technical Examiner

August 23rd, 2007

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Division, DAVID K. BROOKS, Jr., Legal Examiner, WILLIAM V. JONES, Jr., Technical Examiner, on Thursday, August 23rd, 2007, 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.

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I N D E X

August 23rd, 2007
Examiner Hearing
CASE NO. 13,976

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A P P E A R A N C E S

FOR THE APPLICANT:

JAMES G. BRUCE
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P.O. Box 1056
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* * *

WHEREUPON, the following proceedings were had at 9:39 a.m.:

EXAMINER BROOKS: At this time we call Case Number 13,976, Application of McKay Oil Corporation to amend the special rules and regulations for the West Pecos Slope-Abo Gas Pool, Chaves County, New Mexico.

Call for appearances.

MR. BRUCE: Mr. Examiner, Jim Bruce of Santa Fe, representing the Applicant. I have three witnesses. I would ask that we take a short break; one of the witnesses wants to set up the PowerPoint.

EXAMINER BROOKS: Okay, shall we -- Let's have the witnesses sworn if they're present.

MR. BRUCE: They are.

EXAMINER BROOKS: We have a witness missing. We can swear them after the break.

Do you have all the witnesses present?

MR. BRUCE: Yes, I do.

EXAMINER BROOKS: Okay, would each of the witnesses stand and identify your -- state your name?

MR. SCHULTZ: My name is Jim Schultz.

MR. HORN: My name is John Horn.

MR. SANDERS: My name is Charles Sanders.

EXAMINER BROOKS: Swear the witnesses, please.

(Thereupon, the witnesses were sworn.)

EXAMINER BROOKS: Very good. We will take a 10-minute recess, and at the end of that time we will re-convene, and I will summon the Technical Examiner since I think his assistance may be needed in this case.

(Thereupon, a recess was taken at 9:42 a.m.)

(The following proceedings had at 10:00 a.m.)

EXAMINER BROOKS: Okay, we are ready to proceed, I believe. Let the record reflect that we are resuming consideration of Case Number 13,976, the Application of McKay Oil Corporation to amend the special rules and regulations for the West Pecos Slope-Abo Gas Pool, and that William Jones has joined us as a Technical Examiner.

You may proceed, Mr. Bruce.

MR. BRUCE: Mr. Examiner, first of all I've put before you some exhibits. Exhibit 1 contains hard copies of the PowerPoint presentation, and what is on the wall right now is one of those exhibits.

Our first witness, Mr. Schultz, will be testifying from Exhibits 2 through 8.

JAMES L. SCHULTZ,

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

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Mr. Schultz, could you please state your full

name for the record?

A. My full name is James Lynn Schultz.

Q. And where do you reside?

A. Out of Roswell, New Mexico.

Q. What is your profession?

A. I'm an independent petroleum landman.

Q. And what is your relationship to the McKay Oil Corporation in this case?

A. I'm a contract landman.

Q. Have you previously testified before the Division?

A. Yes, I have.

Q. And were your credentials as an expert petroleum landman accepted as a matter of record?

A. Yes, they were.

Q. And are you familiar with land matters involved in the West Pecos Slope-Abo Gas Pool?

A. Yes, I am.

MR. BRUCE: Mr. Examiner, I'd tender Mr. Schultz as an expert petroleum landman.

EXAMINER BROOKS: He is so qualified.

Q. (By Mr. Bruce) Mr. Schultz, what is Exhibit 2?

A. Exhibit 2 is a list of the lands within the Pecos Slope-Abo West area.

Q. The plat on the wall, what does that reflect?

A. That reflects the acreage that is controlled by McKay Oil Corporation within the Pecos Slope-Abo West area.

Q. And what we're focusing on here with the McKay acreage is primarily the northern part of the West Pecos --

A. Yes.

Q. What is Exhibit 3?

A. Exhibit 3 is the pooling order which established the rules and regulations for the West Pecos Slope-Abo.

Q. This is a gas pool. What is the well spacing?

A. The well spacing is two wells per 160, being no closer than 660 from an outside boundary line and 10 from an inside boundary line.

Q. And in this case what is McKay seeking? And I refer you to Exhibit 4.

A. McKay is requesting that four wells be allowed per each proration unit, or 160 quarter section, whether they are vertical or horizontal wells. They are also requesting that the wells be located no closer than 330 feet from a section line and 10 feet from a quarter quarter section line, of course subject to the Division provisions, Rule 111, which deals with horizontal wells.

It's also asking for an administrative procedure for exceptions to the drilling density provision of the amended pool rules, and also a buffer zone within the amended pool rules which will allow a quarter -- will not

apply to a quarter section adjoining any Division-designated Abo gas pool.

Q. Now with respect to the four wells per well unit, four wells per quarter section, does McKay request that -- I don't know if I should say this in the negative. McKay is not requesting that it be one well per quarter quarter section --

A. No.

Q. -- is that correct?

A. No, it's just four wells within a proration unit.

Q. Even if there could be two or three wells on the same quarter quarter section?

A. Yes.

Q. And McKay does have technical witnesses who will discuss the drainage and other reasons for this, will it not?

A. Yes.

Q. Secondly, item (c), the administrative procedure. Does McKay envision that there may be instances or opportunities where more than four wells might be allowed per -- might be desired per quarter section?

A. Yes, on a case-by-case basis.

Q. Okay. What is Exhibit 5?

A. Exhibit 5 is a list of the other operators within the Pecos Slope-Abo West area.

Q. And so this is a rather large pool, but there are very few operators?

A. Yes.

Q. Now one of them that you had listed was Mercury Exploration Company. Do they still own interest in the pool?

A. No, they had one well called M&M Well, and they sold it back in 2002 to Pecos Production Company, which is part of Pecos River Operating, Inc.

Q. Okay. So the Mercury Exploration interest is now owned by Pecos Operating?

A. Yes.

Q. Have you had contacts with the other operators in the pool?

A. Yes, I have.

Q. Do any of them object at this point to the Application?

A. In talking with the other operators, MEW has signed a letter of ratification or consent to the new pool rules that we've applied for, and the same thing with Pecos River Operating Company, has also provided us a letter of support for the proposed rule changes.

Q. Okay.

A. And then I also have talked with representatives of Yates Petroleum, and they told me that they were not

going to object to our request.

Q. Okay. But they did not sign a letter?

A. No.

Q. And finally, notice was given to the interest owners of -- or I should say the other operators of this hearing, was it not?

A. Yes, it was.

MR. BRUCE: And Mr. Examiner, Exhibit 8 is the affidavit of notice. I will note that on the last page I did not receive the green card back yet from Pecos River Operating. However, they did sign a letter stating they did not object to the Application.

EXAMINER BROOKS: Okay, is that letter in the record, in evidence?

MR. BRUCE: Yes, it's the second page of Exhibit 7.

EXAMINER BROOKS: Thanks.

Q. (By Mr. Bruce) Mr. Schultz, as part of your duties on behalf of McKay and other operators, have you had to deal with obtaining surface locations and other matters related to the drilling of a well?

A. I've probably staked and permitted around 400, 450 wells, both federal, state and fee.

Q. And over the years, over more recent years, has it been more difficult to obtain surface locations in

southeast New Mexico?

A. Yes, it has.

Q. And what are the two main reasons for problems with obtaining surface locations?

A. There's problems with topography, being within floodplain areas and things like that, drainage areas, and also archaeology. In this particular area in the West Pecos Slope-Abo, archaeology is seen as being prevalent because of the different arroyos that run through there, and I guess Native Americans used to sit up on these little hills overlooking these little arroyos and would actually make tools and things, so they left sites there, and they're quite numerous in this area.

And then a third thing most recently which has come about, which I guess has slowed down the process of getting locations is the new New Mexico Surface Owners Protection Act.

Q. Okay. Now on the wall is a plat, and Mr. Horn will go into this in more -- will also discuss this. But as part of the plans for further development of this pool, does McKay propose to use a single drillpad to drill several wells?

A. Yes, they've actually staked and want to apply for multiple wells off a single wellpad.

Q. And is the plat on the wall a reflection of one

of those proposals?

A. Yes.

Q. And some of these wells, as the next witness will discuss, will be horizontal wells, will they not?

A. Yes.

Q. By using one wellpad for several wells, will that minimize the surface impact of the wells being drilled in the Pecos Slope?

A. Yes, it will.

Q. In your opinion, will the -- Oh, and I might say, in that Section 35 and Section 34, does that reflect numerous arroyos and other relief which would limit well location out in this area?

A. Yes, it does.

Q. In your opinion, is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes, it is.

Q. And were Exhibits 2 through 8 either prepared by you, under your supervision, or compiled from company business records?

A. Yes, they were.

MR. BRUCE: Mr. Examiner, I'd move the admission of Exhibits 2 through 8.

EXAMINER BROOKS: 2 through 8 are admitted.

MR. BRUCE: I have no further questions of the witness.

EXAMINER BROOKS: I don't believe I have any questions of this witness.

Do you have any, Mr. Jones?

EXAMINATION

BY EXAMINER JONES:

Q. The multiple wells from a single pad, would you intend to deviate those wells to different bottomhole locations?

A. Yes, depending on their geology, it would pick and choose which directions would, I guess, attempt to increase their overall pay or the reserves they would encounter in going those directions, and I'll let Mr. Horn go into that area.

EXAMINER BROOKS: I guess I do have a question.

EXAMINATION

BY EXAMINER BROOKS:

Q. You understand that -- What I understand you're asking for in this is that you can have four wells per spacing unit, and they can be located anywhere in the spacing unit, correct?

A. Yes, sir.

Q. And you would understand that unless otherwise specified in the Rules, the Division would interpret a

horizontal well as being located in each spacing unit in which that well was perforated or in which it was open, regardless of -- even though it penetrated several different units?

A. Yes, sir, I do. And I think there's certain other areas where you're looking at this, that you may have to go into a project area, as opposed to just looking at a set proration unit, being a standard quarter section, in order to completely drain the reserves that are available out there.

EXAMINER BROOKS: Right.

Did you have any further questions?

EXAMINER JONES: I did, actually.

EXAMINER BROOKS: Go ahead.

EXAMINER JONES: Do you know of any other Division or Commission Rules that are similar to this as far as number of wells per spacing unit, but not allocating them to each quarter? So is this a precedent-setting thing?

MR. BRUCE: Mr. Examiner, to a certain extent yes, although with horizontal drilling I suppose you're -- perhaps like the Parallel Petroleum cases, where they're having -- the one that was dismissed today, where they're having two horizontal wells on a well unit. That at time might kind of be the same, although that's a different

situation with a different spacing.

But yes, I do not know of any.

EXAMINER BROOKS: Okay, thank you.

MR. BRUCE: Call Mr. Horn to the stand.

JOHN HORN,

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

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Would you please state your name and city of residence for the record?

A. My name is John Corbett Horn. City of residence would be Littleton, Colorado.

Q. And who do you work for and in what capacity?

A. I'm the owner of a geological consulting group, Orion International, Ltd.

Q. Okay. And what is your profession by trade?

A. Profession by trade is geologist.

Q. In these exhibits not only McKay Oil is mentioned but Rock Resources, LLC. What is your relationship to those entities?

A. I'm a consultant to Rock Resources, who provides technical assistance to McKay Oil, the operator of the McKay Oil properties.

Q. Have you previously testified before the

Division?

A. No, I have not. I have testified before other states' divisions, but not New Mexico.

Q. Would you please summarize your educational and employment background for the Examiner?

A. I have a bachelor's, master's, and a PhD in geology. I've taught at the University of South Carolina and the Colorado School of Mines, have started and run a consulting company, geological consulting company called RPI International, then worked -- started a geological consulting branch for Interra Information Technologies as well as for Norwest Quest Engineering to provide geological input into reservoir analysis and engineering simulations of reservoirs.

Q. And as a result of that did you also become familiar with basic reservoir engineering matters?

A. Yes, I have built reservoir models, geologic models, for reservoir simulations virtually most places of the world, from the North Sea to Bolivia to several Canadian and US reservoir properties.

Q. And for Rock Resources and McKay Oil, did you perform a geological evaluation of the West Pecos Slope-Abo Gas Pool?

A. I have prepared a geological evaluation -- it is still an ongoing evaluation, a long-term ongoing evaluation

-- to compare geologic properties to engineering properties to try to define the controls on gas distribution within the Abo formation.

Q. And are you familiar with the geologic matters related to this Application?

A. Yes, I am.

MR. BRUCE: Mr. Examiner, I'd tender Mr. Horn as an expert petroleum geologist.

EXAMINER BROOKS: He is so qualified.

Q. (By Mr. Bruce) Mr. Horn, if you could go back to the top of your presentation and perhaps start off with the objectives that McKay Oil seeks as a result of this pool rules hearing.

A. Yes, today in the PowerPoint that I've prepared for the hearing today, essentially I'm trying to address two main issues, of which there's a third related issue that needs to be brought in.

One is the spacing -- well spacing within the Abo field and trying to determine the most efficient well spacing to increase the efficiency of gas gathering in the field.

Related to that is looking at horizontal wells versus the vertical well spacing within the field. To do that, we will look at the drainage areas. What are the present drainage areas associated with the cumulative

production in the field, as well as the estimated ultimate recovery of the gas from different wells in the field, and looking at what that drainage area will be.

The second issue which I think is one that we've already mentioned is the mitigation of surface disruption and discussing these deviated well locations as we go through here.

And as Jim Schultz mentioned, the importance of using the limited surface opportunities that are available in some of the areas where we have topography problems and/or archaeological problems, to try to maximize the gas recovery in those areas but minimize the surface damage done, both from the standpoint of drilling off of single wellpads but also reducing the amount of gathering destruction by putting in gathering systems that -- increasing the efficiency of gathering systems.

And then finally, just what has -- are the McKay Oil and Rock Resources groups doing to develop the future potential of the Pecos West field?

Q. Okay, why don't you move on briefly to your next couple of frames and just discuss the gas in place and drainage calculations?

A. Yes, to understand what I've done in here, there are two basic formulas that are basic engineering formulas that come out of the *Petroleum Handbook* published by the

Society of Professional Engineers.

One is to try to define the original gas in place. And to do that simple formula, the EUR is over the recovery factor, and the recovery factor from that *Handbook* for the Abo is given as 65 percent, is the average recovery factor. And so I used that number, which actually boosts the original gas in place in there.

The estimated ultimate recovery, I -- instead of doing the decline-curve analysis that would be the most standard engineering approach in this case -- and where we are in most of the production curves in these fields, we're down to about a 2-percent per year decline.

What I did was, I extended the production, took the last year's production, extended it out flat for 10 years. That's more -- that gives us a higher estimated ultimate recovery than you would get from a normal decline curve analysis. I did that, one, to be conservative in the estimates that end up in what the ultimate drainage area would be. I also did that to take into account some of the things that are being done in the field itself to enhance recovery in existing wells and try to take that into account in this manner.

Prodn curves

The second was to try to come up with the area of drainage, the ultimate area of drainage in there. There is the original gas-in-place calculation that I showed you how

we gathered that from the previous formula.

Also the formation volume factor, which is based on the depth and the pressures of the reservoir, and I used .016 again as a number that's directly out of the charts in the *Petroleum Handbook*.

The porosity in percentages of 100 are measured off of the logs of the individual wells that were examined to come up with these drainage areas.

The height of the pay is the net pay thickness of gas crossover, again from the logs of the individual wells.

The water saturations, the average use for the Abo is 35 percent. Although in this area we produce little water, I went ahead and used that 35-percent number since that was an established number based on a large number of analyses.

Q. Would that also give you a conservative estimate?

A. It gives you a conservative estimate of the estimated ultimate.

Q. Go ahead, Mr. Horn. Oh, one thing, Mr. Horn. As you're going through this, if the Examiners have any questions on a particular exhibit, would you ask that they ask those questions at this time?

A. Yeah, I believe that whenever a question comes up it's better to ask it at that time, so don't feel that you're going to make me upset by interrupting, that's fine.

I think it gives a better give and take, if you have questions as they come up.

EXAMINER BROOKS: Well, if you prefer that, Mr. Horn and Mr. Bruce, I will do so. I'm not an engineer, Mr. Jones is. I'll have to start with the very basic things to be sure I understand where you're going.

I understand the slide with the G equals EUR over RF --

THE WITNESS: Right.

EXAMINER BROOKS: -- I think that's fairly transparent. But I'm going to have to go through these.

Now what is the ultimate purpose -- what factor are you solving for with these equations?

THE WITNESS: The ultimate goal is to determine what will be the maximum area of drainage of an individual well.

EXAMINER BROOKS: So A is the factor you're solving for --

THE WITNESS: Yes.

EXAMINER BROOKS: -- in these equations?

All right, G is the gas in place. That's what you've computed on the previous slide?

THE WITNESS: That's correct.

EXAMINER BROOKS: And 43,560 is the number of acres per square mile?

MR. BRUCE: Number of square feet per acre.

THE WITNESS: Number of square feet per acre.

EXAMINER BROOKS: Square feet per acre --

THE WITNESS: Yes.

EXAMINER BROOKS: -- I'm sorry. Of course, acres per square mile is 640. That's the number of square feet per acre. I'm even more ignorant than I thought I was.

So A is the factor you're solving for.

THE WITNESS: That's correct.

EXAMINER BROOKS: H is the net pay, and you determined that by averaging from the wells that you had logs on?

THE WITNESS: No, actually I did it on an individual well basis, using the logs on those individual wells of where you had gas crossover and good porosity in the well, to calculate the height of the pay within there.

EXAMINER BROOKS: So you're going to have a different -- you're going to have an individual area of drainage for each well, as opposed to an average area of drainage --

THE WITNESS: That's correct.

EXAMINER BROOKS: -- for the entire field?

THE WITNESS: That's correct.

EXAMINER BROOKS: Okay. And what is this Greek symbol? I didn't --

THE WITNESS: That's the porosity symbol.

EXAMINER BROOKS: Okay, that's what it means, but --

THE WITNESS: It's feet, is the symbol.

EXAMINER BROOKS: Okay, and that is -- that's the porosity, which is a percentage?

THE WITNESS: Yes.

EXAMINER BROOKS: And S_w is the water saturation, so 1 minus S_w is the percentage that's not water saturated --

THE WITNESS: That's correct.

EXAMINER BROOKS: -- correct? So what you're -- here you're calculating the volume of the reservoir that is pore space and not water saturated?

THE WITNESS: That's correct.

EXAMINER BROOKS: That's what's above the line?

THE WITNESS: Yes.

EXAMINER BROOKS: Okay, what is the B_{gi}?

THE WITNESS: That's the compressibility of the gases, and that's related to the depth and the pressure.

EXAMINER BROOKS: Okay, can you explain that a little bit more in lay terms?

THE WITNESS: There are a series of charts that have been developed that show how -- the relationship between depth of burial and compressibility of the gas.

The pressure on the gas as you bury it -- At surface it's 14.7 pounds --

EXAMINER BROOKS: Right.

THE WITNESS: -- and the further you bury it, the higher the pressure gets and the more the gas is compressed down.

EXAMINER BROOKS: Okay. So this factor is intended to adjust that to show the volume of space occupied by a given quantity of gas at a particular pressure --

THE WITNESS: Yes.

EXAMINER BROOKS: -- and at a particular depth?

THE WITNESS: Yes.

EXAMINER BROOKS: Okay. And is that specific for this formation, or is that a generic --

THE WITNESS: That's specific for this formation and this depth.

EXAMINER BROOKS: Okay. So then the lower formula is the upper formula solved out -- re-expressed to solve for A?

THE WITNESS: Yes.

EXAMINER BROOKS: Okay, I think I understand it. I'll let you go on.

THE WITNESS: Okay.

EXAMINER BROOKS: Unless Mr. Jones has some

questions on this, and it's all basic for him to have questions.

EXAMINER JONES: Actually not, I was going to ask Mr. Horn real quickly --

EXAMINER BROOKS: Please do.

EXAMINER JONES: -- you still -- you started RPI; is that right?

THE WITNESS: Yes.

EXAMINER JONES: Do you still own it?

THE WITNESS: I still own the studies, yes.

EXAMINER JONES: Okay. Well, I don't want to pry, but do you know Dr. Crafton, then? RPI International, we're talking about?

THE WITNESS: Yes.

EXAMINER JONES: Yeah, I'm familiar with his work, Colorado School of Mines --

THE WITNESS: Uh-huh.

EXAMINER JONES: -- on the -- and anyway, I guess specifically, the 65 percent for the Abo, is that -- for the recovery factor, is that -- is that -- did you talk to any other professionals with these other companies in this field to see if they like that number also?

THE WITNESS: No, I didn't. I got that out of the calculations for all the Abo reservoirs in the southeastern New Mexico area.

EXAMINER JONES: Okay. But a lot of them are not as tight as this, right?

THE WITNESS: That's correct. So if anything, this is a fairly high recovery factor.

EXAMINER JONES: Okay.

THE WITNESS: And the effect of that is that it gives you more gas in place.

EXAMINER JONES: Okay, thanks a lot.

THE WITNESS: This is -- we've discussed this -- or Jim Schultz discussed this before and I don't necessarily need to go any further into it, just showing the acreage position that McKay Oil has in the Pecos West-Abo field.

Putting it into a more general context, this western acreage is shown up here in the northwest part of here. This is a structure map, originally created by Broadhead from New Mexico Tech in 1993, and he showed a general structure of structural dips from west to east through the field, getting deeper to the eastern part of the acreage position.

To focus in on that and come back again to that west Abo acreage, you're north of the faults in there. You have a gentle dip to the east. We're looking on the order of about 100 feet per mile, which is about a degree of dip. 94 feet per mile is a degree of dip in there. So very

gently dipping structural position from the standpoint of the acreage in that western area.

One of the real problems in dealing with this McKay acreage has been the lack of rock information. It's already apparent, I've had to go outside the area to start to bring in the parameters of the Abo sands. And one of the first things that was done was to drill a corehole here -- that was one of the first coreholes in this area -- to try to get more detailed rock information.

And here's just an example of one of the Abo sandstones. It doesn't show in this lighting very well, but it's a very fine-grained sandstone. The lower part of the sandstone has bedding in it, suggesting fairly high-energy conditions. As you come up through the sandstone you start to pick up burrows.

But probably the most important thing that really stood out when we looked at these cores was that the sandstone itself -- and the bottom of that sandstone is down at the bottom of this particular figure -- was how red the sandstones were and how much iron was in the sandstones.

And when you start to go back through how the completions were treated in this area, that was never even considered because people didn't realize that there was a lot of iron in the sandstones. And as a result, they would

go in and they would apply acids that -- and they had some iron problems.

And subsequent to cutting this core we went back and started to look at some of the perforations and found a lot of iron oxides in there that were clogging perforations and preventing some production of gas in there because of the clogging of the perforations.

The other thing we saw was the quality of the seals. Here in this particular core you can see the shales. The shales are very tight and provide very excellent seals between the sands in here. So in many cases one of the things they did was go in and do very broad-interval fracs, and that created problems because most of the frac fluids would go to the zones that could take it the easiest. And so even though there was gas in other zones, they may not have actually produced that gas.

So it was kind of an eye-opener to see what had been missed, largely because of the lack of rock data.

Q. (By Mr. Bruce) So that enabled you to look at what problems there may be and help devise a program to overcome those problems?

A. That's correct, and in the -- As you'll see later on in the presentation, that helped us to start to develop strategies of how to improve production in the field, which is one of the reasons why I went to that flat EUR for the

last 10 years, to try to come up with, hopefully, a more realistic number that will actually produce more out of individual wells.

When we start comparing porosity to permeability -- and this is out of that core -- the thing that really stands out is that we're dealing with very low permeabilities. And in fact, when I show you a summary of the rock properties for the Abo, we're really at the lower end of the permeabilities that we looked at in here. And very few of the permeabilities actually get much above a tenth of a millidarcy in here.

Q. Mr. Horn, the footage figures up in the upper left, what do they reflect?

A. Those are the footages of the different sands that were cut in the core. And you can see the diamond, blue-colored sands. That's where a lot of the better permeabilities are -- if you can call them better; they're less than a millidarcy in there -- but also some of the better porosities are out of that sand.

Now this is a summary of the Abo sandstone parameters. The depths come off of the structure maps.

The range of pay thickness is directly off the individual logs. This is a summary of all the individual logs, so the pay thickness ranges from four to 35 feet, with an average of 22 feet.

In doing the calculations for the drainage areas, obviously you have to use the individual wells in there.

The ranges of porosities again are also calculated off of the individual logs, and those porosities are done on individual wells, and again that helps cause some of the variation you see in the drainage areas. The average porosity is 15 percent.

And again, I had to go outside the area to come up with the permeabilities. And many of these are calculated permeabilities, but we saw a range of from .1 millidarcy to 5 millidarcies, with an average of 2.3. And those, as you could see from the core, are probably kind of optimistic. But that -- being optimistic means that when I calculated the drainage areas on the estimated ultimate drainage areas, that actually I was suggesting it was draining a larger area than in fact it probably is.

Water saturations range from zero to 40 percent. We used an average of 35 percent.

Another factor that we'll get into is, the horizontal wells -- and I kind of threw this slide in here to just give a brief feel for what you're completing in a vertical well, you're completing the sand right around that vertical well, whereas in a horizontal well you're completing the length of the horizontal, and so you have much longer contact of the wellbore in the sandstone, the

reservoir sandstone, in the horizontal well.

Q. Go back to that --

A. Yeah.

Q. -- exhibit for a minute. Just for informational purposes, the bend in the horizontal well, approximately what is the distance of that bend?

A. The distance from the vertical to the horizontal where you're going to complete the well in part depends on the rate of build of your curve out to your horizontal. But in the west Abo play it ranges from 600 feet to 700 feet away from the vertical wellbore or the surface location.

EXAMINER BROOKS: That's a lateral distance --

THE WITNESS: Yes --

EXAMINER BROOKS: -- in your curve?

THE WITNESS: -- yes.

Q. (By Mr. Bruce) Go ahead, Mr. Horn.

A. And you can see again, when you are drilling at a horizontal you have that build in there, and you don't really complete the horizontal leg until you get out into the reservoir itself, and then you do a series of stage fracs at drilling breaks in there, and you can use smaller-size fracs because you don't want to frac out a zone in there, whereas in a vertical well you get into the reservoir and you try to get maximum frac lengths to try to

encompass a large area of the reservoir.

The other thing about the Abo is that it's a multiple-pay reservoir. There are several different sand intervals. As we saw in that core, there were at least three different sandstone intervals in that cored zone of the Abo.

Here's another example from the South Four Mile Draw Well where we have three main intervals in the Abo. Originally the idea was that people would go in and do a broad interval frac in there and frac the whole thing. One of the things that we'll see is, we're coming back and doing limited-entry re-fracs in this area.

Where we do have multiples and we still want to do horizontals, we always have the capability of coming back and doing multi-laterals out of a single wellbore.

And when we look at a regional cross-section across that west Abo acreage, we can see that even though you can be the structurally highest point in there, you have no reservoir-quality sands. Where you have gas crossover is shown here in the pink.

But you can see the lateral continuity of the sands in here is very irregular. And so the sandstone intervals that you penetrate in one well will be different than the sandstone intervals you penetrate in a well right next door to it.

lack of continuity

So it becomes imperative to understand how to go in and complete these sandstones. As I mentioned, this is a good example of where they've done these large, broad-interval fracs in here, and sometimes with good success but sometimes not with such great success. We have very -- you can see here, the very gentle dips from west to east across the acreage.

This is the -- a map of the total gas sandstones or gas-charges sandstones in the Abo in that Pecos west area. And in this particular diagram -- or map, isopach map, we can also see the drainage areas of the individual wells. You can see some have very excellent areas of drainage, others have very poor areas of drainage, and part of that is due to the sandstone quality. But the thing that really stands out in here is that two wells per 160 acres is not adequately draining the Abo gas reservoir in this West Pecos field area.

Now we're going to focus on two areas here and look at it in more detail. One is up in here to look at the effect of horizontal wells, and then down here in the south in the Cactus Federal area to look at the potential of doing these S-location wells.

EXAMINER BROOKS: Okay, now you said you could see the drainage areas of individual wells on here. How are they depicted?

Present spacing not adequate

THE WITNESS: They're depicted by these pink areas surrounding the wells. And at this scale it's hard to tell the details of that. The next slide is going to come in and focus in on that northern area, right in here, so you can see that in a little more detail.

Here's the example of that northern area with the two horizontals that have been drilled in here, and the -- here you have a case of 160 acres where you have two wells in there that are not very adequately draining that area in there.

Q. (By Mr. Bruce) And you're looking at Section 22, correct?

A. Yes. And in Section 15 and 22 here, the inner circle that you see surrounding the wells -- the inner circle is the drainage at this point in time, based on the cumulative production from that well. It's the area that's been drained at this point in time.

By calculating the estimated ultimate recovery for that well, the outer area is the ultimate drainage area. Some of the wells are very near to what they're going to drain, based on the rock characteristics of that well. Other wells, such as this well which has fairly little cum, ultimately is going to drain a much larger area in there. A little better quality sand.

Q. And again, when you made your calculations,

because of the -- certain figures you used for permeability, et cetera, water saturation, in your estimation the drainage that you put forth on this map would probably be actually smaller than what is represented on this plat?

A. It's more conservative than what probably is the case. Actually, the drainage area would start to pull in, because the permeability is actually quite a bit lower, based on our core information.

Q. And as a result, as you stated, two wells per 160 just aren't adequately developing this field?

A. That's correct.

Q. And another matter, does this data also support the request to have a 330-foot setback rather than the current 660-foot setback from the quarter-section line?

Data supports 330 setback

A. Yes, it does.

Q. Go ahead.

A. And another important factor here that we've talked about -- or talked about in the objectives, was the effect of horizontal wells in here. And one of the requests that had been made to produce the horizontal well in Section 22 was to shut down the other two wells in that two-wells-per-160-acre area, and yet there will be no overlap and no drainage interference between those existing wells and where those horizontal wells are, even at their

estimated ultimate recoveries.

And so I think this particular slide shows two things. One is the fact -- the effect that the horizontal wells aren't going to interfere -- the existing horizontal wells aren't going to interfere with the drainage of the surrounding vertical wells. And the second thing I think it shows fairly well is that the vertical wells of two wells per 160 acres are not adequately draining the reservoir, we don't have a very good efficiency of recovery in the reservoir as it stands right now with those two wells per 160 acres.

Just to illustrate that a different way is -- adds on the thickness of the sands that are encountered in those wells, and again we can see -- the attempt is to place the horizontal wells where we're going to encounter and can drill into the thickest reservoir in the area. And if we take that northern area here, one of the things that we do prior to the drilling is put together a wellbore design to try to figure out where we're going to be encountering the reservoir.

And also an important point is the fact that you don't get into your reservoir sandstone until you're between 600 and 700 feet away from the vertical surface location of the well.

The second area is to move south down to the

Cactus Federal area, where we have the high topography. One of the things we want to do is be able to capture the gas from the main Abo sandstone reservoir in that are, but minimize the surface damage because of the topography and the archaeological problems in that area.

The next two slides give a feel for that area. The blue line in here -- ultimately I'll show you a cross-section through three existing wells that give you a feel for the sandstones that we will be drilling for in that area. What you see here is the Tanner -- the Tanner fee surface location, with the idea of drilling a number of S locations out from there to try to capture the gas, plus one horizontal, and again to try to stay away from any interference for any already-existing vertical well.

This is the drainage area of the Tanner fee well right now, but we will be going vertical over in these areas here, so we will be well away from the drainage area of that surface pad in there.

And we showed you this example when Jim Schultz was talking about why we're looking at these already-existing pads and already-permitted surface locations. We have to permit these other locations out here, but we can drill them off of here. We already have an existing pipeline to that well -- that pad, and so we could be bringing that gas to that single pad without having to

build additional pipeline and causing further disruption at the surface.

So we're trying to mitigate the surface damage in parts of the field where there are concerns from the standpoint of archaeology or surface topography.

And this is just a little diagram to help you visualize the three dimensions, what we're discussing, and we'll be using these deviated holes, but not encountering the sandstone until we get back to a vertical. That's why it's called S, because you start vertical, go out at an angle, and then come back down vertical. And also show the single horizontal that will come out of that.

Now we can monitor each well individually. We'll have separate gas-metering systems so that from the standpoint of figuring who's owed what money for each well, you'll have a separate meter for each well at that location there. So that's not going to be a problem.

And this is that cross-section I mentioned, showing from northwest to southeast, the fact that you have a very thick gas chart sandstone in that area. And with the surface topography problems plus the archeological problems, we wouldn't really have a good way to capture all that gas without doing this type of an approach.

Just a couple of sundry slides, I'm about finished here.

In the McKay acreage in the Abo area there are 162 wells that have been completed. 149 are on line. 13 of those wells are in the eastern acreage and not in this western acreage, so that number goes down to 149 wells that have been completed and 136 in the western acreage.

There's already over 80 miles of pipeline with two compressors and six boosters in the area. We're trying to minimize the amount of more surface disruption as we drill more wells in there by using these lower surface areas.

From what we've found so far, we've been repairing and increasing the efficiency of the gathering system. We found that we could go in and clean some of the perforations and increase production.

We've been in the process of starting to recomplete under-performing wells where we've done these broad-interval fracs in the past, and come back and do limited-entry fracs.

They're in a drilling program at the present time to improve gas recovery.

And one of the things we're requesting today is to increase to four wells per 160 acres, to increase the efficiency in the gas recovery.

From a completion standpoint we've found that the limited-entry fracs in the multiple-sandstone reservoirs

are more efficient in improving production.

We're going back in and re-frac'ing some of those intervals that were bypassed in the past.

We're doing staged fracs along the horizontal legs, when we get to that.

And then ultimately we probably will come back to you and talk about drilling parallel horizontals and then coming back and doing simultaneous stage fracs of those horizontal legs to try to get cross-linking between there. But that's for the future.

EXAMINER BROOKS: Okay, what do you mean by limited-entry fracs?

THE WITNESS: Okay, instead of going in and perforating and frac'ing a real broad interval across three or four sands at one time, limited entry you set a series of bridge plugs, and you start with your lowest porous sand, do a limited entry into that sand, frac that, get that producing, then go to the next one and go to the next one, each one individually, instead of a big, broad interval all at once.

EXAMINER BROOKS: Okay, and what do you mean by staged fracs?

THE WITNESS: Staged fracs, you're going in -- when you're drilling your horizontals, oftentimes you'll get drilling breaks where you'll get kicks. And so what

you do is, you set -- essentially doing the same thing, you're setting a bridge plug and you're staging a frac along one drilling break. Then you come and do the next one, and so on.

EXAMINER BROOKS: And that's what you've got illustrated back here on some of these cartoons?

THE WITNESS: Yes, that's correct.

EXAMINER BROOKS: Okay, go ahead.

Q. (By Mr. Bruce) And what are your conclusions, Mr. Horn?

A. Essentially what we've found is that the two wells per 160 acres do not adequately drain the gas in the Abo reservoir, so we're requesting an increase to four wells per 160 acres that would more efficiently recover the gas from the Abo sandstone reservoirs, and we're looking at doing multiple wells from a single pad to reduce surface disturbance.

Q. In your opinion is the increased density requested by McKay Oil Essential to the further development of this pool?

A. I think it's very important to the further development, to more efficiently recover the gas from the Abo sandstone reservoirs.

Q. Was Exhibit 1 the presentation prepared by you?

A. Yes, it is.

Q. And in your opinion is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes, it is.

MR. BRUCE: Mr. Examiner, I'd move the admission of McKay Exhibit 1.

EXAMINER BROOKS: Exhibit 1 is admitted.

MR. BRUCE: I have no further questions of the witness.

EXAMINER BROOKS: Okay. Well, I -- the questions that I have asked cover most of the concerns that I have at this point. I think I'll turn it over to Mr. Jones.

EXAMINATION

BY EXAMINER JONES:

Q. Dr. Horn, the -- what was the original pressure in the Abo reservoir, and how has it changed over the years?

A. Strangely enough, in this West Pecos area the original pressure is about 1100 pounds, based on some work that Broadhead had originally done, had completed in this area. It's still about 1000 pounds, so there's been little or no change in the reservoir pressure.

Q. In order to determine the pressure out there, how long would you have to run a pressure-transient test?

A. It depends on who you talk to. I'm sorry, I

don't mean to be flip in that answer. In a normal reservoir, a 48-hour pressure buildup test would be one of the standards that you would use. In such a tight reservoir you'll get answers up to, You need to shut it in for a month.

Q. Okay.

A. So I mean, it -- that's the kind of range that you're looking at.

Q. Okay.

A. And since nobody's really done that in this area --

Q. Oh, okay.

A. -- I -- yeah, that's a -- I mean, they've done a 48-hour test, but nobody's shut it in for 30 -- you know, 30 days and checked the pressure buildup.

Q. Okay.

A. So there isn't a good answer at this time.

Q. Okay, that's what I kind of thought you might say, but the -- so these are -- the permeability you were talking about when you said it was 2.3, that would be an arithmetic average --

A. Yes.

Q. -- of the existing points --

A. Yes.

Q. -- and not some kind of a abnormal geometric

average? That would be lower than that, probably, wouldn't it?

A. Yes. In fact, I -- and I don't want to take from Charles Sanders' testimony, but in discussions we had yesterday his calculations came out to 1.8.

Q. Okay.

A. And I mean, I'm taking away from what he's going to say.

Q. Okay. It sounds like you're real knowledgeable about engineering and everything, so I guess I'll wait on some of those. But you're -- the Abo reservoir, is it alternating sands and shales?

A. Yes.

Q. So what kind of environment would that have been set down in?

A. The work that Broadhead did in here was excellent, and he's basically showing a fluvial-dominated, braided delta building out from the northwest to the southeast. I believe that he was correct in that.

In the individual sand, in the core what you see is high-energy, flashy discharge-type of sands in the lower part of the sand, giving way to burrowing in the upper part, suggesting that this discharges out and then -- into the marine environment, and then the marine waters come back over the top and the burrowing organisms come in in

the upper part. So I have no disagreement with Broadhead's original interpretation in this area.

Q. Is the reservoir pretty fractured? And what direction would the fractures be?

A. That's a $64 question. I suspect they are. Do I know they are? No, I don't. There has not been the kind of remote sensing work that would be necessary to do that. Seismic in the area has not been utilized, because there's a lot of dissolution that occurs in the shallower part of the section, which absorbs the energy from the seismic. So you get very little in the way of seismic reflectors in here to be able to pick out things like block movements of the basement and faults and that.

So you're limited to the drilling data. And where you have a change in dip slightly, is that because of a fault or is that just because it draped over some basement feature? You can interpret it either way and be just as likely correct.

Could it be improved? Yes, we could fly a high-resolution aeromagnetic survey over the area, and from that you could start to begin to pick up the fracture orientations. Then you'd have to come back and ultimately compare your production to what you were seeing from fracture trends to try to determine which ones were open and which ones were closed in there, because obviously some

of them are going to be closed.

There has also been reported shear movement in this area, and off of the shears which might themselves be tight fractures you get Reidels that come off at about a 30-degree angle that tend to be open, and those might be areas of higher production due to the fracture intensity. At this point in time we don't know. Hopefully in the future we'll have a better idea.

Q. Where's the granite out here? How --

A. The depth to granite goes from right around 3000 feet in the extreme eastern, northeastern part of the area, and if we go over all the way to the eastern acreage that McKay has, it's down below 5000 feet. So you're coming off of the Pedernal uplift in that area, and that's probably the ultimate source of the sands in the Abo.

Q. Okay. How deep is the -- I mean, what's the bottom sedimentary rock in this area? Just going down through the Mississippian and then hit granite, is that what you're saying?

A. I doubt there's any Mississippian in this area. I think you're too far up on the northwest shelf. There's questionably -- maybe some Wolfcamp carbonates get into the eastern part of the area, but whether they get all the way to the west Abo area I'm not sure. There are in places evidences of granite wash, right on top of the granite

itself, and there seems to be significant topography on the granite.

Q. But these wells -- you're not looking at any zones above or below the Abo, you're just talking about Abo today?

A. That's correct.

Q. You're not looking at the need to downhole commingle some vertical wells, even though you might drill them on some strange -- or different, I should say -- spacing? You won't need that out here, you'll just need the Abo; is that right?

A. That's what we're talking about today.

Q. Okay. And the horizontal wells, as far as the direction you would drill them, since you really don't -- Now the fracture orientation identification in using the surface seismic now has come along in recent years. Have you guys used that out here? Has any of the operators used it to determine the direction that these artificial -- these fractures are going?

A. Are you referring to dipole sonics --

Q. No, actually --

A. -- or dipole tomology?

Q. -- actually the surface where you frac -- you artificially hydraulically fracture a well, and you use these --

A. Oh, surface monitoring of the --

Q. -- which way it goes, yeah.

A. Yeah, that has not been done out here.

Q. So how do you know which direction to put your horizontal wells?

A. That's a good question right now.

Q. Okay.

A. I don't know that we have a real good answer for you, other than Broadhead chose a series of northeast shear systems in here --

Q. Okay.

A. -- and if we look at the United States as a whole, or North America as a whole, there tends to be a northeast system and a northwest system. I suspect there is a significant northwest system. Is it open? I don't know. But there's probably a northwest and a northeast system, and there are probably Reidels if you have shear movements in here.

Q. Okay. But you want the capability in this order, requested order, to do horizontal or vertical wells? You guys are not committing to do horizontals?

A. That's correct.

Q. And that's because you really don't know exactly how well they're going to do in certain areas?

A. The horizontals at this point in time are still a

bit experimental, and one of the things that will be done in the future is to acquire other remote-sensing techniques like aeromagnetics to try to help in determining the optimum directions.

The other part that still needs to be done, that we haven't completed is, are there orientations of better-producing wells that might be related to fracture systems in there that would also help to identify that.

Q. Speaking of that, in a lot of systems that have a lot of heterogeneity you might drill 10 wells, and one well would pay out all the rest of them, you know, because it just happened to hit that big fracture. Well, by drilling some of your wells and not maintaining a rule that you have to drill one in every quarter, are you giving up some of your statistical data-gathering here, or chances of even hitting that fracture?

A. I can't say unequivocally, but I think there's been enough of drilling already that if you had the sweet-spot well that hit the open fracture, it probably would have been found at this time.

That's not to say, though, that there still aren't open fractures, they just may not be the glory hole, so to speak, where you're going to drain a huge area in there.

Q. And you were talking -- one last question --

about the meters in -- Were you talking about downhole meters inside wells, or are you talking about surface meters?

A. No, no, surface, because we're talking about drilling off a single pad. We're not drilling one well with all these --

Q. Not multiple laterals?

A. No, it's a series of just moving the rig slightly --

Q. Okay.

A. -- so that you have a different meter at the surface for each of those wells.

Q. And you can afford to do that, rather than just getting some kind of a unitization agreement or something where you just drill multi-laterals?

A. In the -- in analyzing the initial costs of getting different surface locations and different surface pads, going through all the archaeology, going through all the exceptions that have to be completed, to even hope to get that, it's probably less expensive.

And then add the gathering system savings onto it, we feel that it will be economic.

Q. Okay.

A. Can you guarantee it? No.

EXAMINER JONES: Okay. Well, thanks a lot.

THE WITNESS: Sure.

EXAMINATION

BY EXAMINER BROOKS:

Q. So you're actually drilling a different hole from the surface for each of your laterals?

A. Yes.

EXAMINER BROOKS: Okay, that's all. Thank you.

THE WITNESS: Thank you.

EXAMINER JONES: Nice presentation.

EXAMINER BROOKS: You may call your next witness.

MR. BRUCE: Call Mr. Sanders to the stand.

CHARLES W. SANDERS,

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

DIRECT EXAMINATION

BY MR. BRUCE:

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

A. Charles William Sanders.

Q. And where do you reside?

A. Albuquerque, New Mexico.

Q. What is your profession?

A. I'm a petroleum engineer.

Q. Have you previously testified before the Division as a petroleum engineer?

A. Yes, I have.

Q. And were your credentials as an expert accepted as a matter of record?

A. Yes, sir.

Q. And do you have a number of years' experience in the Pecos Slope-Abo field?

A. Yes, since about 1980.

Q. Okay, and so you are familiar with engineering matters related to the West Pecos Slope-Abo?

A. Yes, sir.

MR. BRUCE: Mr. Examiner, I tender Mr. Sanders as an expert petroleum engineer.

EXAMINER BROOKS: So qualified.

Q. (By Mr. Bruce) Mr. Sanders, why don't you start off with your experience in the Pecos Slope-Abo? When did that begin and who were you working for at the time?

A. Well, I was an operator in a company by the name of Sanders Petroleum Corporation, of which --

Q. And were you a principal of that company?

A. -- of which Mr. McKay was a partner.

Q. Okay.

A. And he asked me to be the operator for his new acreage acquisition in the East Pecos Slope-Abo.

Q. And what year was that?

A. 1980. I think we didn't get actually started till 1981, with the drilling.

Q. And were you responsible for a number of wells drilled in the East Pecos Slope-Abo?

A. We drilled around 10 or 11 wells there.

Q. Okay. And then when did you move over to the West Pecos Slope Abo?

A. 1985.

Q. Now you said McKay Oil Corp. was the operator drilling those wells. Did Sanders Petroleum Corp. serve as the drilling and completion consultant?

A. On the east side, Sanders Petroleum was the operator. Mr. McKay got set up with his insurance and all as an operator, and he began our drilling campaign on the West Pecos Slope-Abo as McKay Oil, and I was working for him as a consultant.

Q. Okay, what type of work did you do for him?

A. In the beginning, I designed the drilling operations, the completion procedures, the frac jobs and all that.

Q. Now were the West Pecos Slope-Abo wells initially completed the same way as in the East Pecos Slope?

A. Very much the same. We usually used a 30-pound linear gel or a 30-pound crosslinked gel. If the pay zone would stand the pressure, of course, the thicker crosslinked gel would generate more pressure. And if your zone was well developed enough to where you could use that

you would get a wider fracture, a more efficient fracture without breaking out of the zone.

Of course, that was our primary consideration. We always patterned our gel -- sometimes we used even a 20-pound linear gel if we had a very tight zone to treat. So the amount of frictional resistance, of course, was a prime factor because we knew what the frac-out pressure would be, and we always stayed below that frac-out pressure. So the particular zone that we were frac'ing would be limited to the zone that we were putting our money in.

Q. Now after the initial wells were drilled by McKay Oil in the West Pecos Slope-Abo, did you do an engineering study in those wells?

A. Yes, sir, that -- He had drilled a number of wells before I did the study. Now this study was in connection with a new drilling program that he had started, and about 17 wells had been drilled, and he asked me to do a study on how these wells were performing and how they would result in estimated ultimate recoveries.

Q. And what types of numbers did you have for these wells?

A. Well, it was pretty disappointing in some ways. We had all the way from 3000 MCF total ultimate recovery up to 759,000 MCF. The average for the 17 wells was 116,000 MCF per well. So -- And only three of the wells calculated

over 100,000 MCF recovery per well, and nine of the wells calculated less 50,000 MCF per well.

Q. And did the results of your study then result in further drilling, but differences in how you were drilling and completing the wells in the future?

A. I think the study had helped us to be very careful in utilizing our regional maps that we had made on porosity feet of pay, permeability feet of pay and so forth where we had all that contoured. And we tried to stay and drill within those trends. Of course it didn't always work out that way, because we had a lot of heterogeneity there, the little channels petering out and not being continuous when we had hoped they would be continuous.

Q. So you agree with Mr. Horn that many of the zones are discontinuous from well to well?

A. Yes.

Q. And that the permeability in this area is quite low?

A. Quite low, yes.

Q. And when you're looking at these wells and their drainage areas, do you generally agree with Mr. Horn's figures that he just presented a while ago?

A. That what?

Q. About his drainage figures? Do you --

A. Yes, yes. I see the same spread, you know, the

small circles and the big circles, and you have a pattern, a variation there, that we saw in this early study.

Q. And so you would agree with Mr. Horn that more than two wells per well unit are necessary to adequately drain the reservoir in this area?

A. Yes, sir. I don't think you can adequately drain, drilling with the pattern that we're now using.

Q. In your opinion is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes, sir.

MR. BRUCE: Mr. Examiner, that's all the questions I have of this witness.

EXAMINER BROOKS: Thank you.

Again, I think I'll defer to Mr. Jones.

EXAMINER JONES: Okay, I'll be brief this time, I promise.

EXAMINATION

BY EXAMINER JONES:

Q. Mr. Sanders, so if you were looking at the difference between volumetrically calculated reserves on each well and the decline analysis reserves on each well, do you see a need to infill drill?

A. Yes, sir.

Q. Okay.

A. On my studies I used -- I always use the decline-curve method.

Q. Okay, I noticed you've got some real low numbers.

A. Yes.

Q. Now you didn't do a volumetric study, just the -- Dr. Horn showed us one, I guess, that -- his bubbles would be your volumetric?

A. Yes. No, I didn't go that far.

Q. Okay. Now if -- since you guys together, the team, have done that, does this show that this area has preferential need for more wells versus other areas in the Pecos Slope?

A. Yes, sir, it's tighter, the sands are tighter. The sand grains are smaller, which results in lower permeability, so there's a great contrast between the east Abo slope and the west Abo slope. The more silty material and finer the grains, of course, will show up both on your neutron density porosity log and on your resistivity log. And I did a lot of my permeability determination using those four logs, in addition to the flow tests and the AOFs that we had taken, we could determine the original effective permeability and how much that would increase over the natural permeability.

Q. Okay, that's -- It sounds like that's your argument, and it's a good argument.

difference from other Pecos Slope areas

The gathering pressures out there, are you familiar with those as related to the west Pecos slope versus the eastern side? Are they any --

A. The surface gathering pressures?

Q. Yeah, surface gathering.

A. Quite a bit of difference. A good example would be on our Number 1 well on the east slope, the Samedan Number 2. We had not pump stations, compressor stations or anything in there at that time. Transwestern had just laid a line through there, so we tied in directly to their 600 p.s.i. line, and that well paid out in 43 days, so we had some pretty good surface pressures there.

Q. It sounds like it.

A. My point is, we were bucking a terrific pipeline pressure.

Q. These horizontal wells, what direction would you drill them in, or would it just depend on the area, which area?

A. Yes, sir, it would. I have not been involved in that, I've merely seen the studies. Since Rock Resources took over, they have done all of the studying here. And I have seen the reports and I fully agree that -- with John's report, that additional study needs to be made to determine which direction to drill, because if you're going to frac, of course, you want your direction and your -- with your

fracture.

Q. So you're drilling difficulty is sometimes related to the direction you drill also; is that correct? I mean, how -- Is it not going to be a problem to drill horizontals out here?

A. Well, they're doing pretty good so far. In fact, better than I thought because, you know, I'm an old vertical man myself --

Q. Okay.

A. -- a vertical old man, and I've only drilled two deviated wells in my life. So I'm not an expert in that field.

Q. Okay. Speaking of that, the vertical wells, the fracturing of the vertical wells, did you do staged fracs out there, or down-the-casing staged fracs, or how -- how would you change that in the future, or would you do the same thing?

A. We did stages fracs, especially where we had, say, one good zone below and another good zone above, or maybe there were two zones above. We'd frac the lower one, set a bridge plug, then frac the upper zone. If we had a number of different zones, we'd use limited entry. Whereas the better zones would have fewer perforations, the weak -- or the poorer zones, with the higher resistance to flow, we'd put a lot of perforations in them. And of course

that's all done automatically with a limited-entry program that we own --

Q. Okay.

A. -- that would calculate all that for us. Try to get the same reach with each zone. But if you don't do that and you just frac everything at once, all your frac is going to go to the best zone --

Q. Okay.

A. -- and your weaker zones, your poorer zones, will not get much of the frac, if any.

Q. Were you able to frac down casing and just set a more capable wellhead on your well, frac down casing?

A. Yes, sir, we generally frac right straight down the casing.

Q. What pressures did you -- was you breaking down? You said you knew the pressures. Did it just depend on the area where you were at --

A. It would --

Q. -- as far as height growth?

A. It would vary. Usually 300 or 400 pounds higher than what the fracture pressure would be, because the cement sheath and all that, you've got to break through all that. And your perforation nodes are full of fine particles, and generally we have to go 300 or 400 p.s.i. higher than what we would expect.

And on a number of wells we've had to spot the acid and leave them set on the perforations overnight before we could even break them down.

Q. Oh.

A. Come back the next morning and the well would be on a vacuum, and then we would continue, further frac.

Q. Were you going for long frac lengths, or were you going for wide-propped short fracs?

A. The optimum, just by going by what the program would tell us, you get more and more fallout of your sands, the further out you go. And about the optimum is around 800, 900 feet. If you try to go further than that you'll be pumping fluid, but all the sand will be falling out and you won't get proppant out that far.

Q. 900 feet frac lengths?

A. 800, 900 feet.

Q. 800, 900.

A. 800 to 900.

Q. Have you studied the Jones field up in Wyoming? Do you know if this is anywhere similar to that?

A. The Jones field? No, sir. I've frac'd wells in the Kitty field, but that's in the old days when we frac'd everything with seat-of-the-pants technology.

EXAMINER JONES: It sounds like it was pretty sophisticated. That's all I've got, thank you.

EXAMINER BROOKS: I have no questions, thank you.

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

EXAMINER BROOKS: Very good. Case Number 13,976 will be taken under advisement.

(Thereupon, these proceedings were concluded at 11:28 a.m.)

* * *

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 13976 heard by me on 8-23-07

David K. Brooks, Examiner
Oil Conservation Division

CERTIFICATE OF REPORTER

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Division was reported by me; that I transcribed my notes; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

WITNESS MY HAND AND SEAL August 28th, 2007.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 16th, 2010