NEW MEXICO OIL CONSERVATION COMMISSION

STATE LAND OFFICE BUILDING

STATE OF NEW MEXICO

CASE NOS. 10446, 10447, 10448, 10449

Consolidated

IN THE MATTER OF:

The Application of Yates Petroleum Corporation for Authorization to Drill, Eddy County, New Mexico.

VOLUME V

BEFORE:

CHAIRMAN WILLIAM LEMAY

COMMISSIONER GARY CARLSON

COMMISSIONER BILL WEISS

FLORENE DAVIDSON, Senior Staff Specialist

ORIGINAL

State Land Office Building

October 22, 1992

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WHEREUPON, the following proceedings were had at 8:35 a.m.:

CHAIRMAN LEMAY: Good morning. This is the Oil Conservation Commission, and we're on our second day of this three-day testimony in the cases for exceptions to the rule of drilling the potash area.

I think when we adjourned yesterday we were in the middle of Mr. Case's direct testimony, and at that point we shall continue.

MR. HIGH: Thank you, Mr. Chairman.

WALT CASE (Recalled),

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

DIRECT EXAMINATION (Continued)

BY MR. HIGH:

Q. Mr. Case, we were talking yesterday about Section 2, and you testified that New Mexico Potash has a capability of mining the grade of ore in Section 2.

Tell us, if you will, what problem, if any, the distance of Section 2 from the other parts of the mine presents to New Mexico Potash.

A. There's a federal safety requirement that any mining that is done must be done at a distance that miners can travel to the foot of the shaft or the base

of the shaft underground within an hour.

Until very early this year, Section 2 would be on the fringe or perhaps out of reach of that time requirement.

As we began to find that there was in fact some 10th Ore Zone ore in Section 2, kind of issued a challenge to my people to find a faster way of getting there. And in fact, they have done that.

We have added ten modified either Volkswagen diesel Rabbits or Toyota diesel pickup trucks, and we've taken those down right to the window line, cut everything off so that the height was low enough to get into our mining areas, and we're using those vehicles now for transporting personnel faster now to the faces that we are operating.

But because those vehicles are capable of going faster, they also will have Section 2 well within the time frame requirement of mining.

So that was the second factor.

The first factor was finding the ore; the second factor was finding a way to get people there.

Q. Was the decision to make the investment in this additional equipment dependent at least in part on the ore in these outer areas being available to be mined?

A. That was certainly a part of the consideration. The larger part of the consideration was more immediate in that using faster transportation gives our people longer in the mining operation for each shift that they're there, and that benefit applies immediately, as well as to any future mining.

Q. And what plans does New Mexico Potash have, Mr. Case, to mine Section 2?

A. Part of the independent third-party analysis of our ore reserves and mining plan included a time frame for mining Section 2, and that is certainly a plan for arriving at Section 2.

Q. Let me show you what I've marked as Confidential Exhibit Number 37.

MR. ERNEST CARROLL: This exhibit right here? Is that a mine plan?

(Off the record)

MR. ERNEST CARROLL: Mr. Chairman, at this time I'm going to make an objection to this exhibit.

If you will recall, and we've been told, Mr. High has just confirmed to me that this is a mine plan.

MR. HIGH: I didn't say that. I said I would explain that.

MR. ERNEST CARROLL: I understand that, but I don't think that this exhibit should even be allowed to

be testified to.

The reason why, Mr. Chairman, if you'll remember, we issued a subpoena to get core-hole data so that we could make our own mine plan and present testimony to this Commission.

We were denied that information by New Mexico Potash. We were given core hole 162.

What we see here -- and I think you can very quickly tell that this is not even a complete mine plan. We're not even being furnished the entire thing so that we could even begin to judge its credibility. We haven't been furnished the materials, the core-hole data that's used to develop a whole mine plan.

And remember, what Mr. High just elicited from Mr. Case was that they had a third party come in and evaluate their ore reserves and develop a mine plan. Such information, as based on the testimony that we've already had presented by experts, would necessarily involve the use of all of that information.

Mr. LeMay, since they have refused to give us this information, which had to form some of the basis of this, I do not think that this Commission should allow it to be presented in any form or fashion.

I think this is a rule that this Commission has followed for many years, that if a party refuses to

honor a subpoena issued by this Commission, then they do not get to use that same information in the benefit of exhibits or testimony that they plan to present in a hearing.

This is exactly what they're doing. They're back-dooring us.

And remember -- and I think it's also extremely important that yesterday for the very first time we finally learned what the reason was that we didn't get to get all this confidential information.

They're not concerned about the competitive effect. It's just apparently back in the 1960s, these mines were charged with antitrust violations, and they're trying to protect themselves.

Well, remember, Mr. LeMay, that when you offered -- We had these hearings on the propriety of these subpoenas. The Commission offered to these parties confidentiality protection so that we would never have these problems.

All this is is another example where the potash companies have tried to keep valuable, important information away from us so that we could judge the credibility of what they're putting forth.

There is absolutely no way that we are going to be able to cross-examine this. We don't get the

full mine plan, we don't get the information that it was constructed from, and yet they expect us to be satisfied that this is a fair an open hearing. No way can that be -- can we characterize this situation.

So therefore, Mr. LeMay, based on the fact that they have failed to honor the subpoena when the Commission offered adequate confidentiality requirements, I think this evidence should flatly not be allowed to be presented at this time, or at any time, in these areas.

CHAIRMAN LEMAY: Mr. High?

MR. HIGH: Mr. LeMay, the purpose of this exhibit is to show that New Mexico Potash not only is capable of mining the ore in Section 2, but in fact has plans to do so, and -- or is considering a number of alternative plans to do so.

If you'll recall, up until 1992, New Mexico Potash's LMR extended down to the top of Section 2. We are presenting no evidence regarding anything with respect to that pre-existing LMR.

We are going to present evidence in this case to justify our extension of the LMR down to include Section 2 and we'll have evidence we'll present to do that.

We have provided Yates Petroleum with all the

core-hole data, and we have agreed to the confidentiality of that. We have given them all the core-hole data upon which we relied to extend our LMR down to Section 2.

As far as the core-hole data from up in this other area that we have refused to give them, and we refused to honor the subpoena from this Commission, and we have appealed that to the District Court in Carlsbad, that case is set for trial in February, and we intend to proceed with that trial, because we think that that information should not be disposed, and that issue is being litigated.

This is not, at least in my judgment, what Mr. Carroll has represented it to be. All we're doing is to show what plan we have for Section 2. Are we ever going to mine it? We've been accused of we're never going to mine it. We are going to mine it, and that's all this is.

CHAIRMAN LEMAY: I think Mr. Carroll's objection, wasn't it, that you used that in Sections 26, 34, 35 to produce this data or this map, this interpretation, which he was not given access to and therefore has no way to challenge the document itself or argue it.

Is that true? Do you know what went into

making the map?

MR. HIGH: I have no idea, Mr. Lemay, and I'd be willing to chop out everything except that part on Section 2.

CHAIRMAN LEMAY: Would that be acceptable --

MR. ERNEST CARROLL: No.

CHAIRMAN LEMAY: -- if he chopped everything out but Section 2?

MR. ERNEST CARROLL: -- absolutely not, and the reason why, if you'll remember, Mr. LeMay, we went through a lot of testimony with Mr. Hutchinson which -- A mine plan, you mine blocks and you go from one stage to the next stage.

What Mr. High is leaving out is the middle. How do we get here, how do we know we're getting here, under what conditions are we getting here? That's how we judge the credibility of this mine plan.

We don't know how they're getting here. Are they just flat -- Are they going to run one single line? How many years is it going to take? We have nothing to be able to judge the credibility of this.

And I also want to point out, Mr. LeMay, I got this at three o'clock yesterday afternoon without any explanation either.

But there is no -- The only way you can judge

the credibility -- and he's saying that he wants -- the purpose of this is to show, one, we're capable of mining and, two, that we have plans. Well --

MR. HIGH: No, don't misrepresent me, Mr. --

MR. ERNEST CARROLL: Hey, that -- you can -- We can have the record read back.

MR. HIGH: Read it back.

MR. ERNEST CARROLL: That's just exactly what you said --

MR. HIGH: All right, read it back.

MR. ERNEST CARROLL: -- there were two reasons --

MR. HIGH: Read it back.

MR. ERNEST CARROLL: -- and frankly, that's the only reason that this could be introduced, is to show that they're capable of mining the ore in Section 2 and that they have plans to mine it.

Well, unless we could judge that -- those -- that intent, the capability with respect to the entire mine, we're talking about nothing. It's meaningless. That was the whole point. That's why we presented a complete mine plan.

COMMISSIONER CARLSON: Refresh my memory. You had a mine plan, New Mexico Potash had a mine plan, developed by an outside source; is that correct?

MR. HIGH: We had an analysis of reserves made.

COMMISSIONER CARLSON: Which included a mine plan; is that --

MR. HIGH: A suggested mine plan.

COMMISSIONER CARLSON: Is this part of that suggested mine plan?

MR. HIGH: Yes, sir, it is.

COMMISSIONER CARLSON: Did the subpoena issued, I guess by this Commission, but for Yates, did that include that mine plan developed --

MR. HIGH: No, sir, it did not.

COMMISSIONER CARLSON: -- by that outside company?

MR. HIGH: No, sir. The only thing the subpoena covered was all core-hole data upon which we relied to establish our LMR for the whole mine.

COMMISSIONER CARLSON: And that's what you're contesting, is the --

MR. HIGH: That's right.

COMMISSIONER CARLSON: -- core-hole data?

MR. HIGH: That's right.

COMMISSIONER CARLSON: You did not ask for a mine plan?

MR. HIGH: That's correct.

COMMISSIONER CARLSON: But this mine plan is based on the core-hole data which you have refused to give to Yates; that is correct?

MR. HIGH: Well, it may be with respect to areas other than Section 2. You know, I really don't know. But it's based upon core hole 162 in Section 2.

I don't want to represent to you what all this other company relied upon in coming to this mining plan because I don't have any idea.

COMMISSIONER CARLSON: Is it your intent to introduce the mine plan developed by this company into this hearing?

MR. HIGH: No, sir, I certainly have -- I have no interest --

All I want to show, Mr. Carlson, is that we have plans to mine Section 2. That should be obvious, because we wouldn't have been holding the lease since the Sixties if we didn't plan to mine it.

The only purpose of this document -- and I'm only interested within the area within Section 2 -- is that we do have plans as a mining company to mine Section 2. That's the only purpose for which it's offered.

MR. ERNEST CARROLL: Chairman LeMay, I would -- If the Commission even considers allowing this

to come in, there's some other things that we need to consider.

One, I don't think it should come in unless the entire mine plan comes in.

And then if you'll also recall that we learned for the first time yesterday that these mines have been making three-year mine plans that are updated annually. That came from the BLM witness, and I think Mr. Case confirmed that in his -- early part of his testimony.

Before any mine plan like this can come in -- Because this is done by a third party. There's no proof that it's been adopted or been followed, and the dates on this show 6-16-92. It's only two or three months old.

And he's putting this on to prove that we're going to mine down there.

The only way this should come in is if they are required to produce the entire mine plan and all of their other mine plans so that we can compare them.

CHAIRMAN LEMAY: Okay, let's -- Anything else?

MR. HIGH: Those mine plans have not been requested from us, Mr. LeMay, and we will not offer into evidence the entire mine plan.

CHAIRMAN LEMAY: Rand, do you have anything you want to ask?

MR. RAND CARROLL: No.

CHAIRMAN LEMAY: Okay, we'll confer for a couple minutes here.

(Off the record)

CHAIRMAN LEMAY: We're going to deny this exhibit, and I want you to know why, and I think most of the reasons were explained, were at least objected to by Mr. Carroll, but there were other reasons too.

Number one, this was not Mr. Case who drew it up, so therefore it can't be defended in that nature.

Number two, the data that went into it is necessary for cross-examination on anything. When that's not available it leaves the opposing counsel at a loss to even challenge it. It's like saying, Here it is, accept it and trust us. And that's not the basis of what we've done this stuff in the past. We've always allowed both sides an equal chance to be able to argue their case, and you're just -- you're at a competitive disadvantage, not having that.

Plus, it's not the total mine plan. In testimony you can bring out what Mr. Case would like -- what he would recommend, and we plan to ask him those questions too.

But we just can't admit this into evidence for those reasons.

MR. HIGH: We would ask that it be placed in a rejected exhibit file, Mr. LeMay, so that the record will be complete in the event of appeal.

CHAIRMAN LEMAY: Sure. Do we have a rejected exhibit file? You may be the first to establish a rejected exhibit file.

MR. HIGH: I'm glad to see that Florene's in charge of it, so we'll know where to go.

CHAIRMAN LEMAY: Rejected Exhibit Number 1.

Q. (By Mr. High) Mr. Case, has New Mexico Potash given any consideration to when it might mine the ore in Section 2?

A. We have.

Q. And tell me, if you will, some of the considerations that you've given to that process.

A. The orderly development of the mine, we are concentrating on the southern part of our reserves of the nominally 35-year reserve life that I mentioned to you yesterday.

Perhaps 20 of those years are in the south half of the mine, or the south -- what we call our south ore body.

And for the last several years we have been

concentrating on developing that south ore body with an intent in the future to move to the last remaining large ore body, which is the northeast ore body.

So in the development of the south ore body, certainly all of our leased land is considered in developing those plans.

Q. And what is the current direction of your mine development?

A. Southward.

Q. And Section 2 would be south of where you are now?

A. That's correct.

Q. In the same direction of your current mine development?

A. Yes, sir. Yes.

Q. What do you project, if anything, in terms of time when you might be down there to mine Section 2?

A. Probably the shortest possible time to reach there would be seven, eight years.

Q. And how long do you project it would take you to mine the ore in Section 2?

A. It would probably be mined over a period of 10 to 12 years.

Q. And how much -- You know, when you look at the ore in Section 2, for what period of time will that

ore provide jobs to people?

A. Mr. High, I can't speak specifically for Section 2. But if we take a section of land and assume that it is underlain by our typical ore, just one square mile of it, that currently represents about two and a half years of production. So that would be two and a half years for 280 people.

Q. Okay.

A. Now, obviously you don't mine one section in two and a half years. You use one or two mining machines or faces in that area, and consequently the time to extraction is substantially longer than the two and a half years.

But if we just look at the reserves there, it equates to two and a half years of mine life.

Q. Section 2 would be mined, I take it, using the same procedure you do now where you have a number of different faces and you blend the ore from different areas?

A. That's correct.

Q. Now, you've heard the testimony here, Mr. Case, that the oil people believe they can be in and out of Section 2 before you are ready to mine, have you not?

A. That's correct.

Q. And what is your response to that?

A. I believe Mr. Hutchinson projected a reserve life of 85 years, and I don't know all of the background of that analysis.

I think our more reliable analysis and certainly our long-term projections and presentations upon which several sales of the operation have been based have the same sort of timing that we're looking at in the nominal 35-year period.

Never have we discussed any mine life beyond 35 to 40 years.

Q. And would that projected mine life, Mr. Case, include the -- mining the ore in Section 2?

A. Yes, it would. And I might add, not at the end of that mine-life period.

Q. It would be during it sometime?

A. During.

Q. Okay. Now, what is the -- What are the concerns, Mr. Case, that you have over the drilling of these wells in Section 2?

A. I have numerous concerns. The first is certainly personnel safety. We have the potential of life-threatening accidents by the incursion of methane into the mine.

Yesterday one of the witnesses testified that

the production of gas from all these wells was, I believe, 150,000 cubic feet a day. That equates to about a hundred cubic feet a minute. He presented that to be no problem.

Any amount of methane over about 13 cubic feet will form a true explosive mixture, something that will go off like gunpowder in the end of a gun barrel. And that's literally the sort of thing that we're looking at in a mining drift or tunnel if we have ignition of methane. The results of that explosion have nowhere to go but down that drift. And how far it travels depends on how much methane is there and so forth. That's not my area of expertise.

But suffice it to say, explosive mixtures can form from a hundred cubic feet per minute.

The other thing that I would like to point out is that the encounters that we have had with methane to date in our mine have all been in a depleted air or essentially nitrogen carrier.

That allows two, three, four percent of methane, which is below the explosive limit anyway, to be diluted by air and never pass through an explosive range.

A hundred percent methane -- and the point that was overlooked yesterday, or glossed over fairly

quickly, yes, when that's diluted in 150,000 cubic feet a minute or 250,000 cubic feet a minute, which is our air circulation through the mine, that's normally split in two, so say nominally 125,000 cubic foot in any particular area would be a sort of typical airflow.

Yes, that will dilute methane very quickly to below the explosive limit.

But when it comes in at a hundred percent and goes down to .25 percent or .025, whatever the range is, at some point it does pass through an explosive range.

And therein lies the difference between pure methane coming into the mine and small percentages of methane in a nitrogen carrier. The methane in the nitrogen carrier never goes through an explosive range. Anytime you get anything over, I believe, about 15 percent methane in a mixture, it will come down through an explosive range on its way to being diluted.

All you have to have is an ignition source at the point where that concentration is in that flammable range.

I would submit to you that there are a number of ignition sources in our mine.

One of the things -- Another thing that has sort of been glossed over or not developed fully in the

testimony is the difference between a gassy mine and a non-gassy mine. I think you've heard both of those referred to. I'd like to enlighten you a little bit on what the differences are.

Gassy mines, that is, mines where methane is routinely encountered and has to be guarded against for the safety factor, the explosion possibility, have a type of equipment that is called permissible equipment. And anything that is in the mining face or any of the return air system must be permissible. "Permissible" roughly translates to "sparkproof", okay? All of your electric motors have to have to have special paths at the end bells, for example, to kill any spark that might come from the inside of the motor getting to the outside of the motor.

Nonpermissible or nongassy mines are not required to have all of those safety features.

Another major feature of a gassy mine is that -- I explained to you yesterday, in our mine, our ventilation air goes from one area to another area to another area, a series ventilation system.

In gassy mines, each area has to be ventilated independently or separately. So if we have three areas, you have to take a small amount of air or a portion of your air, circulating air flow, through

area 1 and exhaust it independently of the air that comes in and goes through section 2, and independently of the air that comes in and goes through section 3. All of those streams have to be maintained separately. And anything from the mining face on has to have permissible equipment, booster fans, main fans, this sort of thing.

Gassy mines are required to have their ventilation fans on the surface. Ours are located underground.

For us to convert our mine to gassy-mine standards would literally be a life-threatening cost to our operation, because we're looking at nominally a million and a half dollars in each of those ten mining faces that I talk about to get permissible equipment there, probably an equal amount back to the base of the shaft.

Raising the fans to the surface would be another major expenditure, but by and away -- or far and away the largest expenditure would be the mining of these ventilation drifts in all that's left now in that salt or barren ore. That mining would probably take one to two years to complete. That would be absolutely non-productive time for all of the mining equipment that we have. Hence, it's a life-threatening

situation.

My concerns, Mr. High, are, number one, methane in a mine can be a life-threatening situation to a miner.

Number two, it can be a life-threatening situation to my operation.

And number three, because of the federal mine safety standards, an incursion of methane from whatever source into our mines -- we are currently in a Category 4 mine -- would not only impact our operation but all of the other operations in the same geological horizon. So it is truly an industry-threatening concern that I have.

Q. Well, aside from the fact that methane could create an explosion in an underground mine, at what level of methane do you -- does a potash mine start to have a, quote, problem?

A. Okay, Mr. High, I indicated yesterday, or we developed some testimony that we have quarterly inspections by the Mine Safety and Health Administration, part of -- at least once a year.

Part of that inspection includes sampling for gases throughout the mine. If methane at the level of .25 percent is found in what's called the general mine atmosphere -- that is, in normally ventilated areas --

that triggers a review by MSHA to determine whether we would remain in the Category 4 or Category 3 or Category 2 or Category 1. They are the 800-pound gorilla in this case in determining what the categorization is.

The importance of these categories are that anything above Category 4 requires basically permissible equipment, and again that's a life-threatening situation.

So there's a trigger at .25 that could precipitate an MSHA study and result in a reclassification or recategorization of the mine.

Q. Has there been any attempt by the Mine Safety and Health Administration already to classify the New Mexico Potash Mine as gassy?

A. Yes, sir, there was an attempt in 1981. We had a rather large relief of some of this nitrogen under pressure, containing, my recollection is, up to about two percent methane right at the source of the material coming out of the mine.

We reported that to MSHA as a non-routine event, and they came out, took their own samples, again in what we contend was an illegal fashion in that samples for categorization and so forth should be taken in the general mine atmosphere. Their samples they

took right up where this bleed was coming from the formation. But they encountered over one percent methane in their samples.

Now, again, at that point they did not have the appreciation of this nitrogen carrier. For them, .25 methane was .25 methane was .25 methane, regardless of where it came from. And at that time, the .25 automatically puts you into a gassy mine categorization.

Q. Was MSHA successful in classifying you as gassy?

A. Limitedly. We arrived at an operating plan with MSHA while we were contesting this citation in their finding of gassy that precluded smoking underground, for example, greatly increased the number of methane samples that we took in the mine, limited where we could do cutting and welding work, this sort of thing.

So it was very definitely an added cost while we were litigating all this.

And there was some political intervention as well that reduced their budget or eliminated their budget for enforcing this particular standard on the New Mexico mines until this issue of nitrogen carrier and so forth was worked out. That was finally settled

in what? About 1986 or 1987, in that general time frame, and resulted in this categorization system and the placement of our mines into Category 4, which did not require permissible equipment.

Q. What do you know, Mr. Case, about mishaps in the oil and gas industry in southeastern New Mexico?

A. Mr. High, the only knowledge I have is some information that was developed when these gassy mine meetings were going on, and I have seen a page from a document that categorized, I think, 14, 15, 16 unusual occurrences in drilling operations that have been reported to, I guess, the Oil Conservation Division here.

Q. And do those mishaps in the oil and gas industry create any concern on your part?

A. Certainly.

Q. For what reason?

A. Well, I think we've heard a lot of testimony if everything is done just exactly as it's supposed to be done, we've got no problem.

But we find evidence -- and I certainly don't want to point the finger at the oil and gas industry, because I tell my miners to mine straight, and they end up going off this way or going off that way. But the consequences of mishaps -- or the occurrence of mishaps

indicates to me that things don't always go as planned, and I think that's something that anybody that has had any experience in business is going to concede. And it's that one instance, and all it takes is one.

You know, we may drill a thousand wells out there, and the thousand and first one is the one that gives us problems. That doesn't relieve the problem. As soon as we have it, whether it's on the first well, the five hundredth well, the thousandth well, whatever, when that happens we are in a "life-threatening situation" in the two or three contexts that I mentioned to you.

Q. Mr. O'Brien suggested yesterday that -- although he admitted he had no mining experience -- that we could drill holes in the advancing face, and if we encounter methane, just plug it up and go about our business.

What's your response to that?

A. Once we encounter it, we're under the obligation to notify MSHA. And if we encounter it, I think we're there; it's too late at that point.

Q. What is the purpose of drilling these holes currently, Mr. Case, in the advancing face?

A. We are not currently drilling those holes in the advancing face. At one point in time -- and I was

a little bit disturbed by Mr. O'Brien's more or less -- I don't know whether to call it callous or cavalier attitude toward these nitrogen encounters. He says, you know, we -- in drilling we run into nitrogen, and nobody's hurt but -- or nothing's hurt but feelings.

In 1983 one of my people mined into a pocket of nitrogen under pressure and lost his life as a result of that, and that's a little bit more than feelings being hurt. And I suggest that perhaps Mr. O'Brien was not familiar with that or he would not categorize nitrogen encounters as hurting nothing but feelings.

But Mr. High, that encounter with nitrogen is certainly a problem as well.

We began after that encounter doing what we call longholing, drilling several hundred feet in front of us to try and intersect -- Our conclusion upon investigating that accident was that there was what I call an historic crack. That is, a crack that had accumulated gases under pressure throughout geologic history, not something that resulted -- The crack wasn't something that resulted from mining operations. It was a pre-existing condition, if you will. And there were some theories proposed by rock mechanics as to what might have caused it.

And during the time that we were in that geologic regime or subregime, whatever you want to call it, we were drilling holes a hundred, two hundred feet in front of us. In the event that there was another crack out there, we could relieve that pressure before we mined into it.

And in fact, we encountered one or two more fairly substantial blows, then went another quarter, half mile, and had none, and stopped at that point drilling the pilot holes in front of us.

Q. Are there any existing wells in the New Mexico Potash Mine, Mr. Case?

A. There are three that I know of. All three of them existed before the mining operation, all three of them, to my understanding, were dry, plugged and abandoned.

Q. There's no producing wells?

A. There are no producing wells.

Q. You've heard the suggestion here from the oil and gas people that we as a mining company ought to mine up and leave a 150-foot pillar around these Delaware wells. Will you do that?

A. No, sir.

Q. Why not?

A. Well, to begin with, we've also heard

testimony that anything perhaps up to 15 degrees was considered normal variation for a well. That 15 degrees, at the depth of our mine of 1650 feet, would go out some 400 feet. So that suggests to me that a 150-foot pillar is absolutely a ludicrous number, because if we have a well that for whatever reason wanders off 15 degrees, we'd be two or three times that far away.

What I'm saying is, we might very well mine into the well, thinking it was somewhere else. So that's certainly one consideration.

The other consideration is, a fair amount of time was spent -- and I will certainly acknowledge Mr. O'Brien's testimony. The agreement on the quarter-mile and half-mile spacings has no basis in scientific fact, but a number of people spent a number of hours agonizing over that number and saying that we don't know of a better number to use, so let's use that one. And that would be what -- the guidelines that I would use, unless I had better and more concrete information.

Q. What is your understanding of the purpose of those distances?

A. To protect the oil wells from subsidence and to protect us from subsidence or the possibility of rupturing a strain and getting gas into the mine.

Q. Now, if you want to get closer than that to a producing Delaware well, Mr. Case, is that, in your judgment, going to result in the waste of potash in Section 2?

A. Yes, sir. We have already approved wells that will waste perhaps a quarter to a third of the potash in Section 2. The approval of all four of these wells and a half a mile spacing -- or a half a mile of safety zone, as is required for buffers and that sort of thing, virtually consumes all of Section 2.

Q. So if these four wells are allowed, virtually all the ore in Section 2 will be wasted, in your opinion?

A. I believe so.

Q. And what is your recommendation to this Commission as to how this proceeding should be resolved?

A. Well, Mr. High, I think there are perhaps two or three. One certainly is continuing with the R-111-P Order as presented or as now constituted.

I have grave concerns if one exception is granted to that, that that's going to open a floodgate and we will be spending more time looking at each other than I will be looking at my mining people. So I've got the concern of a precedent-setting action.

Another possibility is the idea of if we are so sure that there are no problems, either the state or the federal or an independent insuring company putting money where the mouth is, if you will. That may be a colloquial term, but basically the problem that I have is that an incursion of methane into the mine will literally be a life-threatening situation for a mine that is currently employing 280 people. It will be a life-threatening situation for an industry that is currently employing 2000 people, an industry that does business of the order of a quarter of a billion dollars a year, an industry that is located within a 400,000-acre concline and has nowhere else to go.

Mr. LeMay, I did a rather cursory study, and the numbers certainly could be refined, but of the 400,000 acres in the known potash area, approximately 200,000 are leased for potash mineralization.

In Lea and Eddy Counties alone there are over 5 million acres of oil and gas leases. This suggests to me that there is an industry employing 2000 people and returning good sums to the State, since 19- -- the early 1930s, and probably well into the next century, dependent on that 400,000 acres for their livelihood. They have nowhere else to go.

The oil industry and the gas industry, by the

same token, although they have some very interesting plays in this area, have other places to go that they can make a living.

And I think one of the considerations needs to be the jeopardy of the industry. For this reason, I think if the certainty is there that we're led to believe, certainly some insurer would like to make some money off that and perhaps charge a dollar a year for a certain thing.

I say that somewhat facetiously, but when I am looking at a potential of anywhere from $50 to $150 million, that's basically the profits that are left in my mine.

And if there is any remote chance of an incursion of methane into my mine, I want somebody to bear the financial responsibility along with that.

We have one industry wanting to do all the drilling and get all of the money for themselves and for the State out of oil royalties, with no consequence if they kill an industry, or if they kill one person.

MR. HIGH: Thank you, Mr. Case.

We'll pass the witness.

CHAIRMAN LEMAY: Thank you, Mr. High.

Mr. Carroll?

MR. ERNEST CARROLL: Are you going to use

that as an exhibit? Have you furnished it to the Commission? I'd like to use it.

MR. HIGH: No, I haven't. I'd rather explain it first. You don't have another one?

May we have just a moment, Mr. Chairman?

CHAIRMAN LEMAY: Sure.

(Off the record)

MR. HIGH: Mr. LeMay, Mr. Carroll wants to use one of my exhibits that we've prepared and given him, and I have no objection to that. Since I haven't offered it into evidence -- I plan to cover it with a later witness --

CHAIRMAN LEMAY: Okay.

MR. HIGH: -- I am going to go ahead and cover it with Mr. Case so he can use it.

CHAIRMAN LEMAY: Great, thank you.

MR. HIGH: So I do have a few more.

CHAIRMAN LEMAY: It helps to have a reference map when we're referring to this.

MR. HIGH: Mr. Case, look if you will at what I've marked -- or what I should have marked as Exhibit 38. If you will write 38 on there.

This document, Mr. LeMay, is marked "Confidential".

CHAIRMAN LEMAY: I see that.

Q. (By Mr. High) Can you identify --

CHAIRMAN LEMAY: This is not to go in the rejected file, I take it?

MR. HIGH: No.

THE WITNESS: I hope the rejected file is confidential as well.

MR. HIGH: I think Mr. Carroll has implied that he's not going to try to put this in that file since he's the one that wants to use it.

Q. (By Mr. High) Mr. Case, can you identify this document for us, please, sir?

A. Yes, sir. It's entitled the "1992 Life of Mine Reserves, New Mexico Potash Corporation, 10th Ore Zone". Gives the townships and range references.

Q. Was that map prepared by New Mexico Potash?

A. It was.

Q. At any time, Mr. Case, have you ever avoided mining on a State lease to avoid the payment of State royalties?

A. No, sir.

Q. You heard Mr. Gary Hutchinson accuse you of that?

A. Yes.

Q. What do you have, respond to that?

A. I think perhaps, Mr. LeMay, the area that

came to Mr. Hutchinson's attention was this area out on the far west or left side of the map, nominally Midships.

You'll notice on -- just above the red outlined section, the green-hatched sections are mine workings, areas where we've already mined or completed mining.

You'll notice some dates along there, mined, I believe, 5/1979 [sic], through 5/1981. In the lower portion and further west, mined 7/1980 to 8/1982. That gives you a time frame to look at.

If you'll notice the State leases immediately to the south and the leases that Mr. Hutchinson strongly suggested to the Commission that we avoid because of high royalties, that lease was not acquired from Mississippi Chemical Corporation until October of 1988.

This raises another concern that I have about some of the testimony that was given earlier. It seems to me that a reasonable review of publicly available documents would have reflected the fact of these two timings.

I believe a review of publicly available records in the instance of the assignment of leases to IMC would have confirmed that that had not in fact

taken place, and I'm concerned with the opposition leaving you with some ideas that facts and available information would have said not so. This is an example.

Q. So the area on the left of this map that has written on it "M-651", is that the one you're referring to?

A. Yes, the State Lease M-651, Mississippi Exchange, October, 1988.

Q. So that lease which Mr. Hutchinson accused you of intentionally avoiding not to pay State royalties wasn't even acquired by New Mexico Potash until six or seven years after you had completed mining in that area?

A. Yeah. Mr. High, I don't know if it was an accusation. It was certainly a flavor that was left with the Commission that that was an intentional act.

Q. Well, I don't want to put words in your mouth, so just -- ever how you heard it, Mr. Case, that's fine.

All right. And the other State leases are shown in red blocks as well?

A. That's correct.

Q. Now, are there any other areas on the state leases that you want to comment on, Mr. Case?

I'll tell the Commission too, we're going to have another witness with this document. I am only doing this, really, so Mr. carroll can use this document.

A. Mr. High, just by way of general knowledge, the area up here that will appear to have been avoided was in fact avoided because we reached what was then cutoff grade at the edge of that lease.

Q. Now, is that the one that the --

A. This is M-19393 and M-15171.

Q. You did not stop mining on that State lease to avoid paying State royalties, did you?

A. That is correct.

Q. It was for mining purposes?

A. For mining reasons.

In the middle of the map, in the north end, we have an area called M-14857 [sic], in this area here. You'll notice that we mined extensively on that State lease until we reached a barren zone, which is shown by the wider blue hatching on the map.

There are some leases to the far northeast that are in the northeast ore body that we discussed earlier, that we have plans to mine in the intermediate future, if you will.

Q. Will they be mined before or after the

development of the southern leases?

A. They'll be mined after the development of the southern leases.

Q. All right. And the southern leases, are those down in Sections -- What?

A. Well, virtually everything south of the centerline of the map.

Q. Okay.

A. This area in here, Sections 26 and 35, Section 2, Section 36, are the predominant sections in that State lease. You might conclude that we have stopped mining just by virtue of -- that's as far as we've gone, right at the north end of that state lease.

As a matter of fact, we're mining in that State lease today with every intention of developing right straight down through that State lease, so --

Q. And that's the southern movement towards Section 2 you referred to earlier?

A. That's correct.

Q. Okay. Does New Mexico Potash even take into consideration, Mr. Case, the royalties it will be paying when it's deciding in which areas to mine?

A. No, sir.

MR. HIGH: Mr. Chairman, we would offer Exhibit Number 38.

CHAIRMAN LEMAY: Without objection, Exhibit 38 will be entered into the record.

MR. HIGH: And I believe that's all we have.

CHAIRMAN LEMAY: Thank you, Mr. High.

Mr. Carroll?

CROSS-EXAMINATION

BY MR. ERNEST CARROLL:

Q. Mr. Case, let's kind of go back in time to the first part of your testimony and flesh out a little bit of the things that you talked about.

Early on, you said that your basic education and I guess early training was in the metallurgic facets of mining engineering?

A. That's correct.

Q. And have you, though, during your period of years -- and it seems like you've been out 20-plus years at this particular mine -- have you had mine production experience? Would you consider yourself as having had to get into that area, what is commonly termed that, anyway?

A. Well, I'm not sure what you call mine production experience. Being responsible for the entire operation, I am responsible for mine production.

Q. All right. And that would include responsibility for determining what a mine plan would

be, what your LMR would be, those kind of things also?

A. The buck stops at the general manager's desk, so to that extent responsible, yes. I have very competent people who have much more mining and geological training than myself on my staff, and I rely heavily on them to do the physical work.

If you're after the fact, have I ever put pencil to paper on an LMR map or tried to interpolate between holes, no, I have not.

Q. But at least would you say that for the 20 years you have been concerned with these mine production type problems such as developing mine plans, developing where your ore reserves are, and have been, at least with respect to this mine, familiarizing yourself with those problems on a fairly daily basis then?

A. Certainly.

Q. Okay. With respect to developing mine feasibility studies, and in particular as these might relate to capital investment, such things as that, have you been also involved on basic -- probably a daily basis, with those kind of issues, in looking at that kind of data for those purposes?

A. Certainly.

Q. All right. Now, New Mexico Potash Company,

who owns? Is this -- What is the ownership?

A. New Mexico Potash is a 100-percent owned subsidiary of a -- of Cedar Chemical Corporation.

Q. Cedar Chemical Corporation?

A. That's correct.

Q. And Cedar Chemical Corporation, is that part of a conglomerate?

A. Yes, it is.

Q. And what's the name of that conglomerate?

A. Trans Resources, Inc.

Q. Trans Resources, Inc., also owns the mine in this area by the name of Eddy Mine; isn't that correct?

A. That's correct.

Q. Does Trans Resources, Inc., own any other mines in the southeastern New Mexico area?

A. No, sir.

Q. Do they own potash mines anywhere else?

A. No, sir.

Q. With respect to the marketing of potash from your mine, New Mexico Potash has engaged at least in some kind of contractual arrangement for another company or producer of potash or group to help market its potash; isn't that true?

A. Yes.

Q. And that company is the Potash Corporation of

Saskatchewan; isn't that correct?

A. Mr. Carroll, that's getting beyond my area of expertise in that the division of responsibility for the potash basically stops at the point that we put it in the rail car.

There's another branch of the company, both of us reporting to the same senior vice president who is responsible for marketing. And quite frankly, I can't talk intelligently with you about the marketing arrangements.

Q. The marketing, then, arrangements are carried out on a higher level of this conglomerate then; is that what you're telling me?

A. That's correct.

Q. But at least basically you know that this -- that there is an entity that does market the potash, and it's also responsible for marketing at least three -- production from at least three mines in southeastern New Mexico?

A. I don't know the particulars of that arrangement.

Q. I understand that, but you are aware that they are at least responsible for marketing the potash from the New Mexico Potash Mine, the Eddy Mine and now the Horizon Mine?

A. I don't know that for a fact.

Q. Are you aware that this conglomerate, that there is a marketing at least for the New Mexico Potash and the Eddy mines?

A. For some of the output of those mines, yes.

Q. All right. And so your degree of uncertainty, then, is with respect to the inclusion of the Horizon Mine into that category?

A. That as well as the particulars of the contractual arrangements.

Q. Certainly. And I understand, and I'm not trying to get into the particulars of the arrangements.

A. Yeah.

Q. It's just there's another -- There is a body that is in charge of marketing at least some of the product, is all -- as far as I'm going.

Are you familiar with a mining journal called *The Mining Journal, Limited*?

A. Yes.

Q. Do you happen to take that publication on a regular basis?

A. If that's the weekly publication that comes from England, yes.

Q. All right. I do believe that is the same one. In the June 19th -- Would you have any reason to

dispute the fact that in the June 19th, 1992, issue it stated that in February of this year, PCS, this Potash Corporation of Saskatchewan, entered into a long-term agreement to be the exclusive sales agent from the Horizon Potash which produces potash from the AMAX Mine in Carlsbad?

MR. HIGH: Mr. LeMay, I'm going to object. The witness already said he doesn't know anything about this.

If counsel wants to introduce it through a witness that does, fine, but this witness has already said that he doesn't know anything about it.

CHAIRMAN LEMAY: Do you have anyone that would be more qualified in this area that you're going to have as a witness, Mr. High?

MR. HIGH: No, we're not going to put on any marketing --

CHAIRMAN LEMAY: You have no marketing at all?

Where are you going with it, Mr. Carroll?

MR. ERNEST CARROLL: Really, I think I'm at my end.

CHAIRMAN LEMAY: Okay.

MR. ERNEST CARROLL: Just to answer the question that --

Q. (By Mr. Ernest Carroll) Do you have any reason to dispute the reports in this -- This is a respected mining journal, is it not?

A. It is.

Q. Okay. And you have no reason to dispute that report?

A. No, sir.

Q. Let's talk a minute in general terms about potash mining in general.

On your Exhibit 38, as I take it, that by your statement that there is -- at some time in the future there is a plan to move back to the north end of your mine reserves or ore reserves or what have you, and begin developing up there; is that correct?

A. That's correct.

Q. If you'll look at your Exhibit 38, up in the right-hand corner there would appear to be a -- I guess a development passageway that goes right up next to the Section 36 that's cross-hatched as State lease. Do you see that?

A. Yes, sir.

Q. Okay. Now, there's a -- It says "Mined 4 of 1983." Is that when mining stopped in that passageway? Is that what that meant to me?

A. Yes.

Q. Okay. So really, right now, is it fair to say that this passageway -- let's say right out there at the very end where it stops at Section 36, that -- The mining was completed there in 1983, but that is still an open passageway?

A. Yes.

Q. Okay.

A. Or will be able to be rehabilitated.

Q. Okay. It hasn't completely closed in or subsided into that hole?

A. No. If you'll notice, there is no mining for a substantial distance on either side of that. That's what we call a barrier pillar. That barrier pillar was left there all the way from the existing shaft out along those entries to insure that that was an area that would remain open or we could rehabilitate for future entry.

Q. Okay. Now, really, that -- I just wanted to set up what I wanted to talk about, and it has nothing to do with, really, that.

It's just -- Many times, mines do stop activity in an area, but they do plan to go back into it, and at times that area may be left open for a considerable amount of time; is that correct?

A. True.

Q. What are the -- how do you keep -- What are the many different ways that you can keep a development entry like this open?

A. Again, general knowledge, not being a rock mechanics expert or a mining engineer, barrier pillars leaving unmined ground on either side, along those entries is, I think, an accepted way.

Another way is mining those entries higher than is required to extract the ore that's contained in those entries so that what closure occurs still gives you enough opening to re-enter those some years later.

Q. What about rock-bolting? Is that another procedure?

A. We will have an expert on mining engineering testifying later, and that is beyond my level of expertise in the mining business, Mr. Carroll.

Q. Well, just -- Again, you've told me that on a day-to-day basis you've been responsible for overseeing this mine, and I'm trying to just get some general categories elicited from you, Mr. Case.

Isn't that another one -- And I want you to limit your testimony to what you use at New Mexico Potash. You've been down in this mine, and you've overseen it, or you've been there for 20 years, and you've overseen it for a large part of that.

What have you observed at work in the New Mexico Potash Mine to protect these and keep open these many entryways that -- Apparently there's several of them up in the northern part of your mine.

A. Basically what I've described to you. You asked about rock-bolting. That is a way that entries may be sustained.

Q. Do you use it at the New Mexico Potash Mine?

A. We rock-bolt in New Mexico Potash Mine for various reasons.

Q. Okay. What other reasons would you rock-bolt?

A. I'd have to defer to my mining experts on that.

Q. All right. Do you use -- I think the terms has been bandied about, stulls or timbers? Do you use that, shoring up?

A. Very, very infrequently.

Q. Okay. Any other ways that you've encountered in your mine?

A. Not that I recall.

Q. Now, this mine was opened up when, Mr. Case?

A. Began production in 1965.

Q. Okay. So it -- The digging and what have you had to occur before that, but production actually --

A. No -- Well, okay. The mine went into production in 1965. The sinking of the shafts and so forth preceded that, obviously.

Q. And judging from Exhibit Number 38, there are large portions of the mine where secondary mining has actually occurred; is that correct?

A. That's true.

Q. In fact, you were referring a moment ago to a state lease, this M-651.

The area to the north of M-651 has in fact been second mined?

A. That's correct.

Q. All right. And that's really what these -- I guess, these dates were, just right above the section there. It says, "Mined 6/1979 through 5/1981". That reflects the period during which this -- that area right there went through the first and second mining stages; is that correct?

A. Yes.

Q. Okay. Now, has New Mexico Potash Mine ever conducted any studies on the surface to measure subsidence?

A. Not since I've been in responsible charge, no.

Q. And what would you -- What is that period

that you're referring to?

A. Since 1980.

Q. 1980?

A. That's correct.

Q. Okay. So that -- For the last twelve years, you know of none?

A. That's correct.

Q. All right. Are you even aware of any being performed prior to 1980?

A. Not specifically for our operation, no.

Q. Okay. Is there a reason why you haven't?

A. I can come at that from a couple of different directions.

There has been a fair amount of subsidence work done, I believe, by the Bureau of Mines, and perhaps Mr. Lane can testify to that later since he's been in the area much longer than I have, even. And I think that we have generally accepted the findings of those studies to be applicable to our operation as well, and consequently did not find the need to develop specific studies for New Mexico Potash Corporation.

Q. So when -- We've had numerous references to studies done by a Mr. Pierson or Mr. Deere and incorporated in the Golder report. Basically what you've told me is that you're aware of those studies,

and the findings have been acceptable, at least, in your mind; is that what you just testified to?

A. Yes.

Q. Okay. Now, I think what you were -- You were here this morning talking about the situation of what we might call pressure explosions, and in fact, you stated that you had a miner -- or a fatality in one of those?

A. Yes.

Q. And by -- I don't want to use the word "explosion", because most people think of a detonated, fire-type thing, but --

A. Fireball, right.

Q. -- that's not what we're talking about.

A. Okay.

Q. And that's not what occurred at your mine?

A. That's correct.

Q. Okay. So what we have is almost like a situation where a kid blows a balloon up just too far and it just goes, right?

A. Right.

Q. Okay. So now, would you -- Because you mentioned some terminology here and you stated there was -- because you were doing certain procedures and you moved from a geologic hierarchy or something, and

I'm not sure what words you used -- Can you give me, then, the benefit of, one, what caused -- apparently you did some studies and what have you.

What was your -- in your mind, the official reason that this pressure explosion occurred?

A. I believe I testified earlier that the conclusion was that we mined into an historic crack that contained these gases under pressure.

You know, we're certainly familiar with the gases under pressure. We drill a vertical relief hole in virtually ever intersection of the mine to relieve those gas pressures. And in fact when they're relieved, with sensitive instrumentation we can see the back or the top of the mine actually move back up a small amount. And so we intentionally drill those pressure-relief holes.

Those holes were up and active at the time of that release of gases under pressure, and in investigating and digging what we could, the extent of that crack went well beyond anything that we could reach --

Q. Uh-huh.

A. -- by digging with our mining equipment and so forth.

And by looking at the inside of that crack

and seeing the crystals grown there and so forth, we concluded that that was not a new crack. It had been there, as I say, historically, that is pre-mining times.

Q. Sure.

A. And there was no certain cause put to why that crack was there.

Q. Okay.

A. There was a lot of speculation, we did a lot of effort -- made a lot of effort to try and find, was there a way of predicting those cracks or sighting those cracks through the rock in front of us, and we came up dry on that pursuit.

Q. Okay. So right now the -- I guess the conventional wisdom of New Mexico Potash is that this -- there was some sort of a cavity which had this gas in it?

A. That's correct.

Q. And you have decided that there is absolutely no way of predicting when and if you'll ever reach another one of those cavities; is that correct?

A. That's correct.

Q. Okay. Now, you said that you dug into this cavity.

How far did you actually follow the cavity,

Mr. Case?

A. Mr. Lane can testify to specifics on that. My recollection was less than 10 feet with our mining equipment.

Q. Okay. Now, the -- You said that for a period of time after you encountered this, that you began to drill relief boreholes ahead or in advance of the face as you moved your mine?

A. That's correct.

Q. And you did this for a period of time and then you stopped?

A. Uh-huh.

Q. Okay. Why did you stop drilling those things?

A. Because immediately after we started doing this, we would occasionally encounter another pressurized point, okay?

Q. Okay.

A. That released pressure. Then we went on several thousand feet and had no such encounters and concluded that that was a localized phenomenon.

Q. Okay. Now, have you done any studies that would tell you that this localized phenomenon will never occur again?

A. I would defer to Mr. Lane on that.

Q. I don't want the substance of it, but have you done -- are you aware of any other studies being performed by --

A. We did a rather exhaustive study at the time of the accident and have done no further studies after that time.

Q. Okay. Is there a way to predict, in your knowledge, to predict whether or not that will ever happen again?

A. We feel like there are portions of the mine that might be more susceptible to that, where you -- Can you predict where they are? No.

Q. Okay, But at this point in time New Mexico Potash is not drilling the boreholes into the faces they're mining? You've stopped doing that?

A. That's correct.

Q. Is it because the cost is prohibitive?

A. That's certainly a factor, yes.

Q. Okay. And in other words, you don't feel it's good insurance -- or it's not necessary insurance anymore to drill those boreholes to protect the safety of your miners?

A. Mr. Carroll if I had unlimited funds I would probably do it, and unlimited time to develop my reserves.

Q. So at least within the potash industry, you as a miner are faced with the everyday problems of weighing economics with safety of the miners, aren't you?

A. Certainly.

Q. And you make those decisions, don't you?

A. Yes.

Q. Now, let's -- Let's talk about monitoring methane gas a little bit.

Do you have to do that right now on a regular basis --

A. Yes.

Q. -- because of federal requirements?

A. Yes.

Q. What's the frequency in -- both in time and area that you have to --

A. We sample with a hand-held methanometer each shift prior to going to work in that face.

Q. Okay, so --

A. Active areas throughout the mine, wherever they may be.

Q. Okay, and it's limited to the active areas in the mine, then?

A. Yes, sir.

Q. All right. And how many shifts does the mine

-- New Mexico Potash, is it running? Is it running three continuous shifts?

A. We run three shifts for ten days or eleven days and then are down either four or three days.

Q. I see. So you run a 24-hour operation for a certain amount of days --

A. Yes.

Q. -- and then you shut down for a while, and then you come back on again?

A. That's correct.

Q. And so you could -- this monitoring, then -- And this is done, I take it, in satisfaction of federal standards?

A. Certainly, yes.

Q. Okay.

A. Federally approved sampling equipment.

Q. Okay, and it's a hand-held device that you -- I guess you just take it close and -- or hold it in proximity and turn it on, and it tells you?

A. That's correct.

Q. Okay. And I would take it that the mine already has a number of -- You have to have one of these machines for every face, then, I would take it?

A. Yes.

Q. The -- Let's talk about the ventilation

system that you've run through here.

You said that you have two main fans?

A. Yes.

Q. Okay. What's the size of those in horsepower?

A. They are, I believe, 72-inch fans with nominally 200-, 250-horsepower motors on them.

Q. Okay.

A. I'm not familiar with those particulars, but that's the nominal size.

Q. Okay. And then you have booster fans that I guess are down in the mine to keep this going?

A. Yes.

Q. And what kind of -- Are we talking about small fans or large fans --

A. No, they're nominally 36- to 48-inch diameter. They're skid-mounted and have probably 50- to 100-horsepower motors on them.

Q. How many of those do you have situated in the mine?

A. I'm not certain.

Q. Okay. Now, is there federal regulations as to how much -- the volume of air that must move in front of a face?

A. Yes.

Q. Are you bound --

A. I'm familiar with those regulations -- I'm familiar that there are regulations. I count on my mining people to tend to that and tell me.

Q. You can't tell me how much cubic feet of air must pass by the --

A. No, I cannot.

Q. Okay. Is someone that's going to testify later going to be able to tell me the exact number of air that federal requirements --

A. I believe Mr. Lane can probably testify about that.

Q. Okay. Now you did, though, testify -- gave a number to Mr. High, and do you recall what that number was, of air flow that --

A. Our total air circulation is approximately 250,000 cubic feet a minute.

Q. Okay, 250,000 cubic feet a minute.

Now, let's talk just a moment about that calculation. You were -- when you were talking about -- One of your concerns is the personal safety of these people from this methane. And you did a compilation. You broke that 250,000 cubic feet per minute down into 125,000 cubic feet per minute, because you said that you basically have two ventilation systems?

A. Yes, it splits the air.

Q. Splits the air. And this 250 was for the entire system?

A. That's correct.

Q. All right. And you made reference to the fact that there was testimony that some of these wells could produce 150,000 cubic feet a day?

A. That's correct.

Q. All right. And now -- and then you performed a -- at least a -- as a rough calculation that you felt like if the stream of 150,000 -- which was measured at 150,000 cubic feet a day entered the mine, that it would be diluted, but it would go through that range which methane would explode and --

A. Yes.

Q. Okay. And what we're talking about there is that methane -- it has to have a certain ratio to oxygen, or it's not explosive?

A. That's correct.

Q. And when methane is in the presence of nitrogen, since nitrogen won't burn or what have you, that's why it doesn't -- it isn't explosive, and that was one of the reasons you defeated the MSHA classification of your mine back in the early 1980s as a gassy --

A. That plus the fact that the concentration of methane even in the nitrogen carrier never got to the lower limit of explosibility or --

Q. Okay. Now, that compilation that you gave assumed, then, if a well was capable of producing 150,000 cubic feet of gas per day, your statements there assume that the entire 150,000 cubic feet of gas would be put into your mine? That's what you were assuming when you were making those statements?

A. Worst-case scenario.

Q. Worst case. Do you -- okay, so that -- At least for that part of your testimony, you assumed that every bit of that gas was going into the mine?

A. That's correct.

Q. And -- But one other conclusion we can draw, that even if we were putting the full stream of gas into the mine, your ventilation systems will dilute that stream, given enough time?

A. Correct.

Q. Okay. Did you try to calculate the time, or have you done calculations?

A. I don't know.

Q. Now, when you were -- Initially yesterday, when you were talking about the New Mexico Potash Mine generally, when you were talking about the first and

second mining phases --

A. Yes.

Q. -- you stated that in the initial pass-through, the first mining stage, you mined between 30 and 50 percent --

A. Uh-huh.

Q. -- of the ore.

Now, in a normal situation, is that closer to 50?

A. No, it depends on where you're mining and what stage of development you're in.

Q. Okay. Could you explain why? That was my next question.

A. Well, certainly if we're going out, say, to the edge of the orebody, the first thing you do -- and if we follow traditional mining practices, go to the edge of the orebody, start mining from there back -- the first thing you would do would be develop a three-entry -- what we call a three-entry system, that is, three parallel tunnels to the very extent of the orebody.

Roughly the center entry carries the belt system, the conveyor belt system. The other entries, the right-hand entry normally has the power, electrical power, required to run the mining equipment going

through that entry. The third entry -- well -- and fresh air goes down the right-hand entry.

There's a curtain wall established between the second and third entries, so that air goes down to the end of the curtain wall, comes back, and the third entry is a return-air entry system.

So I think you can appreciate these tunnels are nominally 25 feet wide, each of the entries, nominally six feet high for long-term access.

There are pillars where each of these -- mining is done between each of these entries about every 160 feet, is my recollection, that establishes connections so that this air flow is within 160 feet of the face at all times.

So you develop the crosscuts, circulate the air around here, then you do a little bit of mining ahead and are circulating your air over the miner, but then very quickly again you do these crosscuts to establish your entire ventilation pattern.

Now, I think you can appreciate you've got a total width of perhaps -- The three entries are separated, my recollection is, about 80 feet apart. So you've got 25 feet, 80 feet, 25 feet, 80 feet, and 25 feet, whatever that adds up to, in this whole expanse of ore.

So you know, at that point you'd say, okay, you know, maybe five percent of the ore that you're looking at to extract through those entries. So it depends. Then you get out and you start taking what we call submains off of those entries, then panels off of those submains. And each of those consumes a little bit more of the ore in place.

Where we draw the line between first mining and second mining is where we get to one of these panels, we drive nominally 2000 feet ahead of ourselves, and then come off of that and start retreat mining.

Everything up to the end of that 2500-foot development is first mining. From there on back, as we're retreating and maximizing the extraction of ore, is second mining.

Q. So at least the speed, then, that your mine advances is dictated by what you're doing? If you're just driving to the edge of the ore, you're going to be covering ground much faster and going farther distances than you would be in any of the other processes that you just described for us?

A. A ton of rock measures the same whether you're advancing or retreating.

Q. What I'm talking about is that -- Let's say

if you're driving down into a new area, though, if you're just driving these three tunnels that we're talking about --

A. Yes, yes.

Q. -- you're going to get there a lot faster if that's all you do, is drive that tunnel?

A. Certainly.

Q. Okay. Now, when we were talking a moment ago, back up here on Exhibit 38, up in this upper right-hand corner where you stopped just before entering Section 36, would that green-hatched area up there leading up to it, would that have the three tunnels that you're talking about?

A. Yes.

Q. Okay. Now, it's -- Is it the policy of New Mexico Potash to drive to the edge of the orebody when you're making advance tunnels like that?

A. If economics will permit that, yes.

Q. If economics will prevent it?

A. Permit, permit.

Q. Permit, okay, excuse me. That was a slip of the tongue, faux pas, I'm afraid. Apologize.

Is it then safe to assume that when you stopped in 1983 at the edge of 36, that economics would no longer permit you to advance that mine shaft to the

end of the ore which technically could be all the way over to the edge of Section 31, the east edge of Section 31?

A. That's correct. That area was one of many areas under consideration. Recall we have ten faces. You have to weigh the economics of all ten of those faces together.

Q. Uh-huh. So anyway, at that time -- You're saying that at that time economics no longer allowed you to advance the face, and you stopped? Or is there some other reason that you stopped?

A. There is some other reason --

Q. Okay.

A. -- and it gets rather complicated, but we were working up on the west side in about Section 6, that's shown on your map --

Q. Uh-huh.

A. -- up in here.

During that same period of time, we were -- The development of the green hatching that is under the R-31-E in this area, we had developed south to the maximum travel distance that we could from the shaft, and were retreating that area back.

And you appreciate the fact that we had basically a mine over here, near the R-31-E marking,

another mine over here. And the economics of supporting those two mines and the distances required for maintenance people to go from the central shops area to either direction, the timing precluded doing any further development to open a third mine if you will.

So it was -- to the extent that that optimization of manpower and resources entered into the equation, certainly that was one of the elements.

Q. Now, what -- So you're saying that the grade of the ore did or did not really affect your decision in this particular case, then?

A. Grade affects virtually every decision, along with economics.

Q. Okay. And the economics that we're talking about is that you were getting too far away from the mine shaft here --

A. Given the equipment that we then had for moving people through the mine, yes.

Q. All right. Back in 1983, are you telling me that they didn't have diesel Rabbits?

A. I'm saying that we did not employ diesel Rabbits in the mine.

Q. Okay, you just didn't use them back at that point in time?

A. That's correct.

Q. Was another consideration here the -- your conveyor belt? You've told us that you have a set amount of conveyor systems.

Were you stretching your conveyor system at that point too, to its limits, for moving the mined material?

A. I don't recall that entering the discussion.

Q. Okay. Now, at the time, then, that -- and basically what you had is that you were -- you were trying to develop two areas on opposite sides from each other, and that put a considerable amount of distance moving people and really aggravated the situation, then, that you found yourselves in?

A. Let's put it, complicated.

Q. Complicated, okay.

When you finished mining -- When did you finish mining the area, second mining block that's in Section 6? Do you recall?

A. It's been within the past two to three years. I don't recall exactly when that was.

Q. Now, the machines that you moved out of there, why didn't you go back into this area up there close to Section 36?

A. Because we -- At that time we had made a

commitment to develop the south part of the mine prior to the northeast part.

Q. Okay. You made a commitment. What are the elements of this commitment that you made? Why couldn't you go back to someplace where you had already started development?

A. The major consideration was that when we finished mining in the R-31-E area over here, we began pulling conveyor belting back and using it in the south part of the mine.

We also made a major capital commitment to run 48-inch-wide conveyor belting, which will carry all of the mine's production, from the shaft which is -- You can see the little red note there, near Section 6, in the left part of the mine -- from the shaft, east approximately half a mile and then south for approximately two to two and a quarter miles, so that we could develop west off of that belt system and east off of that belt system and have the single belt system carrying ore to the shafts, rather than trying to maintain additional miles of belting to support both northeast and south.

Q. Now -- So what you're telling me is that up prior to 1983, though, you had your conveyor belts and system that allowed you to mine all the way up to

Section 36; is that correct?

A. That's correct.

Q. And so this commitment that you made, and when you did it, it caused you to dismantle this conveyor system and rebuild a conveyor system towards the south; is that correct?

A. That's correct, which is part of normal mining development.

Q. Certainly --

A. Anytime you're on development -- it doesn't make any difference where you are -- you've got to hang belt, you've got to hang power.

When you retreat, you retreat belt and you retreat power.

Q. So for you to go back, though, and mine Section 36 and mine stuff up in the northern part, you're going to have to rebuilt your conveyor system back up in there; is that correct?

A. That's correct.

Q. So essentially, then, you're -- to mine that Section 36, you're going to build your mine conveyor systems twice in a historical perspective for this mine. You're going to be involved in or -- undertaken that cost twice?

A. Yes.

Q. Is that economic, Mr. Case?

A. If you isolate that case by itself, probably not. If you consider the entire mine development, it's certainly within reason.

Q. And you're telling us that it had nothing to do with the fact that Section 36 and Section 31 belong to the State of New Mexico?

A. Yes, sir, I'm telling you that.

Q. And you're also telling us that it's just merely coincidental that this development that stopped in 1983 stopped at the lease line?

A. I don't recall the particular instant at which we stopped northern -- the immediate item that made that decision.

Q. While we're talking about that, let's turn over here to this lease number 651. What -- Your map shows that you --

New Mexico Potash acquired this lease back in 1988; is that correct? October?

A. That's correct.

Q. And you had already done your secondary mining, at least in the part, the smaller part here, this south half. I'm not sure what section number it is, but you completed that second mining in 1982, and you completed the second mining up above it, the

adjoining section, in 1981; is that correct?

A. That's correct.

Q. So --

A. Let me say, Mr. Carroll, that may appear to raise the question, how can you mine out here in 1982 if you finished mining here in 1981?

Entries were kept open, belt systems were open, and we orderly retreated the entry system. In other words, the last thing you do is pull the belt in, you pull the power, and then you send your miner in and do what we call splitting pillars.

Q. I understand it. I wasn't trying to question why --

A. That was part of that development.

But well before Kerr-McGee sold the operation, we were out of even the section south of Section 6 -- I guess that would be Section 7 -- having adhered to our federal leases in that area.

The other leases at that point in time belonged to Mississippi Chemical Corporation.

Q. Certainly. And I was not trying to --

A. Yeah.

Q. I understand the fact that the 1982 was out farther away from --

A. Sure.

Q. Didn't bother me at all.

A. Right.

Q. All that I was trying to -- was really getting as a starting point, your conclusion that all of this area had been second mined at least by the end of 1982.

A. Yes.

Q. And that was some six years prior to the acquisition, then, of this particular --

A. Five years.

Q. Five years?

A. Well, yeah, six years prior to the lease or thereabouts.

Q. Certainly. Now, look over on the eastern edge of that section, that large -- and what section did you call that, that full section there?

A. Well -- The one where M-651 is?

Q. Yes.

A. Or the one north of it?

Q. No, the one where it says just M-651 --

A. Okay.

Q. -- and that's the number that's just below the 1979 through 1981 entry.

A. I believe that would be Section 17. I believe M-651 is Section 18.

I'm not as adept as some of these oil folks are at saying which section is immediately south of another section.

Q. I'm not either. I'm not either, Mr. --

A. But I believe M-651, where the lettering is, called M-651, would be Section 18.

Q. And I think -- I'm sitting here, if that section is 6, two above it, that's probably correct.

Now, look along the eastern edge of Section 18 there. I see a notation that this was mined in 1990; is that correct?

A. Yes, sir.

Q. And in fact, that narrow strip there was in fact second-mined down to your entryway in the year of 1990?

A. That's correct.

Q. And that was mined after acquisition of Lease M-651, was it not?

A. That's correct.

Q. And it appears that while you just entered this section 18, you have been driving even further south in your development, because -- and I take it, and I may be assuming too much by this notation, "current area of mining" --

A. Yes.

Q. -- but that is where you're actually moving?

A. That's correct.

Q. And you are moving south; is that correct?

A. In the very heart of the State section there, that's correct.

Q. All right. And in fact you've actually moved out of the State section into -- I guess that would be -- Well, no, you haven't moved out.

You're approaching the edges of that State section in it looks like probably three different areas; is that fair?

A. Yes.

Q. Okay. Can you tell me, Mr. Case, why, after working so hard to get this M-651 lease, that you would mine along the eastern boundary, secondary mine, and then drive south away from areas which on this map I know that -- I understand that there may be some barren areas here because of this red outline, but there are certainly ore reserves up in that area that you're driving away from?

A. Mr. Carroll, this gets into essentially day-to-day, minute-to-minute mining operations.

Our intent was to take that west-trending set of mains through the center of Section 17, directly west, as far as they would go into Section 18, and then

across into the area where the lettering says "State Lease M-651", because some of the best grade that we had encountered in the last, say, five to seven years of mining was along that face where it says "Mined 7/1980 to 8/1982".

Q. Uh-huh, okay.

A. Are you with me?

Q. These federal leases?

A. Yes.

Q. Okay.

A. We left ore at the lease line all along that one-mile front, along the half-mile front trending north, and then not quite as good quality but still definitely minable quality ore along the mile section where it says "Mined 6/1979 to 5/1981".

Q. Uh-huh.

A. We had every reason to believe that there was ore in the full section called M-651 and the half section immediately to the west of that, that was State leases.

As we developed those west-trending entries through Section 17 and into Section 18, we ran into a barren zone.

We turned south and then west again to try and get around that barren zone. Along with the

drilling program that we did last year, which K-162 is part of, there were two holes put down that gave us an idea of the size of that barren zone that's shown predominantly within M-651, but there is a separate area with a little bit different hatching there, just south of the lettering, M-651. You'll see an irregular area in there.

That is a barren zone that we had no idea was there. And we are continuing to probe around that area and to try and find a way of extracting the reserves all the way out to our lease boundaries.

Q. Now, the area that you second-mined along the edge of Section 17, that northwest edge, had you not second-mined that, that would have been an entryway to go west of through the northern part of M-651 and that little edge of the federal leases that you were talking about having left, wouldn't it?

A. Excellent hindsight, Mr. Carroll, and we've tried the same thing ourselves.

However, at that point in time -- One of the balances that we try and do in the mining business, because when we develop entries, we're developing them high and taking a fair amount of salt dilution along with the ore, that lowers the grade that you're mining. Consequently, you try and keep a balance between the

areas that you're retreating at the four, four and a half feet high to maximize the grade there and blend these and keep a reasonably profitable operation going.

I guess another way of saying that is, we don't want a hundred percent of our machines on advance at one time because of the low-ore-grade situation that that develops.

The reason for second-mining both that area that says "Mined 1980" and the one right next to it -- or "1990" -- and the one immediately to the east of it was to give us some of that balance.

Q. The area that you secondarily mined there in 1990 is a very small strip, isn't it?

A. That's a typical panel width in there, probably, Mr. Carroll.

Q. And the extraction that you did there followed the lease line, did it not?

A. What that followed or what -- the ore that that was after, you can appreciate, if those west-trending entries had developed, okay, if they had not run into the barren zone, we would have been doing panel mining to the north off of that entry probably even today.

Q. And today you feel it is more economically feasible to be driving south; is that correct? Than

going back up and getting this area, or access to this area where you said that some of your best ore was found in the north part of Section 18? And I guess that would give you access over into the adjoining section?

A. Mr. Carroll, we're trying to develop our mine to responsibly extract the resources in Section 18, in the section to the west of that.

We also maintain a balance between the southwest and the southeast portions of the mine because of ore-carrying capability of belt conveyor systems and so forth, and we continue to mine in that area.

Q. And you feel it's economically, then, responsible or conservationally responsible to run away from this small area of good ore?

A. I beg to differ with you that we're running away from that. We have current mining going on in that area, trying to find a way around that barren zone to extract the reserves to the west of it.

Q. What about going straight north?

A. Would you like to come and run my mine for me?

Q. No, Mr. Case, I'm just asking you, because you have said that your mine plan is dictated by

certain economics, conservation, and what I see is that you're moving away from it, you're leaving a small area of ore which, because of its smallness in size, has got to be -- it could quite possibly put you in a position that to return at some later date it's going to be economically impossible. Therefore that ore is wasted.

Secondly, you're talking about moving and building systems that are going away, and what -- And again, in the example up here in the northwest corner, you're going to build your system twice. Again, that's got to be building -- If you go in and build conveyor lines and move them -- build them --

A. I don't understand where you're talking, Mr. Carroll.

Q. Well, I'm talking about up here, in the advance that went towards Section 36.

You built conveyor lines up through there once, stopped, you dismantled them, put them all back to the south. And you say, We're going to go back up there. So that means you're going to have to rebuild them.

What you're saying is the cost to get that Section-36 ore going to have twice the capital costs of building your conveyor system involved in the economics of determining whether or not that ore is economic.

And what I'm saying, if you're building and mining in such a situation where you're doubling your capital costs, that cannot, in my mind -- and if you differ, that's fine, and that's all I want to know, is if you differ with my position here, that I'm saying that it is economically unfeasible or at least not in the conservation of your economic resources to put yourself in a situation where you have to double your capital costs to extract a small amount of ore.

A. I strongly disagree with you on doubling the capital costs from the standpoint that you've re-used and re-used and re-used once-bought conveyor belt.

Q. But you do?

A. Yes, you do have to rehang it.

Q. That's right.

A. That's a very minor part of the cost. You've got the hardware, you've got the belt.

Q. But it does involve time, manpower, and expenditure of some kind of resources?

A. Every drop of ore that I get out of that mine involves time and manpower, Mr. Carroll.

MR. ERNEST CARROLL: Let's talk a minute -- Mr. LeMay, this might be a good, since I'm changing, for the morning break.

CHAIRMAN LEMAY: Let's take a break for 15,

20 minutes.

MR. ERNEST CARROLL: Thank you, sir.

CHAIRMAN LEMAY: Make it 15.

(Thereupon, a recess was taken at 10:25 a.m.)

(The following proceedings had at 10:47 a.m.)

CHAIRMAN LEMAY: We shall continue.

Mr. Carroll, you're on cross-examination.

MR. ERNEST CARROLL: Thank you, sir.

Q. (By Mr. Ernest Carroll) Mr. Case, let's get to a little different area. I think yesterday you told me that the value of the mine was somewhere in the proximity of $150 million, your facility.

A. Mr. Carroll, that $150 million would be building a new mine and processing facility. The mine is -- Please understand that that is mine and surface facility combined.

Q. That, then, is a replacement cost type?

A. Exactly, yes.

Q. Now, this mine was purchased back in nineteen-eighty-something?

A. 1985.

Q. 1985, from the Kerr-McGee Corporation who actually, I guess, began the mine or built the mine from --

A. They were in partnership in the early days of

the mine, yes.

Q. And back in 1985, the New Mexico Potash Corporation purchased this mine for a price tag of $3.5 million; isn't that correct?

A. You're talking about something that I don't know.

Q. You don't know. And you have no information about the price tag?

A. No, sir.

Q. Are you aware that -- Well, you don't dispute the fact that this $3.5-million figure is available through public records?

A. I don't know. I don't know the source of it. I was not privy to the negotiations of the sale. I'm not equipped to talk intelligently about that.

Q. Well, then, when you're doing cost feasibility studies and what have you, do you take into consideration the depreciation of capital? What kind of figures do you use? How do you -- Where do you have a baseline, Mr. Case?

A. I'm not sure I understand your question. Could you --

Q. Well, when you --

A. Try asking me a little bit different question.

Q. Okay. Let me try again. And I apologize.

A. Yes.

Q. Please, anytime you don't understand, please have me try to better express myself.

Let's say you're getting ready to go out and buy ten Volkswagen Rabbits. I mean, you have to have some kind of economic figures by which you judge the feasibility of the expenditures.

When you're looking at your income tax, profit and loss, which is -- when you're looking at feasibility of expenditures, you're looking at your profit and loss.

Well, profit and loss is oftentimes measured by corporations in terms of after-depreciation dollars, those kinds of things. And that's what I'm getting to, Mr. Case.

And I'm just wondering, where do you start from? What -- do you -- this -- If the mine sold for $3.5 million and it's worth $150 million, that's an extreme divergency there. And I'm just trying to get a handle on what you use.

Do you use a $150-million plant, or do you use $3.5 million, or do you just assume that there is no depreciation because everything is written off?

A. Mr. Carroll, I believe your question is

directed to depreciation of the purchase price of the operation; am I correct?

Q. Well, when you look at -- looking at what kind of -- Somehow, if you go out and make a new purchase, you've got to pay for that new purchase. You pay for the new purchase out of profit.

Whether or not you're just existing on a cash-flow basis gives you an idea about that profit. Whether you're using depreciation in your situation, your tax situation, that also gives you an idea of the profit.

And I'm just trying to get a handle on that, and -- you know --

A. Okay. Well, perhaps this will help you. Being a hundred-percent owned subsidiary and selling some of our -- and a measurable portion of our output to a sister plant who further refines our product or converts it from potassium chloride into potassium nitrate, the economic considerations are made at a higher level than our operation.

If you're asking me, is there a depreciation line in our budget? Yes.

Do we have capital budgets? Yes.

Are they approved or disapproved? Yes.

Q. But they're performed on a level that is

above you, then, I take it?

A. The financial decisions, if you will, on what the capital expenditure level should be are made at a level beyond mine. We make recommendations, and then an approved amount is returned to us, both for operating and capital budgets.

Q. You told us yesterday that you had upgraded the ore-moving capabilities of your mine through the purchase of somewhere in the nature of three to five years ago of used coal equipment; is that correct?

A. Yes.

Q. Well, why would you be buying used coal equipment? Is this coal equipment going to last 35 years that you've got oil reserves down here?

A. No, sir, it will not. Nor would new equipment.

Q. Well, why did you go after used equipment? Because it's going to have probably a lesser lifetime than new equipment.

A. That's correct. It also has somebody else eating the depreciation on it. Why do you buy a used car instead of a new car?

Q. That works for the same reason why you buy a new -- buy a used -- a mine that's already in existence as opposed to going out and opening up a new shaft;

isn't that true?

A. I think Mr. Hutchinson did a great job of eliciting that part of the potash economics or mineral economics.

Q. And if you were going to go and build a new shaft down in the neighborhood of Section 2, you are talking about in the neighborhood of a $150-million-type investment then?

A. I don't believe that we said anything at all about building a new shaft.

Q. I know, but I just said if.

In the hypothetical, Mr. Case, let's just suppose you're going to go down there and build a new shaft. You're looking at in the face of -- Opening a new mine you're looking at that kind of capital expenditure?

A. Are you talking about digging a new shaft? Are you talking about building a new processing facility? I'm not sure I understand what you're asking.

Q. Well, if you're talking about building something comparable to what New Mexico Potash now has.

A. I have no desire to do that.

Q. I'm not saying you do. I'm just saying that if you -- The figures that you've given me, this

replacement cost, would be a cost that we could say that if -- in a hypothetical -- and I'm not trying to say that you're going to do that; I'm saying that if a party, an unnamed party, wanted to go and build a mine comparable to what New Mexico Potash, you're talking about a capital expenditure on the order of $150 million?

A. If it were a complete grassroots facility, mine to finished product, shipping, the whole works, yes.

Q. What -- Building these conveyor lines, and a cost per foot or mile, whatever you do that, what's roughly the cost of constructing these conveyor lines that you transport your ore?

A. It would be on the order of two-thirds of a million dollars per mile if everything that went into it was new.

Q. Per mile? How much new conveyor line are you going to need to reach Section 2, over what you now have?

A. I don't have that figure immediately at the top of my head. It's included in studies that we have looked at.

Q. Do you have a cost of what it's going to take to get down to Section 2? Have you done studies and

got a figure for that?

MR. HIGH: Mr. LeMay, we have a witness that will address that.

CHAIRMAN LEMAY: Yeah, why don't we limit the question to what he's capable of answering?

MR. ERNEST CARROLL: Well, I didn't know if he's capable or not. And if he's not, that's fine. What witness --

Q. (By Mr. Ernest Carroll) Who is capable, Mr. Case, with respect to that?

A. I believe Mr. Lane will be testifying.

Q. Mr. Lane?

A. I believe so.

Q. We learned yesterday that -- through Mr. Herrell's testimony, and I believe you've confirmed -- that you're required by the BLM to prepare a three-year mine plan which is required to be updated, I guess, on an annual basis?

A. Yes.

Q. How many years have you been required to do that, Mr. Case?

A. I would defer to Mr. Lane on that, but to my knowledge, that's been a requirement for a long time.

Q. You don't remember a time when you haven't had to do that, then, I take it?

A. Right.

Q. Okay. When you're defining a mine plan -- that's really -- When you're getting ready to construct a mine plan, what are the criteria that -- and I take it that you have third parties do this. What criteria -- What are the instructions that -- the parameters that they have to work within? What are the considerations?

A. Optimum extraction of reserve is the bottom line.

Q. Uh-huh.

A. They certainly consider grade, they consider blending of grades from areas. They consider conveyor carrying capacities, so that you don't overload a portion of the mine with equipment that the conveyors can't move ore away from.

Part of the constraints or part of the consideration is annual production levels.

Q. What kind of -- What was your cutoff grade that you used -- I guess let's ask it this way: The cutoff grade that you used in your BLM mine plan and the cutoff grade that you gave to this third party, was it the same cutoff grade?

A. I will defer to Mr. Lane on that.

Q. Okay. Do you know what the cutoff grades

were?

A. No, I do not, not without going to my files.

Q. Okay. You made a -- With reference to that issue, you made a statement that -- back in referring to Section -- or your Exhibit Number 38 -- that there is a State lease, there's two of them, it's right almost in the middle of the papers, M-15171 and then M-19393.

I believe you said, and correct me if I'm incorrect, that there was some development tunnels being driven in that direction. But then the grade of the ore got to a level that was not economic?

A. At that point in time, that's true.

Q. At that point in time?

A. Yes.

Q. Do you recall what that grade of ore was?

A. No, sir, that was going on just about the time that I arrived at the operation, and again, that was one or two phases out of several, and I don't recall. I was not involved in the day-to-day mine planning at that point in time, so I don't know.

Q. As a general proposition, is that ore economic today?

A. Without revisiting the how to get there and the grade of that ore, I don't know. Without doing

substantial file-searching, which I don't have in my mind --

Q. Did the mine plans that -- And you've seen these mine plans, I take it?

A. Certainly.

Q. You review them, the one to the BLM and this third party.

A. Uh-huh.

Q. Did they differ?

A. From what?

Q. One from the other?

A. Certainly -- Excuse me, one from the other what?

Q. The BLM mine -- the mine plan that you submitted to the BLM, as opposed to one of these third parties?

A. We have not had to submit a mine plan since the third-party plan was completed. When I said certainly, I thought you meant from year to year to year.

Basically, Mr. Carroll, a mine plan is a snapshot of a period of time. The one certainty about a mine plan is that six months from now it will be different.

It will provide general guidance, but mining

rates, the blending of ten different areas and so forth, precludes you from doing a very definitive plan. You use it for guidance, you update it periodically, and that's the intent of the study that we've recently had done.

Q. No matter who draws up the mine plan or how good it is, the actual ore itself dictates where you go; is that what you're just -- basically what you just said?

A. That is one of the factors, certainly. It's not the only factor.

Q. When you say that you will be down into Section 2 within a range of eight years from where you presently are -- I think that was roughly -- seven to eight --

A. That was the indication of the plan, yes.

Q. Okay. If you encountered a -- and let's turn to your Exhibit 38. Your Exhibit 38, to get down through -- to Section 2, and on Exhibit 38 you show a barren zone that includes parts of Section 22, 27 and 26; is that correct?

A. Yes, I see that.

Q. If that barren zone moved farther to the -- say to the west, like the barren zone up with the M-651, that could preclude you from ever reaching

Section 2, couldn't it? It's a possibility?

A. Possibility.

Q. So the prediction of being there in eight years is dependent upon a number of things and is basically a guess?

A. As is all the mine plan.

Q. Now, this third-party mine plan, it was prepared this year; is that correct?

A. That's correct.

Q. And do you recall when it was submitted to you, approximate dates?

A. Roughly mid-July.

MR. HIGH: Mr. Chairman, I'm going to object. Counsel has objected to the document and won't let me offer plans, so I'm going to object to his getting into it himself.

MR. ERNEST CARROLL: We're talking about motive now, and that's as far as I'm getting into it.

CHAIRMAN LEMAY: Yeah, but you can't get into the plan if you -- The existence of a plan has been testified to, so --

MR. ERNEST CARROLL: And that's all, that's all I care about.

CHAIRMAN LEMAY: Okay.

Q. (By Mr. Ernest Carroll) At the beginning of

your testimony, and I was unable yesterday -- when I was going back through my notes I made some rough notes that I couldn't make a darn bit of sense out of.

You -- I think you listed some reasons why you hired or contracted for this third-party mine plan; is that correct? Do you recall? Did you give some reasons why you did it?

A. I basically said we were asked by our senior management to have a plan done.

Q. Okay, what was the reasons --

Well, first let me ask you this question: This is not a normal occurrence, then, for you going out and getting a third party, I guess, review of your mine plan and oil reserves?

A. That's correct.

Q. What was the reason why management at this point in time wanted you to go out and obtain this kind of document?

A. I'm not in a position to second-guess my management.

Q. Well, you must have an opinion, Mr. Case.

A. My opinion was that they wanted a confirmation of the information we had been providing them, since they had been owners and prior to them becoming the owners, that they wanted a confirmation of

the information we provided to them.

Q. Okay. And what information do you think they were seeking to have confirmed?

A. Ore grade, ore reserves.

Q. Now, did this mine plan in fact confirm the fact that you had 35 years of minable reserves?

A. Yes.

Q. Now, when you say you have 35 years of minable reserves, what is that based on? What do you call minable reserves? What's your cutoff?

A. Those parameters were given to the consultant that did the study. I don't have them fixed in my mind at this point.

Q. Mr. Lane --

A. There were parameters given to them. They adhered to those parameters and developed a plan using accepted techniques.

Q. Did you, in your directions for development of this, besides giving them parameters of cutoff grade, did you tell them specifically that you wanted to -- a mine plan to encompass mining of Section 2?

A. Mr. Carroll, I was not in the parameters establishment meeting. Appreciate the fact that I have three people on my staff that have lived with and in that mine on a daily basis, and I rely very heavily on

their judgment and their direction in technical -- detailed technical matters such as this.

Q. Now, let's talk a minute about -- I believe that you said that New Mexico Potash embarked upon a core-hole program, and it was the first one that they had had in a number of years. I don't recall the exact number, but it was something on the order of nine. And then you added one more, the K-162 hole?

A. That's correct.

Q. What was the motivation behind embarking on this core-hole program, the drilling of these ten holes?

A. Mine development, mine planning.

Q. And when did this program begin, roughly?

A. We had proposed that -- We meet with our senior management on an annual basis. We had proposed that prior to that meeting. It was discussed and finalized late October of last year. We had proposed it probably mid-year or thereabouts.

Q. How did you determine the areas that these core holes would be drilled?

A. Again, I left that up to my experts and their recommendations as to where they needed information to assist them in mine development.

For example, Mr. Carroll, on the exhibit, we

had run into the edge of the barren zone in that section that we've been calling M-651. I believe it's Section 18.

Q. Uh-huh.

A. And we had run into the edge of that, and they requested that we put down a couple of holes there, or recommended that we put a couple holes down there, to see if we could determine what the extent of that barren area was so that we might have an indication how we could extract the ore on out to the west there that we know to be good ore.

Q. All right.

A. As a for-example. There were other holes scattered across the intended mine workings.

Q. If you were to drive a mine shaft from your present -- wherever you're presently working, down into Section 2, where is the most feasible spot to begin that shaft from?

You've got a broad frontier of -- I'm being corrected, not a shaft --

A. Yeah, okay.

Q. -- but a development tunnel or --

A. Yeah.

Q. -- or a room, that we're talking about.

A. There are two potential avenues into Section

2, running on either side of the barren zone that you know to be 4 and essentially -- Sections 26 and 27.

Q. Now, would New Mexico Potash drive a shaft, let's say, on the west side of this barren zone, and isn't it true that this barren zone, as depicted here in Section 26 and 27, almost touches the edge of your lease line, does it not, there in the -- your lease line -- In fact, you don't control the southwest quarter of Section 27, do you?

A. That's correct.

Q. So that barren zone comes very close to your lease line; is that correct?

A. That's correct.

Q. So if we came down the east -- or excuse me, the west side of the barren zone, you would -- in order to stay out of the barren zone, would have to drive through that very narrow corridor between that southwest corner of 27 and the barren zone?

A. That's correct.

Q. Now, do you intend to drill more core holes before you drive down through there?

A. Certainly.

Q. Do you have those core holes scheduled at this time, Mr. Case?

A. We do not.

Q. Now --

A. Let me back up and say, we have them on a calendar. We do not have an approved core-hole drilling program year after year after year.

We have -- We currently have a proposal for seven additional holes, at least one of which is in that general area.

Q. Where are the other seven holes? Are they going to be --

A. I don't think that that's of importance to the issue of Section 2.

Q. Are they in Section 2?

A. No.

Q. Now, so without additional core-hole testing, we don't have any idea that it's even feasible to drive down on the west side right now? We have no idea what we're going to encounter?

A. True.

Q. Now, let's talk about going down the east side.

MR. HIGH: Mr. Chairman, I've listened to this a long time. I don't know what this section has to do with it or not. If we're going to mine north of it, south of it, east of it. We're here to talk about Section 2, and we're spending an inordinate amount of

time on this section --

CHAIRMAN LEMAY: I would agree with you partly in the sense that we did spend a lot of time trying to second-guess every little thing in the mine operation, which -- I would have to say the same thing I talked to Mr. High: Make your points and make them quick and to the point.

I think when he's talking about reaching Section 2, we have a significant issue there, because Section 2 is what we're considering as part of this case. And how to get there, I think, is part of that.

MR. ERNEST CARROLL: And that's my point, and --

CHAIRMAN LEMAY: It took you a long time to get there, Counselor. We wasted a lot of time mickey-mousing around the mine. I think you're on a pretty good issue now. Why don't you pursue it?

MR. ERNEST CARROLL: Well, I have to learn some things too, Mr. LeMay, and I apologize.

CHAIRMAN LEMAY: Well, in every shaft you've got, I mean, it's like saying -- second-guessing every decision in drilling a well.

Q. (By Mr. Ernest Carroll) The -- Let's look on the east side for just a moment. You would have to come again -- you have the boundary of -- You would

have to get around your barren zone that you show over into 26, would you not?

A. If that, in fact, is an accurate portrayal of the barren zone.

Q. Okay. And in fact, part of your nine core-hole program, you drilled three core holes in Section 26, didn't you?

A. I don't believe so.

Q. You didn't drill 159, 158 and 151?

A. Those are old holes --

Q. Those are old holes?

A. -- Mr. Carroll. They weren't in any of the current drilling programs.

Q. You didn't drill any in Section 26, then, in that program?

A. Not in the program that was completed the first of this year.

Q. Okay. You heard testimony that -- You were here when Mr. Lammers testified, didn't you?

A. Yes, I believe so.

Q. Core hole ERDA, ERD Number 6 is located in the southeast part of Section 35?

A. Yes.

Q. You recall that, don't you?

And you also recall the testimony that -- of

Mr. Lammers that in the 10th Ore Zone, which is the ore zone that we're mining --

A. Yes, sir.

Q. -- with your mine, that it was barren there?

A. I recall that testimony.

Q. You also recall the testimony that the three oil wells -- if you look in Section 2, the three oil wells -- There's four oil wells along that eastern edge.

A. Yes.

Q. And the three bottom-most, Mr. Lammers also testified that, from the use of well logs, that the 10th Ore Zone in each of those three wells indicated that they were barren.

Do you recall that testimony?

A. To the extent that that information would be relied on, yes.

Q. And at least on your Exhibit 38, your LMR line is to the opposite side of that and includes those ERDA 6 and those three oil wells within your 10th Ore Zone orebody?

A. That's correct.

Q. And I guess the final question is, is that if you honor ERDA Number 6, that it's quite possibly -- it's quite possible that this barren zone that's in

Section 26 would extend down and cut off your avenue to the east to Section 2?

A. That's speculation, I believe.

Q. But it is within the realm of possibility, based on that scientific evidence?

A. As well as the realm of possibility that ore is exactly where it's shown.

Q. When you -- just -- Just help me understand. When you do these core holes, like core hole K-162, are they done sequentially in number? Would the last core hole that you drilled have been K-161, or do you know?

A. Normally when we do a drilling program, there will be a block of hole numbers assigned, and they will be completed within that period.

What I'm saying is, for example, if we had ten holes numbered K-170 to -179, those ten holes would be completed in that drilling program. 175 may be drilled before 173, but generally the time frame of drilling you would be able to determine from the hole number because, yes, we do number --

Q. -- sequentially?

A. -- generally sequentially.

Q. Well, would this -- This 162 hole, this is nine- or ten-well program, do you know where those numbers started? Are they in the 150s?

A. I believe they're in the 160s.

Q. Okay, so --

A. Perhaps the 150s, but -- yeah.

Q. You don't have that; Mr. Lane would probably be --

A. I don't have it right up here. Mr. Lane probably has it memorized.

Q. When you -- when you mine, the -- you're taking out probably on the order of four-to-one, or something in that nature, of tons of material to get one ton of potash; is that correct?

A. Mr. Carroll, that's one of those numbers that someone skilled in the art can take and begin to develop costs from. All I can tell you is that that ratio is low.

Q. Okay. And that suits my purposes for this. The material that -- this excess material has to go somewhere; is that correct?

A. That's correct.

Q. And in fact, a lot of this material, after you go through your mining or milling process, is in a liquid form. You use a lot of water, I guess, in your processing, don't you?

A. Yes.

Q. Okay. And in fact, you have a large pond

where this water and stuff goes to?

A. That's correct.

Q. What's the size, just roughly, of your tailings pond out there at the New Mexico Potash?

A. Well, we have two tailings areas.

Q. Okay, you have two tailings areas.

A. One of them is nominally a half section. I'd say one of them is probably three-quarters of a section, something like that.

Q. Okay. These two tailings ponds, are they over areas where you have secondarily mined?

MR. HIGH: Mr. Chairman, I'm going to object. This has nothing to do with this case. We've got nine witnesses to put on, and we're talking about things that have absolutely no relevance.

CHAIRMAN LEMAY: Where are you going, Counsel?

MR. ERNEST CARROLL: My next question is going to be, I want to know if they've done any studies on the subsidence, how it's affected that tailings pond and the leaking of the water into the mines.

I think Mr. High knows the relevance.

CHAIRMAN LEMAY: Ask the question.

THE WITNESS: The tailings pond immediately at the plant site would be over an area that has been

only first mined to protect the plant site pillar and the shaft pillar.

To the best of my knowledge the outlying pond, which is about three or four miles away from the operation, is, I believe, over unmined land.

Q. (By Mr. Ernest Carroll) Have you had any problems with subsidence or have you seen subsidence in the area of these tailings ponds?

A. I am told by, again, Mr. Lane, and -- If it please the Commission, I continue to defer to Mr. Lane. The only thing older than Mr. Lane and this operation is the deposit itself.

CHAIRMAN LEMAY: And that's undoubted.

THE WITNESS: He began his potash experience back in the Fifties and has been involved with Kerr-McGee since Hector was a pup, and he's the man that's intimately familiar with this.

But again, he has the details of that information.

I'm told that for six feet of mining underground we will generally see something on the order of one to two feet of subsidence on the surface.

Q. (By Mr. Ernest Carroll) Have you personally seen any of that in that area, that --

A. I have not seen any of the effects of that,

if that's what you're asking.

Q. That's what I was asking, thank you.

With respect to the -- your ore reserves and your mine -- You're saying you have 35 years of minable ore. Do you -- Have you done any studies as to -- with respect to how environmental issues are going to reflect the length of the longevity of your mine? Is that an issue that is cranked into this figure?

A. That was one of the items that the study addressed.

Q. How does it address them? What were your instructions on how it should be addressed?

A. To give us a general overview of potential environmental problems, and that's like opening Pandora's box, but there was a section of the report, perhaps two pages, that addressed potential environmental problems.

Q. Did it restrict the lifespan of this mine?

A. No, sir.

Q. You, yesterday made a statement that -- and I think you were trying to -- you were quoting from -- I guess it was one of the times when you gave an opinion that you did not agree with the applicability of some of the figures that Mr. Hutchinson used. And one of those numbers that you did not disagree with is -- and

I think you said that you thought Mr. Hutchinson used six feet of 16-percent ore to determine what economic ore was.

Was that a fair statement for you?

A. My understanding of Mr. Hutchinson's statements of parameters required for profitability was six foot of ore, 16-percent grade.

Q. Well, Mr. Case, could you be mistaken about that?

Because I've reviewed the testimony, and the only time the six foot of 16-percent was used was when he was calculating the amount of reserves that would be left around a pillar 150 feet in diameter, for the lifetime of a producing well.

And that -- Those figures only were used, then, to come up with a tonnage figure.

Could you be mistaken?

A. Certainly.

Q. And you do recall that when Mr. Hutchinson was developing his mine plan, that one of his assumptions was -- is that if the ore within your lease boundaries did not -- if the area within your lease boundaries that was unmined did not fall into a barren -- a depicted or plotted barren area that we had shown, he used it as economic ore, and used that as

part of the mine plan. You do recall that assumption being made by Mr. Hutchinson?

A. Yes.

Q. So basically in determining his mine plan, he really gave no importance -- If it wasn't in a barren area, he concluded that it was economic ore for the purposes of the mine plan?

A. But I also believe that he -- in arriving at a number, which I recall to be 135 acres per year, he must have assumed some mining height to generate tons, or assumed some tons to generate a mining height, and the 135 acres per year is in error.

Q. Mr. Case, if you'll recall, the New Mexico Potash Mine is required to show their current mine workings and furnish maps --

A. Yes.

Q. -- to the OCD?

And if you'll recall, I think that it was Mr. Hutchinson's -- He just computed the area of the mined-out areas over the period of some 39 months and arrove -- arrive -- arrived at -- excuse me, my mouth is getting dry -- arrived at that 136 acres from that basis?

A. I understand that that's the way he did it.

Q. All right. And that was just based on what

New Mexico Potash showed as having been mined?

A. If he included all the areas that were mined. You know, I'm not privy to what he used, detail by detail. I don't know where the error arose.

All I'm telling you is that 135 acres per year is wrong.

Q. What -- How many acres do you need?

A. I believe I told you yesterday or told the Commission this morning that one section, which is 640 acres, would currently support about two and a half years of mining.

Q. Currently support two and a half years of mining. And what -- At what rate a year mining are we talking about?

A. Somebody divide 640 by 2 1/2 for me. I don't have my calculator.

Q. It would be 256?

A. Close enough.

Q. No, what I'm talking about, when you're saying support mining for two and a half years, how many tons are you mining a year, then?

A. I believe I testified yesterday approximately 400,000 tons a year.

Q. And --

A. I'm sorry, we are producing. Thanks for

raising your eyebrows. We are producing 400,000 tons per year of finished product, and each section will contain about a million tons of finished product.

Q. And you're producing about 60 percent KCl, right?

A. Of that, no.

Q. What are you producing?

A. We're producing 98.1 percent KCl.

Q. What about K_2O?

A. About 62 percent.

Q. About 62 percent. And when you convert that 400,000 tons, you divide 60 by 14, do you not, to come up with approximately 4.29 tons of material to get the 60 percent or the 62 percent?

A. That may be the way you do it. I have a number of other factors that I've put in there.

Q. The -- Assuming the maps that New Mexico Potash furnished the OCD were correct, they should depict the actual area that New Mexico Potash has been mining the last several years?

A. Yes.

Q. You talked this morning about -- You alluded to mishaps that give you concern. And let us talk about these safety concerns as the last area that I want to visit with you on.

You said that at some meeting or something that you studied some 16 to 18 mishaps in southeastern New Mexico and these caused you concern.

What kind of mishaps are we talking about?

A. My recollection was that they were blowouts in drilling.

Q. These were surface blowouts?

A. I don't know. They were characterized as blowouts.

Q. You did not ask any questions or do any studies to determine what kind of blowouts or the mechanics of those blowouts?

A. I don't know what information was developed beyond the list that I saw, Mr. Carroll. I was not on that committee. I was not responsible for developing the list.

Q. The -- This little incident that you had with MSHA where they came in and found the quarter percent or better of one percent of methane --

A. Yes.

Q. -- did you happen to say that that incident itself led to the adoption of the present gassy classifications, the 1, 2, 3, 4?

A. This incident, one at Mississippi Chemical, and several others across the country, certainly the

Belle Isle Salt Mine disaster had some impact on that.

But basically what generated the new mine-safety regulations in regard to gassy mines was a recognition on the part of industry and MSHA that one classification for every mine, regardless of geologic history, regardless of type of mining, regardless of material mined, regardless of mine atmosphere, was wrong.

Q. Now, the procedure that -- When you get a notice that you may be upgraded from a 4 to a 3, it's a notification process which allows you as a mine operator to protest; is that correct?

A. That's correct.

Q. And that -- The rules themselves state that, in particular, 57.22004, it says, "While the request for the category/subcategory reassignment is pending, the mine shall continue to operate under the standards for the category or subcategory which was originally assigned."

So this process starts out, you've got a right to contest that particular reassignment or the reclassification don't you?

A. Yes.

Q. And the fact that -- Let's just say that we have an isolated leak. The fact that you can go in and

let's say you shut this leak off, that would be taken into consideration and in fact would be your argument that you shouldn't be permanently classified with -- if you could -- if you could shut it off, and I'm assuming that.

A. Here we get into probabilities or possibilities or iffies again.

MSHA, I think, would take the position, knowing the nature of MSHA and their regulatory authority, if it's happened once it can happen again, and we're going to be sure that you're equipped to handle it.

Q. And in fact, when they give you this notice, one of the criteria that they have to point out to you, again, that same section number, is that in their notice, they have to state whether or not the conditions encountered during primary or access development are transient or permanent, don't they?

They have to tell you that, and then -- so that you know what kind of an issue you're dealing with?

A. Yes, sir, and I hope at that point we would be in bed together, saying it's only going to happen once.

But I know the mentality of MSHA, and they

are going to guard against it happening again. If it's happened once, it can happen again.

Q. Mr. Case, you stated that right now, in response to a question from Mr. High, that there's no way that they could -- would force you to mine within a half mile of one of these wells, because that's the buffer -- that's the safety zone. And you, I think equate --

A. I believe what I said was absent any further information or more intelligence, if you will, about mining closer than that.

No one is going to force me. That's going to be an option that we as a company reserve.

Q. You are aware that there are other mines in the basin that are mining up to plugged and abandoned wells?

A. As we have.

Q. As we speak?

A. No, as we have.

Q. As you have too?

A. We have three dry, plugged and abandoned wells that we have mined within 200 feet of.

Q. All right. And the -- I believe when you said that these zones, these half-mile zones -- that there were a number of people that spent a number of

hours agonizing.

Were there any studies that you're aware of that were performed to determine the safety, or was it just agonizing going on?

A. Mr. Carroll, I don't know in detail the history of the initial adoption of that quarter and half mile, but it has been historic since the 1950s or 1960s, and something went into the establishment of that. I don't know what, because I was not privy to those studies.

Q. And New Mexico Potash has not done any studies on its own --

A. We have not

Q. -- to determine that?

You're also aware that when the -- There's at least some consensus of thought that when the half-mile buffer zone was adopted for Delaware wells, that that was merely a mistake and it should have been a quarter mile?

A. Yes. I beg your pardon, a quarter of a mile or depth of ore plus ten percent, and in our particular mining configuration, we think more in terms of the depth of ore plus ten percent because we're mining nominally 1600 to 1700 feet deep.

Q. Are you saying that this depth of ore plus

ten percent, that that is going to provide your mine opening safety for not only subsidence-caused leaks of gas, but just any kind of leak of gas?

A. No. I think it has come out over and over again in testimony, nobody knows what that distance is. It seems like a reasonable distance.

Q. Are you aware of any studies which have been -- that the Potash industries have done to determine or not if that's reasonable?

A. I am not.

MR. ERNEST CARROLL: Pass the witness.

REDIRECT EXAMINATION

BY MR. HIGH:

Q. Mr. Case -- Oh, I'm sorry.

Mr. Case, after -- following the blowouts which you described as being a nitrogen blowout when we had a fatality down there --

A. Yes.

Q. -- Mr. Carroll asked you some questions about discontinuing the drilling the holes.

A. Uh-huh.

Q. Did New Mexico Potash take any additional steps or other steps to protect people in the eventuality that you ran into that condition again?

A. Yes, we built substantial -- I guess the most

descriptive and understandable term is "windshields", if you will, on the front of the miner ahead of the cab.

We were uncertain at the time of the fatality whether flying rock or a lamp that had been blown off the front of the machine came back and struck the operator on the forehead.

What we have done is built shields that would deflect anything coming from that direction up over the head of the operator, and those are installed and maintained on all of our continuous mining equipment.

Q. And as we sit here today, are those protective devices still being used?

A. Yes.

Q. Okay. Now, one area that I didn't ask you about, that I overlooked and I want to just ask you briefly about. You heard the testimony about -- Mr. O'Brien, about the test that was done in the oil industry, about -- in coal mining, about plugging an abandoned well and then mining through it.

A. Yes.

Q. Is that something that you think is feasible in the potash industry?

A. No, it is not.

Q. And why is it not feasible?

A. Well, we developed this morning the difference between gassy and non-gassy mines.

The plug-and-abandoning test that was reported was done in a coal mine wherein if the test had failed, the mine was equipped to handle whatever encounter of methane might have been there.

Such a test in potash would, for safety purposes, require the mine or the area of the mine that was being tested to be converted to a gassy -- permissible equipment to insure that if the plug failed -- the safety of the miners that were trying to mine through that plug.

And again, we discussed earlier, testified earlier, what the costs associated therewith would be.

Q. The consequences of a leak in a plugged oil and gas well like that into a coal mine are virtually insignificant; is that correct?

A. That's correct, because they're dealing with methane day in and day out. I believe the term is coal-bed or coal-seam methane. I think that's a term that's probably more familiar to you all than it is to me.

But right along with the coal that they're mining they get methane on a day-in, day-out basis, and they're equipped to handle it.

Q. And the same cons- --

A. They develop their mines to handle it from the git-go.

Q. The consequence is not the same with potash mining?

A. That's right.

MR. HIGH: That's all we have, Mr. LeMay.

CHAIRMAN LEMAY: Thank you.

Mr. Carroll?

RECROSS-EXAMINATION

BY MR. ERNEST CARROLL:

Q. Did you read that coal-mine report? Have you studied it?

A. I skimmed it.

Q. You skimmed it?

A. Yes.

Q. And it's your opinion that there are no circumstances under which you could ever run a test in a potash mine because you don't have this permissible equipment; is that what you're saying?

A. Mama taught me never to say never, but I would not want such a test done in my mind if there were the possibility of methane coming around the test plug or whatever.

Q. Well, are you saying that we cannot learn

from the fact that the plugging procedures there absolutely precluded the passage of a gas, which wasn't methane that they were measuring; it was another gas that had a higher detectability?

A. Mr. Carroll, I believe if you read the report very closely, you will find that they had three -- two or three, and I don't know how they can't distinguish between two and three -- reflections of sulfur hexachloride in that mine that they attributed to contamination during the injection process.

Was that contamination during the injection process? I don't know. But they got some few number, granted, shows of the test gas on the wrong side of the casing.

Q. But MSHA has concluded, though, that plugging those oil wells provides an effective seal. No gas will escape. That's the conclusion that they report?

A. For mines that are equipped to handle methane in the event that they do fail.

Q. But whether or not -- The fact that they're equipped to handle methane afterwards has nothing to do with the conclusion that the sealing process worked, did it?

A. I'm not certain that the seal process did work.

MR. ERNEST CARROLL: That's all.

CHAIRMAN LEMAY: Thank you.

Commissioner Carlson?

EXAMINATION

BY COMMISSIONER CARLSON:

Q. You mentioned that there was three P-and-A'd oil and gas wells in the mine?

A. Yes.

Q. Where are those? I think I see one, which is in -- I guess that's --

A. Again, Mr. Lane has these memorized. The map that I had in front of me doesn't have that information on it.

Q. I see one in Section 8, I think. And another one way up in the northeast in -- I guess that's Section 1. Or no, thirty- --

CHAIRMAN LEMAY: Thirty-five?

COMMISSIONER CARLSON: Thirty-five, yeah, sure.

THE WITNESS: There is one in 35. I'm pointing at it here, northeast quarter.

COMMISSIONER CARLSON: Right, okay, yeah.

THE WITNESS: There's another one down in the general area of where these mains turn to the northeast in this general area --

COMMISSIONER CARLSON: Okay.

THE WITNESS: -- here, Mr. Carlson.

MR. HIGH: In Section 35 down south.

CHAIRMAN LEMAY: Section 35?

MR. HIGH: Section 35 northeast, Section 35 south, and the one over close to M-651.

THE WITNESS: There's another one over in the west part of the mine. I'm not certain right now where it is.

Again, Mr. Carlson, Mr. Lane can put his finger on those much quicker than I can.

Q. (By Mr. Carlson) And you didn't mine right through those?

A. No, we did not.

Q. You left a pillar?

A. That's correct.

Q. Of --

A. -- about 200 feet.

Q. -- 200 feet?

A. With the knowledge that those had been dry holes to begin with.

Q. When were those wells drilled? Do you know?

A. I believe in the 1950s, but again I don't know and I would defer to Mr. Lane on that.

Q. Do you know if they had shows of

hydrocarbons --

A. I do not know.

Q. -- or were they completely dry?

A. I don't know.

Q. Did you check that when you decided to mine up to within 200 feet?

A. Mr. Carlson, to the best of my knowledge, most of that mining was done before I was involved in the decision-making train.

Q. Would Mr. Lane know that?

A. Yes.

Q. What does it cost to drill a core hole?

A. It will depend on how much roadway you have to build to access the site. The average cost of the ten holes that was drilled last year was about, if I recall, $21,000, $22,000 per hole. The current program that we have in is on the order of $30,000 per hole.

And again, the large variable is the roadway requirements.

Q. Does that include the cost of evaluating the cores?

A. Yes, the analytical work and the geologist's time on the hole.

Q. Mr. Hutchinson, if I can find my notes, he said that New Mexico mines will survive only as long as

Canadian mines let them.

Are you going to have somebody testify about that, or is that something that you're knowledgeable about?

A. I don't know how knowledgeable I am about that. Basically, the Canada dog wags the Carlsbad tail. They are by far the larger producer, the larger reserve holders.

There's some question about their production costs in terms of do they include or do they not include the cost of flooding of mines in their planning and costing of their projects, because two of those mines up there have been lost or nearly lost up there on flooding.

I know of one example up there where in one of the International Chemical mines there, where their pumping costs, their power for pumping is the same as my power bill for the whole -- for my whole operation. So there are some unusual costs, although they have some beautiful ore.

And there are some additional development costs that are not germane to Carlsbad.

But basically, Mr. Carlson, however you look at it, if you add production costs and transportation costs, that will define a line through the United

States, north of which Canada can compete and south of which Carlsbad can compete.

Q. Well, Mr. Hutchinson testified that -- and it was his estimate, he estimated that Canadian mines will let New Mexico mines survive for another five to eight years, and that's all. Do you agree with that?

A. I don't know what goes on in the minds of the Canadians. We certainly haven't plugged that into our mine planning and have not been directed to by people who are much more knowledgeable about the international potash market than I am.

Q. But you agree that Canadian mines do have that market power if they'd choose to exercise it?

A. I don't know that they would shut us down. They would greatly curtail our market area, and unless other market areas were developed that we could serve cost-effectively, yes.

They're, for example, running at 60-percent capacity. It has to do -- And there was a Commerce Department investigation that was completed late in 1987 regarding dumping of Canadian potash into the US at the time that the potash industry was struggling in the mid-eighties. It was concluded that that was as a result of unfair trade practices.

That situation was resolved by setting a

floor below which the Canadians could not sell potash in the United States, and I think that was a company-by-company variation. And since that time we have been able to co-exist very well.

So I assume that if Canada starts to do that again, there perhaps would be some government intervention that would offset that. That's an assumption on my part, but that's what happened the last time.

Q. Was your proposed -- I guess it was a lease assignment to IMC. Was that for langbeinite only, or were you intending to assign your whole rights to all of the potash within Section 2?

A. At the time those discussions were going on, we thought we had only langbeinite in that reserve, and our intent would have been to assign the leases to them, perhaps for the consideration of an override.

Q. So you never gave any thought to reserving any sylvite because you didn't know it was there; is that correct?

A. That's correct. And Mr. Carlson, I'm not sure what either state or federal regulations will allow in terms of two holders, one of sylvanite [sic] leases and one of langbeinite leases. I don't believe that that's a possibility. I think you either get the

potassium lease or you don't get it. And there can only be one leaseholder, my understanding.

Q. I guess -- You testified you wouldn't -- 125-feet radius pillars, you certainly wouldn't trust that. Is there a number you would trust, or is it the half mile?

A. The half mile or quarter mile or depth of ore plus ten percent seem reasonable.

The 125 feet, I think, Mr. Carlson, the reason I don't trust that is that we've heard several people testify that so-called vertical wells can wander off from vertical, and do. In fact, if you get one that you can drop a rock from top to bottom without touching the casing, you've got a miracle.

If they deviate as much as 15 percent -- or, I'm sorry, 15 degrees -- which I've heard that number several times through the testimony too, as perhaps the outside limit. But if that outside limit were approached, if I recall, it's a strict trigonometric function, but if you go down 1650 feet, 15 degrees out is out about 440, 450 feet.

So I would be very hesitant to look at anything that would be much less than that, for fear that we didn't know exactly where that pipe was.

Q. Is there any way to determine -- and you're

probably not the right witness, but exactly where a pipe would be at 1600 feet? Can you tell that when they're drilling an oil and gas well?

A. I assume there are ways. I don't know. I don't know beans about oil-well drilling, so -- I've learned more in the last six days of testimony than I've ever wanted to know, I think.

Q. Well, we already have four producing oil wells in Section 2; is that correct?

A. That's correct, drilled wells. I'm not sure -- I think they're producing as well.

Q. Okay. And so your intent to mine Section 2, you would not get within what? A half mile of those wells already?

A. That's correct.

Q. So over half of Section 2, then, is already unminable --

A. Very questionable, yes.

Q. -- as far as you're concerned?

So when you're talking about mining Section 2, you're really talking about, you know, if I go a half mile out from where those wells are located, you're talking about less than the west half of that section?

A. That's correct.

Q. Now, you stated you check for methane before each shift. Do you ever find any?

A. There may be a .01 or a trace shown.

Q. But you have found --

A. Usually --

Q. You have found traces?

A. Yes.

Q. Do you have any idea what the source of that methane would be?

A. Oh, yes, these placings that we're dealing with contain the nitrogen carrier of methane throughout the mine.

Q. You stated you mine 256 acres a year, and Mr. Hutchinson testified that you're mining 136 acres, and that seems to me a big discrepancy, which is pretty ascertainable, if you will.

I mean, is there any explanation for how your number and his number differ so much?

A. Mr. Carlson, I haven't looked at the maps that were submitted, but I suspect that a large part of it is, those maps are not to the detail that would show, for example, final mining or pulling pillars. They would certainly show panels of second mining. But the step of mining -- the last step of mining, after you mine those panels, is to go in and pull the pillars

in the main entryways, and I don't know if those maps are to the detail that would show, because those entryways would be very narrow on those maps, and --

Q. So your number might be going back in secondary mining on pulling pillars in mined areas?

A. Or final mining, and we've been doing a fair amount of that. And to someone who didn't know our operation very well, I could certainly understand where perhaps a fringe where we pulled a little bit of ore that had been used to hold up roof --

Q. Uh-huh.

A. -- was mined.

Q. So you could be counting, then that acreage twice? in other words, when you go through it once, in one year and --

A. No, no, what I'm saying is the accuracy of the map may preclude him from noticing a small sliver here or a small section here that's done.

Q. All right.

A. Not that we've counted it twice, but --

Q. What about unmined areas? Is it reasonable to assume that it could be 136 acres a year?

A. No, sir, that was the number that I have related to you. If we have a section of typical height, typical grade ore, that will be mined at the

rate of -- What was it? 256 acres per year.

Q. Completely mined, in other words, the pillars pulled too --

A. Yes.

Q. -- during that --

A. Now, perhaps the mistake that is made or part of the error, when I say that section would be mined in two and a half years, I mean it would be mined in two and a half years, and there would still be some ore left in place, the 20-some percent that is left for final roof support and so forth.

Now, if somebody takes the number of tons I mine and backs into that calculation and forgets about the ore left in place, that's a source of error.

Are you with me? I see kind of a questioning look there.

Q. Yeah, yeah. No, I understand.

What I'm trying to get at is, if I look here, and approximate somewhere between a quarter and a half section a year, and look at where you're mining now, and that risk of bringing up a mine plan, which we haven't seen, but I guess on the western edge there, where it has "current area of mining" --

A. Yes.

Q. -- you've got a lot of full sections or

partial sections there to mine.

A. Yes.

Q. Also going over to the east side where you're talking about "current area of mining", say, in sections --

A. Yeah, around 24, in that area.

Q. Yeah, or even north of there, 13, 14, into 15. I mean, you've got a lot of -- and in 22, 23, and 24. You've got a lot of areas in there to mine.

Assuming that you progress, it's hard for me to imagine that you'll get to Section 2 in seven or eight years.

A. Mr. Carlson, the optimum way or the traditional way of developing reserves is to go to the edge of the reserve and then come back.

Now, a couple things that we have to consider here is, that the conveying system -- If you'll notice, there is a green-hatched area that comes north -- or runs north and south directly -- essentially in the middle of the map, just an inch to the left of the fold of the map.

Q. Okay.

A. That is our mainline conveyor system that must carry all of the ore that is mined. That is a 48-inch wide conveyor system, down nearly to a little bit

larger square that you see right where that stops and then T's left and right.

Q. Uh-huh.

A. Beyond that, we will try and keep a balance of mining so that we have a southwest section and a southeast section.

And again, what we're trying to do, and I think you can see evidence, we didn't mine a whole lot of area along those west-trending mains out toward M-651. We were heading out that way to get as far out as we could go and then retreat back.

And the reason for that is, if you try and mine along either side of those entries, you have to leave about an 800-foot-wide barrier pillar to insure that those entries don't collapse before you can get out to the edge of the ore and back.

If you get out to the edge of the ore, you're running those entries through essentially virgin ground, that is, the maximum protection of those entries staying open.

And that's the reason for going out to the edge first and then coming back.

Q. But by going to the edge -- How far out? You wouldn't go all the way down to Section 2 and work all your way back. I assume by --

A. That's certainly the direction that the third-party plan has in it.

Q. In other words, go directly there, and then work back?

A. Yes.

Q. You said you don't take royalty rates into account.

First of all, you're aware that the state royalty rate is a sliding scale, while the federal one is a flat 2 percent for sylvite?

A. Mr. Carlson, both of them are sliding scale. The -- By -- what? consent or whatever, the federal leases have been excused from sliding scale down to a set two percent. That has been done two years at a time for about three two-year periods.

Q. So for six years now, the federal one has been at two percent?

A. For approximately six years, yes.

Q. Okay. I was under the impression they had made that permanent, but they haven't?

A. No, they have not.

Q. It's still a two-year deal?

A. It expires again the end of 1993.

Q. But at the present time the state royalty rate you could conceive of being higher than the

federal royalty rate?

A. It is higher than the federal royalty.

Q. Mr. Hutchinson said that for each one percent of royalty it translates into a four- to six-percent net profits interest. Do you agree with that?

A. I'd have to put pencil to paper, and I don't have the information at my fingertips to do that right now, Mr. Carlson. I could certainly get back to you on that one, but I'm not --

Q. Well, it's not important except that it is some multiple of the percent royalty rate.

My question is, how can you not take royalty rates into account if it translates -- if we're talking the difference between a two-percent and a five-percent royalty rates, and that's, according to Mr. Hutchinson, a difference between 12 and 18 percent of the net profits --

If I was a miner, I would take royalty rates into account when I decided to mine. You stated that you certainly take economics, and that to me is straight economics.

A. Okay. Number one, we're not at the five-percent royalty rate. That -- And I think Mr. Prando testified to that yesterday. There's a cutoff minimum ten percent. Anything ten percent or less is a two-

percent royalty rate. I believe the top end is 17 percent or more, is five percent. And we're mining toward the middle to low middle of that range.

Q. Okay.

A. So that begins to halve what you quickly conclude.

Basically, in our budgeting process, because orderly mine development is so much more costly than royalty decisions, as I budget year by year, I will ask Mr. Lane's department, what percentage of our ore do you expect to come from state leases and what from federal leases, so that we do have a royalty consideration in our budget.

But we do not make mining decisions based on those different royalties.

Number one, the mining plans are longer than these two-year extensions that we've gotten from the federal government. And I'm very reluctant to develop a plan based on different royalties, because within now a year those might change to where they're the same. And they are identical, when the federal people do not -- or if they do not continue the two-percent reduction.

I believe they entered that two-percent production -- or reduction or two-percent flat royalty

rate, if you will, at the time of this Canadian settlement, recognizing the importance of the potash industry and those 2800 or 2000 jobs to the state's economy, to the federal economy. And they said, We'll give the folks a little bit of a leg up.

And I certainly appreciate Mr. Hutchinson's suggestion that perhaps the state should consider following suit on that.

But because of the potential imminent expiration of that, we have not done any mine planning based on royalty considerations.

Q. Well, if you'll remember, the state did follow suit for a while there with a case-by-case determination.

A. Yes.

Q. I don't know if your mine ever came in and got --

A. Yes, we did.

Q. -- but we did issue a couple two-percent royalties, until companies could no longer justify the economics. In other words, they had to come in and show us --

A. Right.

Q. -- that they needed it to make money --

Q. Yes.

A. -- and people quit doing that, so --

A. And the royalty was the last thing standing between profitability or non-profitability.

Q. Right. I believe you said that you anticipate being in Section 2 within seven or eight years at the earliest, I think you said.

A. Yes.

Q. What is the latest that you anticipate being in Section 2?

A. I really can't put a number on that, Mr. Carlson, other than generalizations.

Nominally two-thirds of the remaining life of the mine is in the south section, nominally a third of it is in the northeast section. If we say we've got 35 years, then we should be in and out of the south side within -- what? Twenty years, 22 years, something like that. And certainly Section 2 would be earlier than that, because it's at the very edge.

Q. But it could be as long as 20 years?

A. Yes.

COMMISSIONER CARLSON: That's all the questions I have. Thank you.

CHAIRMAN LEMAY: Commissioner Weiss?

COMMISSIONER WEISS: Yes, I have several.

EXAMINATION

BY COMMISSIONER WEISS:

Q. Whereabouts on the map, on Exhibit 38, did the nitrogen burst occur where you had the fatality?

A. Again, you see the north-south trending main entries near the middle of the map. The outburst occurred just after we turned that corner from the -- You'll see a fairly heavy dark area around what's called "mine shafts". You go east from there three-quarters of a section, and turn south.

Q. Yes.

A. It was approximately where that turn occurred. It was what we call a 1 breakthrough or nominally 180 feet, 160 feet south of that turn.

Q. So you've got that -- that fuzzy line down below it, going south from the --

A. Right.

Q. What was the pressure?

A. We have no idea.

Q. Have you ever used your methane detector to look for gas outside the pipe in some of these wells that are scattered around?

A. We have not mined anything other than dry, plugged and abandoned, and we can't get any closer than 200 feet to them.

Q. Okay. Well, what about just going out on the

surface and sticking it around a wellhead?

A. We have not done that.

Q. How come?

A. I don't know.

Q. Oh, yeah, this is a good point, I think, that was brought up. What happens if the EPA stops salt-water disposal down there on the surface?

A. That's a whole 'nother ballgame. And that, again, is a life-threatening situation for us, obviously.

Q. I would think it would be, yes.

A. By the same token, our leases permit us use of surface lands as required by mining.

Now, I assume that there will be some kind of confrontation between the BLM or the State Land Office and the EPA if that comes to pass, we'll see who has the biggest club, I guess. But, certainly that's a threat.

Q. Yeah, I don't think you've got much of a chance against those guys.

A. Well, I'll not inject pure opinion at that point.

Q. Then this issue of confidentiality, that took place, your antitrust problems began -- What year was that?

A. My recollection was that the trials were held in the late Sixties.

Q. Well, were the mines developed -- these mines that are there now, I don't know if there's -- Are there any new ones since 1960?

A. No. No, our mine began in 1965 and it was the last one that came into being in this area.

Q. So the issue of confidentiality had nothing to do with the development of these mines; is that right?

A. Well, in fact it probably went the other way. The rather free flow of information, as these mines were being developed, led to the problems that caused the antitrust hearings to be held.

Q. But there were mines developed prior to the antitrust problems?

A. Oh, yes.

Q. Since the antitrust problems, we don't have any more mines --

A. Correct.

Q. -- except yours?

A. Correct. Well, no, no, ours was developed before the antitrust problems as well.

Q. I see.

A. But we were the newest and last of the

operations.

Mr. Weiss, I might say for perhaps your clarification, what has changed was not the antitrust situation but the Canadian potash deposits.

Q. That had nothing to do with it?

A. As far as I know, no.

Q. And then in cementing -- Maybe your expert would be better equipped to answer this question. But when you cement your test holes, you know, plug them, do you go out there with a pump truck and pump cement down under pressure and fill it full of cement, or do you use a ready-mix truck, or --

A. No, my understanding is that we use a cementing firm. Again, Mr. Lane is the one that directs those operations, and he'll talk to you intelligently about that.

COMMISSIONER WEISS: All right. That's my only questions. Thank you.

THE WITNESS: Okay, thank you.

CHAIRMAN LEMAY: Don't lose Mr. Lane.

(Off the record)

EXAMINATION

BY CHAIRMAN LEMAY:

Q. When you're developing these shafts, now, do you know exactly where you are underground in

relationship to the surface? I mean, you're tying it to benchmarks, and you're pretty good there.

A. Yes. If you like, I can relate an interesting incident to you.

When our mine was developed, we developed off the current USGS map for that area. When the National Mine was developed, which was the mine immediately preceding ours, there was a different issue of the map. My understanding, those two maps were off by like 30 seconds.

And we in fact had an encounter with the National Mine where we're supposed to leave a barrier pillar between mines and between leases. And so 30 seconds translated out ten miles or so, closes that hundred-foot gap pretty quickly.

But yes, we do tie to existing USGS maps and section corners and that sort of thing.

Q. Well, then, if a well was drilled and you knew exactly where the intersection of that well was with your mine workings or where your mine workings would be, assuming you could pinpoint it, we didn't have a 15-degree --

A. Sure.

Q. -- variation?

Actually, if they go to five degrees they

have to --

A. Yeah.

Q. -- run a bottomhole survey. But the industry can tell you where that well is with a directional survey.

Assuming that pipe was located, what then would you consider a safe pillar radius for protection?

A. Well, Mr. LeMay, I think I mentioned the 400 feet, if that were the only consideration. What I said was, when you come down 1650, 15 degrees out is 450 feet. But I would hesitate to go closer to that without better information.

Q. Well, assuming you knew exactly where that was.

A. If we've got the information, that eliminates that consideration.

Q. Right.

A. But it doesn't eliminate the consideration of if gas gets out --

Q. Right.

A. -- and then I have to go back to the half mile, depth of ore plus ten percent or quarter mile, whatever those things are, because people, I think with a lot more intelligence than I have, established those, and they appear to have worked.

Now, if --

Q. So you'd still use the same protection zone, even if you knew where the location of the well was? You'd still --

A. Yes, yeah. I think the protection zone might be meaningful if you had a dry, plugged and abandoned well, and the rule is you don't mine through those; you leave some kind of a barrier around them. And that might be --

Q. What would you recommend there?

A. -- germane in issuing these things.

I think historical practice, where the location of the well has been known, it's been 200 feet.

Q. Okay, a radius of 200 feet?

A. Yes.

Q. Looking at your map -- and this is just a layman talking, so please help me on this thing, please -- as you start working south, you're running that east/west tunnel there in the north part of Section 22 to 24.

A. Okay.

Q. It looks like you're bumping into a lot of barren zones down here. Does that influence what might be economic ore? If you knew those barren zones

existed before you started to run these shafts, do you think you'd run the shafts? Is there enough ore there left in order to go after?

A. Oh, sure, sure.

Q. Because in the northeast or northwest part of your map we don't see those barren zones but --

A. Right, there are a few -- Some of these white areas, for example, are there because they were barren.

But in general it seems that the further south we go, the more frequent we are -- more frequently we're running into these barren zones.

And if I had an unlimited capital budget I'd do a lot more drilling to find those. I do not have an unlimited capital budget, and I have to buy a conveyor instead of drilling holes sometimes.

Q. Yeah, I guess that's my next question. If you had information to outline these barren zones ahead of time, get more information, would that help you in the development of your mine plans and make it a more economic operation?

A. It would certainly help in the development of the mine plans, yes.

Q. Because is it the way you go now, you say these mine plans are only a snapshot in time because what's happening is, you run into barren zones in there

and have to change your -- what you plan to do in the future?

A. Yeah, and we have instances where we have mined within four feet or eight feet of a core hole with a certain analysis given to us and had three or four percent difference in grade.

So at best, the core holes give you an idea of what's in that three- to five-inch diameter hole, and --

Q. So it's not a projectible thing. You say you could have a commercial ore right next to a zero core hole and --

A. Well, Mr. LeMay, to the extent that these deposits were laid down by the evaporation of an inland sea and you expect them to be continuous, in other words, just the geologic occurrence that laid these beds down, this is why this is a leasable as opposed to a locatable mineral, because it occurs generally over a broad expanse of territory, and we expect a continuum of ore.

Now, there are these things called salt horsts or barren zones that come up with -- rather unpredictably.

But we don't get into the situation where we run into, if you will, an ore horst. Okay? We expect

the ore to be continuous with some interruptions. We don't expect continuous intrusions with some ore.

Q. Well, just looking in this area, it looked like -- I could draw a circle around it. It looked like you have at least as much barren zone in this particular area as you would commercial ore, according to your map, taking 24, 25, 26, 22.

A. Yes, and certainly these known barren areas are taken into account when we assign lifetimes to mine reserves. The unknown ones obviously aren't.

But on the other side of the coin, we will count as reserves only reserves up to a lease line. And for example, that whole block north of State Lease M-651, we were ordered across the boundary, as Mr. Herrell testified yesterday, because when we got to the lease boundary, there was ore there, and likely no one else would develop that ore.

So if it was to be extracted, it was to be extracted by us at the time we were there. And that whole nearly -- what? Half of three-quarters of a section in there, was unexpected ore.

So you get those offsets as well that are adjacent to but immediately outside of your lease boundaries, and to a degree those offset some of the unexpected barren zones.

Q. Have you explored the possibility of a mining partnership with Yates Petroleum to join and develop your properties and --

A. Well, as I say, I was surprised after Yates got those leases they didn't come knocking on our door about what to do with Section 2, because that's -- that what was in our play.

So I have not approached Yates because basically we're in contention over Section 2 right now, not over the potash reserves but over the oil/gas versus potash reserves.

So no, I have not pursued subleasing or assigning the potash leases in Section 2 to Yates.

Q. Well, in developing a mine plan, I guess the point I'd like to ask is if the oil industry was cooperative with the mining industry, more so than they have been, in being able to, say, run a side-wall core or something of an oil test, using more sophisticated logs, is this of beneficial use to you?

A. Well, Mr. LeMay, any additional point of information we get would be helpful.

Q. What's your cooperation to date between the oil companies in this regard?

A. Well, a completely independent third party to this -- and if you want the name I'll give it to you; I

don't know that the name is germane -- called and asked about what our intentions were on some leases around Section 2, if it was not specifically in Section 2.

And I told them that our best judgment was that there was ore in that section and that at some point we would develop it and that we would include it in our life-of-mine reserves. In fact, it was included in the life-of-mine reserves.

And I said -- We pursued the cost of coring off of a full-blown drilling rig, as opposed to our truck-mounted, basically portable rig. And where we're talking $20,000 to $30,000 a hole, my response from the oil company was, it would cost at least $50,000 to do the coring off of the rig, although it's there and in place. But just the rig time and what have you.

In pursuing it a little bit further, the bottom line for the oil company was, Gosh, we'd like to go with you but we're afraid of what we might find.

Q. Now, that's --

A. And so, you know --

Q. That may be a consideration --

A. Well, I think --

Q. -- if they're working on it --

A. -- the major consideration on the part of the oil companies --

Q. Yeah, I think that's very --

A. -- within the KPA.

Q. Sure, sure. And vice-versa, you may be afraid to see a core hole in something because it might indicate a bigger barren zone than you anticipated, and --

A. Mr. LeMay, we have encountered so many barren zones that another one will not be a surprise to us.

Q. Do you have a problem with oil wells in barren zones?

A. Depending on the size of the barren zone, no, if we can keep the spacing.

Q. When you're blending ore -- This is a question. You get the high-grade stuff and you say you're -- you can blend that with the weaker grades of ore.

Is it easy to find the lower grades of ore to blend with the higher stuff? Is that stuff readily available or not?

A. There's probably more low-grade than there is high-grade.

Q. Yeah, yeah.

A. You know, every mining operation -- It's probably like oil fields: You drill right in the middle of a pool if you know where the pool is, and you

start pumping like hell. Right?

Q. They don't mix two wells; They're top-allowable wells --

A. Okay. Again --

Q. -- for the refinery --

A. -- but depending on the economics --

Q. Yeah.

A. -- senior management, corporate ownership will direct you to get the best rate you can, because we're headed into a tough time, and --

Q. So there's -- You are valuing your higher grades at a higher grade than your lower grades, I guess?

A. Well, what we do is attempt to mine at the grade or blend to the grade of the remaining life, so that we're neither high-grading nor low-grading.

Does that happen a hundred percent of the time? No.

We have some grim years where we have gotten into unexpected low ore grade situations across the mine, and I always accuse my predecessors of getting all the gravy, so --

Q. Have you purchased any oil leases or drilled any oil wells in --

A. No, sir.

CHAIRMAN LEMAY: That's all the questions I have.

Additional questions?

MR. HIGH: Just a couple of follow-up.

FURTHER EXAMINATION

BY MR. HIGH:

Q. Mr. Case, would you look at Exhibits 14 and 15 in front of you, please?

Mr. Carlson asked you about the source of the traces of methane gas found in the basin. Do Exhibits 14 and 15 address the source of those traces of methane?

A. Mr. High, Exhibit 14 is geology of the Carlsbad Potash Mining District with emphasis on brine and inert gases adjacent to or within the ore beds --

Q. Okay.

A. -- prepared by George Griswold. And when somebody talks to me about the Griswold report, yes, I associate that with the occurrence of the nitrogen pockets and the minor amounts of methane that are found with that.

I believe Exhibit 15 was prepared by Mr. Chattabetti [phonetic] for the -- part of the WIPP study, called occurrence of gases in the Salado formation. I am not as familiar with that report as I

am with Mr. Griswold's report.

Q. But it does address the occurrence of gas in the Salado formation?

A. Yes.

MR. HIGH: Mr. Chairman, and we would offer Exhibits 14 and 15.

CHAIRMAN LEMAY: Without objection, Exhibits 14 and 15 will be admitted into the record.

MR. HIGH: And we have nothing further.

CHAIRMAN LEMAY: I think Commissioner Weiss had additional questions.

FURTHER EXAMINATION

BY COMMISSIONER WEISS:

Q. Yeah. Again, on the confidentiality issue, is there a need for it today if the Canadian industry is what dictates the start of a new mine?

A. I'm sorry, Mr. Weiss, is there a --

Q. -- need for this confidentiality that exists in your business down there if the Canadians are the ones who dictate a new mine?

A. Well, Mr. Weiss, appreciate that there are six mines in the Carlsbad Mining District, in that 400,000-acre area, and all of us must compete in whatever market.

You know, I mentioned to you that the

production costs plus transportation dictate a line that runs nominally along the Oklahoma-Kansas border, for example, south of which Carlsbad can compete and north of which Canada can compete.

In that area of US competition, we are head-on-head in a number of instances with our competitors.

So yes, the need for confidentiality is there, because we do not -- I believe you're familiar enough with the antitrust laws, that you can't get into price-fixing situations or anything that's construed to be price-fixing.

And the interpretation of that, following this lawsuit back in the Sixties, was that US producers do not talk among themselves on issues of prices, manufacturing costs, or significant portions of manufacturing costs that could be easily compiled or projected into manufacturing costs.

Q. Well, my point is, as I see it, on the issue of these core holes, for instance, the value of those core holes is whether you're going to develop a new mine. I would think you --

A. No, no, no, no, no. Not at all. The value of the core holes is in developing a plan for an existing mine.

Q. Which is there. There's not going to be any

more if I understand your testimony.

A. No, that's correct.

Q. So why have the confidentiality? You guys have the data. Hey --

A. Because there are still exchanges of lands going on between the companies.

For example, this Mississippi Chemical lease that we picked up, that in fact was a trade, because there were some Mississippi leases that were close to where we could mine. We had some leases that we were unable to mine that were close to an area that Mississippi might potentially mine. So we swapped that information.

The confidentiality of the information lies in, until you get into those business negotiations, letting the competition know what you've got. And also from that information, from the grade of ore and the rate of mining, those are some of the factors that very quickly can be fairly reasonably or reliably projected into costs.

Q. My point is, the competition is not going to come open up a new mine.

A. The competition is there with their mining.

Q. Yeah. And so whatever agreements you make are going to be between offset mines.

A. They're among competitors, though. We're not all owned by the same operation.

Q. Yeah, if I want to see the logs or the equivalent of a core hole --

A. Yeah.

Q. -- in the oil field, I can go upstairs here --

A. I understand that.

Q. -- and look at some file cabinets and see the logs on every well --

A. Yes.

Q. -- in New Mexico.

A. Right.

Q. And the competition is, believe me, great in the oil business in New Mexico.

I have a lot of problems with the issue of confidentiality down here.

A. Well, those are the guidelines I've been given and learned to live with, and as a result of antitrust hearings, and I don't know where to go beyond that, Mr. Weiss, other than just to say if someone gets a different reading of the law that says open up your books to anybody and everybody, I will then consider relaxing my standards.

COMMISSIONER WEISS: Thank you.

CHAIRMAN LEMAY: Thank you very much. We appreciate a couple long days there.

THE WITNESS: Thank you, Mr. LeMay.

CHAIRMAN LEMAY: Rather than start another witness, why don't you take those -- an extra 15 minutes at lunch?

MR. HIGH: That's fine with me, your Honor.

CHAIRMAN LEMAY: Okay. Can you all stay till six? Okay. Can you?

Okay, we'll go on to six tonight to make up for it.

MR. ERNEST CARROLL: Reconvene at 2:00?

CHAIRMAN LEMAY: Two o'clock.

(Thereupon, a recess was taken at 12:30 p.m.)

(The following proceedings had at 2:03 p.m.)

CHAIRMAN LEMAY: If you'll be seated, we'll continue on with the direct on the potash companies.

Mr. High?

MR. HIGH: We would now call Dr. Bill Mitchell. I believe Mr. Mitchell was sworn earlier, but I'm not sure.

Were you sworn earlier, Dr. Mitchell?

DR. BILLY J. MITCHELL: Yes, I was.

MR. HIGH: Okay. We're going to have some overheads too, so we're going to --

CHAIRMAN LEMAY: Fine, great. Do we have copies of those as exhibits in here or not?

MR. HIGH: No, sir. I don't believe they're there. We have them here, though.

CHAIRMAN LEMAY: Okay.

MR. HIGH: I'll give them to you.

BILLY J. MITCHELL,

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

DIRECT EXAMINATION

BY MR HIGH:

Q. Dr. Mitchell, would you state your full name, please?

A. Billy Joel Mitchell.

Q. And where are you employed, Dr. Mitchell?

A. Colorado School of Mines, Golden, Colorado.

Q. And how long have you been a professor at Colorado School of Mines?

A. Since 1966. About 26 years.

Q. And in what area do you teach?

A. Oil-well drilling.

Q. Do you hold any other titles there at the Colorado School of Mines?

A. Yes, I'm the Director of the Center for Directional Drilling Research and Principal

Investigator for the Gas Migration Consortium and Principal Investigator for a group called Drilling Engineering Research.

Q. What is the Center for Directional Drilling Research? What is that all about?

A. We do research for some of the major companies, Norway, Dubai is another one in the Persian Gulf, Mobil, for instance.

So we do the research, accuracy of surveys, surveying techniques, those sorts of things.

Q. And as Principal Investigator of the Gas Migration Consortium, what's that all about?

A. Well, companies are wondering how gas migrate in the wellbore, and we basically make studies to show that -- or demonstrate observations of how this could occur.

For instance, in the percolation process by which gas migrates, we're asked things like, What is the effect of the rugosity of the hole, hole diameter versus the pipe diameter that's in there, and the angle of the hole or the slant angle, deviation. Those sorts of things.

Q. All right. Would you relate to us, Dr. Mitchell, your educational background please?

A. Yes, in 1957 I received a BS in petroleum

engineering at the University of Oklahoma, 1962 a master of petroleum engineering, and 1970 doctor of philosophy, all from the University of Oklahoma.

Q. Are you certified as a professional engineer in any states?

A. Yes, in Colorado, and my number is 9442.

Q. And after you got out of school and got your degrees, where did you go to work at that point?

A. I first went to work for Exxon in their Drilling Research Lab, and I worked there about two years. I had a break for the military. I was in the military for three years.

Q. Okay. And then you went to the Colorado School of Mines?

A. No, I actually went to Venezuela and worked for another 25 months there and returned to the Colorado School of Mines.

Q. All right, what were you doing in Venezuela?

A. I was a drilling engineer.

Q. And so you first joined the faculty at the Colorado School of Mines in what year?

A. 1966.

Q. And you've been there ever since?

A. Yes.

Q. Tell us, if you will, Dr. Mitchell, some of

the courses that you teach at the Colorado School of Mines.

A. Well, the beginning level, I teach -- they're all drilling, by the way, so I teach a basic course in drilling, secondary course in drilling, and advanced courses in drilling such as horizontal drilling, directional drilling, casing design, air and gas drilling, bit selection, type, material, typical drilling.

Q. Do you have a specialty that you deal with? Are you a specialist in any particular area of petroleum engineering?

A. Well, petroleum engineers more or less divide themselves into production, reservoir, and drilling, and I happen to be in the drilling phase.

Q. Have you taught any industrial courses?

A. Yes, I teach numerous industrial courses.

Q. And what are industrial courses, Dr. Mitchell?

A. Well, someone like Exxon, Shell, Mobil, would like to have courses taught to their professional engineers, kind of an update, maybe, that sort of thing, and I go and teach the schools for them.

Q. And what are some of the courses or topics that you've covered or taught in these industrial

courses?

A. Oh, blow-out control, casing design, tubing design, cementing, air drilling, bottomhole assemblies, drill pipe design, for instance, would be another one, air and gas drilling, drilling fluids, that sort of thing.

Q. Are you involved in any ongoing research there as a member of the faculty?

A. Yes, as I stated earlier, I'm the Director for the Center of Directional Drilling Research and Principal Investigator for the Gas Consortium. And for the DER group, the Drilling Engineering Research group, I'm the Principal Investigator there too.

Q. Where do those research projects come from, Dr. Mitchell?

A. Basically, companies come to me, want certain studies made, and I do it. We perform it as a service there, more or less.

Q. All right. Have there been any other research projects in which you've been involved?

A. Well, earlier I was in foam drilling, air drilling, and foam cementing, cementing wells with foam cement rather than just a normal liquid cement.

Q. And have you done any industrial teaching?

A. Let me back up. I also noticed on my résumé,

and I forgot this, I was a co-investigator for a straight-hole mine shaft drilling project for US Bureau of Mines, and also on the board for the Deep Observation and Sampling of the Earth's Continental Crust, called DOSECC, also on a drill-bit project for them.

You asked me about my industrial teaching. Well, I still teach for -- And since there's been a big shutdown in the oil business as we all know -- in the United States, I might add; overseas it's booming -- but I still teach for Oryx, I teach overseas for a company called P.T. Loka Datamas Indah, Mobil Oil Corporation. And I teach basically tubular design, tubular running and handling practices and optimum drilling practices.

I teach some courses for myself.

Other people I teach for off and on would be Tenneco, Continental, Shell, Consolidated Natural Gas, Exxon, Preston Moore. Taught in Petrobras in Brazil, I taught a directional drilling course there. And I teach -- I've been a guest lecturer for the Society of Petroleum Engineers since 1982. And on my résumé I show that I stopped in 1987, however they've contacted me and would like for me to start teaching again.

Q. Do you have any on-site oil well drilling

experience, Dr. Mitchell?

A. Yes, I started out -- My grandfather worked in the drilling business, my father worked in it, four uncles, my brother. My dad actually owned a drilling company, and I started roughnecking when I was twelve. I was kind of big for my age, so I started roughnecking when I was twelve and have been at it ever since.

Q. And what type of jobs have you actually worked in?

A. Well, I've been a roughneck, derrick man, tool pusher, rig supervisor, drilling superintendent, drilling manager and drilling engineer.

Q. All right. Would you give us some --

A. I've been a drilling research engineer also, for Exxon.

Q. Okay. And would you give us some of the locations where you have on-site experience?

A. Well, Egypt -- I'll just read from this list here. Egypt, Dubai, Abu Dhabi, Indonesia, Malaysia, Argentina, Canada. Alaska also should be added in there. United States, Alaska, Gulf Coast, west Texas, Rocky Mountain and California, Texas and Louisiana.

Q. And have you actually planned and supervised the drilling of some oil and gas wells, Dr. Mitchell?

A. Yes.

Q. And are the various companies that you have either planned or supervised the drilling for set forth in our résumé?

A. Yes, I notice there's -- I've listed 35. I'm sure there's more. But if -- most of the people that are operating today.

Q. Okay. Have you ever testified before in a court proceeding or to a commission like this before, Dr. Mitchell?

A. Once to a commission, and not more than 14, 15 times before a jury or a court.

Q. And were the issues that you testified -- had to do with petroleum engineering?

A. Yes, and drilling in particular.

Q. Have you designed any computer software for the oil and gas industry?

A. Yes, I have.

Q. And what types of computer software --

A. It's all drilling software, and I distribute it with one of the books that I've recently written, and it's gaining popularity, actually.

Q. Do you continue to serve on committees that are addressing issues in the oil and gas industry?

A. Yes, in the Society of Petroleum Engineers I currently am on the Education Committee. In the past

I've served on the Deep Observation and Sampling the Earth's Crust, National -- National Science Foundation arm, served on their board, Chairman of the Pressure Control Committee of the International Association of Drilling Contractors, called IADC, and annual meeting session co-chairman for ASME.

Q. And have you published any works at all, Dr. Mitchell?

A. Yes, I've published newsletters, books and manuals and papers.

Q. How many books have you written?

A. Four.

Q. And could you give us the titles or the subject matter of those four books?

A. Well, I wrote one in 1977 that has 244 pages called *Well Drilling Handbook*.

I wrote another one that was called *Advanced Oil Well Drilling and Engineering Handbook and Computer Programs*. It has currently -- I revised it recently. It has 615 pages.

Oil Well Fishing I wrote in 1991, has 153 pages.

And then *Horizontal and Directional Drilling*, I wrote that, and it has about 180 pages or so at this time.

Q. All right. What's the newsletter that you referred to?

A. Oh, when I go out and teach, people ask me complicated things that are somewhat difficult to cover in a course, in a five-day course or two-day course, so I publish a little newsletter covering some of those items that people have asked most about, and it's fairly popular.

At the time I wrote this, I had 402 subscribers. I think maybe that might be cut in half when I publish again here.

Q. All right. How about manuals? Have you had occasion to prepare any manuals for use of the oil and gas industry?

A. Yes, I have a list here, *Tubular Design* for Mobil Oil Corporation, 356 pages.

Optimized Drilling for Mobile, 282 pages.

Tubing Running and Handling Practices, 371 pages.

Air Drilling Manual for Conoco; it has about 60 pages.

Marine Riser Operations for offshore location of -- running of risers and how to handle risers offshore, for Continental.

And *Directional Drilling Manual* for

Petrobras. I wrote that in 1987.

Q. Okay, and I notice in your curriculum vitae, Dr. Mitchell, that you have written or listed some 48 different papers, theses and reports. Let me ask you, are any of those related to the topics that we're talking about here today?

A. Well, they all relate to drilling, and there's actually 49, because on October the 7th, I gave a paper in Washington, DC, at the National Society of Petroleum Engineers conference.

I went through and checked off some titles that might -- people may want to hear for future questions:

Fluid Characterization and Pressure Drop and High Pressure Drop and High Pressure Foam System; Foam as the Drilling Fluid; Foam Pressure Loss in Vertical Tubing; Strength, Permeability and Porosity of Cellular Oil-Well Cement; Determination of Laminar, Turbulent and Transitional Flow -- Foam Flow -- in Pipes; Strength, Permeability and Porosity in Foam Cement; Rheology of Foam Cement; Compressive and Tensile Strength and Setting Time of Foam Cement with Common Additives; Long-Term Strength and Permeability of Foam Cement at Elevated Temperatures; Recommended Cementing Practices in Wyoming; Wellhead Loans and Surface Casing

Failures; Centralizer Spacing with Plain Casing Bending; Gas Flow after Cementing, a Physical Model; Effect of Cement Column Inclination on Gas Migration; Oil Well Tubular Deformation and Severe Doglegs; The Effect of Hole Inclination on Gas Migration; and the last one, which you don't have, is Bending of Tubulars in Horizontal Wells.

Q. That's the most recent one you just told us about?

A. Yes.

MR. HIGH: Mr. Chairman, I would ask that the Commission accept Dr. Mitchell's credentials, and I would also offer into evidence Exhibit Number 20, which is a copy of his curriculum vitae.

CHAIRMAN LEMAY: His qualifications are acceptable.

Q. (By Mr. High) Dr. Mitchell, what did I ask you to come here to do?

A. You asked me to look at the risk of gas entering the wellbore and migrating up to the potash zones and to give a cost estimate, provide a cost estimate for drilling of a directional well into the Delaware formation.

Q. And you are prepared, I take it, to do that?

A. Yes.

Q. Now, about how much time do you split or have, Dr. Mitchell, between the academics that you pursue and the work that you told us about? As a professor, do you have time available to do both?

A. Let me add one thing about why I'm here. I'm really here to help -- community service.

As a professor, we're required to teach, do research and provide community service, and so I would like for everyone to know that I'm here to assist you, I'd like to assist Yates and assist the Oil Conservation Commission in any way that I can, and I'll try to answer all the questions that are asked --

Q. Very good.

A. -- impartially.

Q. Would you give us some idea of the amount of time that you have available, Dr. Mitchell, to do some actual hands-on type work?

A. Yes, people often think that professors are geared to the academic, and as a matter of fact, I think if you tried to do that, you'd probably end up getting relieved of your position.

Of course, at CSM -- There's 365 days a year. We have 124 academic days that we actually teach, and that leaves 240 days for work. And if -- For instance, I'm down here now; I have a capable associate teaching

my classes. He has ten years of experience in drilling. He's 34 years old. He even worked for two or three years in southeastern New Mexico drilling wells for Arco.

And for instance, in comparison with industrial employees, there's still 365 days in a year. There's 104 weekends, ten vacation days, ten holidays, given 241 days of work, so professors have a lot of time off. And the taxpayers expect that -- they don't expect people to -- professors to stay in an ivory tower and not provide the latest information for the students.

Q. All right. You understand, Dr. Mitchell, as I have explained to you, that the potash industry's concern with respect to methane gas is both from the point of not wanting to have an explosion in a mine, but also directed to a much smaller amount that might result in a mine getting classified as gassy?

A. Yes, I discussed that also with Warren Traywick, and I hope I've arrived at some understanding of this.

But I'd like to remind everybody here, I have no mine experience, and I have been in one inactive gold mine in Colorado, and I think I walked in about a hundred feet and then I walked back out.

Q. But you can tell us, I take it, how much methane gas it would take to propagate an explosion?

A. Well, I have one reference, and that's from the US Bureau of Mines, and that reference is by J.J. Forbes and J.W. Grove, and the title of it is *Mine Gases and Methods for Detecting Them*, Miners Circular 33, Bureau of Mines, United States Printing Office, 1954, page 7.

Q. All right. And what does that document show, Dr. Mitchell?

A. Let me read this. It's a US Bureau of Mines study, that one I just mentioned, opined that in a coal mine with the presence of coal dust, which we don't have, that at least 200 cubic feet of methane, a natural gas usually found in petroleum natural gas, are required for an explosive oxidation of the gas.

Two hundred cubic feet would be a box that would be five feet high, five feet wide, and eight feet long, would hold 200 cubic feet, so five by five by eight.

Q. All right. And given the amount of gas that would be produced by one of these Delaware wells, Dr. Mitchell, can you tell us about how long it would take to put that much gas in one of these potash mines?

A. Yes, I relied on a document that Yates sent

to Mr. Randy Patterson, and that document has that the average production rate for the first year out of the Delaware formation would be 17,941,000 standard cubic feet per year, and in that case -- and if it all were to go into the mine, which is not likely, but it would take 5.86 minutes to produce 200 cubic feet into the mine, 5.86 minutes.

Q. Now, Dr. Mitchell, you heard some testimony about the bottomhole pressure of a Delaware well and the pressure in the casing and the pressure alongside the McNutt member.

Can you tell us, please, what in your opinion those pressures would be?

A. Yes. We've heard a lot of estimates. This would be a Delaware well --

MR. HIGH: Excuse me, Doctor. Let me just say, Mr. LeMay, if I may, Dr. Mitchell's exhibits will be Exhibit 39, starting with A through whatever letter, and what he has on the screen now would be 39B, just to keep them in consecutive order.

Q. (By Mr. High) I'm sorry, Dr. Mitchell. Go ahead.

A. We can see we have a Delaware well here with 5-1/2-inch casing at 8400 feet. A reservoir pressure of -- given to me by Mr. -- excuse me, Dr. Boneau -- of

2800 p.s.i. And we'd have perforations, holes through the cement, through the casing, through the cement and into this zone, which we would anticipate the gas to flow up the well.

And assuming that under some conditions we could have a gas column in there as well -- there may be an oil column at times, but if the gas pressure builds up it can easily push the oil back into the formation, which has happened.

But anyway, at the McNutt level, we'd expect a pressure in the ballpark of 2395 p.s.i.

Q. All right. And can you tell us, Dr. Mitchell, if you'll recall, Mr. O'Brien said the p.s.i. at the McNutt member would be 2000 p.s.i. Do you remember that testimony?

A. I guess I do.

Q. Do you agree that the p.s.i. at the McNutt member would be about 2000 p.s.i.?

A. Well, I think Mr. O'Brien somehow -- and I have the ultimate respect for Mr. O'Brien -- confused what we'll call pressure with stresses.

Now, if this McNutt is 1600 feet deep or thereabouts, then we could expect the stress in the rock from the overburden to be in the range of 1600, and maybe as high as 2000.

But the pressure of the liquid in the McNutt, which is going to try and attempt to push back on the gas, will only be about 700, maybe as low as 400.

Now, I rely on Mr. Robert Lane. You've heard his name a lot. But he said if you were to drill a well through McNutt, that the water in there would stand at about 700 feet deep, and if that were the case you'd have about 1000 feet of water that would stay in there. So the pressure would be exactly equal to the head of the water plus atmospheric. All that adds up to in the range of something like 450 to maybe 700 p.s.i., if the wellbore actually were to fill a little higher than what he thought it could or what he felt like it could.

Q. So needless to say, if the pressure at the McNutt was 700 p.s.i. and there was gas present from wherever at 2395 p.s.i., it would go in the McNutt formation?

A. Yes. Well, if it had a path.

Q. Now, do you know, Dr. Mitchell, if any studies have been done concerning the gas getting out of the wells in southeastern New Mexico?

A. Well, not in the Delaware wells. I could not find one of those.

And I think we ought to make a distinction

between the shallow 1900-foot wells, where -- I noticed in one of them it said TSTM, which stands for too small to measure.

Those types of wells should be separated from a well that's capable of making 18 million standard cubic feet in one year. I think that separation should be made.

Q. And you've heard some testimony here from other witnesses about other wells that should be used for comparison with these Delaware wells.

Is it your opinion that that comparison should not be made?

A. Well, you know, I think any data point is good. But I think the parallelism between a 1900-foot well and an 8500- or 8400-foot Delaware well should be carefully looked at.

So I would say that from an 18 million to a too-small-to-measure is quite a jump for a data point.

Q. All right. Would you tell us, if you will, Dr. Mitchell, what are some of the risks to the underground potash mines if oil and gas wells are allowed, as Yates seeks to do in this case?

A. Well, I have a series of slides here I might show you that elaborate on that.

I'm not a mining man, so I can't really say

what would be a risk to the mining people, but I feel like we could talk about the risk of getting gas up and to the wellbore opposite the McNutt.

Q. This would be Exhibit 39D?

A. Thirty-nine?

Q. Yes. For the purpose of our record here, yes, it's 39D.

A. So one of the first ways it could happen is during a blowout.

And then people say, Well, blowouts probably aren't going to happen.

But I noticed a well that was drilled by Exeter, one of the four wells on the eastern side of Section 2 -- Exeter Company in Denver -- had a fire that burned up part of the rig during the week that we were here. It was in the paper.

So blowouts, you know, do occur. And I'm not trying to paint any horror stories.

But during the drilling of the well, it could be conceived that the -- you've drilled down into the oil zone, blow out some of the or all of the mud that's in there, go up through the cement and some of the passages I might be talking about, or, better yet, go up into the casing, you may have a hole in the casing, and then whether it enters the McNutt or not, I don't

really feel like I'm an expert to testify to.

But anyway, we can get the gas up to the McNutt formation.

Q. There are a number of ways, are there not, that gas can get up to the McNutt member?

A. Yes.

Q. All right, go right ahead.

A. One of the ways is to -- is during production. Or that other way is during drilling and have a blowout.

But during production particularly one is going to have gas in the wellbore. And again, 2800 p.s.i. is your driving force into the wellbore.

Up the wellbore we have a hole there in the casing. That requires two holes, 5 1/2 and the 8 5/8, the other casing on the outside. And then we could have gas opposite the McNutt in the wellbore.

Or else we could have a leaking casing connector. In that case, what -- I think you heard Mr. O'Brien testify that the strength of the couplings, connectors would be somewhere around 4000 p.s.i., and since I could not find in any of the records what these were, what type of couplings they were, I couldn't make a standard American Petroleum Institute calculation of what the strength would be. I'll take his word for it.

I'm sure he's in the ballpark in regard to that number.

But what really can happen is that the couplings can have gas pass along through the threads. They don't really match up perfectly. They don't get in there and form a perfect seal around this thread loop. So they put dope in there. It's called pipe dope, and the popular dope is Modified Eighties, it's called.

So we put that in there -- I'll say "we" because I'm in the drilling business. We put that dope in there to seal this. And the strength of the coupling, the resistance to leaking would be like maybe 4000, 4500, if it fits together correctly.

Now, the primary problem for the reduction in the strength of these couplings is that the taper along the thread here is not constant, nor is it at the right angle.

Now, you realize that people have to cut these quickly to make money in casing, and they do the best they can, and it's pretty good. Usually, the casing companies manufacture it very accurately.

And then the threads aren't cut the right depth. And if the casing -- since this thing is going to seal by compression of the casing into the coupling. So if the casing is manufactured with levality -- and

there are limits that API allows for levality -- then the casing when it screws together will have too much compression on one side, not enough on the other side, and a reduction of 50 percent in the leak resistance of the casing is maybe one out of a hundred joints, and the usual reduction is about 70 percent. And of course, a lot of those will be stronger than the 4000.

So anyway, that's one of the possible leak paths.

And to make sure that, for instance, that we don't try to match a connector with the wrong casing taper -- you see, you could get them so they would be way off -- why, we use a device called a Torque Turn. People come out and torque up the pipe and turn it, and for this type of pipe you'd expect to have about three turns after what they call intimate contact to make up the pipe, make it up correctly.

And the Torque Turn people, if it doesn't fall within a range of -- number of turns and amount of torque, they take that out and lay it down and pick up another one.

Now, I don't know that Yates is going to hire Torque Turn company or not, and we'd have to ask them. It is not in any plan that I saw.

So that's one of the real issues here.

Something that I'd also like to bring up is that leak from the outside for the inside in a wellbore is more difficult because from the outside you'll have a mud-caked form and that will act as a seal, and on the inside you usually have clean fluid, which pushes the dope out.

And one of the classical tests was done by Shell Oil Company. They tested a casing for six hours. It leaked, so they pulled the whole string out, run in another string, tested it again for six hours. It leaked, up around about 70 to 80 percent of its rating. And that was in a well that was about 8000 feet deep, 7000 to 8000 feet deep.

Now, most of the time, I think Mr. O'Brien stated that these -- that they would test the casing. Most casing tests last 15 minutes, not five hours. And in five hours it will extrude the dope out and then start leaking.

Q. This would be Exhibit 39F, just for the record, Mr. LeMay.

Go ahead, Dr. Mitchell.

A. Well, there's some -- I think we actually have three categories that we might put gas leakage into, and one of the might be a scientific amount, in other words, maybe not even detectible, but somehow you

know in your heart that it has to be leaking. And then an amount that would be detrimental to the economics of a mine. And then maybe an amount that would be hazardous to the employees of a mine.

So one of the ways that you could get some natural migration would be for the gas in the Delaware just simply to migrate up through the formations. Well, it's been there for a million years, I guess -- I'd have to ask Dr. Boneau -- but it would be there for a long time. It didn't really migrate any significant amount. So possibly that I would call a scientific amount and --

Q. So absent any disturbance, the gas should migrate from the Delaware up to the McNutt?

A. Well, not in any reasonable amount, other than just scientific purposes.

Q. Mr. O'Brien touched on microannuli, and he said, well, he didn't even know if they exist.

A. Well, that's true. You know, I think what you say is, as I've seen, courts and lawyers deal in facts, and scientists and engineers deal in observations. We observe something, and then we try to explain it. We try and find a mechanism which will explain the phenomena which we see occur.

And one of them is that, for instance, with a

cement bond log, if you show that you have a micro- -- or you show that the cement hasn't really gripped the pipe and the cement bond log shows a little ringing noise -- And it's rather simple; it either rings or it doesn't ring. If you had a cup I could demonstrate it.

But anyway, so what you really expect is, for a microannulus, is for the cement to set up, and then the pipe over here could be reduced in temperature, maybe you pump a cold fluid down, maybe you do something of that sort, and the reduction in the temperature is going to cause the pipe to shrink more than the cement. So naturally we expect to see a gap.

Now, you make these calculations -- Oh, by the way, the pressure would also cause the pipe -- You reduce the pressure, then the casing would also shrink a little bit in diameter.

Calculations show that anything over 30 thousandths of an inch of shrink would be a lot, and anything under a couple of thousandths would be probable, possible.

Q. Are the size of these annuli, Dr. Mitchell, nonetheless, of the size that would allow the passage of gas?

A. Yeah, I worked out a little problem here to show people how much you expect, you know, or to...

And what we really have here, I picked a 5000-foot-long section, and a gap of 15 thousandths of an inch, about average, and I used Weymouth's equation, which is popular in some areas, and I found that you could expect through that not more than 26 standard cubic feet per day.

It might be important as far as mine classification, but I really don't see how it could ever cause a hazard to the mining.

Q. But it is nonetheless one of the ways which gas could go from the Delaware up to the McNutt formation?

A. That's one possible path, yes.

Another one I have is gas flow through the cement. And cement is relatively impermeable. I think Mr. O'Brien stated some of the permeabilities, and I couldn't disagree with those. In high-temperature situations, which we don't have here, the permeability could go up maybe to 10 million millidarcies, which would match a lot of gas zones that people produce gas out of for sale.

But anyway, gas flow through the cement under the worst conditions, which would probably not occur in a single stage, I used -- again, I used Weymouth's equation, some typical values for the viscosity of gas.

But anyway, you get there to the bottom line and, sure enough, it's 55 standard cubic feet per day. And you may not even detect that in a line, or else -- you know, you might.

Another way is mud channels. And just having a mud channel in itself is not sufficient to have a gas channel.

So what happens here is -- and this is done -- could be -- happen in two ways, is that over -- Now, it's a hydraulic principle that it's easier to displace mud out of this section of the pipe with flowing cement than it is next to the wall. And I think if you think about it, that makes sense. But anyway, this will have mud in it, and here we have the cement bypassing that mud.

Now, once it's bypassed -- O'Brien alluded to this but he didn't ever really say it. Once it bypasses the mud, then it's very difficult to ever get it out. The cement will just flow by it and it may not ever clean it out.

But then after you have the mud channel, somehow we've got to get gas to go through it. And then that requires that something in the mud channel dissipate the -- part of the mud or part of it or all of it.

But this type of a gas channel is really troublesome, especially in small holes like the 7-7/8-inch hole by 5-1/2-inch casing, because that gap is very small.

And R-111-P does not state how many centralizers, if any at all, will be put on the casing, for instance, by an oil company. I'm sure, having been in an oil company, that the oil companies will do their best to make this seal. But on the other hand, centralizers do cost money, and each one of them, although they're a little piece of steel like this, and I called up Halliburton, and they want $57 for each one that they're going to put on 5-1/2-inch casing.

Anyway --

Q. Central- --

A. Could I apologize to whoever owns the chair?

Q. Centralizer, Dr. Mitchell, would it cure the offsetting of the center that you have shown?

A. Well, not entirely. I did -- I was involved in a study for API on location of centralizers and how much they would do, what good they would do.

And if you've got a dogleg in the hole, then between the centralizers you could have a close location here.

And even at the centralizers, if you pull

hard enough on the casing, you'll just compress the spring. They're a spring device. You'll compress the spring, and they'd move a little closer to the --

Q. Can these mud channels occur over long distances?

A. Oh, yes, these are notorious for connecting two zones that are some distance apart.

Another way the mud channel could occur... Let me first of all show you something here.

The volume of gas through a mud channel is not inconsequential. The -- Here I just worked this out, and what it shows is, you have a mud channel, and you have to work out the geometry for the hydraulic radius of the channel and whatnot, and that's what all this is, just math. But down here I used Weymouth's equation again, and I show a value of about 503,385 standard -- that's what the calculation did -- standard cubic feet per day could go through the channel.

Now, these wells, I've heard the number 130,000 standard cubic feet per day would be maximum that the well could produce. And then if you take that 18 million, or close to 18 million, and divide it by 365, you actually end up with a little over 49,000 standard cubic feet per day.

So 503 could go through the channel. I doubt

that the well would produce that. So we would see maybe closer to 50,000.

Q. In either event, a lot of gas could pass through one of these mud channels?

A. Yes, that's true.

I'm about to skip something. Let me look at...

Well, another way that -- This was actually done by a Union Oil study, and they have to give me their report. What they're having trouble with was offshore. If you set this pipe off bottom down here, I think Mr. O'Brien said that they planned on setting the casing two or three feet off bottom, but mistakes are made.

One of the ones that could be made, for instance, and not really be that big a mistake, would be drill an extra 30 feet of hole, because the drillers often lose track of the number of feet of hole they drill. But anyway, drill an extra 30 feet of hole, and then would you actually buy another joint of pipe to run to the bottom, or would you just leave it 30 feet off bottom?

Well, anyway, Union -- Also I did some work for Canmar in the Beaufort Sea on this problem and how to solve it. But anyway, the casing was going to be

run some distance off bottom.

And now, if this cement that you're going to pump up here is heavier than the mud, then the mud will -- the cement will come down and go up the hole. See, it really won't -- Well, it will start to try to fall to the bottom of the hole through the mud, but it won't have time to fall that far, probably.

Now, then, in the lab what we've noted -- I've got a cement lab, and of course people pay us to demonstrate this type thing, or give us money, so -- called research grants.

But anyway, the cement comes up the hole like this, but then it starts to fall down the hole, and it's called "swapping out" because the cement is going to fall down and the mud is going to go up, right? They have to swap because there's no volume to displace something without something else being displaced.

So what happens is, in the wide part of the hole, out here in this part of the hole, is where you'll have a stringer of mud going up.

Now, Mr. O'Brien said that it was his -- he thought that the mud would start up and it would form a gel with the cement and wouldn't really go very far. People have believed that they've gone -- In the lab I can't go more than about 60 feet. But people believe

that the swapping out has gone one up to as much as a thousand feet. Five hundred is -- from the cement bond log, is what we kind of thought that Canmar was having trouble with.

And if you've got two production zones, they'll commingle and go through these -- the channel caused by swapping out.

Gas percolation is also called gas migration, and that's the one that people gave us a research grant to demonstrate and model, because I guess they didn't want to fool with it. Anyway, what happens here, you do make a clean displacement to the bottom of the hole, let's assume, and the cement and the mud -- the cement particles and the liquid base, water, put a pressure on the bottom of the hole.

For instance, you might want to double the pressure on the bottom of the hole with a liquid column. What you could do is put in solid particles. As long as they don't settle out or set up, they're -- and freely suspended in the liquid, they'll add pressure to the bottom of the hole and up its resistance, pushing on the gas.

Now, as soon as that cement starts to set up, the particles grab the wall of the hole, and the gas then only has to overcome the liquid column, which is

usually water in -- let's call it dirty water, but anyway water. And so the pressure on the gas may drop from equivalent 12 pounds per gallon, or 12.6, all the way down to 8.45, something like that.

So the gas now has enough pressure to push this water column up the hole, and it pushes the partially set cement particles out of the way.

Now in Sumatra, Arco asked myself and -- you know, like -- Well, what do you think the phenomenon is that burned up our last two rigs? You think, well -- The first one, you might think, Well, they should have found out. But that's not the way it is with cementing.

Mr. O'Brien was correct in the aspect of this, that it's behind pipe, it's downhole, and you can't see what took place. And you can only -- And he called it theory, and that's correct. You can only theorize what took place. But then you can eliminate things and come up with this.

Now, we felt certain that gas percolation -- or gas migration is also a cause -- probably burned up those two rigs. And corrective measures were taken.

Q. And how deep was that well, Dr. Mitchell?

A. Oh, it was about 9500 feet.

Q. And the gas migrated all the way to the top

of the well?

A. And burned up the rig.

If you expected a gas percolation path -- And of course, our research grants, we have to make measurements in the lab. But if you just apply a formula that I've applied already before, you end up with around 900,000 standard cubic feet a day could go through one of these channels.

The -- another one is -- This is a south Texas problem Exxon ran into, and what we have here is bridging and gas cut cement.

So suppose that you have a water zone up here, something of that sort, and you form a bridge in the wellbore here, and the pressure of this fluid, the weight of this fluid rests on the bridge.

Now, the way I've got it drawn here, it looks like, you know, the bridge has to be a real strong entity. But in reality, the gap is only about an inch and a quarter on a side. Well, it's actually 7 7/8 minus 5 1/2, divided by 2, exactly the equation that O'Brien used.

So anyway, it's like this thick. If this zone here were 25, 50, 100 feet thick, then you've got this building here, and you've got this bridge in there that's formed. So it will support the weight of this

fluid, taking the pressure off of the gas down here, since the weight will be supported by the bridge.

Then the gas comes out of the zone, comes up and forms bubbles, and a channel maybe, and could go up into something like the -- I don't say it can go in. I want to say it can go up, opposite, in the wellbore, of the McNutt. That could be a possibility.

Now, the -- this well, as others have done in the past, have been stage-cemented. Now, stage-cementing, as told to you by Mr. O'Brien, was straightforward. He simply said that we pump cement up to a DV tool, which is a device -- You're going to open a hole in the pipe and circulate cement out that hole and finish filling up to the next DV tool, and then use three stages needing three sets of cements, then open up -- close that hole, open another hole and pump cement out, and all the bore will be full, because they're going to overlap each stage.

Now, you know, I heard the term last time I was here, "fantasy world". Now, that is fantasy. What really happens is -- And it doesn't happen every time; don't get me wrong. What happens is that the stage collar, the cement, you lose cement out one of the zones someplace in the wellbore, and the cement does not arrive at the next DV tool. So there's a gap

there. And that gap is shown right here, you see. This would be the gap that would occur because the cement did not get up to this DV tool.

Now, when you cemented the next stage, it would go up to the next DV tool, next one on up, and you could use as many as three or four stages.

So we have this gap down here, and that gap could become a passage for natural gas to flow up the wellbore.

Now, the correct -- What most people do for correction of this gap is to perforate holes into the casing and then pump out. And this is called a squeeze cement job. Set a packer in the casing, pump the cement out, and hope it fills upward and fills the gap.

Now, that's nice. One time I pumped six stages of squeeze -- trying to squeeze up to -- and finally we said, That's close enough.

Now, the way you know that it didn't really do it is, you can run a cement bond log or a temperature log and measure the temperature outside of the casing, because cement has an exothermic reaction and gives off heat. So you would expect to see the temperature rise, and if it doesn't, well then, you didn't get the cement up there.

So squeeze jobs in a correction of a faulty

cement is not always the answer. Of course, a lot of times it works.

The -- Something that could be of benefit would be an external casing packer shown here, and it screws into the casing.

I called up Halliburton. They said, Well, one that is two feet long costs $5000, and thereafter they cost a dollar a foot. So, you know, you could -- might spend $25,000 for an external casing packer right here, and that's a large portion of the sum of the well. In fact, that's about 20, 25 percent of the well costs. So an external casing packer, I'd call it an expensive solution.

But anyway, here we -- We can set it.

Things that can go wrong is, we set it in a permeable zone so the gas would just go around it.

Another one would be, we would have an enlarged hole and the packer would never really get out there to seal, especially if it were a short one.

And then it could pass around it and go up and out -- No, I don't want to say it could go out. It could go up adjacent to the McNutt formation.

Now, it turns out -- A lot has been said about angling wells, but in truth, the doglegs are the serious problem. And one of the things could happen,

for instance, to the 8 5/8 casing is the drilling of the rest of the well, you could be rotating the pipe, which is a normal, standard practice, and wear a hole in the casing.

Now, the casing -- You think of casing maybe as being something strong and big and hard and all that. But actually, the wall is about 3/8 of an inch. That's with most casing. So you're -- got to wear through about three -- But you don't have to wear all the way through it; you just wear partway through it and you let the pressure crack the rest of it.

So anyway, here we could have worn casing and a dogleg, and that could actually be more trouble.

Now, in the 5 1/2, you could get a hole in the casing by running wireline tools, tubing and rods up and down where you have a dogleg.

I have a little chart -- I have a calculation that comes out of RP7G and -- about doglegs.

Q. What is RP7G, Dr. Mitchell?

A. It's Recommended Practice published by American Petroleum Institute.

Okay, let me read this to you. The API charts, American Petroleum Institute charts, RP7G, April 1st, 1989, page 58, shows a contact force between the drill pipe and the wall of the casing here of 2000

pounds, and API says you've got 2000 pounds, you have potential problems.

And this is a typical 4-1/2-inch drill pipe, and if the pipe is in tension by 125,000 pounds, which would be possible on these wells, the -- if the curvature is three degrees per hundred feet of length -- So we'd get that 2000 pounds if we have a three-degree dogleg in the well. We'd get that 2000 pounds, and it would push up -- it would pull it up and could give us a problem.

For instance, in a -- if you had a well that were 25 degrees but straight, straight 25-degree well, then you would expect to have a contact force of 233 pounds on a tool joint, on the drill pipe. 233 is approximately one-tenth of 2000.

So you can see that the doglegs, which API actually has a chart, would be one of the factors that would give you casing wear.

The other one, of course, is running pipe in and out of the hole or dragging cable or pipe up and down through the dogleg would also cause trouble.

Q. Did you look, Dr. Mitchell, at the possibility of some of the casing in these wells being loaded to the point where they might wear a hole in them?

A. Yeah, I made up a little chart here. This is a chart from the Graham AKB State Number 1, and it shows the inclination. And I think in the State of New Mexico it's called a deviation chart or deviation survey, and other places it's called inclination. But anyway, it's the angle of the hole at various depths.

And you can see that we started out here at about a half a degree, is what we measured. The accuracy of these inclination surveys is probably about a half or a quarter of a degree, depending upon how much money you spend for the instrument and how long you take to run it.

So at 2000 feet we have about a degree and a quarter. It goes out to four and a quarter and then back down. So you can see that we have changing inclinations, which is exactly what a dogleg is, curvature in the hole. And you can see that there are curvatures and doglegs.

Q. Is it -- The doglegs in the AKB State Number 1, which is already drilled, how close is that to the point where API says you might have a problem with wearing a hole in the casing?

A. Well, their surveys aren't close enough together to get a true dogleg severity, like one for every hundred feet. So that really can't be said.

But what can be said is that we do have deviation going from one out to about four and a quarter, and that would be over that distance, and then from four and a quarter back to about a half.

So the possibility does exist that you could have a dogleg in there that might be severe enough to wear a hole in the casing, according to API, or cause potential trouble.

Q. All right. Are there any other ways, Dr. Mitchell, that methane gas could possibly get from the Delaware up to the McNutt formation? Is that pretty much the ones that you have to tell us about?

A. Well, you could always have -- You know, I don't like horror stories, but you could always have an earthquake break the pipe off. I don't think that's likely to happen. I haven't looked at the earthquake survey for the area, but -- You could have it. It happened in California. Looked at seven wells, and sure enough, after a minor quake it reported they could no longer get in the hole and produce the wells.

Q. Now --

A. Well, another way would be -- is to collapse the casing strain. And in a casing collapse, usually the collars don't collapse, so you're left here with a connector. And those connectors are about a foot long,

nine inches, a foot long. And the pipe could collapse. Of course, give you a hole by collapsing.

I don't see that happening here either, by the way.

Q. And I take it, Dr. Mitchell, you're not saying that the ways in which gas can get from the Delaware formation outside the casing up to the McNutt that you've gone through, is not going to happen every time somebody drills an oil and gas well either, is it?

A. I would say if you drilled a hundred wells -- Are you looking for a number?

Q. Well, let me ask it another way. Inside the known potash area --

A. Yes.

Q. -- there are currently over 1000 oil and gas wells?

A. I've heard that testimony, yes.

Q. Okay. Assume, if you will, that within the known potash area that there are over 1000 oil and gas wells.

What, in your professional opinion, is the probability that in some of those wells methane gas has gotten out of the casing, up to the McNutt formation?

A. Well, in the shallow wells I doubt that a significant amount has gotten out of any of them. But

of course you can always could have a little bit.

The Delaware wells I would put at four or five percent of them may have some gas outside a well.

And on the other hand, I think I could say that four or five percent of them would have no gas outside. In other words, that were drilled. And the true answer, I'm sure, is someplace in between.

Q. What would you say the odds are that all 1000 of them have never leaked any gas outside the casing?

A. Well, I --

Q. That's a negative question.

A. Yeah. Well, you know, there has to be at least one or -- I would say one, or more.

Q. Are you also involved, Dr. Mitchell, with directional drilling?

A. Yes.

Q. And have you actually done some directional drilling?

A. Yes, I have.

Q. Did I ask you to take a look at these wells and come up with a plan for directionally drilling these wells and a cost estimate?

A. Yes, you did.

Q. And did you do that?

A. Yes, I did.

MR. HIGH: Mr. Chairman, I'll have a series of exhibits -- or Dr. Mitchell will -- that will be Exhibit Number 40, starting with the first page being 40A and going up to whatever the letters are. And I have copies for each of the Commissioners here when we get through.

THE WITNESS: Due to a time -- Oh, are you through?

Q. (By Mr. High) Yes. Go ahead, Dr. Mitchell.

A. Due to a time constraint, I took one well, the Flora AKF State Number 1, and looked at an estimated cost of directional drilling that well, and here is what we're talking about.

Drilling the well -- it's actually this one down here -- from this location, which is 330 feet from the corner -- from each side of the vertical and horizontal line, over here to this location, which is -- would give a departure -- and I think Mr. O'Brien called that a deviation or -- anyway, it's commonly called a departure from this point to that point of 2660.55 feet. And so that's the one I would like to discuss.

And my experience is that the amount of departure -- and I think one of Yates' people said this too. Up to about 45 degrees it doesn't really matter

what the departure is, that the costs are about the same. You still have to hire the same people, drill approximately the same footage.

And so these two wells up here, although they're only 1320 feet, will be at about the same cost as these. Of course, you have a little more footage down here, but not nearly as much as it looks on that chart.

So my plan -- And believe me, if you ask ten engineers, drilling engineers, to write up a plan for you, you'd have ten different plans. And an architect in buildings, geologists and their maps...

So anyway, I picked 2000 feet as a kickoff point. That's in the salt. Now, Mr. O'Brien said that ten years or so ago, that he knew they had trouble kicking off of the salt. And may I say, that's correct, ten years ago. Today it's not much of a problem.

The problem is, ten years ago it was difficult to maintain hole diameter, and so when you run your tool in the hole, why, it would slop around the hole instead of taking off and drilling in the right direction.

Little bottomhole motors today, isn't really that much of a problem anymore. In fact, one of my

friends in Denver told me that in the State of New York they drilled a horizontal well, kicked it off, drilled it out and had no problems, and that's what we would expect. There's nothing new there.

So today's practices, kicking off in the salt is no problem.

The two degrees per hundred feet was selected to keep below that three degrees that's going to give us the trouble with holes in the casing, so we're not going to wear any holes in the casing.

And then down here I've got 24.3 degrees kicking off to 2661 feet or 2660.55 feet. Going to give a hole here, a length of 9055 feet or an extra 555 feet of hole we would expect to have to drill.

Now, the expensive part is, starting up here at the kickoff point, is making that angle.

Well, it's not so tough to drill the angle. In fact, that's rather easy. What's tough is getting all the equipment out there and getting people ready, and that takes time, and you lose a lot of time in making this kickoff.

Then below this, drilling this hole, as Mr. O'Brien said, it can actually be faster than drilling the vertical, depending on how you drill it.

So there's going to be a balance between the

tools and method you choose to drill the hole, and the additional time. If you go cheap, it's going to take longer to drill it. If you go expensive with tools, it takes less time to drill it. So there's a balance, and there's a tradeoff. And that's -- Anyway, that's what I found in my experience over here.

So that's my plan.

And the plan for a 1320-foot departure, the upper two wells, gives an angle of about half what you would expect, about 12 degrees.

I have those angles here, and this one turns out to be -- some computer software -- turns out to be 24.337 degrees, close enough to 24.3. And for the other well we have, the 1320-foot well, we have a value of 12 degrees, and then .02, a fraction more.

So those are typical numbers that a directional driller would be interested in.

For a cost comparison, which is to a vertical hole, I took the letter that was sent to Randy Patterson by a fellow by the name of Boneau, and he's listed in there the costs that Yates expected. I didn't have any costs. I relied on their expert or their people to give me those costs. If they're wrong, I'm wrong. If they're right, I'm right.

So anyway -- And it did look reasonable from

my experience. So I didn't think that they had inflated the numbers or deflated the numbers. I thought they looked reasonable in what they had.

And here is the Graham AKB State Well Number 2, and the State Well Number 1, and this -- I got these bit records, and this is a bit record from Hughes Tool Company, and they actually faxed them to me. And I used those as my data well, my information well at which to construct at cost.

The -- Plot this up, we see something like this. Start out over here on the 26th of March, they spud the well, bit number 2, they hit an air pocket which -- they ran 13 3/8 casing, hit an air pocket, took about three-quarters of a day to subside.

Bit number 3 went to about 3000, all the way down to -- ran the 8 5/8 casing here, and bit number 4.

Bit number 5 there, bit number 5 came out of the hole here. Finally they ran down to TD and set their 5-1/2-inch casing, and that took about 22 days, I believe.

And then on the other well, the Pogo Well, State Well 2, I did the same thing to get an idea of what was taking place in drilling these wells.

And here once again, we spud the well, pull a bit or two that are dull, ran the 13 3/8 casing, ran

the 8 5/8 -- you might notice it took quite a bit longer here -- and finally finished the well and in some regard quite similar to the previous well.

Now, comes the estimation part. What do we think we can do in the way of directional drilling, and how long will it take?

Well, I took the well here, and I have regular drilling time, 16 days, estimated drilling days from the bit record. Daywork days, six days. Drilling footage, 8500 feet.

So my drilling rate in days per thousand feet is 1.88, and I'm going to use that as a factor later on.

My drilling footage is going to be 9055 feet. The footage in the build section where -- the two degrees per hundred feet -- is going to be 1217 feet.

Estimated additional days for that is three point -- Additional days, so it's going to take 4.8 to drill it. And I put a factor in there of 2.5.

Now, if you had been drilling these wells routinely, then 2.5 would be too high. I think even Mr. O'Brien alluded to that. If you haven't been drilling them, well, then, maybe 2.5 is about right.

So our footage in the slant section is 5838 feet. And for the tools I picked, I figure that it's

going to take about three-tenths longer or a 1.3 factor. And I'm just going to take an additional 3.3 days.

Then I've got to drill this 5500 feet, and so I've got my 1.36 total -- Well, anyway, the days turn out to be 8.5 additional days total, and my days to drill this 555 feet is a 1.36 days.

Anyway, it all adds up to 30.5, and that's what I've got for the tools that I thought might ought to be out there.

So my directional drilling time, regular time, is a factor of 1.384, and my drilling footage over a vertical well or near vertical well would be 1.065.

So I'm going to multiply the appropriate cost factors by those two numbers.

So what I did -- I put this estimated costs of Flora AKF State Number 1 -- was make a comparison here for the regular dryhole, which ends up with $317,600 which comes directly off of the report sent to Mr. Randy Patterson through Yates. So that's based -- that is their number.

Again, I'm going to add in a directional dryhole and add in the various costs here.

I have to drill an extra 555 feet; I've got

the bend. And so I come down, and it looks like --

Oh, I have to buy some centralizers. R-111-P states that the hole is going to be directionally drilled, and you have to put a centralizer on each casing joint, and the casing is about 40 foot long, so we put them on there. And that turns out to be an additional cost of -- where are my centralizers? -- of $3286.

Directional equipment I figure will cost $55,000, and -- so my total intangibles.

Finally, I have a directional dryhole cost of $443,861 or an additional $126,261. That's an increase of 40 percent.

Now, Mr. O'Brien stood right here and said, in his best knowledge, it would be about 35 percent.

Q. So yours is a little higher than Mr. O'Brien's?

A. Yes. But I'm not inferring that he's wrong.

Q. Okay.

A. I mean, you know, because estimates can be off, you know.

So anyway, that's the 140. I got 140 percent with -- using the method I did. And of course, a lot of practical experience in there.

Okay, here's a regular oil well, comes down

to -- What is that number?

Q. $581,700.

A. $581,700, and we add in the directional drilling costs here, the centralizers, additional time to drill the curve using those factors I had over there. Additional casing costs are in here as they are over here. And the additional costs for mud and whatnot is also in this cost.

For instance, you might notice that for drill stem testing, $10,000 for a regular one. Well, they've got to run the drill stem test a little deeper so they can charge you more money, and I put in $10,650, $650 more. So you can see that we have additional costs over here.

Anyway this number comes down to $135,723 additional dollars or 123 percent of a vertical hole.

Now, stuff like casing, that stuff could be exactly calculated. That's why this number has the less variance for directional versus vertical than this number does. And you've got a little better feel for a lot of costs.

Q. So the difference in your estimated costs for Yates to drill the AKF State Number 1, Flora Number 1 well, if that well was drilled directionally as opposed to straight, the additional costs would be $135,723?

A. Yes, of the items that they considered in the Randy Patterson letter.

I noticed they didn't have fracturing in there. But on the other hand, I don't know if they fracture these wells.

Q. So if we wanted to avoid any possible risk these wells would cause to underground miners, or if we wanted to not waste potash, we're talking about spending an additional $135,723?

A. Well, I really can't say that because I don't really understand -- I mean, I don't feel like I do -- the risk to the miners.

But let's say that if we don't want to get gas up opposite the potash -- okay? -- then, yes, that's correct.

MR. HIGH: All right, we'll pass the witness, Mr. Chairman.

I would offer into evidence New Mexico Potash's Exhibits 39A through whatever the number turns out to be, and Exhibit 40A through whatever the number turns out to be.

CHAIRMAN LEMAY: Okay, let's take a short break before cross-examination. About 15 minutes.

(Thereupon, a recess was taken at 3:23 p.m.)

(The following proceedings had at 3:44 p.m.)

CHAIRMAN LEMAY: We shall resume. We're at the point where Dr. Mitchell is still on the stand.

This is cross-examination by Mr. Carroll.

CROSS-EXAMINATION

BY MR. ERNEST CARROLL:

Q. Mr. Mitchell, just as a matter of housekeeping, I'm going to go right back through your exhibits in the same order you presented them, so I hope you have them so that we can...

And it probably would be wise to use your overhead projector again, if you don't mind.

A. Okay.

Q. Do you have them available so that you can go through them like that?

A. Well, I tried to put them in order.

Q. Okay, well --

A. I thought you knew that.

Q. Okay. We'll bear with you if you have a problem.

A. Okay.

Q. The first thing, just kind of a matter of curiosity, Mr. Mitchell, I don't think it's proper for me to assume that you've donated your time to Charlie High, have you?

A. You know the definition of community service,

right?

Q. That's what I'm really interested in. What is your definition of community service?

A. Well, preachers serve the community, don't they?

Q. Yes, sir.

A. And you pay them, right?

Q. Right.

A. Thank you.

Q. All right. Well, that's the definition I wanted.

The next thing, am I also to assume that a professor at the Colorado School of Mines doesn't get weekend days off or vacation days or holidays?

A. Some do take those off and they're usually in the poorhouse. You know how a professor's pay is, about half of what yours is. Oh, not yours, but a lot less.

Q. All right.

A. So you've got your choice, you know.

Q. Okay.

A. Work or go hungry.

Q. You're still hungry; is that what you're telling us?

A. No, I'm not hungry, huh-uh.

Q. Why don't you turn to your 39B exhibit, if you'd put that up on the board?

A. Let's see, now. I really don't have -- But you just flash and I'll --

Q. That's the first. That's the Delaware well, is the title at the bottom.

A. Delaware Well, very good.

MR. HIGH: That should be 39B.

MR. ERNEST CARROLL: Excuse me, 39B, I just misread.

Q. (By Mr. Ernest Carroll) Now, when you were talking about, you were saying that this particular diagram here is drawn with the -- an assumption that you have a gas column; is that correct?

A. Yes, that's true.

Q. Now, you said that a gas column could occur under some conditions. Well, Mr. Mitchell, would you tell us what conditions it would take before a gas column -- or for a gas column to exist in a Delaware well that we're talking about?

A. Yes, I'd be happy to. What would happen is, you'd have -- In a Delaware well you'd expect to have the gas and oil flow into the well. And then if you had the well closed in -- Now, closure of a well is quite common. You might want to work it later on,

something of that sort, change the rods or something, run a pressure test of some sort.

And in doing that, the gas would separate from the oil and shove -- push the oil back into the reservoir, leaving a gas column.

Q. Well, Dr. Mitchell --

A. By the way --

Q. Excuse me.

A. -- under some circumstances the gas could go above that 2395.

Now, I don't have a sample of the reservoir crew nor the report, so I don't know whether that's possible or not. But it could be under some circumstances.

Q. Now, you are aware that these Delaware wells that we're talking about are oil wells; is that correct?

A. Well, yes, I saw your letter. In that letter from Mr. Boneau to Randy Patterson he does show that oil will be produced.

Q. Well, these are primarily and are classified by the Oil Conservation Division as oil wells. You know that to be a fact, don't you?

A. No, I didn't, but thank you very much.

Q. Okay. You are also aware that these wells

produce about as much water as they do oil?

A. I'm not aware of that either.

Q. All right. Now, are you also aware that the experience out here in the field is that there are --

A. Let me -- Could I ask you a question?

Q. Yes.

A. At what time does the oil and water production become equal?

Q. From the beginning.

A. From the very beginning?

Q. As I understand.

A. Okay, thank you.

Q. And then I am also to take it that you're not aware that the general experience out here is that there will be a column of probably 6000 to 7000 feet of oil and gas in these wells normally?

A. That could be very true, yeah, I would expect that to occur at times.

Q. Now, your diagram here that -- this Delaware well, it is missing some very important items.

First of all, we don't have the tubing through which this well would be produced; is that correct?

A. That's correct.

Q. Now, when you're producing or pumping this

particular well, when you start pumping it, you're going to be pumping off the gas and the fluid, and you'll be dropping off these pressures, won't you?

A. Well, I'd like to agree with part of that, and you're absolutely correct. But gas isn't really pumped, so -- You might bleed the gas off, take it some other way.

Q. And really, I thought it was very interesting on your next Exhibit, the 39C --

A. Okay.

Q. -- that's your calculation.

A. Is this the one that shows blowout?

Q. It says "Expected Natural Gas Pressure in the Well Bore at the McNutt".

A. Okay, I have that one. Go ahead.

Q. In the upper part of this calculation, you list the variables. You have the Pb with the 2800 pounds, which is the bottomhole pressure.

A. That's true, sir.

Q. And then the next one, Pt, you have the 700-pound wellbore pressure at the McNutt zone. You are aware that that is approximately the expected pressure that we normally find at -- or would expect to find at this area, not the 2300 pounds?

A. I do show a wellbore pressure at, not in, nor

does it say in the casing, but at McNutt zone. So --

Q. Well, then, explain to me what is the difference between wellbore pressure at the McNutt zone and your notation down here. It says "Expected pressure...adjacent to the McNutt..." Isn't that the same thing? Or shouldn't it be?

A. Well, this is the pressure in the McNutt at the wellbore level of the McNutt, and that's how we get to the 700.

I think that was made clear in my testimony.

Q. Well, are you saying that you -- am I --

A. The pressure inside the wellbore, inside the wellbore, inside the casing --

Q. Right.

A. -- would be 2395. I think you follow what I'm saying now.

Q. I'm sorry, I don't understand how you can in one instance say it's 700 pounds and in the next instance say it's 2395.

A. 2395 inside the casing, 700 in the McNutt, at the level of the --

Q. If you have -- But I take it, then, you have not tried to determine the actual wellbore pressures that do exist out here that are commonly found in this particular field?

A. Are you asking me do I have experience at collecting data to show what wellbore pressures are?

Q. No, I'm asking, have you done that in this particular case in preparation for your testimony?

A. No, I haven't.

Q. Well, you heard testimony, then, of Mr. O'Brien and Mr. Boneau where they suggested that the pressures in these areas are going to be in the neighborhood of 700 pounds, within the wellbore?

A. Well, that's -- Yes, I agree, that's totally possible at times.

Q. Now, let's talk about your blowout and closure exhibit, which is the next one.

Let's talk about, first of all, the -- What you're assuming here, I guess, in this example, is that you're going to be drilling into the Delaware; is that true?

A. Yes.

Q. And you hit gas and it's going to cause a blowout; is that correct?

A. That's a possibility, yes.

Q. Possibility. Well, isn't the most likely possibility is that this gas is going to go up to the surface?

A. Yes.

Q. All right. Also, if the gas is not going to go out to the surface, isn't it even -- the next likely place that this gas is going to go is into a weaker formation somewhere above the salt section and above the Delaware section?

A. Well, let's take one question at a time.

It probably won't go out the top as shown here, because we're going to close the BOPs, the blowout preventers, at the top of the hole. If you don't, you're going to burn up your rig, okay? Yes?

Q. Yes, I understand.

A. Okay. Now, next, it is true that there are weak zones down here, as pointed out by Mr. O'Brien.

Q. Right.

A. And those zones will take gas. They'll be like a pressure relief valve until they either pressure up around the wellbore from accumulation of gas in the zones, or else, cemented, they may be strengthened by the cement and not be all that weak.

I would venture to say that those zones have not been tested after cementing but have been tested during the drilling.

Q. Well, there is going to be a considerable amount of hole between the bottom of the 8 5/8 casing and the 4200 and the Delaware at 8500. Some 4000 foot,

right? That wouldn't be cemented?

A. Well, I show 2500 feet. Somehow I was led to believe that the Delaware started at 6700 feet. But I think that's insignificant. Go ahead, yes.

Okay. Now, there are a -- There is a lot of hole, yes.

Q. All right. Now, if we're talking about now, what you -- for this diagram to even -- for the gas to, let's say, to get into the McNutt area, you've, one, got to assume that you've got a hole or a perforation of some kind through the casing. That's your first -- one scenario, right?

A. That's -- Yes.

Q. Okay. And then through that perforation, then, your gas has got to move into the McNutt formation; is that correct?

A. That's shown on the diagram. In my testimony I just said that I would explain how the gas would get to -- in the wellbore, adjacent to the McNutt.

Q. And the reason you didn't explain anything else is because you know the salt is impermeable and that that gas is not going to go anywhere because there is no effective permeability for the gas to enter the McNutt section?

A. Let's see, now, you just told me what I knew,

right?

Q. I --

A. If you'd like to --

Q. I think so. I'm suggesting that that's the reason why.

A. Would you like to -- I'm trying to be helpful, you know, I mean -- So would you rephrase your question?

Q. All right. For the gas, after it goes through this perforation in the steel and in the cement, for it to move beyond the edge, there has to be something permeable there for that gas to flow into; isn't that correct?

A. Absolutely.

Q. If the area there is impermeable, you've got no movement of gas; isn't that correct?

A. That's absolutely true.

Q. Thank you. Let's go to your holes-in-the-casing exhibit next.

A. Okay.

Q. I believe that as I judge from your testimony that this particular exhibit was really to be used in connection with the next exhibit, the coupling gas leakage, because here again you were -- this is just to show that -- how you get gas to the outside edge of the

casing in the McNutt area, and it would be your coupling problem; is that right?

A. That's a hundred percent true, but not necessarily does it go with the next slide.

Q. Well, what -- Was there some phenomenon that you were discussing that was other than that --

A. Well, you can get holes in the casing --

Q. -- with respect to this exhibit?

A. Well, you get holes in the casing from wear, and corrosion, also, by the way.

Q. Okay, but --

A. -- leaks is just one of them --

Q. All right.

A. -- if I may be of help.

Q. Okay. But then again, even with this exhibit, the same thing would hold true, is that for the gas to move beyond the edge of the casing, you'd have to have a permeable body in which the gas -- to go into?

A. That's absolutely correct. I agree with that a hundred percent.

Q. Now, the gas coupling problem. Now, these threads are designed according to API standards, aren't they? That are used on J55 casing?

A. When you say "designed" do you mean --

Q. Or, excuse me, they are manufactured according to, I think, would be a proper --

A. That's better, yes.

Q. For -- if you go out -- I guess if you went out on the black market somewhere, you might get anything.

But if you go to a reputable dealer and a -- reputable steel products made in the United States, and they represent to you they have a particular type of coupling, well, on J55 casing, that you're going -- you know that that coupling was designed according to certain API standards?

A. Well, they attempt it, but, you know, Shell and Exxon and Mobil have shown that five percent of the casing fails to meet the API standards, and they sell it as API anyway.

In other words, there's always that small fraction of casing that doesn't meet the standard that is sold as meeting.

But in principle you're correct.

Q. All right, so --

A. They are sold to meet the tolerances specified by API.

Q. Okay. Now, let's talk about, now, a set of circumstances for gas to get out from a wellbore into a

particular zone.

A. Yes.

Q. First of all, we have our casing, and we have to assume that there was some error made in the construction of the threads so that they don't totally meet up; is that correct?

A. Yeah, that's correct.

Q. That's the first mistake that we have to assume?

A. Yes, I'll help you keep track.

Q. Okay. The second mistake that we have to assume is that -- Now, pipe dope is also manufactured according to certain standards; isn't that correct?

A. That's true, yes.

Q. In fact, there's a variety of types of pipe dope with all kinds of additives to perform different kinds of functions, and one of them is to seal pipe threads?

A. There's -- The way you made it sound like, there's millions of them to choose from, but actually, there's very few.

Q. But there's several, more than one?

A. Yes, that's true.

Q. And they are manufactured to standards, and standards are designed so that this product meets its

particular purpose?

A. Well, we'd hope so.

Q. We would hope so. So the next problem, too, is that we would not only have a thread failure, but we would have a failure of the --

A. No, don't call it thread failure. That's not true.

Q. Okay.

A. And don't call it pipe-dope failure. That's not true either.

But let me agree with you in principle that you are correct.

Q. Okay. Then the next item, the second item, is that the pipe dope fails to meet the needs that it was designed to be --

A. That could be.

Q. All right. Now, we now have this -- and let's assume that this our 5-1/2-inch casing.

We next go, and we know that this 5-1/2-inch casing is surrounded by an encasement of cement, correct?

A. Well, we would hope so.

Q. Well, that was our plan?

A. Yeah, that was our plan.

Q. Okay. And we're sitting here in a completed

Delaware well like we have seen described, and we're trying to get gas from the wellbore into the McNutt series.

So item three would be that we would then have to get our gas -- Somehow the cement would have to not be impermeable as it's designed to be?

A. Well, you could have cracks in the cement.

Q. Okay. But it's designed not to have cracks, right?

A. Design is such that we never depend upon the cement to contain pressures.

Q. All right. Then if this is up in the McNutt series, we then go in after the cement, we go to the 8 5/8 intermediate string of casing.

A. I think they call it the salt string, but yeah.

Q. The salt string, right?

A. Right.

Q. Okay. Now, somehow we have got to get through the metal pipe, either through a hole or through the threads in this casing. 8 5/8 has threads also and couplings just like the 5 1/2?

A. By "hole" you meant worn hole?

Q. Worn hole or whatever.

A. Or whatever. That's true, yes.

Q. And let's just -- If there was already a worn hole in the 8 5/8 when we set the 5-1/2-inch casing, that cement would go into that worn hole, wouldn't it?

A. Well, we would hope it would, yes.

Q. Okay. So --

A. Doesn't mean it has to, though.

Q. So again, if we've got a hole, the cement in the hole has got to break down and become permeable when it wasn't designed to be, or again we go through the same steps that the threads wouldn't hold or the pipe dope wouldn't hold, to get it outside of the 8 5/8 into the cement, which encapsulates the 8 5/8, right?

A. Yes. I mean, that's --

Q. Okay.

A. -- obvious.

Q. And then again we've got to have the problem about that sheath of cement would have to break down and become permeable.

A. That, I think, would be a minor problem.

Q. And then, if we're here in the McNutt series, we've got to have a zone out there that's permeable rather than impermeable before we could get that gas moving away from the well, from the bore, et cetera.

A. Let me ask you one question here, because I don't want to confuse anybody.

When you say the McNutt is impermeable, are you talking about the salt or the stringers that are in there?

Q. I'm talking about the salt section.

A. And not the stringers that just lie right on top of the salt?

Q. Well, are you talking about stringers on top of the salt or within the salt, Mr. Mitchell?

A. Well, I'm talking -- I saw that record off of that 162 corehole. It had stringers in there.

So what I really need to know is, are you talking about permeability between the planes, between the clay and shale and that type of stuff?

Are you talking about those planes between the salt and those -- Or are you talking about just a solid salt there?

Q. Well, Mr. Mitchell, you were here when Brent May testified, weren't you? The geologist for Yates?

A. Would he hold up his hand? Yes, I was here.

Q. And you also heard him testify as to the nature of these layers as being clay, right?

A. I can't remember the testimony, but I did see the core report.

Q. And you know enough about drilling, that clay is impermeable also?

A. Well, that's not altogether true.

Q. Well, that was Mr. May's --

A. I would love to agree with you, and the bedding planes definitely aren't impermeable.

Q. Well, whether or not we want to debate the permeability of the clay seams --

A. But let me say this, that if you had the McNutt opposite this and you had that impermeable salt, and gas were contained in a six-foot mining zone I keep hearing about, then it would be kind of difficult, except for cracks in the McNutt, to get it to go in there. I mean, that I will grant you.

Q. All right.

A. And I'm not a mining engineer, and I'd like for the OCC to definitely take that into account.

But I think I can see how you could be right under, you know, a limited circumstance.

Q. Well, Mr. Mitchell, can you calculate the probability of all of that series of accidents or whatever you want to call them, occurring for gas to get all the way from the wellbore within the 5-1/2-inch casing out to the edge of the casing?

A. Yes.

Q. And what -- is that -- Have you calculated it?

A. You asked me if I could.

Q. Yeah, could you? Have you calculated it?

A. No, I haven't.

Q. You have a -- It would be almost so small that it would be immeasurable, wouldn't it, Mr. Mitchell?

A. Oh, I'd say that -- As I said before, four out of five wells drilled down there, you'd have some type of gas outside the casing.

Q. But in that number of situations where you go through that much steel in the casing?

A. Well, there's other ways too, you know. You could have it flow up.

But just through this particular -- The scenario that you described probably would be somewhere around three or four wells, and the others would add another two or three.

Q. Three or four wells.

Have you done any studies to back or verify your three or four wells in a thousand wells, Mr. Mitchell?

A. You said three or four wells in a thousand?

Q. I guess that's what you're referring to.

A. No, I meant three or four wells in a hundred wells.

Q. In a hundred wells?

A. (Nods)

Q. Do you have any empirical data which tell you in fact that's what happens when wells are cased as these are cased for this Delaware section according to R-111-P standards?

A. Well, RP-111 -- What, now? Wait just a minute. I think you brought in something that we haven't been discussing yet.

Q. The well design, the casing design that we've been talking about in these wells, is dictated by Order R-111-P, which controls the drilling for oil and gas within this area.

And what I'm asking is, when you -- Do you have any empirical data to back up your statement that three or four wells out of every hundred wells, when cased according to this kind of criteria, are going to have gas outside the casing?

A. Absolutely not.

Q. Let's go to your next exhibit -- Well, that was where you had these little arrows going up through the Delaware to the McNutt, and I think you basically said that that wouldn't happen.

A. No, no, no, I said that would happen, but it would be immeasurable.

Q. Immeasurable.
A. Small amounts.
Q. If it were --
A. That's this one.
Q. If it were immeasurable, there wouldn't be any oil and gas in the Delaware, would there?
A. That's right, so it wouldn't be --
Q. Let's talk about your next one, is the microannuli path.
A. Yes.
Q. All right. Now, you're saying that this microannuli path could provide a path up into the McNutt area; is that correct? And this diagram is supposed to depict that?
A. Basically, yes.
Q. Now, the cement that you're talking about here, is that the 5-1/2-inch casing. Or is that the 8-5/8-inch casing? One's missing, isn't it?
A. Well, it could be a combination.
Q. Well, that's what's interesting. Let's talk about the microannuli path that would lie against the 5-1/2-inch casing.
If we assume that it went 6000 feet, it would be -- as it got up to the level of 4000 feet, it would then become inside or go inside the 8-5/8-inch casing,

wouldn't it?

A. Well, not necessarily. You know, both of them could shrink. The 5 1/2 could shrink, the 8 5/8 could shrink, and it would go up outside the 8 5/8.

Q. But you would have to have a path from -- right along the pipe of the 5 1/2 casing, a path to the outside of the 8 5/8, wouldn't you? You'd have to have a connection, wouldn't you --

A. Oh, definitely.

Q. -- for it to get on the outside?

A. Of the 8 5/8.

Q. Now, Mr. Mitchell, have you done any studies which confirm the fact that one continuous microannuli exists anywhere in the world, 6000 feet in length?

A. No.

Q. And in fact, in your -- one of the books that you describe, the *Advanced Oil Well Drilling and Engineering Handbook and Computer Programs*, you list this as one of your problems, and you give solutions to it, don't you?

A. Well, there's solutions to every -- Let me see this. There's solutions to every problem in here, if the oil company or the operator wants to spend the money. Every one of them.

Q. And the solution with respect to the

microannuli that you offered in your book was that you just reduced the pressure inside the casing so that you don't have it pushing against the cement, and then when it does, when pressure goes off, that allows it to come in? That was your proposed solution?

A. That is, but there's one other aspect, and that's temperature. If you had the full book, you would see a solution to that.

But anyway, if you have a temperature problem too, why I mean the temperature problem is so narrow in the annulus that not much gas would get through, but a little bit would.

Q. Let's turn to the next exhibit, was this "Expected Natural Gas Flow Rate through Micro Annulus".

Now, you use -- The key figure here that I'm interested in is the gap, and it's .015 radial width of the annulus in inches.

A. Yes.

Q. Where did you get that figure?

A. It's rather -- You know, from mechanics you calculate -- Let's say you put 3000 p.s.i. on a piece of pipe, and you've got the temperature up pretty high, so you cool it down, reduce the pressure bolt, and the thing would -- could shrink as much as .015.

Q. You've never measured a microannulus at

zero -- .015, have you?

A. I've never measured a microannulus.

Q. And you are aware that after this phenomenon or this, I guess, theory of this phenomenon had been discussed, that there have actually been tests where holes have been drilled and companies have tried to pump up into these microannuluses and have failed?

A. Well, I would -- I'd have to see the test before I could say that that's true or not true.

In other words, people attempt to demonstrate things that -- and observe, you know, what happens, and sometimes they get confused.

Q. And in fact, what -- All this equation here is just an attempt to demonstrate something by yourself, isn't it, Mr. Mitchell?

A. I think microannuluses are recognized in the industry. And yes, I'm trying to show that a microannulus will present a small problem in cementing.

Q. Now, you've used the Weymouth's equation also here; isn't that true?

A. We've always called it Weymouth.

Q. Okay. I'm sorry, I'm not an engineer, and this is one of my first --

A. I'm sure some people do call him Weymouth.

Q. Okay. Well, Weymouth.

A. Yeah.

Q. Wasn't the Weymouth equation developed to determine this flow rate in short lengths of smooth steel pipe? That where it's valid?

A. It's most valid there. But in drilling it's used by Angel in producing air charts and, for instance, by Pottman for his air charts also, for the production of fluids.

But it's a common equation that's used.

Q. Let's go to your next exhibit. You have an exhibit here, "Gas Flow through Cement", and it's just an arrow going through what I could -- understand this to be cement, right?

A. Yes, that was my intent.

Q. And what we're talking about here is gas flow through solidified cement?

A. Solid cement.

Q. Solid cement, that's cured or set.

Would you turn to your equation? Now, you heard Mr. O'Brien testify that cement -- the permeability of neat cement is usually considered in the industry as one millionth millidarcy -- one millidarcy, I guess, is the proper way to say it.

A. No, it's closer to one-tenth millidarcy. In other words, ten times smaller than just -- what you

said.

Q. Well, is that what this figure is under "k" in this upper part?

A. Yes.

Q. All right. Then you basically stated that there's a possibility, based on this equation down here, the bottom equation, that there could be 55.226 standard cubic feet a day flow through the cement; is that correct?

A. Yes, that's what that equation works out.

Q. That is only possible if you reduce the permeability that you show up here under "k" to .01, isn't it? Or increase it, actually, increase the permeability to that?

A. That's what I was going to say.

Q. Excuse me.

A. That would be an increase. And that really would be the outer extreme. That's 10 millidarcies.

Q. Right.

A. And so we would never expect 55 in this well. In some wells that's possible.

What we really would expect is to have this half a standard cubic feet that's called .55. That's what we would expect according to these equations.

Q. Well, are you -- So what you're saying is

that you would expect to see gas flowing through impermeable cement as it comes from --

A. Well, first, you know, there's no such thing as impermeable cement. Even O'Brien said that there cement has permeability. It's just that it's lower. You know what I mean? So I'm in agreement with him.

Q. All right. So at least --

A. Maybe I ought to state that differently. He's in agreement with me.

Q. All right. And basically what his position was, this isn't a problem?

A. No, I think he said that he would be concerned, because see, cement that's not blended correctly can develop permeability, as high as ten millidarcies.

You know, in a swimming pool -- Let me say this: In a swimming pool, if you don't block the permeability and you have a sand zone below your swimming pool, you'll go broke buying water. Cement is very permeable under some conditions.

Q. So really, there is one additional factor that's not shown here on this table, and that assumption is that the cement is not going to be mixed properly before it would become impermeable?

A. No, I think I've got it here. You know, if

you take a look at it -- I show that -- what do we really expect? A half a standard cubic foot. Concern, but not a problem.

And down here, just in case somebody thinks that there may be a mixing problem or some other problem that could occur, we could expect no more than 55, which would be a concern, but maybe not a problem either.

So I mean, at both ranges I show that it's probably not a problem.

Q. Let's go to your next exhibit, your mud channel. This phenomenon here as it's depicted would, one, assume that if you were using centralizers on your pipe, that you didn't get your pipe centralized properly?

A. That's totally correct. I have to agree with you there.

Q. All right. And now, what you're saying here is that for some reason the cement is going to overrun the mud and go on beyond it, past it; is that correct?

A. Yes, I think -- You know, this has been observed in the lab, Mobil, Halliburton, Exxon, and they spent about 5 million bucks in Ponca City, and what they did is, they had a bunch of cementations like this, the pipe out of center, and they pumped mud by,

then they went back and cut the pipe up and showed where these -- mud had been bypassed by the cement. This is a standard, known thing in the industry.

Q. And again, like all other problems, it's one that can be corrected, one, through the use of centralizers, two, raising and lowering your pipe, three, rotating --

A. The most effective way is rotating the pipe. And Mobil Oil Company showed that if you rotate the pipe at 35 r.p.m. for one minute, you'll mix that mud into a casing.

But there's a problem. You can't usually rotate the pipe if you put centralizers on it. And if you don't put centralizers on, the pipe will definitely be up against the wall of the hole.

So you've kind of got a choice there. A lot of people choose no centralizer rotation, and that partially resolves the problem.

And like T.B. O'Brien said, he prefers to put centralizers on and rotate -- and then reciprocate. And that doesn't solve the problem either.

This is a major problem that's with us today in the oil industry, without a concrete solution.

Q. Now, where this is going to exist and where it's going to present a problem is within -- inside of

the 8 5/8 casing; isn't that correct?

A. What do you mean by "inside the 8 5/8 casing"?

Q. Well, you've got -- what I think you're talking about here -- Well, the reason why is that first of all, the intermediate string that we have --

A. Yes.

Q. -- that goes down about 4000 feet?

A. Yes.

Q. -- it doesn't enter any of the oil and gas producing zones, does it?

A. No, but it still could have mud channels.

Q. It doesn't enter any of the oil and gas producing zones, does it?

A. No, but it still could have mud channels.

Q. For us to have a problem, we've got to have gas; isn't that what we've been talking about in all of this hearing so far?

A. Yeah, but you could have a mud channel and then have gas problems too.

Q. All right, and --

A. I mean, I would like to agree with you, and -- I really do. But if you've got a mud channel and you have gas, that can migrate up to the channel. Then it can further migrate through that channel.

Q. Now, if you had this mud channel --

A. Yes.

Q. -- that's going to be a void that's detectible with a temperature log or a bond log or one of those logs, isn't it?

A. No. I'll tell you what, I'd like to show something that T.B. tried to show. Has anybody got a little cup here? Could I borrow that cup? I need one that will have a ring to it, and I think maybe --

MR. ERNEST CARROLL: He doesn't trust you to give it all back.

THE WITNESS: You know, a cement bond log, he said it's an acoustic device. And what it does is, it sends a ring out of the casing -- through the casing out to the cement and down the hole. And what it really does is measure the amount of ring in this thing, see? [taps cup] So if the cement isn't gripping -- [taps cup] -- the casing, it sounds. It will ring.

But now, if you grip it like this -- I'm only going to grip it on one side -- [taps cup] -- it sounds like that. Okay?

And that's what the cement bond log does. In principle, this is a hundred percent correct. Notice, that if I grip three-fourths of the way around -- [taps

cup] -- it sounds about the same. [taps cup] Over here it sounds the same.

So actually the cement bond log tells you, one, is it totally free? Or, two, is it not totally free? [taps cup] And I think you could ask -- [taps cup] -- There. And that's the principle.

So, you know, a bond log, as T.B. said, you know, it's questionable whether it's of all that value or not. Okay.

Q. (By Mr. Ernest Carroll) How many of these mud annuli have you measured in -- at a length of 5000 feet?

A. None, but I tell you what. I was in Alaska one time, on the Cook Inlet, on the Grayling Platform for Union Oil, and they had a gas zone at about 3500 feet. They cemented 9-5/8-inch casing, and they had lost circulation, just like you have here in this area.

Q. And what you're talking about -- Excuse me, I'm sorry.

A. And what happened was that we put a line on the top of the casing and sent it out to a burner on the platform. And the well made a volume of gas up through the annulus for 3500 feet that was about 25,000 standard cubic feet per day, as estimated by the production man on location. He looked at it and said

about 25,000.

Well, 25,000 on an enclosed platform in the Cook Inlet has got to be dangerous in anybody's world. So he immediately set up a task force, solving the problem of intermediate casing strings.

But go ahead.

Q. That was a gas well with extremely high pressure to it?

A. No, oil well, and the pressure was about normal.

Q. Well, what's that?

A. Well, about water gradient. In other words, the amount of pressure that water would have at that depth.

Let me say this in your behalf: The pressure here is less than water gradient by about two pounds per gallon.

Q. Let's go to your next exhibit, "Swapping Out". If you do this well as has been testified -- and "do" is probably a bad word -- drill it and set casing which is a foot or two off the bottom of the total depth, I think even you admit that you're not going to have a problem; isn't that correct?

A. You wouldn't expect it. I'll even go further than that: You would not have a problem.

Q. The only time you would have a problem is if, like you -- I think you suggested that maybe the driller would go and drill 30 extra feet of hole; is that correct?

A. Yeah, that's happened.

Q. I'm sure that's happened, and I know that you've been on a number of rigs just like I, and the standard procedure is when you bring that pipe out of the hole you strap it out, don't you? Well, you know exactly how deep you drill?

A. What pipe?

Q. You strap the drill pipe. That's the only thing that causes the hole, right?

A. Well, that and the bottomhole assembly. Yes, that's standard practice.

Q. And when you're putting that -- tool joints together, you strap each one of them so that you can total those up and you know exactly how deep you are?

A. Well, you'd like to think you hadn't made a mistake.

Now, let me ask you this, since you seem to be knowledgeable about this and you've been on a rig. Have you drilled an extra 30 feet? Have you ever heard of it?

Q. I have heard of drilling an extra 30 feet,

but we always knew about it because but we always measured it. We knew how much pipe was in the hole.

A. That's true, but did you buy an extra joint of casing and make sure it would go to the bottom?

Q. Absolutely. When you say --

A. Well, some people won't buy that extra 30 feet of casing.

Q. Well, Mr. Mitchell, that's what has been prescribed by this drilling program, and I think I'm going to be safe and assume --

A. Well, you have me at a --

Q. -- that we're going to be doing it like we say we are.

A. You have me at an advantage. I haven't seen your drilling program.

Q. Okay. And there's also available what they call something like an E log to measure total depth of the hole? That's commonly used in the industry, isn't it?

A. Oh, yeah, usually the State record is based on the driller's measurement, though.

Q. And with respect to this, because -- for this swapping out -- and the reason I think -- and I think we need to tell the Commission why it's not going to be a problem, is that for this passageway or annuli to

occur, we have to have mud, enough mud to create the opening, don't we?

And if you run out of mud in the swapping out process -- or maybe the better way to put it is, it's only going to go as high as you've got enough mud to go that high? Right?

A. Well, how high is that?

Q. Well, how high is it? You can calculate the volume of mud at the hole and if you --

A. Careful now. How big is the shaft of mud going up through the cement? What's its diameter? You see, that's going to be a factor too.

Q. That's right, that is going to be a factor.

A. So it's not only the volume of the mud but the size of the --

Q. Size of the annuli.

A. The size of that pipe going up that --

Q. And I think what you -- You told us that some people believe that there might be some that exist a thousand feet; is that correct?

A. Yes, that's true.

Q. And what we're talking about is something like -- on the order of 6000 feet, aren't we?

A. That's true. Let me totally agree with you. So it would take a combination of these things to --

you know, in some cases to reach this, you know -- But go ahead.

Q. Going to your next exhibit, and I think it's called "Gas Percolation" --

A. Yes.

Q. -- now, let's talk about first of all -- Now, this gas percolation process, so that we understand what's happening, this is gas percolating through unset cement; is that correct?

A. Partially set cement.

Q. Partially, but it --

A. What most people -- yes.

Q. But it has not become a solid?

A. Semi-solid.

Q. Okay. Well, now -- So right away, if -- This problem of gas percolation is only going to be a problem that we have with casing and cementing that's going to go into a zone containing gas, right?

A. Well, yes.

Q. So the problem here is limited only to the 5-1/2-inch casing, not the 8 -- the immediate inner salt string or the surface or the conductor pipe?

A. That's true.

Q. So --

A. That's what's drawn in the picture too, by

the way.

Q. But you've got arrows that go from this darkened hole out into the cement of the 8 5/8 casing?

A. Yeah. But see, you would expect a gas channel to go from the Delaware all the way to the surface if it could. There may be something to block it in there.

Q. Uh-huh.

A. But anyway, if it could, it would go all the way to the surface. And then in order to get gas in the wellbore opposite the McNutt, it would have to go some other way, in other words, a gas channel or a microannulus or something that exists that would be in combination with this gas percolation. And that's totally possible, it just is.

Q. The -- When you were talking about this gas percolation exhibit you mentioned that you had an experience over in Sumatra of a rig burning up.

A. Two of them.

Q. Was that a -- Two?

A. Yeah.

Q. Was this high-pressure gas wells?

A. Oh, well, yeah. It doesn't parallel the zone here all that much. It was slightly overpressured so, you know, instead of being able to drill the well with

water, you'd have to use something like -- I think it was 11.2 pounds per gallon, but -- So that aspect of the parallelism does exist.

Q. And for the calculation that you performed after this gas percolation, you assumed a diameter of a single annuli or channel of .75 inch or another three-quarters of an inch?

A. Three-quarters of an inch, yes.

Q. And so for this to occur, then, you've got to have a tube 3/4 inch in diameter. And if we're talking about -- Well, diameter. And that would be diameter for -- at least to get up to the McNutt level, approximately 6000 feet in length?

A. Well, yeah, I mean, I can't see anything wrong with that.

Q. Have you ever measured --

A. Oh, yes, yes, I've --

Q. -- 6000 feet, three-quarters of an inch?

A. Oh, I was -- I've measured three-quarters of an inch before, but not 6000 feet.

Q. All right. It's interesting, I was just noticed it, and I've seen it on several of your calculations down here. You say that this well, then, has the capability of producing 889,512 standard cubic feet a day through this three-quarter-inch channel?

A. No, I object to that. I object. You know exactly what you said to me.

Q. No, I don't, I'm sorry. Please explain -- what --

A. You said I said that the well would produce 8000-something standard cubic feet -- 800,000-some standard cubic feet a day. That's not what I said.

Q. Well, I --

A. You know --

Q. -- thought I said it could.

A. No.

Q. I thought I said it could, so I'm sorry if I didn't.

A. Okay --

Q. What I'm saying, what you said, this projection --

A. I would like to have an apology.

Q. Well, you can have it, Mr. Mitchell.

A. Okay, thank you.

Q. Now, Mr. Mitchell --

A. What I said was is that the channel has that capability if the well does.

Q. Okay, and that's my point. You know that these wells don't have that capability, don't you?

A. Absolutely do not have that capability.

Q. Now, the next exhibit, this "Gas Cut Cement and Bridging", isn't this also kind of the same or similar phenomenon with gas percolation?

A. No.

Q. It is gas getting into the cement, and it doesn't percolate, or what is that -- what is the -- What is the difference, then?

A. Oh, it rises through the cement; in that way the parallelism is correct.

Q. Okay.

A. But the way that the pressure is relieved on the gas zone such that it can enter the formation is totally different.

Q. Okay, what is the mechanism, then, if you would describe it? Because I --

A. You form a permeable block up here and call it a bridge up here, and it supports the weight of all of this mud above it.

The pressure down here could decrease by bleeding of some of the filtrate in the cement into a water zone, something of that sort, lowering the pressure on the gas. Then the gas would percolate through the cement.

Q. Is this cement that is still in a non-solid state?

A. Yes.

Q. Okay, it would --

A. As a matter of fact, it would be in a liquid state.

Q. Be in a liquid state?

A. And then the percolation would continue till it set and you would have gaseous cement and bubbles down there.

Q. Again, this particular exhibit is missing some very important ingredient, and that's the 8-5/8-inch casing, isn't it?

A. Oh, that's -- Yes, that's true.

Q. So this gas -- your exhibit here, if we had our 8-5/8-inch casing imposed outside here, these arrows would stop or could be stopped by the casing, the 8-5/8-inch casing? Rather than --

A. Yeah, I agree a hundred percent. You'd have to have a secondary path there through the 8 5/8.

Q. All right. Now, this problem that you're talking about here, voids in the cement --

A. Which one is that?

Q. This is the "Squeeze Cementing" problem, I think.

A. Oh, yes.

Q. Again, these voids in the cement, the

solution that the industry uses is to condition the hole by circulating, and then when they pump cement into the hole they pump known quantities and more than enough, like circulate 200 or more sacks, or less, cement; is that correct?

A. Well -- I don't understand the question.

Q. Okay. Maybe I don't understand the problem that you were trying to describe here.

A. Well, that's -- Let me explain it again, then, please.

What happens is that you have a void, especially in a stage cement job, where you might have the cement fill to here in the first stage, and in the second stage it might fill higher, right? So you're going to have a section of the hole here which may not have any cement in it at all.

Q. Uh-huh.

A. Okay? Now, the correct procedure is, that most people use, is to perforate the casing and try to fill up that void section there with cement.

Q. Uh-huh.

A. It's not void; it's full of mud. But anyway, it's void of cement.

So they pump it out there, and instead of the cement rising to the top and filling this section here

with cement, it simply goes out into the formation down here and never fills up. Part of the casing there, that is void of cement.

Q. That is a very detectible problem, isn't it?

A. Yes, a cement log will pick that up instantly.

Q. Okay. External casing packers, they're not widely used in the industry, are they?

A. No, they're not. They're expensive.

Q. I have heard the number of one percent of the wells. Is that a fair, in your experience --

A. No, that would be too many.

Q. Too many. So we're talking about something that is very limited, then?

A. Yes.

Q. And the problem, then, that you are describing here is limited to the use of these kind of packers and further complicated by having set one of these packers in a very permeable or weak zone?

A. Or fractured.

Q. Or fractured zone.

A. Yeah, uh-huh.

Q. Let's talk about your "Worn Casing and Doglegs" exhibit, Mr. Mitchell. Now, we're talking here -- This truly was intended just to depict the

8-5/8-inch casing; isn't that correct?

A. Well, you can wear a hole in any casing, so that's -- As shown here, you'd expect it. Since you're drilling out, it has to be an 8 5/8 for this particular drawing.

Q. Well, we know if we set 5-1/2-inch casing we're not going to be drilling through that. I mean, that's casing that goes to the bottom.

A. Let me agree with that. But you will be running tubing and whatnot through the 5 1/2, also wear holes too. No, both strings have the wherewithal and whatnot to wear holes in it.

Q. If you did wear a hole in this casing, one of your expectations is that when you do the cementing of this 8 5/8 -- excuse me, when you do the cementing of the 5-1/2-inch casing, when it's run, that you would -- the cement would go into that hole and fill it, wouldn't it?

A. You would certainly hope that would happen. But even if it did, you wouldn't have pressure integrity.

Q. Wouldn't have what?

A. Pressure integrity. In other words, the cement isn't nearly as strong as the steel, pump the cement in there.

Q. When this cement is in, encapsulated or within and has -- because we're not -- we don't have free-standing cement.

The pressure -- How much pressure are we talking about would bust or destroy the integrity of this cement when it's setting in a situation like this?

A. Oh, you know, for design purposes -- Well, no one really knows that for sure. Bur for design purposes, we'd use it strength zero for the cement because -- You see, the cement is really going to break in tension.

I mean, you've got -- You look at it kind of like a balloon, one of those long-dog balloons, you know?

Q. Uh-huh.

A. You blow it up and the pressure is going to expand the cement like this and crack it longitudinally, probably, so that gas will go out.

Q. So what we really have is the fact that if we have pressure coming up the wellbore and get in contact with this cement, was filling this gap, we'd actually be finding the cement in compression, wouldn't we?

A. Well, you probably wouldn't have any cement back there anyway. You'd have that gas -- that mud channel back there, you know, the one I drew. So you

probably wouldn't have any cement there anyway.

But if you did have the cement there, then the cement probably couldn't be depended upon to give you much strength, if any at all.

Q. But if -- But the cement would be in compression in that sort of circumstances?

A. If you pressure it up on the wellbore it would put the cement in tension, not in compression, if it were there at all. It probably wouldn't be there.

Q. Let's go to the inclination survey. Now, this was taken from an instrument called a totco; is that correct?

A. I don't know that. I took that off -- Let me tell you what I did.

When I was here last time I went up and got the state records, and in there they had a listing of the directional -- or the inclination surveys, and I really don't know how they did it.

Q. Okay.

A. But let me say this: I would suspect that you're right, because that's the cheapest instrument out there.

Q. Common use in southeastern New Mexico?

A. Well, it's used all over the world.

Q. All over the world.

Now, these kind of surveys, as we're talking about here, they give you a degree of inclination, but they don't give you any orientation, do they?

A. Well, by "orientation", you mean direction?

Q. Which direction.

A. It's called azimuth.

Q. Azimuth, right. I couldn't think of the word.

A. Okay, yeah.

Q. So we don't know anything about azimuth then?

A. Yeah. I could say this, though, that any change in azimuth would add to the dogleg, not subtract from it.

Q. The -- We know from experience that, as Mr. O'Brien said, is that when we drill an oil and gas well, it doesn't go straight down. It kind of rotates down into the ground; isn't that true?

A. You know, that happens some. But if they have any depth to the beds whatsoever --

Q. Uh-huh.

A. -- and you know, in our Directional Drilling Research Center we have a little program that allows us to look at this stuff 3-D, and it's oddly enough that most wells go down and then take off in one direction and maintain that direction, and that surprises a lot

of people.

Q. Now, when you look at the point out -- the first point that goes out to 4 1/2 degrees on your diagram --

A. That looks like 4 1/4.

Q. It may be 4 1/4.

A. Yes.

Q. Anyway, it's the farthest one out. It's the first one -- It's just below, somewhere below 2000 feet.

You show that the -- Then the next one drops back to 3.5, and this -- We see a jagged type reflection here on your diagram.

A. Yes.

Q. You don't know that that in fact -- Is that going back --

A. No, no --

Q. There's something missing with this diagram; it's not in three dimensions, is it?

A. We can do better than that.

Q. Uh-huh.

A. It isn't jagged, as sharp corners here representing doglegs.

Q. Right.

A. You know, the bottomhole assembly must drill

a curved hole, must.

Q. So that's really what we've got. This could very well just depict a gradually curved hole, couldn't it?

A. Considering -- the error within a certain -- Not really.

This point here, back to this point here, probably is a real thing, because it's a little bit too big. You know, here's a 4 1/4 to a 3 1/4, so you probably do have a pretty sharp little turn there.

Q. One degree in several hundred feet; is that correct?

A. I don't know where that turn occurred, but I could draw you a little diagram and show you how the turn could occur in a few feet instead of a lot of feet.

Q. But the only way that that is measured is, it's measured in one degree over the distance of several hundred feet here on your diagram?

A. Well, just because it's -- you know, you take a survey here and here, doesn't mean that you have a gradual turn. You could have it sharp and then go all the way down straight, see? Do you see what I'm trying to say?

Q. Well, what you're saying is anything's

possible --

A. I don't know.

Q. -- but we don't know.

A. I don't know.

Q. All right.

A. But I do know that it could be a dogleg of consequence, especially the one down at 3500 feet. See, that looks very suspicious.

Q. Well, really you've got quite -- this --

A. See, we go from three-quarters out to 4 1/4. See, that is in the range of being troublesome, according to API's chart.

Q. That's interesting that that occurred at approximately 3500 feet. That's within the salt section, isn't it?

A. Where is the bottom of the salt? I mean, I'll take one of your experts' word for it. I mean, I want to agree with you. I think Dr. Boneau would know. Where's the bottom of the salt, Dave?

You mean nobody in here knows that number?

FROM THE FLOOR: Forty-two. T.B.'s exhibit number.

THE WITNESS: Okay, I agree with you, it's in the salt.

Q. (By Mr. Ernest Carroll) All right. And in

fact, all of this problem, the most -- the -- most of the deviations that we see occur in the 2000- to 4000-foot area, which is, as we learned, is the salt section? From looking at your diagram.

A. Well, the top of it, the top of the salt, I think, is around 700 or 800, unless I stand corrected.

Q. The -- Well, then, that would include most of these, then.

That does give some credence to the fact that you do have deviation problems or hole problems when you're in the salt, don't you? Like Mr. O'Brien indicated?

A. I don't think he ever said that, no.

Q. Well, when you're trying to kick off and drill a deviated hole?

A. Yeah, that's another one. That is not what you said.

Well, let me agree with you that most of the deviation problems here in the way that this well was drilled is in the salt, yes, let me agree with that.

But I can't agree with you that kicking off would have something to do with these deviations shown here. No correlation.

Q. Well, if -- When you have holes and deviating -- when you have a problem in deviating a hole, they're

usually caused by the strata that you're going through? There are certain --

A. Oh, no.

Q. -- strata that we know do cause deviation problems; isn't that true?

A. No. I wish I could agree with you. It's one factor, but not the major factor.

Major factor is the bottomhole assembly, the bits and the location of the reamers and stuff like that on your bottomhole assembly. And charts have been published by Lubinsky and Woods showing exactly how to drill a straighter hole in troublesome formation.

Q. If you turn -- You had a set of exhibits that dealt with the Flora Number 1. These are the, I think, the group. And you have a graph drawn on the Graham AKB State Well Number 2.

A. Are you over on --

Q. This is Exhibit 40, and I don't have any idea where --

A. Oh, okay. Let me find my through to that one. Okay, I've got it.

Q. Yeah, it's a time -- It's a foot-and-time graph.

A. May I put this away?

Q. Yes, I'm not -- I'm through with those

exhibits.

A. Which one, now? The Flora or the --

Q. Yeah, well, it says "Graham AKB State Well Number 2", and under that it says "Dates in 1992". And what you've got there is the spud date, the bits are noted on that and...

A. Yes.

Q. The portion of this particular hole that took the longest to drill is that portion that goes through the salt section, isn't it?

A. From about 1000 feet down to 4200 feet, yes, that took up the major amount of time.

Q. That took close to 12, 13, 14 days?

A. I'll take your word for it.

Q. Okay. Isn't it quite possible that the problems with drilling the salt here, the crooked hole and those kind of things, contribute to or could cause that kind of a drilling time problem in the salt section?

A. If they didn't drill it correctly, that could be true.

I would think, though, that these companies, drilling as much as they have, probably drilled it, you know, problem-free.

Q. The salt can cause problems in drilling,

can't it?

A. That's -- Well, that's true, you know. All rock can cause problems, you know. It's --

Q. Now, let's talk about this directional drilling. Now, you were told and asked to look at drilling a directional hole out of there.

What criteria, designwise, were you given by Mr. High to crank into your formula here so that you can come up with a cost?

A. He never said anything.

Q. All right. Now, isn't it true that one of the best ways to determine what's going to really happen in any particular locality is to look at actual case experiences?

A. You know, what I wished? I wished I could have drilled a well, then done the cost --

Q. Sure.

A. -- but that wasn't possible.

Q. And -- Because actual drilling experience is going to be a better guide than just the theories or formulas that you've got here?

A. Yeah, the only help I had was my assistant who's 34 years old and worked for Arco as a drilling engineer, and he had drilled some wells down here.

Q. Have you drilled any deviated holes down here

in southeastern New Mexico, in this potash --

A. No, you know, and neither had he, so that made it double-tough.

Q. Okay. Were you aware that there had been a recent deviated hole drilled down here in the salt section?

A. Yes, that came out in the testimony by --

Q. The Bonneville well?

A. Yeah, that's the name of it, yes.

Q. You were aware that the deviating offset in that particular well was 750 feet?

A. I tell you, I never looked at the well, you know, because the drilling of one well is just one data point, and often confusing.

Q. Well, you're -- That deviated hole at 750 feet would be something on the order of about one-quarter of the distance that you were using for your Flora Number 1 Exhibit, because you're talking about 26.

A. Talking about 26?

Q. Right.

A. I'll take your word for it.

Q. Okay. Roughly a quarter, and I'm not trying to be exact here.

And you -- In your formula, you arrived at a

30-day drilling record for drilling this particular well?

A. I thought it was 30.5

Q. 30.5 Were you even aware, or even considered the fact that the Bonneville AK -- whatever the -- the one Bonneville well took 31 days to drill?

A. You know, when you said that, I thought, My goodness, I hit it again, you know, because I hadn't looked at it, I hadn't got the bit record for it or anything else.

Q. Now, you made an interesting statement that -- You said that if you go cheap it takes a longer time to drill. If you go expensive, you can drill these wells quick.

A. Well, not quite.

Q. What did you choose?

A. Not quite, okay?

Q. Well, those were words that you said, and all I'm wondering is, where did you fall in, I guess, these two extremes?

A. Well, I chose a bottomhole motor, right? I chose a bottomhole motor technique --

Q. Uh-huh.

A. -- which would mean that it would be fairly fast.

Q. So are you saying it's in the middle to upper range, then, of --

A. Middle to upper range.

Q. Now, in your formulation here, you certainly --

A. Are we through with this one?

Q. Yes, yes. You certainly -- Let's talk about things that I don't think that you tried to cover. Here --

A. Okay, sounds good. What exhibit are we --

Q. Well, I'm talking about basically here your last two in this group. They're these calculation sheets. That's the first --

A. Okay, I see.

Q. That's the next to the last one.

A. You mean you're going to skip all these others?

Q. We've already talked about one or two.

A. Okay. Which one do you want first?

Q. Well, first of all, with respect to these items, let's just talk about things that I don't think that you attempted to even render an opinion, and I want to make sure.

A. Okay, sure.

Q. The -- With respect to the economic viability

of the well, you didn't make any predictions or any calculations as to that?

A. Oh, I -- No, not any at all.

Q. Not any at all.

A. I had no reservoir, except that one letter from Patterson.

Q. Certainly. And with respect to the calculations you've performed here, you didn't attempt to calculate what the difference in the cost of operating a directional hole would be as opposed to a straight or a standard hole? Cost over the life of the well, operational cost?

A. I did not take that into account.

Q. You didn't deal with that.

And those were two things that Mr. O'Brien did deal with in his testimony, and that's the difference: You didn't render any, or give any evidence as to those two issues?

A. Well I don't know about what you mean by evidence, but I didn't take --

Q. Testimony, I mean.

A. Okay. Yeah, let me agree with that. I did not take operating cost, just the cost of the well --

Q. Now, one of the -- With respect to the designing of the -- you can design a deviated hole in

lots of different directions -- different ways, can't you?

A. Well, let's call it a directional hole.

Q. A directional hole.

A. Yeah. Oh, yes, there would be a hundred -- You know, no one would come up with the same thing.

Q. Are you aware that the deviated holes that are being designed down here tend to be in -- rather than kicking off like you do at an angle and then go straight into the formation, that they tend to go -- they kick off and then another deviation to drop more on a perpendicular basis through the Delaware sands? Were you aware of that?

A. Now, those are kind of universally called S-type wells.

Q. S-type, okay, good. You've got nomenclature there.

A. Okay.

Q. The well you designed, that was not an S-curve type well; is that --

A. That's true.

Q. Okay. Now, are you -- did you take -- or did you even know or were you told that the Delaware zones out here are in multiple pay?

A. Yes, I did. I heard that from Dr. Boneau.

Q. All right. Did you design your well, trying -- taking into consideration that when -- that the Oil and Gas Commission requires the production of these wells from certain ortho- -- from locations that have to be within certain proration units and not too close to boundaries, and that's because of -- someone else may own the oil and gas adjacent.

Did you use that at any point?

A. You said Oil and Gas -- You mean the Oil Conservation Commission?

Q. Oil Conservation Commission.

A. All right. I wasn't aware of that, no. But I'm sure that their rules are similar to other states that have petroleum production.

Q. Well, the S-curve type deviated or directional hole would be more expensive than -- I'm not sure what you would call that, the C -- What do you call the kind of directional hole that you designed?

A. Do you know that API Bulletin D-50 discusses directional wells, and they do not name the type of hole that goes straight down --

Q. Okay.

A. -- straight. I call them slant wells.

Q. Slant wells, okay.

A. Slant wells.

Q. Slant wells, as opposed to S-type?

A. Yes.

Q. Which is more expensive, in your experience?

A. They'd be about the same.

Q. There's no additional cost in trying to --

A. No, because you have to have a little higher angle, which doesn't really enter into the cost till you get it, as one of your experts said, out to about 45 degrees. So you have to have a little bit steeper angle.

But when you get ready to drop, it's rather simple to drop back to the vertical from something like 12 degrees or 24 degrees. It's old hat. You just simply let her drop into the target.

So it's about the same cost.

Q. Let's talk about the risk factor.

Drilling a directional hole over a straight hole, the risk of completing the well, actually getting down there, it's greater for the directional hole, is it not?

A. Yes.

Q. How much -- Do you have in mind a figure in your experience where -- how much the risk increases?

A. Yeah, I have a figure. Continental Oil Company used -- They're called contingency factors --

Q. Uh-huh.

A. -- and for a -- for their worldwide vertical holes -- Well, for all holes, they have 22 percent contingency.

In other words -- And they really didn't distinguish between -- Come to think about it, they didn't distinguish between vertical and directional.

But I don't put a number on it. Oh, maybe an additional four or five percent. I mean, you have -- That's just an estimate, based on my experience.

Q. With respect to problems in producing these kind of wells, do you -- they are increased problems in production a directionally drilled, whether it be a slant hole or an S-curve type directional hole?

A. You know, you are out of my expertise, and I know it's hard to believe but I've never worked in production where they actually pump wells and that sort of thing.

But I will say this: I have talked to people -- Maybe it's best that I not make a statement, since it's out of my expertise.

MR. ERNEST CARROLL: I think I'll pass the witness.

CHAIRMAN LEMAY: Thank you. Any redirect?

MR. HIGH: Yes, I have just one question.

REDIRECT EXAMINATION

BY MR. HIGH:

Q. Dr. Mitchell, upon what do you rely for your opinion that in the 1000 or so wells, oil and gas wells, that have been allowed in the known potash area, that some of those wells have allowed gas to get out of the casing?

A. Well, experience first. I have had gas get out of the casing.

And then second, it's just overwhelmingly reasonable that that would happen.

MR. HIGH: That's all I have, Mr. LeMay. Thank you.

CHAIRMAN LEMAY: Thank you. Mr. Carlson?

COMMISSIONER CARLSON: Just a couple questions.

EXAMINATION

BY COMMISSIONER CARLSON:

Q. Following up on that point, it's your expert opinion, expert estimate, that there would -- you said between three and four -- I gather that was percent, not wells?

A. Well, three or four out of a hundred would be percent.

Q. Right, okay, it wasn't three or four of the

thousand. It would be 30 or 40 out of the thousand?

A. Okay. Now, I think here you -- this thing was -- the bore was really -- three or four out of a hundred, I think I would expect to find some gas outside the casing.

Q. Okay. And that isn't gas that has migrated up to the potash zone; that's gas that's outside of the casing, somewhere on the casing in those wells?

A. That I would expect to find opposite the -- adjacent to the potash zone.

Q. Adjacent to the potash zone?

A. Yes.

Q. Three or four percent?

A. Yeah. Casing leaks are much more prevalent than what people suspect because no one ever measures or tries to detect it. So it's going to be tough to put a number on it as gas outside.

I drilled three wells in San Maria one time, and we sent down what's called a noise log. It's just an earphone, and we run a wire line. We were listening for gas outside the casing. And sure enough, we had gas outside the casing in that case. It was about a 6000-foot -- They're all about 6000.

Q. Obviously you don't know the cementing program and what went into those thousand wells.

Is your three- or four-percent number based on a cementing program similar to the type we've been talking about today as proposed by Yates and as in your exhibit?

A. Well, I suspect there would be all types of cements, but --

Q. Right, but your three or four percent would be -- your -- This?

A. Yeah.

Q. Of every hundred wells drilled and completed like this, three or four percent of them would have gas?

A. Some gas.

Q. Some gas.

A. Not explosive gas, for sure, but there'd be some gas out there.

Q. Some gas outside the casing in the McNutt zone formation?

A. Yeah, opposite or adjacent to that. I sincerely believe that's true.

Q. Mr. O'Brien yesterday -- He said that it would take pressures greater than 3000 p.s.i. inside the wellbore to get gas into the salt formation.

Do you agree with that? I noticed --

A. Well, yeah, that's what he -- You know, you

have to understand what he was saying.

If you wanted to go into the salt, in the McNutt zone, then you would need about ten thousandths. I think he started at two and went to three.

But if you want to get gas in the bedding planes, in the shale, that type of stuff, then you're talking about maybe only 700, pressure differential. You know, 700 would overcome the liquid pressure inside -- inside the bedding planes.

Q. Do you have any feel for how far that gas would migrate under that pressure differential? Obviously, as long as that pressure differential remained. But could it go 400 feet? What are we looking at? Through one of those shales?

A. Well, if you had the total, about 1700 pressure differential -- you know, 2300, 2400 inside, 700 outside -- then that could go quite a distance, probably to the end of whatever that string is.

Q. You said you didn't take the operating costs in your directional drilling calculations.

Do you have a feel for what those operational costs would be compared to a vertically drilled well?

A. About the same.

Q. Now, you heard Mr. O'Brien, and I don't have his testimony, but -- his exhibit. But I think it was

-- he claimed it would be $200 a day, versus $50 a day, if I remember correctly.

A. Well, he's in the same position I am. I know the man personally. He relied on Yates's people to give him those numbers. And of course, I don't have them.

But in a lot of drilling work 20 degrees or less is considered vertical. You know, 20 degrees is just not very much. 24.3 is a little bit more than 20, so -- Deep in my heart, I would feel that the operating costs would be somewhat similar.

If you get out to something like 35 degrees, 40, then I know they'd go up.

But let me remind you, I've never worked as a production man. Just things I've heard at meetings, things of that sort.

COMMISSIONER CARLSON: Thank you.

CHAIRMAN LEMAY: Commissioner Weiss?

COMMISSIONER WEISS: Yes, sir.

EXAMINATION

BY COMMISSIONER WEISS:

Q. Most of your exhibits that showed the various ways that gas can get from the Delaware up behind the pipe, it just looks to me like it ought to go to the surface more often than not.

A. Oh, it probably would.

Q. Rather than, you know, into another zone.

A. That's -- That's an astute observation. That's true.

But if they close in the well or something like that, then of course it can't go to the surface. They'd close in the BOP's or do something of that nature to prevent it from exhausting to the atmosphere. Now is when you're going to get into trouble.

Q. Well, I'm talking behind the pipe.

A. Oh, well, that's -- yes, that's -- But the cement is rather impermeable. I think I showed that, you know. So rather than going up the outside of the annulus to the surface, it could stop or accumulate opposite the McNutt.

Q. It looked to me like if there's a crack of any type, microannulus or mud channel that extends -- although people say they don't extend too far -- if they extend 6000 feet, they ought to go another 2000 to the surface.

A. Oh, that's totally possible, yes.

Q. That just seems to be more realistic than not.

A. Well, one other thing too, Mr. O'Brien said, you know, that the pressure inside the mine is also

atmospheric, and so it has to go from the wellbore in the annulus into the mine. Might be easier than going 2000 feet through the annulus. You've got to keep that in mind too.

Q. Okay. But yet -- And now there's 40 or 50 wells out in that area that might have gas leaks on the surface, is my point.

A. Well, that could be. I doubt that anyone ever measured it.

Q. Obviously nobody has. I don't know why not. If I were concerned about things of that nature, I damn sure would.

A. You know the Alaskan story I told you? We tapped in at the surface, you know, and sure enough, the thing made 25,000.

Q. Yeah, that was a good story.

A. I mean, you hit it right on the nose.

Q. Yeah, it seemed important to me.

And then you mentioned in one of your exhibits there, I think it was -- it had an air pocket -- hit an air pocket while drilling at 2000 feet.

Did you happen to see a pressure associated with that, from your research?

A. I've got the record with me if you want to look it up.

Q. Yeah, I'm curious about what the pressure is at 2000 feet. I would appreciate it.

A. Let's see. Maybe one of the people with Yates would know what that was. This is going to take me a little while to find.

Q. Let's see, was that in your -- here, it's on this -- It's on Exhibit 40F, for Graham AKB State Well Number 2, Yates Pet., Dates, 1992. It shows "hit air pocket". Took about a day.

A. Okay, this is it. Oil Conservation Division report here. It says, "...into a high pressure zone at a depth of 1557 feet. Blowout preventers were closed immediately to control abnormal pressure. Shut-in pressure reached 500 p.s.i." Okay.

COMMISSIONER WEISS: Thank you very much.

THE WITNESS: By the way, that's a pretty good reading of what the real pressure is at 1557 feet.

COMMISSIONER WEISS: Yeah, that's kind of my thinking.

I have no more questions.

THE WITNESS: Not 2000 or 3000 but 500, which, by the way, agrees very closely with Mr. Robert Lane of 450 or so.

CHAIRMAN LEMAY: Okay.

EXAMINATION

BY CHAIRMAN LEMAY:

Q. Dr. Mitchell, did your experience ever address tools?

A. I ran a water-well machine for my dad. You're talking about hammering on steel, aren't you? Yes, I addressed tools.

Q. Your analysis of a lot of -- oh, the -- your testimony, I guess, concerning the gas coming up and all, and what we're trying to go with, is trying to somehow measure the risk associated with gas entering the potash zone.

All this -- Is it your expert opinion that this applies to wells that are currently producing, or what about depleted wells after they've been plugged and abandoned? Would you have the same risk assessment for those wells as you're applying to these type wells?

A. The risk would be reduced, maybe by half, you know. I don't know. But somewhat. It would be reduced, of course. Yeah, you're right there.

Q. I think what we're talking about is not necessarily having producing wells opposite mining operations, but the timing of such. My idea is, Yates wants to get in there and get out. When they get out, they're plugging the wells. And then when the mine comes to them, you'll have a different situation,

maybe, than trying to assess the situation we've actually --

A. You know, I don't really think this applies, but -- Well, I guess it could apply too. But it is a phenomenon that casing leaks out of the casing much more than it leaks from the zone back into the casing.

So if you pressure-up a zone, then when it tries to come back, the mud and the debris in the formation plugs the leaks. You follow what I'm saying? So that the gas can't get back inside the casing to be produced.

But if you were to wait 30 years, well, you know, that would tend to alleviate itself.

But nevertheless, that does -- that phenomenon does exist.

Q. But your expert opinion would be, you're lessening by about 50 percent the danger of gas --

A. Yes, I would say so.

Q. -- getting up into the zone?

That's all --

A. That's a pretty rough number.

CHAIRMAN LEMAY: Okay, that's all I have. Thank you very much.

Additional questions?

MR. HIGH: We have no more questions.

CHAIRMAN LEMAY: Okay, he may be excused.

Let's go off the record for a minute.

(Off the record)

CHAIRMAN LEMAY: Well, let's just break for today, then.

(Thereupon, evening recess was taken at 5:20 p.m.)

* * *

CERTIFICATE OF REPORTER

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

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

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

WITNESS MY HAND AND SEAL November 6th, 1992.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1994