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 IV

BEFORE:

CHAIRMAN WILLIAM LEMAY

COMMISSIONER GARY CARLSON

COMMISSIONER BILL WEISS

FLORENE DAVIDSON, Senior Staff Specialist

State Land Office Building

October 21, 1992

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CHAIRMAN LEMAY: Good morning, this is the Oil Conservation Commission. On my left is Commissioner Bill Weiss. On my right, Commissioner Gary Carlson representing the Commissioner of Public Lands. Our attorney for the day is Rand Carroll, who is taking the place of Bob Stovall who is in Breckenridge, Colorado.

We're here to hear the continuation of de novo Cases 10446, 10447, 10448 and 10449, which are the applications of Yates Petroleum Company to drill in the potash area, Eddy County, New Mexico.

I think the last place we were at, we were going to finish up with Yates. I think Yates had one more witness, is that correct, Mr. Carroll?

MR. CARROLL: That is correct, Mr. Chairman.

CHAIRMAN LEMAY: Does this witness need to be sworn in?

MR. CARROLL: No, sir. He's sworn in. T. B. O'Brien would be our witness.

CHAIRMAN LEMAY: Is there anything that either of you gentlemen would like to say before we begin, or should we just get into it?

MR. HIGH: We're ready to roll.

CHAIRMAN LEMAY: Okay. Let's roll.

MR. CARROLL: Mr. O'Brien, would you please take the stand.

T. B. O'BRIEN

Having been first duly sworn upon his oath, was examined and testified as follows:

EXAMINATION

BY MR. CARROLL:

Q. Would you please state your name and address, sir, for the record.

A. I'm T. B. O'Brien and I live in Midland, Texas. My address is #2, Lazywood Lane, Midland, 79705.

Q. Mr. O'Brien, what is your present occupation?

A. I'm a petroleum engineer. I specialize in drilling and completing oil and gas wells. I have a company, of which I'm one of the principals. The name of the company is O'Brien. We operate as drilling engineers and consultants to a variety of companies in the industry, both domestic and foreign.

In addition to that, we furnish well site supervisers. We have a joint venture with a drilling contractor in which we do turn-key drilling primarily on deep wells. We run a number of schools for the industry. We consult with, primarily, national oil companies in connection with their field operations. That's a thumbnail sketch of it, I suppose.

Q. Mr. O'Brien, your experience in the oil and gas industry, how many years does that span?

A. 45 years.

Q. I believe you mentioned that you do consulting work for both domestic and foreign corporations. Does that mean that your experience in the oil and gas industry goes beyond the continental boundaries of the United States?

A. Yes. My personal experience goes to 28 states, and I think the count is up to about 32 countries at this point.

Q. Does one of the states that you've had experience include the State of New Mexico?

A. Yes, it does.

Q. Are you familiar with Southeastern New Mexico and had occasion to work on and supervise the drilling of wells in and around, say, Carlsbad, New Mexico?

A. Yes.
Q. Now, could you state briefly what your educational background or degrees are in?
A. I have a bachelor's degree in chemical engineering from Louisiana State University, and I received that degree in 1948.
Q. With respect to your professional status, are you registered as a professional engineer in any states?
A. I'm registered both in the State of Texas and Louisiana.
Q. Now, you have prepared a more detailed resume for the Commission, and that is Exhibit No. 67, is that not true?
A. I think that's correct.
Q. The last several pages of your resume include a number of authored papers, works, where you've either authored works or contributed chapters to other books, is that correct?
A. Yes.
MR. HIGH: Excuse me. We have not been provided a copy of that.
MR. CARROLL: We sent it to you.
[Discussion off the record among counsel.]

Q. Your work experience has included working for some of the major companies, is that correct?
A. Yes.
Q. In fact you've worked for Gulf Oil, is that correct?
A. I went to the oil field working for Gulf and I was on their payroll for 19 years.
Q. Did you help design any of their work manuals during your time?
A. I authored the first version of the Gulf Casing Design Manual, and co-authored a couple of revisions to it over the years that I worked with Gulf.
Q. That basic manual is still the manual in use by Gulf Oil, is that correct?
A. Well, Gulf doesn't exist anymore. But the same manual is in use, I think, in a somewhat revised form by Chevron.
Q. What does API stand for?
A. American Petroleum Institute.
Q. Is that a recognized body within the oil and gas industry in the United States?
A. Yes, it is.
Q. How is it recognized?

A. It is the, I guess, primary industrial industry organization that represents the industry.

Q. This organization is responsible for developing many manuals for many of the problems or everyday, I guess, work situations that you encounter in the oil and gas industry, is that correct?

A. One of the things that it does and one of the early things it did and still does is, it has committees that writes standards for the industry. Initially it started out standardizing the dimensions and strengths and so forth of the casing that we used and later that has been expanded to a very wide variety of equipment and materials and so forth that are used in the industry.

In addition to that, there are numerous practices that, through cooperative effort, have been developed and improved and so forth. And the API, through its standardization groups, publish that information to the industry.

Q. You have participated in several of those standardization processes over the years, have you not?

A. I either am or have been at some time a member of the standardization committees on tubular goods, casing, drill pipe, tubing on wellheads, cements, muds, drilling muds. There was another one. I forget what the other one was.

Q. One of the latest works you've helped or contributed to for the American Petroleum Institute is their volume on worldwide cementing practices, is that correct?

A. I have a contribution in it, yes, sir.

Q. That would be probably one of the definitive works, I guess in the world, on cementing practices with respect to oil and gas drilling?

A. Yes, it is.

Q. As of late, you've been the recipient of numerous awards such as Engineer of the Year and then, just in October of this year, the distinguished member award. Would you please tell the Commission about those.

A. Well, the Engineer of the Year is the award that, in my particular case, is by a group of professional engineers or the professional engineering society whose area is generally West

Texas.

And then the distinguished member award, that is the Society of Petroleum Engineers and the total number of people in that category is less than one percent of the membership.

Q. This is a country-wide organization, the Society of Petroleum Engineers, isn't that correct?

A. It's international.

Q. International. What you're saying is that you've received this distinguished member status which only involves approximately one percent of the total membership of that international society?

A. That's correct.

Q. This came in October of this year, is that correct?

A. Yes, sir.

Q. You have had occasion in the past to testify before the Oil Conservation Division here in New Mexico, have you not, Mr. O'Brien?

A. Yes, I have.

Q. Have you had your credentials as a petroleum engineer accepted by the Commission at those times of testimony?

A. Yes, sir.

MR. CARROLL: Mr. Chairman, I would tender T. B. O'Brien at this time as an expert in the field of oil and gas petroleum engineering.

CHAIRMAN LEMAY: His qualifications are acceptable.

Q. Now, Mr. O'Brien, turning to the cases at hand, you're familiar with the four applications of the cases Yates has before the Commission today and, in fact, sat in on the testimony that transpired several weeks ago?

A. Yes, sir.

Q. Now, as a consulting petroleum engineer, you have had occasion to deal with casing problems or designing casing to deal with problems for various reasons, have you not?

A. Yes.

Q. Have you had experience in dealing with casing in areas of subsidence?

A. Yes.

Q. Now, with respect to the applications that we have before the Commission, have you had the opportunity to familiarize yourself, then, with the kind of well that we are talking about, these four Delaware wells that are planned for

Section 2 here in Eddy County, New Mexico?

A. Yes, sir.

Q. In fact, you have caused to be prepared an Exhibit No. 68, which depicts one of those, a schematic for the proposed plan for the Flora No. 1, have you not?

A. Yes, sir.

Q. Would you, then, for the Commission, turn to your Exhibit No. 68 and describe it and point out--and I believe this is a copy of it here on this larger board and the Commissioners have a smaller one, is that correct?

CHAIRMAN LEMAY: No, we don't.

[Discussion off the record.]

Q. If you would, Mr. O'Brien, then, would you please go through this exhibit for the Commission and explain the items that are depicted on it.

A. The casing program for the Delaware wells includes three strings of casing. The first one to be set at a string of 13-3/8-inch casing which is set, in this case, to anticipate to go to 861 feet, which will put it at the base of the Rustler and at the top or just above the top of the Salado. It is set and cemented solid from bottom to top, and it covers the aquifers in that interval.

The next string is a string of 8-5/8, 32-pound-per foot, J-55 casing, that is set at 4200 feet, and that is at the base of the salt. It likewise is cemented solid from bottom to top. That 8-5/8, of course, covers the salt and the ore zones that are of interest.

The third string is the string of 5-1/2-inch 17-pound, and 15-1/2-pound J-55, and it's set at total depth, 8400 feet, and that string of casing is also cemented solid from bottom to top. That string of casing, when it's run, is wash to bottom, and they pick it up off the bottom just far enough to hang it. Typically that's a foot to maybe three or four feet maximum, but it will be off the bottom, typically, about two to three.

The cement that is used on these strings of casing are shown on the second page of this exhibit. The 13-3/8 is set with an open guide shoe and you run an insert float 40 feet up, or about that. It's cemented with 600 sacks of lightweight cement and 200 sacks of Class C, which is basically a neat cement, a very fine-grain cement that produces a high, early strength.

And, in addition to that, there are accelerators added to both of these so that the cement will set quickly in the time required by the State. The cement will have acquired enough strength so that it will perform properly.

They typically will circulate cement and some excess of cement will be pumped out to a pit. The intermediate 8-5/8 casing is set at about 4200 feet with a float collar about 40 feet or so off the bottom. It's cemented with 1,600 sacks of lightweight cement, including 10 pounds per sack of salt, some Gilsonite and Celloseal, which is a material to prevent loss circulation, both of them are, and the Gilsonite reduces the density of the cement somewhat.

It's followed by, at the bottom, 200 sacks of Class C, which is the same type of cement that we used at the surface. Also with calcium chloride to accelerate the set of the cement.

In this case we would expect to circulate about, oh, 250 to 300 sacks of cement out to the pit. That gets any contaminated cement out of the hole so that you end up with good cement from bottom to top.

The production casing is set at bottom and they run DV tools or stage collars, one at 4485 and one at 7400. They are run because the formations that you drill through are so weak that you can't circulate cement from the bottom of the hole all the way to the top.

The first stage of cement is put in and, when it is in place, the bottom DV tool is open, and then you circulate, and we put enough cement in so that the cement passes that--covers that DV tool. When you circulate at that point, then, we get that excess of cement out of the hole.

Then we put in the second stage of cement. Likewise, at that one, there is enough cement used to cover the second DV tool and have cement above it. It's opened, and you circulate and get that excess cement out of the hole. This has the effect of removing any contaminated cement that is in the first part of the cement that goes in, that part which might mix with mud. It's removed from the hole.

This circulation at each one of these

times is about in the order of three hours or so, which gives the cement, that you have just put in place, sufficient time to take its initial set. That way we can go ahead and cement above it without forcing that--that cement is no longer liquid, and we can't push it into the formation which cumulatively allows us to get cement all the way from the bottom of the hole to the surface.

And, in addition to that, having gotten that cement which might be contaminated out of the hole, we pump a large volume of cement and, in so doing, we remove any traces of mud that might be in the hole so that we get a good, clean bond between the cement and the casing and between the cement and the formation.

After the second stage, the third stage through the second DV tool, then, that cement circulates to the surface and the excess is pumped out to the pit. That's the way it's left. Pipe is then hung and we're ready to complete the well.

In this case, this pipe is cemented in three stages. They use 225 sacks of Class H which is the coarse of cement that's used at a greater depth. It has some additives in it to keep the viscosity down and to extend the setting time, which is necessary to temperatures that are involved.

And then the second stage includes some Class H cement, and it has its density reduced by these additives that are put in it. And the third stage, then, is circulated with Class C and it has its density reduced so that it can be circulated to the top. And you follow it with some neat cement that has a high density, so that you have high-strength cement around the DV tools.

And that's the way the well is left. They bump the plug with 3,000 pounds of pressure, which serves to test the casing to ensure that it is in good shape.

Q. Now, just so that the record is clear, we've used a number of terms that I want to develop. One, each time you were talking about the casing, you used the nomenclature J-55. What does that mean?

A. J-55 refers to the strength of the casing or to the strength of the steel that is used in the casing. The API rates the steel that it uses by its minimum yield strength or the minimum allowed yield strength.

For this particular casing, J-55 can have a minimum yield strength of 55,000 pounds per square inch and a maximum of 80,000. This fixes the strength of the casing for the usage and for the designer so that they know, when they look at this, what the strength of that casing will be.

Q. The strength of that casing becomes relevant when we begin to talk about such phenomena as subsidence, does it not, Mr. O'Brien?

A. Yes, it does.

Q. Another term that you used was hanging the casing. You said you normally hung it a foot or two off the bottom before you began. What significance does the term "hanging the casing" have?

A. The first string of casing or the surface pipe, in this case 13-3/8, is set and the cement is allowed to set around it. Then it's been hanging from the elevators in the drilling rig.

When it is released from the elevators,

the cement holds it in place and a head is put on it. Then the 8-5/8 is run and it's cemented, but it is also--the weight of that string is hung in the head that has been installed on the 13-3/8.

The 5-1/2 that is then later run is likewise hung in that same head or another stage of the same head, and the weight of all of those strings of pipe is suspended from the surface and the load is transferred to the earth through the 13-3/8 and the cement that holds it in place.

Q. Taking the 5-1/2-inch casing, when it's hung, then, that string of pipe is not actually in a state of rest but it's more in a state of tension, is it not? It is being stressed by its own weight?

A. It's hanging in full tension.

Q. And the cement, then, encapsulates that pipe as it's in that stressed or tensioned position, is that right?

A. That's correct.

Q. The purpose of the cement, what is that purpose?

A. In the 13-3/8, of course, it transfers the load from the pipe to the earth. It furthermore provides a seal and isolates between zones in that particular string between the aquifers that are behind that casing and from whatever may be below it.

Also, in that one, from anything that might go in the annulus between the casing and the hole, it might go in from the top. So basically it isolates all of the zones that are covered by that casing.

Q. The intermediate casing, in this particular kind of well, goes all the way through the salt series or the McNutt series--or I guess really it's the Castile--does it not?

A. It does, and it isolates that zone from everything that's behind it. That is, it isolates everything between the bottom of the 13-3/8 and the bottom of the 8-5/8, and isolates any zones that appear within it, the various ore zones or any other zones that might be within the salt.

Q. Well, does the cement provide an impermeable seal, or are we just talking about a protective casing or what, Mr. O'Brien? Please elaborate.

A. The cement that we use or that is used here, by a number of measurements that have been made, has a permeability in the order of one-thousandths of one millidarcy. There are numerous tests that have been run on these particular lightweight cements of this sort that have a permeability--actually, a thousandths of a millidarcy is about the lowest that the industry knows how to measure, so we give it that number and, in essence, it's impermeable.

Q. All right. In your experience and, therefore, based on your opinion, can gas, or oil and gas, whether it be in the form of the liquid oil or in the form of a gas, can it then pass through or flow through the cement?

A. No.

Q. Now, is cement something that there's just one kind, or can you actually design cement to take care of this problem? And is this what we've been talking about? Because you've used a lot of nomenclature, different classes of cement and that sort of thing.

A. There are numerous classes of cement, each one of which has different properties, different compositions. And, in addition to about probably six or eight general classes of cement, there are some innumerable groups of cements that can be produced by the addition of a variety of chemicals and other materials to the cement.

Q. Can you decrease, then, adjust the permeability coefficient that you give cement by the addition of these additives that you're talking about?

A. Basically, I think it would be proper to say that almost anything that we do to cement reduces from--just the Class H cement is the coarse of cement we have, and it would have the highest natural permeability. And almost anything we do to that cement will reduce its permeability. It's really rather difficult to increase it.

There are some conditions that do increase the permeability of cement. One of those is high temperature. But the temperature that's involved is much higher than any of the temperatures that we're concerned about.

Q. The cement, then, that is being used, as depicted in your Exhibit No. 68, the surface casing and what have you, that cement there, isn't it fair to say, that's to provide a seal as to the water formations and those things that one would encounter above the salt zone?

A. That's correct.

Q. And the cement that's used, then, through the salt zones or even lower, that's to provide protection or a seal from those elements that are down below the salt from going up?

A. Each one of them provides isolation or seal for the intervals with which it comes in contact.

Q. In your professional opinion, do you believe or have an opinion whether or not the casing program and the cementing program, as designed on Exhibit 68, would that adequately seal this particular well from--or seal it off from any leakage that might occur?

A. I don't think there will be any leakage, but if you want to hypothesize that there might be some, then the cement will seal it.

Q. Okay. With that, one last question with respect to this, when we're talking about sealing in this salt zone, is there an additional factor that, in your mind and in your experience, it is going to seal at least within this area?

A. Well, of course one of the big

questions is the movement of salt which leads to subsidence and the general creep in the salt. As a result of that phenomena, that salt movement will tend to produce a compressive load on the cement and the casing, which would further enhance the seal that we would normally attain in a normal cementing operation.

Q. Let us hypothesize a moment here. Let us suppose we, for some reason, caused a hole to occur in this casing in the area of the salt, say the area of the potash zones. What kind of pressures would have to exist before you would get movement of the fluid or the gas from the wellbore into the formation?

A. The stresses in the salt are equal to about one pound per square inch, per foot of depth. Just to use a round number, if we were working at 2000 feet, the stress in the salt would be about 2,000 pounds per square inch. That is, the overburden load that it compresses it vertically is about 2,000 pounds per square inch. Actually, it's a little higher than that.

And the horizontal loads in both directions, or in all directions, would be about the same number. In salt, the stresses at a point are about equal. That's because the salt is plastic and it, by its movement, it tends to equalize all of these forces.

Now, we've had many instances. My personal acquaintance with salt in a number of places, it is very difficult to inject a fluid, whether gas or liquid, into cement. We have, on occasion, because somebody we were working for wanted to--I won't explain why they wanted to because I don't know--but decided they wanted to pump into the salt. And it frequently will take pressures almost to the range of two pounds per square inch, per foot of depth, to pump through perforations into salt. This would be pumping water.

Q. In other words, then, Mr. O'Brien, you have to have pressures existing within the wellbore that are great enough, then, to overcome these stresses which you equate to the one pound per foot of depth formula, is that correct?

A. I'm sure that they're related to that formula or to that stress, but the numbers invariably are higher than the stresses that exist in the salt.

Q. So what you're saying is that it's

going to take, if you had 2,000 pounds of stress, it will take more than 2,000 pounds of pressure in the wellbore and, in your experience, up to almost twice that, the two pounds per square inch?

A. That is correct. In this area I would expect, if you perforated into the salt, that it would take pressures in excess of 3,000 pounds per square inch at the face to pump into it.

Q. Now, you've also--let's not totally turn away from this casing issue. You've prepared two more exhibits, have you not, Exhibits 69 and 70?

A. Yes, sir.

Q. What do these two exhibits depict, Mr. O'Brien?

A. Those are schematics of coreholes that were drilled. One of them is Core Hole K-162 in Section 2, and the other is Core Hole FC-81 in Section 3. Both of them in 22-31.

Q. Now this K-162, Section 2, that's our subject section here, where our applications to drill are, is that correct?

A. That's correct. And that well would drill in a 24 to 48-hour period in December 91.

Q. Would you, starting with Exhibit No. 69, why don't we go through--you have a number of notations here. Would you acquaint the Commissioners with what's being depicted here?

A. Mine's not numbered. Which one is 69?

Q. 69 is K-162. Excuse me.

A. All right. The notations on the right show the tops of the aquifers that are present in this area. There's the Santa Rosa, Dewey Lake and Rustler, and the depth that they come in.

On the left side there is a listing of the geologist's or driller's interpretation of the rock that he drilled through in that hole. Then they drilled to 1500 feet and reduced the hole size and cored and reamed from that point to 1713 feet which was through the marker bed 119 and 124, and that is what this shows. It shows they set no casing, the hole was plugged with cement from total depth, 1713 to the surface, at the completion of the operation.

Q. These first three, the Triassic, the Permian and the Rustler, these are the water-supply zones out here in this particular area of Southeastern New Mexico?

A. I don't know whether all of them

produce water in this area, but they are the primary water-producing zones in that part of the State.

Q. In fact, isn't it true that the Rustler formation provides the water for the WIPP project or it is from that formation?

A. I understand that's the case.

Q. Now, this hole was apparently drilled and filled with cement without the steel casing that we've been talking about that you described with reference to the other exhibit, is that correct?

A. Well, I haven't described it yet, but that's correct.

Q. I'm sorry if I've gotten ahead of you. Please go on.

A. Okay. The FC-81 was drilled in 1961. They drilled it. They drilled down to 1980 feet and ran 5-1/2 casing, which they set in with mud. They didn't cement it, but they set pipe and mudded it off.

Q. By mudding it off, are you saying putting a barrier of mud on the outside in the place of where one might put cement if you were cementing the casing?

A. Yes.
Q. What is the purpose, then, for not putting cement there as opposed to the mud?
A. Well, you put the casing in there to isolate these aquifers from the salt water that you would drill with, and they're putting mud behind it so when we get through with the well we can pull the casing through the core hole. We can pull the casing, recover it, and use it again.
They said they didn't cement this one solid. They set cement plugs from 900 to 1735, which is total depth, and from 640 to 880, and then they set a 10-foot plug in the top of the core hole.
Q. Now, with respect to this FC-81, you actually had, then, three plugs placed in this well, was that correct?
A. That's correct.
Q. They were not continuous throughout the entire depth of this core hole?
A. That's correct.
Q. What about in K-162? Did they set a continuous plug in that well?
A. In that well they set continuous cement

from bottom to top.

Q. Now, is it possible to use noncontinuous plugs and still seal off the zone?

A. Yes, sir.

Q. Does it appear that these plugs that were placed were set so as to isolate these water-bearing aquifers from the salt?

A. Yes, sir. Basically, they isolated bringing cement up to 640 feet; this would have covered the Rustler and isolated it from the shallower aquifers.

Q. Now, you don't have any notation on these and I don't know if you know, but let's just talk about this idea. In going back to your previous exhibit, you stated the procedure for plugging the Flora No. 1 well involved not only the placing of the cement in the hole, but it involved circulating the cement out.

If you don't circulate the cement out in these core holes, is there a possibility that some of this cement will be contaminated with mud that was in the hole during drilling, that sort of thing?

A. It could be.

Q. So, if you did not circulate the cement out, then apparently that contamination process must not have appeared to be a problem for the driller of the particular hole?

A. I think that's correct. I should state that a different way. I think that the cementing of the casing in the oil well, the Flora No. 1, would provide a better seal, a more reliable seal, than would be obtained in the plugging of these core holes.

Q. Now, if one of these core hole seals, either these wells or any of the other core holes that are drilled fail, would there then be a possibility that the water in these aquifers could leak into the salt section and invade the salt section?

A. I'm told by people who are acquainted with these core holes, that there are core holes that enter the mine workings. And if this cement were not adequate, then it's almost certain that you would get water from the aquifers into the mine workings.

Q. Have you been aware of any such failures from core holes that have caused water leakage into or flooding of mines in Southeastern New Mexico?

A. No, sir.
Q. Is it your information that these core holes actually exist within the mine workings today?
A. That's what I understand.
Q. Is it your information that these core holes actually exist in areas where there's been secondary mining or the pulling of the pillars where subsidence can occur?
A. I don't know that I could answer that particular question. I do know that they entered or I'm told that they entered the mine workings. Whether it's secondary mining or primary mining, I don't know.
Q. Let's assume for purposes of my next question that there has been testimony that these core holes do exist in secondary mining areas. Would these core holes, then, as they're plugged and you do have subsidence, are these kind of core holes, if they're in a subsidence area, are these the same kinds of stresses and same kinds of problems we would be facing with an oil and gas well in Section 2?
A. The same general type of problem, yes. You would be relying solely on the cement that

was placed there and without the benefit of the steel that was put in in casing.

Q. In your opinion, then, if you had a core hole in a subsidence area of a potash mine, that would provide some example, then, for you to look at when you're trying to determine what your problem is with oil and gas wells in relation to subsidence?

A. Exactly. If this method for plugging a core hole is adequate to isolate that hole through--in a subsidence area, then certainly the methods that are used for cementing oil wells should be at least equally as good and, I think, somewhat better.

Q. The purpose of these two exhibits were basically to show two different ways that core holes, to your knowledge, are commonly drilled and plugged, is that correct?

A. That they have been drilled and plugged in that way, yes, sir.

Q. All right. Let's go a little farther here and, using again our Flora AKF No. 1 well, the diagram that you've described up to this point, Exhibit 68, shows a producing well, does it not?

A. Yes, sir.

Q. Let's go a step farther, now. Let's assume that we're going to have a plugged and abandoned well. Would you describe for the Commission what happens, then, what you would expect to find in a plugged and abandoned well? And then my next questions will address a plugged and abandoned well.

A. If you drilled a well and it was a dry hole from the start, then you would fill the hole below the 8-5/8 with cement and, I presume--well, at least fill that part of it. There might be additional plugs to put in the 5-1/2 above the bottom of the 8-5/8; that is, above 4200 feet.

If the well were a well that was completed or it had 5-1/2 casing in it, whether it was completed or not, then you would fill the 5-1/2 casing with cement at least up to the depth of the bottom of the 8-5/8 to isolate it and provide a seal on the inside of the casing.

Q. That's just normal plugging procedure?

A. It is for this kind of operation, yes, sir.

Q. There has been earlier testimony that such a well could be filled with cement all the way to the top. Is that also an acceptable method?

A. It certainly could.

Q. Is there an advantage one way over the other, Mr. O'Brien, in your opinion?

A. If you fill it full of cement, then that would take care of any problem that might exist. I suppose the alternative would be to fill it part way and leave the 5-1/2 open so that you could observe it and make sure there was no pressure build-up inside of it from any cause.

Q. You could then put a cap on and a gauge and monitor that?

A. A cap and a gauge and monitor it.

Q. Now, would this gauge, if you're monitoring it, would that be a relatively accurate way of determining if there was some leakage from the oil and gas reservoir? Is the gas going to come up and be reflected in this gauge, or is it going to go somewhere else?

A. Well, you could put a gauge on here that would register small pressures, so that any pressure that would develop there from whatever cause would be registered on that gauge.

Q. Now, Mr. O'Brien, do you have an

opinion of whether or not you could mine through, that is go through the area, that part of this plugged and abandoned well that goes through, say, the potash zone, do you have an opinion whether or not you could mine through that?

A. If it's cemented as shown here and it's plugged by filling it full of cement, then I don't think there would be any problem at all with mining through it.

Q. And when we're talking about problem, you are addressing the problem of the leakage of oil and gas up from the depths of the Delaware at 8000-plus feet to the ore bed at 2000 feet?

A. That possible problem is included.

Q. Since we're talking about this problem, this problem of leakage of gas, there are a number of, I guess, phenomena working here. We're talking about the travel of gas some 6000 feet, are we not?

A. The potential, I guess, is from 8000 feet.

Q. Up to the 2000-foot level?

A. Yes. I understand what you're saying, yes.

Q. Now, for that gas to get from the

Delaware up to the 2000-foot level, it would have to find a path the entire length of 6000 feet, would it not?

A. Yes, sir.

Q. Now, that path is fraught with many obstacles, is it not? Is its tendency going to go the 6000 feet or what other forces are going to be operating?

A. Well, inside the 5-1/2 will be plugged, solid with cement. The exterior is likewise cemented. Now, you have to assume some path which the gas might take. The cement on the inside of the 5-1/2 will form a seal. There have been tests run that shows that it does seal.

For safety, a mechanical plug can be put in which would further prohibit the movement of any gas. Then, the alternative is that the gas would have to travel up to the outside.

So it has two or three choices. Some of these are more just ideological concepts than they are practical possibilities, but if one were to assume that we had treated the producing zone and in the course of that fractured it or acidized it or whatever we did to it, that we would create a fracture that might allow the gas to go up the hole. This is one of the things that I've heard of as a possibility of gas migration.

As a matter of fact, it is very difficult in the process of fracturing to create a fracture that extends over any substantial distance that is relative to a 6000-foot interval. It's very difficult to create a fracture that is of any significant height. Fractures do tend to go upward, but they also stop at the first impermeable or nonporous section. You come to a strong rock, they quit going there, and then they go laterally into the porous rock that we're producing from, so that there would be no likelihood that gas would go from 8000 feet all the way up to 2000 feet.

The next possibility is gas going through the cement. There are some theories that have gas permeate cements, and most of them have to do with high pressure gas, where the cement and the gas--the pressure exerted by the cement and the pressure on the gas are very close to being equal. That's not the case here. We're talking about something that is 2,000 or, say, 2,500 pounds of pressure maximum at the bottom, and the casing would have about--the cement would have over 3,000 pounds of pressure, so there's not going to be any movement through or percolation of gas through the cement.

There have been discussions of what's known as microannuli, where the gas will work its way up. Those may or may not exist. But there's no indication that anyone ever had one exist for 6000 feet.

Furthermore, if it did happen that you got gas to go up the hole, the pressure in the Bell Canyon and the top part of the Cherry Canyon is so low that the gas would rather go in there than it would to continue on up the hole. And we know this to be the case from pumping liquids. We lose returns into those zones when we're drilling, and that's the reason we have to put in two DV tools because we can't get cement to go up the hole. It would rather go into those zones, and the gas would do the same thing.

Furthermore, when you get to the 8-5/8, that 8-5/8 is cemented, and by the time you put this production casing in here, that has been cemented for a long time. That cement is not liquid or semi-liquid so that gas can percolate up through it.

Furthermore, the salt has had time to flow in and around the casing and enhance the seal that is provided by the cement so that the gas is not going to go up the hole. So there are many restrictions that both nature and operators place on the movement of gas from this long interval.

Q. Well, Mr. O'Brien, what you have been saying, these different theories that you've been discussing, what we are concerned with here, when we say leakage, all we're talking about is movement of gas?

A. That's right.

Q. Movement of a liquid. For movement to occur, you have to have it moving from a zone of higher pressure or influence to one of lesser pressure or resistance, is that correct?

A. That's a way of saying it.

Q. Or you don't get movement, is that correct?

A. That's right.

Q. And this gas, if it has a choice, it's going to take the zone of least resistance, isn't that also a fair statement?

A. That's correct.
Q. Let's talk about salt and, let's say, the permeability of salt as compared to cement. How do they rate? You've given us the numbers with respect to cement, that it's very low, if measurable.
A. And salt is similarly very low and is not measurable because it is lower than we know how to measure it.
Q. So, for this leakage or movement of gas to occur, one, we have to get a path for it, that path is marked by least resistance, and it's got to move 6000 feet before it ever gets to our area of concern in the potash, the salt?
A. As I said, it would have to go in one of these permeable productive or permeable porous zones below the bottom of the 8-5/8 before it ever got to the 8-5/8.
Q. That's one of those obstacles it's got to overcome? It's got to do that or it's never going to become a problem?
A. That's correct.
Q. Even if, for some unimaginable reason, it got up there, there's got to be some way that this gas can get through the seals of the cement

and the seals of the salt before it could ever reach a mine?

A. And furthermore, since we're hypothesizing that it is going to go up there, there's no reason for it to stop at that point and go out. Since the path of least resistance would continue, assuming all these things that you've assumed, the path of least resistance has to be upward. So there's no reason at all why it shouldn't just keep going on out the top.

Q. And bypassing the salt zone altogether?

A. You would never know it was there.

Q. Going back to your original opinion which started this line of questioning, which is you feel you can safely mine through an oil and gas well, do others share this opinion of yours and is there experience with such a phenomena, mining through oil and gas wells?

A. Yes.

Q. Would you describe that for the Commission.

A. Well, first off, there was a demonstration of safely plugging oil wells in the Appalachian coal mines.

Q. Is this your Exhibit 71 that you're

referring to?

A. Again, mine are not numbered. It's the next one.

Q. I'm sorry. It is 71.

A. Basically what they did, they had a coal mine that had a number of wells through it, and about 2000 feet deep, or the wells were, and they pressured up the old producing interval with a gas that is traceable down to a sulfur hexafluoride. This gas doesn't exist in nature, it has to be made, and they can get it and find it at quantities less than one-half of one part per billion.

They charged this zone with this gas and then they abandoned wells and checked for the flow of this gas or the gas in the mines and they didn't find any. They did find some in some adjacent oil wells that were still producing, but they did not ever find it in the wells.

And based on this and other things, the Mining Safety Commission--

Q. MSHA is the acronym we've been using throughout this proceeding.

A. Whatever it is, has a procedure for abandoning wells that will be in mined areas. So the coal miners use basically the same process that we are describing here for plugging wells, to plug wells, and they mine through them.

Q. We're talking about running cement from top to bottom, the same kinds of cement that we were talking about?

A. Basically the same kinds of cement.

Q. Now, going back to this procedure, this gas that we used to test, this is a gas that doesn't occur in nature, is that what you're telling us?

A. That's correct. Somebody has to make it.

Q. But that's what's significant? It's something that is artificial, something that if we detect it we know it's there because we put it there?

A. That's correct.

Q. And they pressured up this producing reservoir, is that correct?

A. Yes.

Q. And then they sealed or plugged and abandoned these wells, is that what you're telling us?

A. That's what they did.

Q. And we know that this gas got into that producing formation because it was found in other wells?

A. That's correct.

Q. But it was not detected after these wells were mined through? Is that what you're saying?

A. That's correct.

Q. And this study, then, formed the basis of the procedure which is now used today to mine through oil and gas wells?

A. Yes.

Q. And it's presently being done in the coal industry in the coal areas of the United States?

A. That's correct.

Q. And I don't know, because I've never asked you this question, is coal comparable to potash with respect to its plasticity and its ability to seal, as you've described?

A. Coal would not be as good.

Q. So if we were initially comparing our situation to that, the potash forms would help in performing a better or safer seal, is that correct?

A. That's correct.

Q. The wells that we're talking about in this area, some of these wells date back into the 1800s, do they not?

A. 1890, I think, some of them were listed.

Q. This was an area of old production as opposed to what we're talking about today?

A. Yes.

Q. And the techniques of drilling and what have you would most certainly be less sophisticated and different from what we're using today?

A. That is correct.

Q. I guess again, the key point here is, a seal can be effective to keep that gas from moving, or oil?

A. I think it's stated slightly different. Using the techniques I have described here, a seal will be effective.

Q. Not "can," but "will"?

A. That's correct.

Q. Let's turn now to another subject. We've been dealing thus far with oil and gas wells and the sealing properties in a noneffective state. Subsidence has been the term, and the terminology has been bandied about throughout this hearing. Is subsidence a new concept to you, Mr. O'Brien?

A. Not at all.

Q. Have you had occasion to deal with it, or been forced to deal with it during your 45 years of experience in the oil and gas industry?

A. Yes, sir.

Q. Is subsidence, then, something to be feared or to be respected?

A. It's certainly to be respected.

Q. Can you, then, in your respect, design casing-- Well, let me change that question a little bit. Can it be calculated and then designed for, if necessary?

A. I think that the calculation is probably less accurate than the design. We can make estimates and, based on those estimates, we can design casing that is adequate to withstand the forces that are applied by subsidence.

Q. Well, why don't you, for the Commission here, as an expert who has had 45 years of dealing with this phenomena of subsidence, describe for them the stresses, the things that you're designing for when you sit down and plan an oil and gas well.

A. Fortunately, only a very small percentage of oil wells have that problem, but in those cases that we do, and those cases arise not only from mining problems but over some shallow reservoirs, high porosity zones, that when the liquids are removed or oil is removed, the rock is not strong enough to support the overburden and you have subsidence.

One of the most notable of these, or a couple of them are in California, even along the Coast, where they had bridges and buildings and so forth that could not be used because of the subsidence that took place. There are numerous other similar subsidence problems in a variety of places.

Another real notable one is on the east side of Lake Maracaibo in Venezuela where, since in the 20s they've been producing oil and they got to a subsidence that totaled over a large area of about 12 feet, and because the lake leveled or the bottom of the lake subsided and the ground alongside of it also subsided, they had to put up a seawall to keep the lake off the land where people live.

Q. The North Seas is also another field where it had more than 12 feet, in the order of 20 feet of subsidence because of the producing of the oil from underneath?

A. There are a number of them. Some of them in California go in the order of 30 feet or so, and in some of them they put liquid back in the ground and actually raised them back up some, and many of them by injecting water, they've stopped the subsidence.

Nonetheless, there is differential loading on wells as differential subsidence, so that there is some earth movement, lateral earth movement as a result of the subsidence. In the first place, that has not created any problem of any magnitude.

There are some cases where, within the zone, that the subsidence occurs within the producing zone, where the subsidence becomes thinner. There have been cases where the casing and tubing within that zone was compressed longitudinally and damaged. But there are very, very few, if any, instances of any damage to a well in any fashion due to subsidence.

There have been cases, in one case in Bolivia, where the sides of the mountain moved. It wasn't a subsidence problem but it was lateral movement, and it passed through a number of wells. The wells leaned over, oh, in the order of about between 30 and 45 degrees. They were pumping wells, and they couldn't pump them that way, so the Bolivian company just tied onto the wells with a cable and hooked a Cat on them and pulled them back up straight. They later cut them off down at the ground level and went right on producing them.

There have been instances of, again, not subsidence but lateral movement, where ships have run over wells out in the Gulf of Mexico and bent them over. I was tying onto one of them with a line attached to a barge and pulling it back up straight and putting the well back on production. We braced up the platform and put the well back on production. No real damage to the well. It certainly was bent and probably the casing was kinked, but the well produced and without any leakage.

Some of these wells are--the ones in the Gulf of Mexico are wells that had surface pressures in the order of 3,000 psi, so--

Q. Let's break there just a moment since you brought up the issue of surface pressures. This Delaware well that we're talking about for drilling in Section 2, what kinds of pressures are we talking about between the wellbore and the surface?

A. The surface pressure tends to be about 6- or 700 psi. That's to start with. Obviously they don't stay there very long. The pressure goes down as you produce the wells and the wells are put on pump so that the casing pressure will be in the order of about 50 psi, whatever they maintain on the heater treater. And the tubing pressure will be about in the same order.

Q. 50 pounds?

A. About 50 psi.

Q. Now, the pressure down at the bottom, the initial reservoir pressure, what is that going to be?

A. 2,600, 2,800 psi, somewhere in that neighborhood.

Q. Why wouldn't that pressure, 2,600 pounds, exist all the way up and be found in all depths within the casing? Why is it 50?

A. This is an oil well and the hydrostatic head of the oil overcomes the bottom hole pressure. And then of course as you produce the well, that starts out at about 600 pounds, something of that nature, and as you produce the well you draw the formation pressures down and the pressure then drops off to about 50 psi.

If it's left closed in long enough it might go up to 100, but the operating pressure will be about 50 pounds.

Q. So, when this well is sitting there in nature and, let's say you've got it and you have 50 pounds of pressure, that 50 pounds, that would be if you could measure at a level of 2000 feet? Would that be what you would be finding there?

A. No, it would be a little higher than that. 50 pounds at the surface is 2000 feet. Maybe 20, 30 pounds psi. Maybe.

Q. Less than a hundred?

A. Yeah.

Q. And that is the pressure then, if this were a producing well and for some unimaginable reason you got a communication from the wellbore to the salt, that's the pressure you would have working on the salt?

A. That's correct.
Q. In your opinion, will that cause that oil and gas in that column to enter the salt?
A. No.
Q. Getting back now to your discussion, and I interrupted you and I apologize.
A. Well, the point of all this is that the fear that surrounds subsidence and a well in proximity to mine workings and hence the subsidence, is that some lateral motion takes place as a result of subsidence. You don't get a simple vertical drop from above the mine workings, and it goes--the movement goes out at an angle.
Q. Now, Mr. O'Brien, so that we kind of keep our testimony attuned to what we've seen before, this lateral movement, we've seen these diagrams, and I think Mr. Hutchinson talked about and presented to the Commission, we showed a trough with sloping sides. Is that what you were just talking about as causing that kind of surface phenomena?
A. That's correct. There will be movement from the sides into that trough that's created directly over the mine. And, as a result of that

movement, are the result of the stresses that are created; some movement takes place. This movement generally goes away from the mine at some angle.

The movement doesn't follow a straight, smooth curve. It varies somewhat, although the magnitude of this movement over a foot-by-foot interval is very small. There is more movement in one place than another because of different strengths in the rock. The difference is still small because the total movement over a distance, a short distance, is small.

Q. Now, Mr. O'Brien, let me ask you one question here. In your opinion, must we be concerned with all movement in a situation here?

A. I think we need to be concerned with it. We don't need to panic over it.

Q. Okay. Will all movement damage an oil and gas well?

A. No.

Q. Why?

A. Because the stresses that are created in this movement are relatively small. The stresses that are created will be in the order of--probably the limits will be certainly between

12 and 15 or 16,000 pounds per square inch.

Q. How do you arrive at that for a number?

A. There are a number of ways of doing it. One of the methods that is fairly simple is that the stress in the rock, in the salt, is about 2,000 psi. If you mine the salt to 85 percent, which is about the limit of what they normally mine to, the remaining 15 percent of the salt must bear the overburden load.

So, the 2,000 pounds divided by 15 percent grosses this thing up to about 13,000 psi will be the load that is imposed. That, I think, is probably the simplest, most straightforward method for determining these loads. There are other methods that are somewhat more theoretical. They're dependent on the assumptions that go into them, and even using those methods we come up with a load of somewhere in the order of about 15,000 psi. So these numbers are somewhere close to being right.

Q. The kind of pipe that you told us about that is being or intended to be used in this particular well, can it withstand 15,000 pounds of stress that you just described?

A. As I said, this casing has a strength of 55,000 psi, the steel has, and if you take the 13,000, this gives us a safety factor of about 4-to-1. Even if we're off by a factor of two, we still have ample strength for the casing to support the loads that are imposed on it.

Q. That number, 55,000, that comes just from one strength of pipe, is that correct?

A. That's correct.

Q. Now, the area of, let's say this Flora well, the area of the casing that's going to be affected by subsidence is going to occur above the bottom of the intermediate, is it not?

A. Yes.

Q. So, if we talk about the pressures being exerted on the intermediate string that is somewhere between the 42,000 and the 1,000 or the 900-and-something feet that the surface is set to, you have not only one string of casing with an encasement of cement, but a second string of 55,000-pound casing, is that correct?

A. That's correct.

Q. And a second encasement of cement?

A. That's true.

Q. Is that going to increase the strength of the resistance of that string of pipe or is it going to decrease it?

A. There are tests and papers that have been done on this, the strengths of multiple strings of casing, and the result is that they find that two strings of casing, cemented together, the strength becomes the sum of those two strings of casing plus about around 25 percent; 20 to 30 percent. So that the strength, the combined strength is more than the sum of the strengths of the two strings.

Q. Now, and if we decide that we want to concentrate on the area above 900 feet, we then have three strings of casing, do we not?

A. That's correct.

Q. Would that, again, be stronger than the two strings?

A. That's correct.

Q. Now, with respect to this issue of subsidence and this trough phenomena that we see, this tension that we're seeing from this lateral movement, is it going to be greater closer to the surface or at depths?

A. The lateral movement increases from the bottom to the top.

Q. So the very top of the surface is where you're going to have the most lateral tension?

A. That's correct.

Q. That would be your real problem area, wouldn't it, or at least in terms of amounts of strain or stress?

A. Well, the thing is, if that were the only movement, if there were no movement below it, the answer would be yes, but that's not the way it is. The top moves some amount, and right under it it moves a little bit less and a little bit less and so forth, so the incremental movement per foot is what you're concerned with. This is more uniform from top to bottom, just gradually decreasing. So the actual load on the well at the top, or the actual lateral load on the well, will be more or less uniform from the point of first movement until it reaches the surface. The movement will be greater at the surface, but the stress created will be more or less the same. That assumes that this is a straight line, which this is probably not.

Q. But all of this in this area of stress is going to be above the salt or the area of the mine, is that correct?

A. Yes.

Q. It's not going to be below it, is it?
A. No.
Q. That area is going to be undisturbed, is that correct?
A. That's right.
Q. Now, you've heard the term angle of draw?
A. Yes, sir.
Q. What does that mean to you?
A. That's a number that the academics use for--use to assume this is a point beyond which no influence from the subsidence can be measured or found or hypothesized.
Q. So the angle of draw will extend as far as man's capability to measure will allow?
A. At least that far.
Q. At least that far, maybe into infinity then, is that correct?
A. That may be overstating it a little, but a long way out there.
Q. A long way out there. Is the angle of draw the angle that this Commission needs to be concerned with?
A. No, sir.
Q. If you've got a thousandths of an inch

of movement out there, is that going to affect the Flora well as it's designed?

A. No, sir.

Q. There is a point that this stress reaches a maximum, is that correct?

A. Yes, sir.

Q. What is that called?

A. I think it's called the angle--I think they call that the break angle.

Q. Now, that angle can actually be calculated, can it not?

A. It can be for a local area. It's calculated from empirical data.

Q. I used the wrong word. "Calculated" is not right. "Measured" is the proper word?

A. Basically that's correct.

Q. By "empirical," you mean going out and observing and making notes as to what actually happened?

A. That's correct.

Q. This angle of break has been calculated with studies done in the potash area?

A. Yes, sir.

Q. In fact they've been referred to in earlier testimony by Mr. Hutchinson?

A. I think that's correct.

Q. Using the figure of 10 percent, this angle of break that some of these studies report, or roughly, and I'm being approximate, where we have this maximum tension, is that going, in your opinion, to be sufficient to cause leaks or destroy the casing as you've described it and designed it?

A. From that point outward, there will not be enough movement to cause any leaks. Very likely for some distance inside of that, but certainly from that distance out there will be insufficient movement to cause any kind of problem.

Q. And if we're talking about a problem, a problem can only occur, isn't it true, if that well is producing?

A. I think so.

Q. And what I'm saying is, as opposed to a plugged and abandoned well.

A. A plugged and abandoned well will have no effect on anything.

Q. Angle of break, angle of draw, they're meaningless, aren't they, with respect to a P & A'd well?

A. That's correct.

Q. The subsidence in this area that we're talking about, let's first generally start, subsidence occurs at a rate dependent upon the kinds of rocks you're dealing with, is that correct?

A. The rate and magnitude is dependent on the rocks, yes, sir.

Q. The kind of subsidence that we're having, that we experience in the potash area, is influenced by the nature of the salt which is above the excavation into which we're finding this subsidence, is that correct?

A. Yes, sir.

Q. Is this the kind of subsidence that, in your experience, would cause a sheering effect?

A. No, sir.

Q. You touched upon this briefly, but let's suppose we've got this subsidence and we've got the salt bed; it's flowing, it's plastic, and it's subsiding. Now, all of the formations above the salt are not of the same plastic nature, there may be some fracturing going on, just for a hypothetical here.

Are we going to be creating avenues, by

these fractures, that are going to be going back down into the salt, or in which direction are we going?

A. They will not go down since the movement becomes greater as you go up. If there were, which there won't be, but if there were a continuous crack, for the want of a better term, from some point, it would not--the flow would not go downward, it would go up, because the crack gets bigger as you go up. There's no resistance.

Further, when you get to the salt, the salt is plastic and it's not going to fracture anyhow and it will flow, there's not going to be any flow going down through the salt. Any flow of any nature that took place would go up.

If there were liquid produced, it would fill the crack to whatever level it would come, and if there were some gas present, by segregation, the gas would work its way up through the water that filled the crack and work its way out to the surface.

Q. Isn't it true that this cracking that we're talking about is, again, going to be movement of something towards paths of lesser resistance?

A. Yes.

Q. Is that not the reason why it goes up?

A. Well, that and--yeah, that's the reason it goes up. The paths are easier going up. Yeah, that follows.

Q. Because the overburden is less than the overburden lower? That's one of the pressures of one of the stresses that you're talking about, is that correct?

A. Yes. And to get that, you have to have lateral motion which would cause a continuous conduit, crack, to exist.

Q. This angle of break, that's where your lateral stresses separate and your movement starts or terminates, I suppose, is maybe a better word?

A. If you get a crack, that is the line along which the crack will occur. And if a crack occurs, then the tension will be relieved and there will be motion away from the crack, in both directions.

Q. Now, if our subsidence causes, again for some unimaginable reason, causes a hole to appear in this pipe and the cement and our gas

gets to the formation, the gas, in your opinion, is going to travel upwards or downwards?
A. Gas will go up. If it has any way to escape at the surface, it will go up.
Q. For it to go down, you've already told us the fractures it might be, and that fracture would the pass of gas, right?
A. That's correct.
Q. They're going up?
A. They're going up and, furthermore, you will not get a continuous crack into the ore zone because the salt is plastic and it won't fracture. You will not get a crack at that point. Any crack that you did get, if you got that much subsidence, if you got sufficient subsidence to cause a crack, the crack would go upward, not downward. The crack would be larger going to the surface. There would be less resistence going to the surface.
If there was gas there and you got gas out of the pipe, out of the well into that fracture, it would go to the surface.
Q. Practical experience is always our best proof of a hypothesis, isn't that correct, Mr. O'Brien?

A. I think so.

Q. We've had testimony that in the area of the New Mexico Potash mine that they drilled somewhere on the order of three-plus core holes per section of area that they have mined or developed in this potash mine.

If there has been no leakage of water from these core holes, doesn't that stand as proof, in your mind, of the viability of the mechanics of things that you've been talking about?

A. I think that if this core hole won't leak, an oil well won't leak.

Q. Let's talk about some other phenomena, Mr. O'Brien. There has been some indications from looking at exhibits, that gas, a path of leakage of gas can be the couplings used on the casing. You've seen that exhibit?

A. Yes.

Q. An exhibit prepared by New Mexico Potash for later use. Do you have an opinion as to whether or not that is a valid hypothesis, or is there a valid problem there?

A. There will not be a problem here. There have been numerous tests on the type threads that are used, and there is no leakage on anything at all below about 3,500 pounds per square inch. The industry uses 4,000 for its own purposes.

If we should get to higher pressures than that, there are other connections that can be used which have perfect seals up to 15,000 pounds per square inch. There are other methods of obtaining seals besides that, for intermediate pressures.

The presentation that's made in that particular exhibit, I think it's extreme, beyond anything that happens, showing the pathway that is unobstructed that would give you the impression that the pathway was like an eighth of an inch, or something of that nature. The unimpeded pathway that does exist is in the order of ten-thousandths of a square inch when the joint is made up, and that void that would create that pathway is filled with what we call pipe dope. It's a lubricant seal material. And, as a result, the testing that the industry has done has shown that with gas there is no leakage to about 3,500 psi and, as I say, the industry uses 4,000.

Q. The J-55 casing that we're talking about, is it designed, the couplings that are used on J-55, are they designed to hold pressures up to this 4,000 pounds?

A. Yes.

Q. A Delaware well is not going to encounter 4,000 pounds?

A. No, sir.

Q. And what you also told us is that we're not limited by what we've designed here. If there were a problem, all you need to do is come up with the usage of another already known and tested form of coupling, is that correct?

A. Or connection, yeah.

Q. Or connection, excuse me. Your parlance.

The pipe dopes are very scientific in their formulation, are they not?

A. Yes.

Q. They're designed to meet the needs as we perceive them?

A. Yes.

Q. In that same vein, talking about J-55 casing, that's not the only kind of casing available in the oil and gas industry, is it?

A. No.
Q. Are there stronger casings?
A. Considerably.
Q. Again, we're not hampered or bound by that limitation, are we?
A. That's correct.
Q. Just so the record's clear, you talked about the design of the threads. What are we talking about here and how did that differ with the picture that we saw?
A. Well, this picture shows a bunch of irregular spikes and so forth, and what we use is a well-designed well machine, uniform thread, that the thread on the pipe and the thread on the coupling mate together, and the taper of them is such that when it's made up, they do form a seal.
Q. Again, something that is thought out beforehand and very carefully executed?
A. With lots of experience.
Q. You briefly kind of touched on another concept, this microannuli. Let's talk about it in terms of one explaining it in terms of how this concept was developed, where it stands within recognition of the industry, even its treatment in the worldwide cement practices

book. Could you give the Commission the benefit of your experience there.

A. Well, in the first place it's not treated in that cementing book. The concept originated when we started using bond logs, which is a sonic device that is supposed to measure whether you have a good cement job or not. They found that there were times when the bond log indicated that there was no bond, but we ran physical tests and found out that there was no leakage.

Q. Now, by "physical tests," what are you talking about?

A. We ran perforated casing and ran--put pressure difference across it, with water or even with gas on occasion, and there was no movement of fluids so that the bond log just had to be wrong. So somebody, in order to explain this, came up with the concept that you have to have a mechanical bonding between the cement and the pipe in order to transmit this sound. And if you don't have that bonding the sound doesn't transmit, and it says you don't have a good cement job. But we knew we had a good cement job.

So they came up with this, a microannulus switch, that was of such magnitude that it did not allow the test fluids we had to pass through it, but it was still of such magnitude that it did allow or did attenuate to sound. And we used that.

Now, in order to get a good bond log, one of the treatments that we use is to pressure up the casing and expand the casing and close this microannulus, if that's what it does, and that gets a good bond log. It doesn't change the quality of the cement job but it does get a good bond log.

So, this has been an argument among folks in the industry and, over the years, I think engineers have been convinced by this argument that that probably does exist. The microannulus, if indeed it does exist, it has to be continuous over an awful long distance for this movement of gas, as it's hypothesized here, to occur.

One of the best ways, in fact probably the best way to eliminate that as a possibility, is to use a large volume of cement and let the large volume of cement pass by a particular spot. And here, they're putting enough cement in here to cover the entire pipe so there's an awful lot of cement goes by most all of the casing. And that would be enough to remove any microannulus if indeed one ever did occur.

Q. What you're talking about is the practice which is depicted in Exhibit 68, and that is the practice of circulating 200, 250, sacks of cement?

A. That's correct.

Q. What you're saying is that there's a cleansing action almost or a scrubbing action? As this cement is circulated it's going through or rubbing the pipe and it's actually destroying the possibility of these things occurring?

A. That's correct, and the fact that in order to make all this work better, we pump relatively heavy cement on the outside of the pipe, displace it with a lower density fluid down the inside of the pipe to the completion of the cement job, and then we release the pressure off of it so that there is a compressive force on the casing from the outside regularly, and that would cause the cement to come in more intimate contact with the casing.

Q. Now, let's just for a moment say we've got a microannuli. For it to become a concern and to cause the movement of gas from the Delaware formation, it would have to be continuous some 6000 feet, would it not, up into the zone of the potash?

A. Well, it gets worse than that. If you could have a 6000-foot microannulus on the 5-1/2, that would put you up inside the 8-5/8, so from then on the pressure would be less, and the path of least resistance would be for it to continue right onto the surface. So we not only have to have a microannulus on the 5-1/2, but we have to assume some kind of similar path in the annulus between the 8-5/8 and the salt. But the salt has moved in this period of time and it's compressed this annulus, so that would do away with any microannulus that might have been formed there, and I just don't think it can happen.

Q. That's your professional opinion, Mr. O'Brien?

A. Very plainly put, yes.

Q. You said that the microannulus theory was postulated as a result of bond log tests. Are you aware of any of these bond log tests that showed this problem that you're talking about, that extended continuously for 6000 feet?

A. No.

Q. In fact, it showed that they were confined to very small or restricted areas, didn't it?

A. They have some bad bond logs that shouldn't be, but--well, I'm not sure when you have one. If you have a short interval on the bond log that looks bad, then you could call it that. I guess if you had a long interval on one of them that looked bad, you could call it that.

Q. But, in your experience--

A. In my experience, the answer is that I haven't seen anything on a bond log that I would attribute to a microannulus over a long interval.

MR. CARROLL: Chairman LeMay, would it be possible to take our morning break right now? We've been at it two hours. I know Mr. O'Brien's voice is getting weak. Just for a few minutes? Would that be possible?

CHAIRMAN LEMAY: Sure, I didn't know how much longer you had.

MR. CARROLL: I still have some, and my throat's awful dry.

CHAIRMAN LEMAY: We'll take 15 minutes then.

[A recess was taken.]

CHAIRMAN LEMAY: We'll resume with direct examination of Mr. O'Brien.

MR. CARROLL: Thank you, Mr. LeMay.

Q. (BY MR. CARROLL) Mr. O'Brien, when you stated, and going back one last question on our microannuli phenomenon, with respect to the worldwide cementing practices manual that was published last year by the API, American Petroleum Institute, you stated it wasn't even treated but is it recognized as a problem by the API when they were deciding what issues to discuss in this manual?

A. It's not mentioned and they didn't recognize it as a problem.

Q. Now, let's turn to another problem that has been described, and you briefly touched on it. It's gas flow through cement. Would you describe what the theorists have theorized with respect to that kind of phenomena and your opinion with respect to it?

A. There are probably several cases. The simplest would be just a simple flow of gases through a permeable medium. And, as I said, the permeability of the cements that we use is so low that there would be no flow through it. It's in the order of a thousandths of a millidarcy, which is the smallest thing we can measure, so it's something less than that in reality--the permeability is.

There are several other cases, the most notable of which is a condition that is theorized to develop, which as cement sets, it develops a gel strength that, due to filtration, the pressure in the annulus between the casing and the wellbore becomes equal to the pressure in the formation. When that occurs, in fact it may even in theory at least and in some of the tests that they've run, that pressure may get to be less than the pressure in the formation, in which case gas starts to move out of the formation and then upward through the cement.

And there is some indication, in fact there are examples, where gas has come out of formations as the cement was setting. This generally occurs, in fact all the cases that I'm aware of, have occurred in high pressure reservoirs where the cement and--or the pressure exerted by the cement was very close to the formation pressure.

There are several methods for preventing that, and one of them that they use is that the cement is substantially heavier, more dense than that required to balance formation pressure. So even if some pressure is lost, it's still enough to keep the gas from coming into the wellbore.

There are cement designs, such as a cement that's known as a right angled cement. That's one that stays very fluid until it sets and then it sets very rapidly so that the gel strength that is supposed to develop, it doesn't develop. And then also they're using cements that have a reduced fluid loss and the cements that are used here do have a reduced fluid loss.

So the techniques that we use and the conditions that we have are not amenable to the development of this kind of a problem.

Q. So, one, it's not going to happen here because of the pressures we have on the Delaware zone? You haven't seen it associated with these kinds of pressures, is that correct?

A. That's correct.

Q. And then, even if we did have it, we know how to prevent it from occurring?

A. That's correct.

Q. Now, there's also kind of a related, I guess, phenomenon that's discussed, channeling. Could you describe for the Commission what is meant here by the oil and gas industry and what we do to prevent or take care of that problem?

A. The channeling of cement most frequently occurs under one of two or three circumstances. If the hole is enlarged such that the velocity of the rising cement at the hole enlargement gets very low or very slow, channeling can occur where the cement moves through the mud that is there.

Another condition that arises is when the pipe sits eccentrically in the hole. Those are the two most frequent.

Another case is when very, very low pumping rates or displacement rates are used, even up to some moderate pumping rates. Some channeling may occur in any event, particularly in the first part of the cement, and we overcome that problem by several methods.

We can, to some degree, control the

hole enlargement, but sometimes we can't. The second case, we put centralizers, a mechanical device, a spring device that's put on the casing, which centralizes it in the hole so you don't have the eccentric condition. And we use enough cement so that on each of the three stages, the first part of the cement is discarded. That is the part that is most likely to be contaminated as a result of channeling.

And then the remainder of the cement that is left in place, although it could have some mud in it, it will still be adequate and have sufficient strength to provide the seals and so forth that it's meant to provide. We do it on each stage and get rid of the cement that is potentially contaminated.

Q. For channeling to even be a problem, it's going to have to be a continuous channel to get from the Delaware to the potash zone of some 6000 feet, is that correct?

A. That's correct.

Q. Have you encountered channeling of that distance in your practical experience?

A. No.

Q. Furthermore, for channeling to be a

problem with respect to setting of this long string of casing, the channeling you're talking about would most likely occur up to the bottom of the intermediate and then occur within the intermediate, is that correct?

A. That's correct.

Q. And bypass the potash zone?

A. That's correct.

Q. And lastly, for channeling, we're talking about a sizeable void, aren't we?

A. Yes.

Q. Is that detectable by a bond log?

A. Should be.

Q. It's unlikely that it would occur, but we have a method of detecting it and knowing when it would happen?

A. Not a full-proof method. I do not rely on bond logs as much as a lot of other people do, so I can't sit here and tell you that these things are that wonderful.

Q. In your opinion, is channeling a phenomenon we must be concerned about with respect to protection of the potash zones in the Delaware formation?

A. I'm not saying--it's something we need to be concerned about and we do the things to prevent the occurrence of channeling. It's not something that if we do the things that are done as proposed in this well program that we have discussed, it will not be a problem.

Q. Would the salt, if we somehow got a channeling effect on the outside of the intermediate of the salt string, is the salt string going to affect this or is it going to have an effect on it?

A. Say that again.

Q. Let's talk about channeling on the outside of the intermediate string that goes through the salt. What's going to happen there?

A. If you got a channel, when they test that string of casing they drilled out of the salt, if you have a channel and you test that string of casing, then it would leak off, and they do drill out and test that zone or test that shoe, and it would leak off and then you would correct the problem at that time. If you didn't correct it, the strength of the salt is such that by the time--well, the salt would flow and close off this channel.

Q. So, for channeling to become a problem, somehow it's got to get past this intermediate casing? And this intermediate casing, one, it's tested so you know you don't have that leak--

A. That's correct.

Q. --and two, again you have the action of the salt, the plastic nature of it sealing off and making an impermeable seal starting at the base of the salt?

A. That's correct.

Q. Another term that's been used and we've seen in some of the exhibits is swapping out. Can you describe for the Commission what "swapping out" is?

A. Well, if you have a high density fluid on top of a low density fluid, then, by gravity, they will change places, provided they don't mix.

Q. How can that occur? Would you describe the circumstances?

A. Well, in a general way if you have water and oil, you have water on top of oil, the water will go to the bottom and the oil will go to the top. In an oil well, if you set casing some distance off the bottom and put heavy cement around the pipe, then that cement would tend to go downward through the mud and displace mud up around the bottom of the casing.

We frequently spot cement plugs in wells. We frequently set casing off bottom. And, while we do get some mixing, the mixing that we get occurs only in the less than one joint of casing or less than 40 feet. And the reason we don't get any more than that is that the cement and mud mix, and we end up with a very thick, highly viscous material that doesn't flow anymore. So, if we did have mud to try to swap out, as the term is, it won't go very far.

The other thing is, when this casing is run, the 5-1/2 particularly, and the 8-5/8 as well, they are run to bottom and they just pick up just barely far enough off the bottom to hang the pipe, which is in the order of one to maybe as much as four feet; typically two or three feet, and there's not enough mud down there to make any difference. If it's two feet off the bottom, the flow action of the cement coming out the bottom of the casing is enough to wash all that out anyhow.

Q. So swapping out wouldn't occur?

A. There wouldn't be anything to swap out.

Q. Now, the void created by the mud that is swapping out, the void is what we've got to concern ourselves with, because that is the path in which there might be gas leakage, is that correct?

A. You have to assume it's going to swap out in a discrete channel. It doesn't do that. It doesn't move up in a straight line. Whatever movement there is will be in a rather crooked, tortuous path and, as a result, it mixes with the cement. And, as I say, what happens is in a very short distance.

Q. Is the amount of channel that is created directly related to the volume of the fluid in the bottom of the hole that's swapping out?

A. One would think so. That may or may not be the case.

Q. Well, is it possible that a gallon of mud could move all the way 6000 feet and leave an open channel behind it for the 6000 feet?

A. Certainly not.

Q. That's what would have to happen for this to become a problem, is to create an open channel 6000 feet?

A. Well, it would have to be a channel

that would be filled with mud through that whole interval. You couldn't just have a channel that would be a void. The liquid cement would close in it.

Q. So there would have to be at least enough volume of material there to keep the void open, then, as it created it?

A. That's correct.

Q. Just like when you frac a well, you use a profit?

A. That's correct.

Q. And that's all we're talking about is that same kind of mechanics, the mud, then, becomes, in a way, a profit?

A. It would have to.

Q. In your opinion, then, is this swapping out phenomena a problem with respect to the kind of well we're discussing or concerned with here?

A. It would not be a problem.

Q. If you had the swapping out and it just went so far, is the gas going to, if it goes up in one of the weaker zones just above the Delaware, will your gas go there or will it keep on going to the surface?

A. It would go to the Delaware.

Q. And if it reached the bottom of the salt, again the phenomena you're talking about, the sealing effect, would that continue?
A. It would stop it.
Q. Let's talk about gas percolation. What is that, in terms of--
A. This is kind of pretty much the thing that we talked about, the gas coming out of the rock and moving up through the liquid cement.
Q. Is this a problem? How high will this percolation effect occur?
A. Conceivably it could go a long way. As a practical matter here, it wouldn't happen, but if you did get gas in it, it would have to travel until the cement got set until it would reach the point that the cement would set enough to stop its movement.
Q. In your opinion, is this a problem with respect to these kinds of wells?
A. No.
Q. This percolation effect only occurs while the cement is in its, I guess, liquid state or predrying state, is that correct?
A. It occurs in the process of the cement setting.

Q. The setting of the cement cuts this off?
A. It would stop it.
Q. And, therefore, that would stop the channeling effect, then?
A. The percolating effect, yes, and channeling effect.
Q. Have you ever encountered and experienced the percolation of gas on 6000 feet to cause a problem like we're discussing?
A. I have, in cases where we drilled underbalanced, that is, the weight of the cement and what mud was in the hole produced less pressure than the formation pressure, so the formation was flowing and it just had a higher pressure than the pressure in the wellbore. So we got gas and we had percolation of gas over a fairly long interval.
Q. You can cause that to happen?
A. We can.
Q. And likewise, you can design to prevent that from happening?
A. That's correct.
Q. Let's talk about another concern here. Let's talk about directional drilling, Mr.

O'Brien. Have you had experience with directionally drilling oil and gas wells?

A. Yes, sir.

Q. Have you designed and actually drilled directional holes?

A. Yes, sir.

Q. Are you familiar with that process in Southeastern New Mexico?

A. Yes, sir.

Q. Have you performed a study, then, to be presented to this Commission concerning directional drilling out here in this particular area?

A. Yes, sir.

Q. Would you please present your--well, first of all, what is your basic opinion with respect to directional drilling as a viable alternative to drilling straight holes out here in the potash area?

A. Well obviously it is much less expensive to drill a straight hole. It is less hazardous, in that fewer things can happen to you that will cost large amounts of money or even make you lose the hole. And the longer lateral reach you have, the higher the cost.

We have records of a well that was drilled here that kicked out 750 feet, and the excess cost over a straight well was about 35 percent.

Q. That was the Bonneville well that Yates drilled a few months ago?

A. That was the Bonneville. It was a well-drilled well. There wasn't anything unusual about it. But their proposal is to drill a quarter of a mile and a half-mile to kick wells off that far are very close to four times the 750 feet.

Q. What you're talking about there are the actual proposals to drill the two Graham wells, which are the subject of these hearings, which are approximately a quarter of a mile, is that correct?

A. About a quarter of a mile.

Q. And then the two Floras are approximately a half-mile?

A. Yes.

Q. All right.

A. So, I took conditions of a straight hole and based that on history of wells drilled in the area.

MR. HIGH: Excuse me, Mr. Chairman. I'll object to this. We've already heard Yates' testimony about the cost of drilling these wells directionally. All this witness is doing is repeating what our exhibits are going to show. I object. It's cumulative.

CHAIRMAN LEMAY: Do you plan to present this as cumulative? or do you plan to get to something we haven't heard before?

MR. CARROLL: No, sir, not at all. This is stuff that we haven't heard before, and based on the exhibits that Mr. High has furnished us, the numbers that Mr. O'Brien will develop are a large divergence. They're not cumulative to those numbers. In fact, they're totally different.

CHAIRMAN LEMAY: Mr. High?

MR. HIGH: Mr. Chairman, we've heard every Yates witness that got up there that talked about economics tell us what it would cost to drill these wells directionally, and I don't think we ought to hear it from yet another witness.

CHAIRMAN LEMAY: Well, we'll continue to hear it for a while. See if you can get off the cumulative type testimony and get into something new, Mr. Carroll.

Q. (BY MR. CARROLL) All right, Mr. O'Brien, would you continue?

A. My estimate is that it would cost about $600,000 to drill a straight hole, and it would cost about $900,000 for Yates to drill a directional hole and kick it off 2660 feet.

Q. That's the half-mile that would be involved with the Flora 1 or 2 well?

A. That's correct. The protective life of a straight hole is about 14 years. The productive economic limit is about two barrels a day.

For a directional hole, the productive life would be about 12 years and the economic limit of 13 barrels per day, and, as a result, it would be 5000 barrels of oil lost or about $100,000 worth of oil.

MR. HIGH: Excuse me, Mr. Chairman. I hate to interrupt again, but it's obvious the witness is reading from something, and I would like to request at this time those papers that he's reading from.

CHAIRMAN LEMAY: Are you going to read

your testimony or are those just notes to help you out?

THE WITNESS: I can put it up on the board right quick, or whatever you want to do.

MR. CARROLL: They are just notes.

MR. HIGH: I would like to request a copy of those for purpose of cross-examination.

CHAIRMAN LEMAY: We'll take that one under advisement. Let's see how much he reads from those notes, or whether they're just going to help him in his testimony.

MR. CARROLL: Can you put those numbers up just so we have them then before us?

CHAIRMAN LEMAY: Is this what you want, these kinds of figures, Mr. High?

MR. HIGH: No, I don't want them up there. All I want to do is see Mr. O'Brien's notes so when I cross-examine him, I can ask him about some of those numbers.

CHAIRMAN LEMAY: These are the numbers here.

MR. HIGH: I'm requesting a copy of his notes.

CHAIRMAN LEMAY: We'll take that one under advisement.

THE WITNESS: I'll put them up here and then you can have them.

CHAIRMAN LEMAY: Is he volunteering his notes?

MR. CARROLL: I think he is.

CHAIRMAN LEMAY: All right, you won that one. There's probably no need to put them up there if he's volunteering his notes.

THE WITNESS: These other people don't want them?

CHAIRMAN LEMAY: The other people, we'll consider them not important at this point.

THE WITNESS: I'll read them to him and then give them to him.

A. In any event, the upshot of all this is that the operating costs per day for a straight hole is $50; the operating costs for a directional hole will be about $200 because they can't pump it with a rod pump economically, they have to use the downhole electric pump.

And the operating costs for a straight hole over 14 years is $255,000. It's $876,000 for the directional hole, a difference of $621,000.

Taking half of that to the present

worth is $310,000. The value of a straight hole is $850,000 for a typical sort of well. The incremental cost is $610,000, that is the $300,000 extra to drill plus the $300,000 present worth operating costs, which reduces the value of the well to $240,000 and that will make the well uneconomical. We will not drill a well for $900,000 to get a $240,000 return in excess of pay out.

Q. Mr. O'Brien, would you write your calculations? You started it there. I would like to see those numbers on this piece of paper and we'll mark it as an exhibit, because you did move rapidly through them.

MR. HIGH: Mr. Chairman, we would object to that. We exchanged exhibits. You told us to. The only reason we're hearing this from Mr. O'Brien is because Dr. Mitchell has done a calculation with respect to directional drilling and you made me give it to Mr. Carroll, which I did, and that's all we're doing and I object.

MR. CARROLL: And I got that a day ago, so we've had to prepare something, and this is how we do it.

CHAIRMAN LEMAY: Give the notes for

cross-examination purposes. We'll see the numbers again.

MR. CARROLL: Well, I would like to see them as something in written form. There are just a few numbers, how he calculated the ultimate value, Mr. LeMay, just to preserve the record.

CHAIRMAN LEMAY: Normally our procedure is to have an exhibit with these numbers on it. We've always operated that way. And the fact you don't have that is not helpful to the Commission.

MR. CARROLL: I understand that and I apologize. Until we got the numbers from Mr. High, which we only got in the mail a day ago, it made it very hard to even anticipate this.

CHAIRMAN LEMAY: Let's continue with it, then. This is not normal procedure, Mr. Carroll. Do you plan to make this an exhibit?

MR. CARROLL: Yes, sir, I do. We'll mark it as Exhibit 72.

CHAIRMAN LEMAY: Is that acceptable to you, Mr. High?

MR. HIGH: At this point I don't care. I'm going to get the notes and that's what I want.

CHAIRMAN LEMAY: What's the exhibit number that's going up there?

MR. CARROLL: It will be Exhibit 72.

CHAIRMAN LEMAY: Will it be what he's writing now, or his notes?

MR. CARROLL: They're the same, so we'll just use the larger piece of paper, then, so Mr. High can have it.

[Discussion off the record.]

MR. CARROLL: All right. If you'll hand me that, I'll give it to Mr. High.

Q. (BY MR. CARROLL) Now, when we're talking about a directional well and we're talking about a straight hole and we're talking about the economic limit, is what you're saying is that this well could be produced down to two barrels a day and at that point it's no longer economic to produce?

A. That's right, and that would be in about 14 years.

Q. That's basically the value of the product over the cost of pumping the well?

A. That's correct.

Q. With a directional hole, it's your

opinion that that economic limit will be 13 barrels, is that correct?

A. That's correct. As a matter of fact, I got that number out of this economic calculation from a gentleman with Yates. I don't remember his name.

Q. That's based on what the cost is from pumping a directional well--actual cost?

A. That's correct.

Q. So, at the time a directional well, then, reaches 13 barrels, it's not going to be profitable to produce that well anymore?

A. That's correct.

Q. You get down here to your calculation of value of oil lost, then?

A. I left the zero off the next one. That's 5,000 barrels that's lost, and at $20 a barrel, that's worth $100,000.

Q. This figure right here?

A. Put the zero there. There you are.

Q. And this is barrels?

A. Yes.

Q. And then what you have then taken, the operational costs, then, for a straight well and a directional well, that's $255,000 versus the

$621,000?

A. No, versus $867,000. The difference is $621,000.

Q. So the cost of operating this well is probably one of the single, largest, most significant costs, then? Not just the drilling costs, is that correct?

A. That's correct.

Q. So really, when we talk about whether or not it's viable to go out and drill directional wells, you cannot just stop with considering what the cost is of just drilling?

A. That's right.

Q. So the difference, then, is the $621,000, and you've reduced that to today's present worth?

A. That's correct.

Q. And you basically just divided it in half, then, for the purposes of this example to the Commission?

A. Or 10 percent. That's pretty close.

Q. So, then, you looked at the value of the hole versus the incremental cost, and what you've done is add the additional cost of drilling and the costs of operating?

A. That's correct.

Q. And that's how you've--that's the number that you reduced, the present worth of those numbers, you've reduced the $850,000?

A. And that leaves you the net value of this well at $240,000 and that would not justify a $900,000 drilling cost.

Q. You have a drilling cost of almost three times what you expect to get back?

A. That's correct.

Q. And that just is not economic, is it?

A. That's correct. These numbers for the directional well may be optimistic as far as drilling costs are concerned. I took as a 1.5 factor the results of drilling operations that were similar to this except that to get this depth to hole and so forth, you would have to kickoff in the salt at about 2000 feet and drill roughly 2000 feet of salt while you build an angle.

Directional drilling and salt, controlling the direction and building the angle, is not easy. Directional problems, deviation problems in salt are notorious worldwide, wherever salt occurs. So it's entirely probable that the actual costs to drill that well would be higher than the $900,000 that I have used.

When you get down to the bottom, it doesn't make any difference. These numbers could be off by a substantial amount, and the answer would still be that the well is not an economical one to drill.

Q. Now, these numbers were based on a directional hole that was kicked off below the salt, is that correct?

A. Part of it was. There was a well drilled that was kicked off below the salt and it kicked off 750 feet. But I have drilled other wells in Southeast New Mexico and we kicked off considerably farther than that, and I'm basing the number on those. We did not kick them off in the salt.

So that's the reason I say that very probably the number will be higher than the $900,000 that I have taken for the drilling and completion costs. If I were going to drill the well, any of these wells, and certainly if I was a mine operator, I would certainly rather have you start your directional drilling much deeper than that.

Q. Under a directional hole, the 5,000 barrels that you would not be able to produce because it's uneconomic, that oil would be lost or wasted, would it not?

A. That's right.

Q. And if--let's suppose directional drilling were instituted or forced because there might be a possibility, however remote or likely, that potash mining might occur in this Section 2, do you have an opinion--say if there was never any potash mining there, is that undue waste of oil and gas?

A. The fact of the matter is, the well wouldn't be drilled. The total of all the oil that's attributable to this well would not be recovered, none of it would be, because you wouldn't drill the well.

Q. So if this well had reserves of 120,000 barrels of oil, that's the figure that you're talking about losing?

A. Exactly.

Q. Just because the costs prohibit it?

A. That's correct.

Q. With respect to the order of drilling and mining, do you have an opinion as to how that order should occur?

A. I think what should be done, since we don't know when or indeed if mining will ever occur here, that what seems to me to be a reasonable approach would be to drill these wells vertically and produce them.

At the rate at which mining is presently progressing, the wells very probably, in fact at least a 99-percent chance, those wells will be produced and abandoned before the mining ever gets here. However, if that did not occur, then the mining people can mine up to some reasonable distance, and as they go along at some desirable point, they can make measurements as to the possibility of subsidence and to what degree it may occur, so that you'll have positive numbers to apply here to see actually how close you can get to this well without any damage at all.

And then several alternatives present themselves: They can mine around it and come back and take it out on their way back; it may be that they can mine up quite close to it and leave it as some of the pillars that they would leave anyhow; and if it's necessary to get down into the tail end of the life of this well, then together it could be worked out what could be done with the well to ensure that it didn't pose any problem to them.

But to arbitrarily at this point say there won't be any drilling here, when no one knows when or if the mining will actually take place, I think is apt to waste a substantial amount of oil in that there are a number of these wells that will not ever be drilled.

Q. In your opinion, if mining arrives in the vicinity of these wells after they've been plugged and abandoned, in your opinion, will there be any waste at all of potash?

A. There will be no waste at all. There would be no problem at all with them mining through the abandoned well.

Q. If mining arrives at the vicinity of these wells while they're still producing, will there be an ultimate waste of that potash, in your opinion?

A. Obviously at some point the well will be abandoned and at that point, then, all of the potash at that point can be recovered.

Q. So the answer is, no waste there

either, is that correct?

A. That's correct.

Q. In your opinion, then, would the granting of these applications, all four of them, by the Oil Conservation Commission, would they in your mind prevent waste and protect correlative rights?

A. Yes, they would.

MR. CARROLL: Pass the witness.

CHAIRMAN LEMAY: Would you like to start your cross before lunch, Mr. High?

MR. HIGH: Yes, sir, I surely could. Unless you want to break now for lunch.

CHAIRMAN LEMAY: Not necessarily. We could go a half-hour or so. Your witness.

EXAMINATION

BY MR. HIGH:

Q. Mr. O'Brien, it seems to me that you are of the opinion that the drilling of oil and gas wells to the Delaware zone is so safe with respect to the people who are working underground, that you ought to be able to go out and buy an insurance policy to protect the underground miners. Would you agree with that?

A. I don't have any idea what attitudes

the insurance people might take. If I was in the insurance business, I would be more than willing to do that. Unfortunately, I'm not wealthy enough to handle it.

However, if, on my opinion, and as I say I can't speak for the insurance people, I think that you should.

Q. You think the risks are low enough that it ought to be insurable?

A. Yes, sir.

Q. If somebody wanted to drill these wells, then they ought to be able to go out and find some insurance somewhere or maybe even post a bond?

A. I don't know whether they could or not.

Q. Let's talk about a bond. If the person who is going to drill these wells is so sure that it's safe and you're not going to do anything to the people working underground, there shouldn't be a big risk to the person drilling the well if they are required to post a bond?

A. As I said, I have no idea what the attitude of the people that do that sort of thing might be. I don't expect them to be sophisticated either in mining or oil well drilling, and my experience with insurance people is that they're not, and whether they would grant such an insurance policy or bond, I haven't the slightest idea.

Q. Have you had any experience in drilling wells in and around underground mines where people work?

A. No, I don't think so.

Q. Your background, as I understand it, is it primarily consulting or are you in the oil and gas business?

A. Primarily consulting.

Q. How long have you been primarily a consultant?

A. Since 1976.

Q. So that's--

A. 14 years.

Q. --a long time. So, from 1976 forward, your primary business has been the consulting part of it?

A. Yes.

Q. And, I take it, that's to the oil and gas industry?

A. In part, and a number of industries.

Q. I'm sorry?

A. A number of industries.
Q. Okay. I didn't mean to cut you off. Have you done any consulting for the mining industry?
A. Yes, sir.
Q. Which mines have you consulted for?
A. I worked for the--I can't remember the name of it. It was the Johannesburg something or other gold mines in South Africa.
Q. Did it involve the drilling of oil and gas wells in and around underground mines?
A. No, sir, it involved drilling core holes in and around mines.
Q. So your livelihood, I take it, from 1976 forward, has depended primarily upon the oil and gas industry?
A. Yes.
Q. Now, the casing program, and this is the exhibit that was up on the board there, Exhibit No. 68, do you have that in front of you there anywhere? Or if you have a copy, you might refer to a copy.
A. Yes, sir.
Q. Did you prepare this document?
A. I had it prepared.

Q. It was prepared under your direction?
A. Yes, sir.
Q. In your office?
A. No, sir.
Q. Was it prepared by Mr. Carroll?
A. No, sir.
Q. Well, who did prepare it?
A. Somebody with Yates prepared it. I'm not certain who drew it.
Q. I note down at the bottom, and I want to make sure everyone understands this, down at the bottom it says, "Scale, one inch equals 1000 feet"?
A. And it's not exactly the scale throughout.
Q. The reason I asked that question, I measured the thickness of this cement as a half-inch, would mean it would be 500 feet? You don't mean to say that?
A. Certainly not. The vertical scale of the casing is what the reference is to.
Q. The scale has nothing to do with the cement that's shown on Exhibit 68?
A. That's exactly correct.
Q. How thick is this cement?

A. Well, if you have 5-1/2 casing in a 7-7/8-inch hole, that's about an inch, inch and a half. Is that right? No, it's almost two and a half inches, ain't it?

Q. I don't know. I'm asking you.

A. About two and a half inches. It's half of that if it's in the middle of the hole and it's all of that if it's on one side, so it's somewhere between half of two and a half. From one and a quarter to two and a half inches, depending on where you are.

Q. So that would be the thickness of the cement around the casing?

A. Yes.

Q. That's not going to be uniformly all the way down that hole, is it?

A. That's what I said.

Q. There are things that happen that don't let that pipe stay right in the center of the hole?

A. That's correct.

Q. In fact, that hole is not the same size all the way down, is it?

A. It will be 7-7/8 or slightly larger.

Q. Is there any variation in the size of

that hole as you're drilling it?
A. As I said, it will be 7-7/8 inches or slightly larger.
Q. What do you mean "slightly larger"?
A. Up to maybe two or three inches.
Q. Now, this cement that you told us about, you say it's impermeable?
A. Yes, sir.
Q. At what age?
A. From the time it sits.
Q. For how long?
A. Ever more, as far as we know.
Q. Never changes?
A. It probably would change a little bit but not materially.
Q. And the cement that's shown on Exhibit No. 68, as far as you're concerned, that ought to keep anything from happening, in terms of gas getting outside that casing?
A. Yes, sir.
Q. Is this what is normally done in the oil and gas industry to keep gas from getting outside the casing, is to just put this cement in there?
A. Yes, sir.

Q. Do you know what an external packer is?
A. Yes, sir.
Q. What are they designed to do?
A. To isolate zones in the annulus, between the casing and the--
Q. But if the cement was so good, why would you use an external packer?
A. Because of the conditions that they perceive in some wells; particularly in very high-angle holes they use external packers.
We use them on some occasions where the strength of the rock is so low that we are not able to raise a very large column of cement, so we put some cement in, we put an external casing packer, and that provides a base for putting in additional cement.
There are a few cases in vertical holes where they do use external casing packers or attempt to use them to isolate without the use of cement.
Q. Aren't there some instances, Mr. O'Brien, where you use an external packer because you don't want gas from one zone to get up to the gas on another zone?
A. As I say, there are cases where they

perceive of isolating with a packer.

Q. And that's because the gas will migrate along the cement up to the other gas level?

A. Not if it's a reasonable cement job.

Q. But if it's a reasonable cement job, you don't need the external packer, do you?

A. That's correct.

Q. So you use the external packer because cement doesn't always do the job?

A. Let me say, you say I use the cement packer--

Q. I'm talking about the industry.

A. There are a few people in the industry, and what you're describing is not a common practice, the success of those packers is highly questionable. There are a few cases that they perform quite well but, in most cases, the vast majority of cases, cement--and I'm not talking about high-angle holes, the higher the angle gets the worse it is, and we have lots of problems there that we don't have to consider here, or I hope we don't--but aside from that, the use of external casing packers is extremely limited because it is not particularly successful.

Q. Well, I'm not asking about the use of it. My question is very simple. Aren't external packers used by the industry because of the problem of gas migrating around the cement job up to another gas zone?

A. They probably have been.

Q. Now, if everything is done perfectly, if you drilled a well like is shown on Exhibit No. 68 and everything was done exactly correct, you're saying there's no problem in terms of safety?

A. I don't think I said that.

Q. Mr. Carroll kept asking you if it would be a problem?

A. That's right.

Q. I'm not quite sure what you were talking about when you said there wouldn't be a, quote, problem, close quote.

A. I said I would be concerned about it, but it would not be a problem.

Q. When you say it wouldn't be a problem, what's the concern you have and the no problem? How do they fit together?

A. If you don't know what the problem is, we're wasting time.

Q. I know what the problem is, Mr.

O'Brien. My question is, do you know what the problem is?

A. I know what I think it is.

Q. Well, that's my question. Tell me what the concern is and the no problem you're talking about?

A. All right. Just hang on a minute. The problem that has been described to me in which I've heard you question people about is the possibility of getting gas into the mine workings. Now, certainly the migration of gas is a concern. What I'm saying is, if these techniques are followed, they don't have to be perfect, which is why I disagreed with you a moment ago, they don't have to be perfect and they will perform adequately to prevent the migration of gas, so that there will be no problem.

Q. And again, the "no problem" means that gas won't get outside the casing?

A. Gas will not get into the mine workings.

Q. It might get outside the casing but not in the mine workings?

A. That's correct.

Q. So the "no problem" you're talking about is, the gas that does get outside the casing, you don't think will find its way into the underground mine workings?

A. That's correct.

Q. Okay. There are a number of ways gas can get outside that casing, and you went through those, leaks from the threads, gas flow through cement, channeling, all that kind of stuff?

A. These are methods that are conditions that have been mentioned as possibilities. And there are some of them I said will not happen. Some of them I said if indeed they did happen, they would not pose a problem.

Q. And the problem being again that the gas that gets out of the casing won't migrate in the mine?

A. That's correct.

Q. Now, do you know, Mr. O'Brien, of any studies, any empirical data at all, that has studied whether or not the gas that gets outside the casing, in Southeastern New Mexico, will or will not migrate into underground workings?

A. No. But on the contrary, there has been no study made that shows that that is or ever has been a problem.

Q. Do you know of any studies that have been done in Southeastern New Mexico on whether or not and how much gas has gotten out of the casings of the wells in the known potash area?

A. No.

Q. You are aware that, as we stand here today, there's over a thousand wells that have been allowed in that known potash area, aren't you?

A. I don't know what the number is.

Q. You have been in the hearing ever since we started, haven't you?

A. Yes.

Q. Let me just represent to you that the testimony has been that there are over a thousand wells that have been allowed in the known potash area.

A. Okay.

Q. Would you agree with me that the chances are pretty high that in some of those thousands, gas has gotten outside the casing?

A. There's no evidence of it. I don't know that I would agree with you at all.

Q. Do you know of any tests that have been done on whether or not that gas has, in fact, gotten out of the casing?

A. No.

Q. Do you think it's important, Mr. O'Brien, to people who are working underground who might be adversely affected by these wells, to have some studies like that done before you put this oil and gas well in there?

A. No.

Q. Now, you were talking about the amount of pressure in these Delaware wells, and I think you said the bottom hole pressure was somewhere around 2,600, 2,800 psi?

A. Initially, yes.

Q. And then it goes down to about 50 psi, or I think you said within 20 or 30 psi? I misspoke.

A. Well, we were speaking initially of the bottom hole pressure at 2,600 or 2,800 psi, and the 50 to 80 pounds that we are now talking about is a different pressure. They're not comparable.

Q. If you drill a Delaware well, the bottom hole pressure is going to be somewhere around 2,600 psi?

A. That's right.

Q. What are you going to do if it blows out?
A. It blows out. I guess we would kill it.
Q. Do you know whether or not there's a blowout plan for these wells?
A. Yes.
Q. Have you seen it?
A. Oh, I don't know that there's a written one but I know there's a plan.
Q. It would be just what they always do when this happens?
A. Pretty much.
Q. When you say kill a well, what does that mean?
A. Stop it from flowing.
Q. And to make sure we're both speaking the same language, what do you call a blowout?
A. The uncontrolled flow of formation fluids to the atmosphere or into another zone.
Q. And that does sometimes happen in Southeastern New Mexico, doesn't it?
A. It does.
Q. When that happens, when you have a blowout, you kill the well?

A. That's correct.
Q. Is that the same thing as shutting it in?
A. Sometimes.
Q. If you are or were drilling one of these four and you had that blowout and you shut it in, what would be the pressure in that casing?
A. It would not be over 2,000 psi at any point, and it would be less than that at the surface. I can't tell you exactly what it would be, but it would be less than that. It probably would not be over 1,500 psi.
Q. You would have a whole lot more than 50 psi, wouldn't you?
A. Certainly.
Q. And as long as that well was shut in it would stay up at that high pressure--
A. Well--
Q. --unless it migrated somewhere else?
A. No. It would migrate. It would go into some of these other zones below the 8-5/8 is where it would go, and it would bleed off, because that's by far the weakest thing in there.
Q. Okay. And do we have any idea, Mr. O'Brien, where that gas would go?

A. Yes, sir.
Q. Where do you think it would go?
A. I know where it would go. It's not a matter of thinking.
Q. All right. Where do you know it would go?
A. It would go into these Delaware sands in the Bell Canyon.
Q. And nowhere else?
A. That's right.
Q. None of it would get outside the casing?
A. It would not get outside the 8-5/8.
Q. Now, you were talking about these core holes, Exhibits 69 and 70, and then I thought you said that if these seals failed they would allow water to enter the salt in the mine workings?
A. That's right.
Q. Is that what you said?
A. Yes.
Q. And, at the same time, I thought I heard you say earlier that it takes about 3,000 psi to pump something into the salt?
A. That's right.
Q. Are you saying that the water in these

aquifers, which you have shown on Exhibits 69 and 70, would be above 3,000 psi?

A. Certainly not.

Q. So things can get into the salt that are less than 3,000 psi?

A. I don't know whether they can or not. Well, you can carry a bucket of water down there, you know, but the thing is we're talking about here is that you have this core hole plugged with cement. If the subsidence were to--or any subsidence were to occur and that would destroy the seal, then the bottom of the core hole is into an open mine working so that you're not putting water into the salt, you're putting it into a mine gallery, or whatever the proper term is.

Q. You're not suggesting, are you, Mr. O'Brien, that what's done with one of these core holes is what ought to be done with one of these Delaware wells, are you?

A. No.

Q. I would hope you would agree with me there's a whole lot of difference with respect to hazards to underground miners?

A. You missed the point of what I was

talking about.

Q. And I'm going to give you a chance to say it.

A. Okay. Go ahead.

Q. And if you'll give me a chance to ask my question, I assure you I'll give you a chance to answer.

A. Okay. I thought you were making a speech.

Q. No, not yet. We'll save that for another time. You're not suggesting that the core holes that you show in 69 and 70 are anywhere near the same kind of hazard as an 8500-foot Delaware well?

A. There's no comparison made between the core hole in that regard at all.

Q. Whatever way you plug a core hole, as shown on Exhibits 69 and 70, is not necessarily the way you ought to plug an 8500-foot Delaware well, is it?

A. That's correct.

Q. Would you also agree with me that a hole drilled down to the Delaware formation presents a greater risk to underground miners than one of these core holes shown on Exhibits 69 and 70?

A. If you drilled in the area where there was gas and/or oil present above the top of the salt, I think that the hazard produced by the core hole, where they mined into the core hole, I think that the hazard presented by that core hole would be at least equal to that presented by the Delaware well.

Now, if there is no gas above that--no gas or oil above the salt, then it wouldn't present any problem at all other than conceivably possibly getting wet.

Q. Now, as far as plugging and abandoning these wells and then mining through, you referred to an article here that Mr. Carroll introduced, Exhibit No. 71. I take it you picked that up in your research?

A. Yes.

Q. You weren't in any way involved in its preparation?

A. No, sir.

Q. Now, the wells that were involved in the study reflected in Exhibit No. 71, were how deep, Mr. O'Brien?

A. About 2000 feet.

Q. And of course here we're talking about wells that are roughly more than four times that?

A. That's right.

Q. And what was the pressure, the reservoir pressure of the wells involved in Exhibit No. 71?

A. They pressured them up to about 2,000 psi.

Q. What was the initial reservoir pressure? Do you have any idea?

A. The initial reservoir pressure was probably slightly less than a thousand pounds.

Q. And you got that out of Exhibit No. 71?

A. No, sir, but that's normal pressure for that part of the world. When they drilled them in 1890, that would have been the initial pressure.

Q. What was the pressure at the time this study was done of the wells that were under consideration?

A. Until they pressured it up it was extremely low. I don't remember. There may be a number in there and I don't remember what it is, but it was in the order of very few pounds of pressure.

Q. Very, very low, I take it?
A. Yes.
Q. In fact, the wells involved in the study, Exhibit No. 71, were what were called pressure depleted reservoirs?
A. Yes.
Q. Would you agree with me there's a whole lot of difference in that and a producing Delaware well, in terms of hazards that are presented?
A. No, I don't think so. Had that been--well, I'm not sure what sulfur hexafluoride or what this is, I'm not sure how hazardous it would be, but just from the name of it it sounds pretty bad. But I don't think that 2,000 psi, at 2000 feet, is any less of a hazard than 2,800 pounds at 8000 feet.
Q. Are you suggesting that the tracer gas was a hazard in underground mining?
A. It could be. I don't know. I just said, I don't know how hazardous that material is. I would think it would be.
Q. You understood that the hazard that was being looked at in Exhibit No. 71 was methane gas?

A. Yes.

Q. And the possible release of that methane gas from an oil well into a coal mine?

A. Yes.

Q. Now, do you know what size pillars had been left around the wells that were being looked at in Exhibit No. 71?

A. I don't recall whether it's in there or not. I don't know.

Q. Do you know how many strings of casing were involved in the wells in Exhibit No. 71?

A. I think there were two strings of casing involved. Some of them may have had three.

Q. Let me suggest to you that the report says that there were three to four strings of casing. You don't disagree with that, do you?

A. No. They were not all the same.

Q. That's correct. I'm not suggesting they are, but there were some wells in the study that had three or four strings of casing?

A. And some of them had two.

Q. When they were preparing to do this, and if you'll look at the top of page 6, when they went in to do this study, they found what we are concerned about. And if you'll look at page 6 at the top, Mr. O'Brien, it says, "In several cases, the presence of gas behind the casing made it difficult to interpret the neutron log and accurately locate the coal beds." Do you see that sentence?

A. Uh-huh, yes.

Q. So the gas that was inside of these wells, where the pressure had been depleted, had somehow gotten on the outside of the casing?

A. Not necessarily.

Q. Well, isn't that what page 6 says?

A. There can be gas outside the casing. It does not have to be in the annulus. That gas very well may have been in porous zones outside the casing or coal outside the casing. Methane does occur in coal; methane does occur in numerous porous zones that would cause a reaction on the neutron log.

Q. Now, in doing this test, they put this tracer gas in, and you did read and study this, of course?

A. I did read it.

Q. And your recollection is that it was pressured up to a thousand psi?

A. Something of that order.

Q. Well, let me refer you to page 6 again, down in the third paragraph, second sentence. "The SF_6 was injected at pressures below 300 psi so it would remain in a gaseous state"?

A. There's also in here somewhere, and I don't know where it is, conditions where they pressured up to considerably higher pressure.

Q. Well, if you find that, point it out to me. But, even at that pressure, the tracer gas that was injected into that well, or these wells, migrated, didn't it?

A. It migrated to other wells.

Q. And it was found in other wells through testing?

A. Sure.

Q. We don't have any empirical data like this in Southeastern New Mexico, do we?

A. Not that I know of.

Q. Now, as they started to mine up to this well after it was plugged, they encountered methane, correct? Do you recall?

A. I don't recall. They could have.

Q. In fact, if you read the report, you'll see that they incurred or encountered increasingly larger amounts of methane the closer they got to the well, right?

A. I don't know. They may have.

Q. In fact, when they were mining up to it they even smelled oil, and when they got up there, they found that the casing had a hole in it, and, in fact, oil had leaked out.

Would you agree with me, Mr. O'Brien, that they would never have known that if they hadn't mined up there to it?

A. They probably wouldn't.

Q. So what's going on underground with these oil and gas wells, sometimes we never know about, do we?

A. I suppose sometimes. But, on the other hand, these wells were not cemented or plugged, either one, back in there, back in the days that they were operating as these are drilled or plugged.

Q. Do you know whether or not there is a barrier pillar requirement around oil and gas wells in the coal industry now?

A. If there's what?

Q. A barrier pillar requirement around the oil and gas well in the coal industry.

A. I think there is. I don't know what the size of it is.

Q. You understand that's to protect the underground miners?

A. I would think so, and, likewise, to protect the well.

Q. Are you familiar, Mr. O'Brien, with the differences between the regulatory requirements between a coal mine and a potash mine?

A. I have looked at them. I certainly don't know them in detail. I know that there are substantial differences.

Q. Would the consequences of an oil and gas well leaking methane into a mine be different, in your judgment, if the consequences in a coal mine were different than the consequences in a potash mine? That's an awkward question, and if you don't understand it--

A. I think so.

Q. Okay. The point I'm making is this. If you're considering whether or not something should or shouldn't be done or allowed, should you take a look at the consequences if something does go wrong?

A. Certainly.

Q. If you're looking at a coal mine, the consequences of getting methane in a coal mine are what, if you know?
A. Well, largely, coal mines have some methane in them so they're prepared to handle it.
Q. They encounter that on an everyday basis?
A. Yes.
Q. Do you know whether or not the same is true of a potash mine?
A. Generally not.
Q. If you're not prepared to deal with it, would you agree with me you ought to be a little more cautious in a potash mine than you are in a coal mine?
A. I think if I was a miner I would be more cautious, yes.
MR. HIGH: Mr. Chairman, I'll go to another subject now. I don't know what your plans are for lunch. I'm perfectly willing to go ahead, unless you want to break. I'm starting on a new subject area now.
CHAIRMAN LEMAY: Any idea how much longer you will be?
MR. HIGH: It won't be long.

CHAIRMAN LEMAY: Why don't we finish this witness up, and we can take a late lunch.

MR. HIGH: Well, I don't think I'll be that quick. I'm perfectly willing to finish him up, but I'm not going to represent to you that it will be that short.

[Discussion off the record.]

CHAIRMAN LEMAY: Why don't we continue for a while.

MR. HIGH: Okay.

Q. (BY MR. HIGH) You talked about subsidence, Mr. O'Brien. Have you had any actual experience in drilling oil or gas wells in areas of subsidence?

A. Yes, sir.

Q. Caused by underground mining?

A. No, sir.

Q. The subsidence you're talking about, is that these mountains are moving and that sort of thing?

A. That was one of them. I have dealt with subsidence that several of them, from those that were--the subsidence was just a drop, the sides were vertical in some very shallow oil wells. I've dealt with some where there was differential subsidence across a structure so that--sometimes fairly sharply differential so that the wellheads ended up at an angle.

Q. Well, have you had an occasion to study how the ground moves in the subsidence that we experience in Southeastern New Mexico?

A. Based on the studies that I have seen, there have been several calculations, at least theoretically we assume that these various angles are straight lines from some point on the surface to the mining area, although I don't think that actually happens.

Also, in talking to rock mechanics experts, they have the opinion that the movement is not a straight line function but rather one that is an angle, increasing angle as you leave the mining face and/or the wall as you approach the surface.

That assumes a homogeneous interval from the surface to the mined area, which we don't have, so there probably will be some differential movement between beds. And that's what I get out of the studies that I have seen.

Q. And that's in connection with subsidence in Southeastern New Mexico?

A. Yes.

Q. Have you ever had a case where you were retained as a consultant to advise someone in connection with the impact or possible impact of subsidence, like we get in Southeastern New Mexico, upon that well or possible well?

A. I have not as a consultant, but when I was working for Gulf I did that in connection with subsidence. It was, I think, fairly similar.

Q. Would you say that one of your areas of expertise is dealing with wells or proposed wells in the areas of subsidence, like we encounter in Southeastern New Mexico?

A. I guess I have to ask, as compared to who? I think, and my expertise is probably about as good as you run into with drilling people in the oil field, probably better, and I don't know how many mining people know what happens to wells, either, so I bet I'm about as good as the upper five percent or something.

Q. I guess what I'm getting at, Mr. O'Brien, would you want to consult with, say, someone who has more rock mechanic expertise than yourself before you went around drilling a well in an area of possible subsidence?

A. Yes.

Q. Or would you feel comfortable dealing on your own expertise?

A. That probably would depend on the degree of subsidence that was anticipated.

Q. Do you know the directions of movements of the subsidence caused by underground mining in Southeastern New Mexico?

A. They generally tend to move perpendicular to the directions of the mine.

Q. Any other movements?

A. Down.

Q. Okay. Well, that's what I'm saying. Any other movement other than down?

A. I said perpendicular to the direction of the mine.

Q. So, it's your understanding that the subsidence in Southeastern New Mexico is a single movement and in a downward direction?

A. No, sir.

Q. That's what I'm asking. What other direction?

A. I just told you. The mine runs in some direction, the gallery or whatever you call this thing, runs in some direction, and there is movement towards the center of that mine section and it's more or less perpendicular to the direction of the mine.

It's more or less two-dimensional, not much in the third direction or longitudinally along the mined area.

Q. Would subsidence affect the cement job on an oil and gas well?

A. If you've got enough subsidence, perhaps. In the subsidence that's indicated in the studies that I see here, I think not.

Q. What is the tensile strength of cement? High or low?

A. It's about the same as rock.

Q. Will cement that are used in these oil and gas wells, stand very much horizontal movement without breaking?

A. It will bend some. And the amount of moment that takes place in the subsidence, the lateral motion for a given interval per foot, is small enough that the cement would be able to withstand it without any problem.

Q. Well, would you agree with me that there is a greater risk, if a well is in an area of subsidence, that something bad will happen to that cement?

A. I guess it depends on where it is in the area.

Q. Do you think that if a well is in an area where it might be affected by subsidence, that that creates a greater unknown of what might happen to this gas if it got outside the casing?

A. No.

Q. So you don't think subsidence would have anything to do with possible gas migration? Is that what you're saying?

A. I didn't say that.

Q. Well, will subsidence increase the risk that whatever gas got outside of a casing will migrate to some place that we don't know where it went?

A. Did you ask me whether that's something I could conceive of? Ask me the question again. I'm not sure what answer you're looking for.

Q. I'm looking for an answer to the question. If you don't understand the question, just let me know.

A. That's my problem.

Q. Okay. Do you think that a well in the area of subsidence, that that subsidence increases the risk that the gas that might get outside the casing will migrate some place and we don't know where it went?

A. Within some reasonable limits, no.

Q. But then I take it from that answer, there are some limits within which you would say yes?

A. Well, obviously, I don't know if it's going to go three feet up there or three feet--because you've got to put some kind of practical limit. There's nothing that I know of anywhere that's absolute. So when you ask me one of these questions that you want an absolute yes or no answer, why, you're asking an improbable question.

So what I'm saying is that certainly if you've got gas outside the pipe, it's going to go somewhere.

Q. Okay.

A. All right. Now, it has a choice of two or three places to go. I know some of the places it won't go, but I know that it is in proximity to the well or it will move upward.

Q. Okay. All right. Assume for a moment

that gas got outside the well casing and got in the McNutt member of the Salado formation where the potash is. Do you think that subsidence in that area would increase the risk that that gas would have a place to migrate to?

A. No.

Q. Do you know whether or not there's any separation of the beds in the strata as a result of subsidence?

A. There can be.

Q. Do you think that would create a path of migration?

A. For some small distance.

Q. Now, this subsidence and its effect on the casing that you were talking about earlier, you were talking about J-55 pipe. I believe you said it was designed for a maximum of 55 psi?

A. No, sir.

Q. What was it, then?

A. It has a yield strength of 55,000 psi.

Q. That's yield strength, you call it?

A. That's correct.

Q. Is that horizontal tension strength?

A. In any direction.

Q. Is that number, Mr. O'Brien, designed to be uniform around the pipe?

A. Yes.

Q. Will pipe withstand the same amount of uniform pressure if that pressure is applied, instead, at a point?

A. It will withstand whatever the point load is.

Q. So is it your testimony that you can take 5,500 psi and apply it to a point on J-55, and there will be no difference than if you apply that same stress in a uniform fashion around the pipe?

A. The number that I said was that this pipe has 55,000 pounds per square inch minimum yield strength.

Q. Okay. And my question is, is that a point number or is that a uniform pressure number?

A. It's neither one.

Q. So it makes no difference whether it's uniform or from a point?

A. Not as far as that's concerned.

Q. If subsidence causes pressure against a casing, does it make any difference if that subsidence pressure is applied uniformly around

the pipe or to a point on the pipe?
A. I think that the movement that you have is so small, it doesn't make any difference.
Q. Okay. Now, you used the term angle of break?
A. Yes, sir.
Q. Is that what Mr. Hutchinson was talking about up here the other day?
A. The best I can understand what he talked about, yes.
Q. Now, you said salt won't crack? Did I hear you say that earlier?
A. I don't think so.
Q. Well, I wrote it down and I put quotes around it. Maybe I misunderstood what you said. Will salt crack?
A. Under the proper conditions, yes.
Q. Have you ever seen a roof fall in an underground mine?
A. No, sir.
Q. Now, the conditions that Mr. Carroll led you through, starting with leaks from the threads and the microannulus and all those sorts of things, those were reflected in exhibits that Dr. Mitchell prepared, were they not?

A. Yes, sir.

Q. You were just responding to the anticipated testimony of Dr. Mitchell?

A. In a way, yes. I was just answering his questions.

Q. I understand that, Mr. O'Brien. You will agree with me, though, I assume, that there are circumstances in which gas will leak around the threads of the casing?

A. There are, and I described when that might occur.

Q. Sometimes you don't get a good mate between the casing?

A. No, sir.

Q. Pardon?

A. No, sir.

Q. You always get a good setting?

A. Yes, sir.

Q. Have you ever had a situation where you had a leak from around the threads?

A. Yes, sir.

Q. So that is one way gas can get from inside the casing to outside the casing?

A. It's one conceivable way, not necessarily one which will occur here.

Q. I believe you said that microannuli probably do exist? Is that what you said?
A. They probably do, in some limited intervals.
Q. That there is a space, ever how minute it might be, between the cement and the casing and/or the cement and the earth, that will allow or might allow gas to migrate along?
A. As I say, over limited distances.
Q. And, in fact, it's partly for that reason, or that may be one reason why you might want to use an external packer or somebody else might want to use an external packer, correct?
A. If they think that's going to happen and they use that, I guess your statement probably is right.
Q. As far as gas flowing through cement, that does happen or can happen, can't it?
A. Under some particular circumstances it can happen.
Q. And that gas can go from the bottom of the hole to the top of the hole through cement?
A. Under some specific circumstances which do not apply here.
Q. And that distance can be 10,000 feet,

can't it?

A. It can be further than that, but that doesn't apply here.

Q. But it is one way that gas can get through impermeable cement?

A. If you want to take ridiculous things, we don't cement to well, but that is no more ridiculous than the proposition that you're proposing.

Q. Well, you have encountered circumstances, Mr. O'Brien, where you've had gas outside the casing, haven't you?

A. Absolutely.

Q. People didn't intend the gas to be there, though?

A. Right.

Q. They didn't intend that?

A. That's exactly right.

Q. Things happen?

A. Things did not happen in a well like this, the conditions that you're describing.

Q. Would you agree that mistakes can cause things to happen that people don't want to happen?

A. I think that that's probably a

reasonable sort of statement.

Q. Mistakes can cause gas to get from inside the casing to outside the casing, and you don't want it out there?

A. That's right.

Q. Do you have any idea how much gas it would take to cause some serious problem for the underground potash people?

A. I have attempted to find out from the mining people how much air they circulate through a well, and our last encounter I tried to find that out and didn't. However, I made some calculations based on the kind of wells we have here, that the probable maximum amount of gas that one of these wells might produce is in the order of maybe 150,000 cubic feet per day.

Q. Are you speaking in terms of blowing one of these things up?

A. No, I'm not blowing up anything. If I took one of these wells and took all the gas it would make and turned it into the mine, the most gas it would produce would be about 150,000 cubic feet per day. That's caused by the--these are oil wells, and that's what they will produce.

Now, you can stand a quarter of one

percent methane and still be within the limits of your rules. So, the amount of air that it would take to maintain that gas at a proper dilution would be the amount of air that is furnished by about a three-horsepower blower. And I am told that the blowers that are used to ventilate mines are far in excess of that size.

Now, this doesn't mean that if you shut the blowers down and let the mine sit there for a long time that you wouldn't conceivably fill the whole thing with methane.

Q. Do you know the size of the samples people take when they're checking for gas in an underground mine? Do you have any earthly idea?

A. No, I don't. I've measured methane with some kind of testing device, but I don't remember what that size was.

Q. Now, as far as the directional drilling of these wells are concerned, Mr. O'Brien, I take it you undertook the study you talked about here with--

CHAIRMAN LEMAY: Do you want to break now? Is this a good point?

MR. HIGH: It's entirely up to you. I'm fine.

CHAIRMAN LEMAY: Let's take a break and be back here at 1:30.

[The noon recess was taken.]

CHAIRMAN LEMAY: Please be seated, and we'll continue where we were with Mr. High on cross-examination of Mr. O'Brien.

T. B. O'BRIEN

Having been previously duly sworn upon his oath, resumed the stand and testified further as follows:

EXAMINATION RESUMED

BY MR. HIGH:

Q. Mr. O'Brien, you said you had some experience with directional drilling in Southeastern New Mexico. Have you actually drilled some directional wells in Southeast New Mexico?

A. Yes, sir.

Q. How many would you say you've drilled?

A. 15 or 20.

Q. I guess we can assume, given the fact that you drilled the wells, that they were economic?

A. No, sir, not necessarily. It wasn't for my account.

Q. Now, in preparing the numbers that you put up on, I guess we called it Exhibit No. 72, did you do any time studies on how long it would take to drill these wells and that sort of thing?

A. Not exactly. What I did is, I have experience with drilling wells about like this, and I had had experience drilling straight holes, so I know from that experience what the increase in costs would be percentage-wise, and I applied that here.

I didn't get this until yesterday and I didn't have time to go into any long-winded theoretical studies. I just had to take what I knew worked, and took this from it.

Q. You're not representing what you said here that's shown on Exhibit No. 72, as being a complete report or as complete of a report as Dr. Mitchell did in the one that you looked at, are you?

A. It's not as many pages. I think the answer is as good.

Q. You didn't reduce any of this to writing other than the notes that you brought with you?

A. That's all I did. I got to that at

10:00 o'clock last night.
Q. So your entire directional drilling plan that you testified about is reflected on Exhibit No. 72?
A. That is not a drilling plan.
Q. You didn't do a drilling plan, did you?
A. No, sir.
Q. When you're talking about a directional well-- Let me back up.
Who prepared these numbers?
A. Who prepared the numbers?
Q. Yes. Who did these numbers?
A. I did. Now, some of the numbers I got from somewhere else.
Q. That somewhere else would be Yates, wouldn't it?
A. Yates, from their histories on wells that they had drilled.
Q. Okay. When you're talking about a directional well, at what angle do you consider a well to be a directional well?
A. Any time you control the angle of the hole, it's a directional well, if you control it to zero degrees or control it coming back up, I guess. Whatever it is, it is a directional well

if you control the direction and deviation.

Q. Is there's a certain point off of vertical that the well becomes known as a directional well as opposed to--

A. No.

Q. What's the most deviated straight hole you've ever seen?

A. In excess of 50 degrees.

Q. I guess that would be error?

A. Be what?

Q. I guess that would have been deviated by error?

A. No, sir, that wasn't an error, that's what nature did to us.

Q. It was intended to be vertical, correct?

A. No, I never have intended to drill a vertical oil well because they just don't happen and I would be frustrated, myself, by trying to do something I know just won't work.

Q. No well is straight vertical?

A. If it is, it's a pure accident. The only place they ever drill vertical holes are these shafts they drill vertically, and they drill the holes for the atomic energy testing vertically, and any others are pure accidents.

Q. At what point does the deviation start taking on additional cost and--

A. Whenever you start to control the deviation of the well and have to rent the tools and hire the people to do that work, it takes on extra cost.

Q. If a well, Mr. O'Brien, is deviated five degrees, is it going to make any difference whether it was intentionally done that way or just happened to be that way, in terms of cost?

A. Yes, it would.

Q. So, to complete that well, the cost would be the same whether you intended to deviate it or it just happened that way?

A. No, sir.

Q. Then maybe I don't understand you. It doesn't seem to me like both of us could be correct. Is the cost of completing and operating an intentionally deviated well--

A. Oh, excuse me. You were talking about the completion portion of it or are you talking about drill and complete?

Q. Yes.

A. Drill and complete?

Q. Yes.

A. The cost to drill and complete a well that is directionally controlled will be higher than one which you do not control the direction or deviation.

Q. If a hole winds up being deviated 15 degrees, whether it's intended or not, is the cost to complete that well and pump it, or get the oil out, any different if the deviation was intentional or simply it happened that way?

A. You're talking about completion only? Not drilling?

Q. I'm talking about the point you start putting new numbers on your Exhibit 72.

A. In that case, the cost to drill, the drilling part of it, that's why I have the $300,000 difference, that cost would be greater for one that was intentionally deviated or intentionally controlled. The cost to produce it, if it's a 5- or it's a 15-degree hole, it doesn't make any difference what you did or what your intentions were when you drilled it, the cost to produce it will be the same.

Q. The 35-percent cost that you estimated or testified about, directional over a straight hole, are you just shooting from the hip on that or--

A. No, sir.

Q. That's based on the numbers you got from Yates?

A. Yes, sir.

Q. Now, in coming up with these numbers, there are certain things I guess you need to know before you can determine the cost of a directional well with respect to how the well is going to be drilled, right?

A. Yes.

Q. You'll have to know at what depth you're going to kick off?

A. Yes.

Q. You'll have to make some judgment on what is the angle going to be?

A. Well, where you kick off will probably determine where the angle will be.

Q. The sooner you kick off, the smaller the angle might be?

A. Generally speaking, that's accurate.

Q. And how deep did you go down in your mind when you were coming up with these numbers?

A. Sir?

Q. How far did you go down in your mind when you were coming up with the numbers?
A. In my head?
Q. When you were coming up with the numbers on Exhibit 72, what did you assume to be the kick-off depth?
A. I assumed it to be 2000 feet.
Q. Is that because that's what Dr. Mitchell used?
A. Yeah. I didn't have a better one.
Q. Are all your other assumptions that don't appear on Exhibit 72, basically the same numbers that Dr. Mitchell came up with?
A. There are not many others there, really. He had a 8500-foot hole and a 9000-foot directional hole and he kicked off at 2000 feet. His drilling costs are not exactly what mine were for the straight hole.
He came up with a different set of numbers for the percentage increase in the cost, and he based it on whatever he based it on and that's fine. I based mine on my experience in drilling in the area as to what that increase would be. And, on that basis and from there on, I don't think there's anything that I took from

his estimates. About the only thing I took was the kick-off displacement, the horizontal displacement, and the point of kick off.

Q. So you kicked off, in coming up with these numbers, at about the same place Dr. Mitchell did?

A. That's right.

Q. So the angle of vertical ought to be the same as Dr. Mitchell came up with, right?

A. Pretty close.

Q. Okay. Well, if you kick off the same place it would be the same, wouldn't it?

A. Yeah.

Q. It wouldn't be pretty close, it ought to be the same?

A. Well, in theory it will be. As a practical matter, it may or may not be.

Q. What was that angle?

A. I think he had 24, 25 degrees and, if I did it like this angle would be somewhere between--it probably wouldn't be any less than 24 but it might get a little higher than that.

Q. You don't disagree that if you kick off at about 2000 feet for this well, you'll have an angle of somewhere around 24 degrees?

A. That's right.

Q. You used that in coming up with the numbers on Exhibit 72?

A. Yes.

Q. Okay. Now, you said that if these holes were drilled directionally, you would have to use a submersible pump? Did I understand that correctly?

A. That's right.

Q. What does a submersible pump do?

A. It pumps the oil.

Q. And you use a submersible pump in lieu of pumping it with a rod?

A. With a beam pump, yes, sir.

Q. At what angle do you start using, and I'm talking about, Mr. O'Brien, at what angle of deviation do you start using a submersible pump on a directional well?

A. There are wells, depending on the depth and the rate of angle build-up and probably some other things, that would determine what that angle would be. There are some very shallow wells that are pumped at considerably higher angles than this. There are some very deep wells that you couldn't handle at 25 degrees, so you can't answer the question that you have with an angle.

Q. You answered the question with respect to these Delaware wells with saying a submersible pump will be required?

A. And the reason that I took that number, I had Yates estimate for me the cost of operating with a beam pump in this condition, and with an electric pump, and it came out that the electric pump was cheaper, so that's what I used.

Q. So in the numbers you came up with and if these wells were drilled directionally, your testimony is it would be cheaper to use a submersible pump than pumping them with rods?

A. That's correct.

Q. Why do you ordinarily use a submersible pump as opposed to pumping with rods, Mr. O'Brien?

A. Most of the time it's used where you're pumping large volumes.

Q. It really doesn't have a whole lot to do with the angle, does it?

A. It does when that's a critical consideration.

Q. How is it that you concluded that using submersible pumps would be cheaper when the reason you use a submersible pump ordinarily is because of volume?

A. That's what you ordinarily do, but when you have a different circumstance, you use them for a different purpose.

Q. Can you pump a well with a 24- or 25-degree deviated angle with rods?

A. Sometimes.

Q. Do you know of any wells with angles at least that high or even higher that are being pumped, as we sit here today?

A. I don't know whether they're still being pumped, but I know of some that have been.

Q. What is the highest angle that you know of where a well has been pumped with rods?

A. There are some shallow holes off the coast of Peru that I think are at about 60 degrees and, to my knowledge, that's the highest. They start them off at 45 degrees or 40 degrees.

Q. In the deviated wells that you drilled in Southeastern New Mexico, and I'm not talking about this, but the ones that you have been involved in--I think you told me about 15 or so?

A. Somewhere in that neighborhood.
Q. --did you use submersible pumps in any of those?
A. No, sir. They didn't, all of them, make wells. Those that made wells, I think, were gas wells, so we didn't have the problem.
Q. Did you pump any of them?
A. I don't think so.
Q. What do you attribute, Mr. O'Brien, the difference between your number on the cost to drill these wells directionally and Dr. Mitchell's number?
A. I think it would take longer than he estimated, and the cost of controlling and the effort to control the deviation and direction will be higher than he estimated.
Q. That's why I asked you earlier if you did any studies, because you saw Dr. Mitchell's report, right?
A. Yes.
Q. He even included in that report a detailed time study on how long it would take to do each of these steps, right?
A. Yes.
Q. Did you do one of those?

A. No.

Q. He listed all the expenses and the things that would be required right down to--in fact, he may have put in there legal expenses for lawyers?

A. He probably should have.

Q. Did you do anything like that?

A. No. Would you like for me to tell you how I did this?

Q. No, I think you already have.

A. Okay, then, there's really no point in this.

Q. Are there any other areas that you think make up the difference between your number and Dr. Mitchell's number, in terms of cost?

A. There are probably some other costs. I don't know what he put in there for all of the directional. He's got a flat number in there for directional cost, and I don't do it that way. I do know that if he got somebody to bid the directional cost it would be higher than--I think it was something like $55,000 that he had in there. It will be higher than that, unless he has a lot cheaper directional people than I have.

Q. You also mentioned kicking off in the

salt, which is not something you would want to do if you were a mine operator?
A. That's correct.
Q. Have you drilled any directional wells that were kicked off in salt?
A. I have tried. Yes, I have drilled some.
Q. When was the most recent one you were involved in?
A. Somewhere between 10 and 15 years ago.
Q. Since that time have you tried to kick off in a salt?
A. No.
Q. Has anything changed in the last 15 years you know of that might make it a little easier to do now?
A. No.
Q. What's so difficult, in your opinion, to kick off in the salt on a deviated well, intentionally deviated well?
A. I'm not sure that we really know. There's speculation in the industry as to why you have difficulty with deviation control in salt, but I think the customary wisdom is that salt, being crystalline, it has some strange effects on

the action and reaction of bits.

Q. What difficulty did you encounter in trying to kick off in the salt?

A. The difficulty we have is maintaining deviation and direction and, on some occasions, building angle as we wanted to build it.

Q. Did you go out and seek any outside assistance in any of those instances where you--

A. In every case.

Q. Pardon?

A. In every case.

Q. Now, when Mr. Carroll asked you what ought to be done in this case, you gave a fairly long answer. I just want to ask you about one part of it. You mentioned that the mining people are to mine up to a reasonable distance to these wells. You think they ought to go ahead and drill them and the mining people could mine up to what you said was a reasonable distance. And I wrote that down just like I heard it. But you never did say what that distance was.

A. I think you're correct.

Q. I'm going to ask you now. You looked at that study in the coal industry and you know what kind of distances they have there. You heard Mr. Hutchinson get up here, and some of the other people, and testify that this same distance used in coal ought to be used here, I think it's a 125- or 150-foot pillar.

Do you have a number in mind that you think is a reasonable distance?

A. I think that you would be safe with a 125-foot to 150-foot radius. However, in an abundance of caution, I would say probably somewhere around a 300-foot radius.

Q. Now, you don't own the potash mines, of course, right?

A. I certainly don't.

Q. Would you agree with me that what we're doing here is, we're asking the potash mines to assume a risk that's being brought into the area by the presence of the oil and gas well?

A. I think that's--I'm not sure how to answer that exactly. I don't think that there is a significant added risk to the operations that they presently perform. If we drill the wells, produce them and initially have somewhere in the order of 150- to 300-foot radius pier column, whatever it is, and then, at some point, come back and, maybe after the well's abandoned, come back and remove that material that has been left.

Q. Does it offend your sense of fairness at all, Mr. O'Brien, if one industry is asked to assume the risk created by another one operating in the same area?

A. I don't think it's creating a risk. If there were a significant risk, I think I probably would agree with you. However, as I understand this business, both industries have or should have access to the reserves that are there, and the opposite side of the coin would be equally as bad and you expected these people to drill wells or go off and leave their reserves, because you wouldn't expect them to get within a reasonable distance.

Q. You understand what the potash operators consider a reasonable distance, might very well differ from your definition of what is a reasonable distance?

A. I don't doubt that a bit.

Q. Wouldn't you also agree that just because you think a 150-foot pillar is safe and therefore wouldn't waste potash, that potash will be wasted if the potash operator disagreed with you and won't get that close?

A. I think that they can assure themselves, without risk, that this is a proper and reasonable method of operation.

Q. But my question, Mr. O'Brien, is this. If the potash people disagree with what you think is okay and won't get up to 150 feet of these Delaware wells, that's going to waste potash, isn't it?

A. That's based on their decision and really doesn't have anything to do with the conditions that exist. If they don't want to go out there and dig a mine, certainly it will be wasted.

Q. Do you know of any way that you can make these potash people mine up to what you think is a safe distance instead of what they think is a safe distance?

A. I can't make my wife do anything, much less them.

Q. I, too, share that.

A. You know better than that.

Q. In the plans you came up with, both on this one and at any point, did you consider the use of centralizers?

A. Yes, sir.

Q. Is that in this Exhibit 72?

A. All of them.

Q. But not in the straight well?

A. Yes, sir, centralizers on the casing, yes, sir.

MR. HIGH: I believe I'm through, Mr. Chairman. Let me just take one quick look at my notes here.

Q. Just one minor point, Mr. O'Brien. You answered a question to Mr. Carroll about the WIPP project gets its water out of the Rustler formation?

A. I did.

Q. Do you know that to be a fact?

A. That's the best information I have. It came from the State Engineer's Office, I think is the proper title. If he's wrong, I'm wrong.

Q. Look at Exhibit No. 68.

A. What is that one? Mine are not numbered.

Q. That's the one that has the casing program.

A. Okay.

Q. That doesn't show us anything about centralizers. I'm just curious, where do you see that?

A. It's not in that. That's not on here. That much detail is not present. It doesn't have the floating equipment or that sort of thing, either.

Q. What number is it in up here?

A. In the cost to drill a well.

Q. Just lumped in with a lot of other things?

A. Yeah.

MR. HIGH: That's all we have, Mr. Chairman. Thank you very much.

CHAIRMAN LEMAY: Thank you, Mr. High. Additional questions of the witness?

MR. HIGH: Let me return to Mr. O'Brien the notes he made before.

MR. CARROLL: Mr. Chairman, one housekeeping thing that I forgot before lunch, I need to move admission of our Exhibits 67 through 72. 72 is the sheet of paper.

CHAIRMAN LEMAY: Without objection, Exhibits 68 through 72 will be admitted.

FURTHER EXAMINATION

BY MR. CARROLL:

Q. Mr. O'Brien, in some questioning by Mr.

High, Mr. High was inquiring as to whether or not there had been studies performed out here in the southeastern part of New Mexico in the potash areas dealing with gas leakage outside of the casing and that sort of problem.

Have you, in your experience, encountered any situations out there in Southeastern New Mexico which would even dictate the need to run these kinds of studies?

A. Not in this kind of well.

Q. Now, what we're talking about is leakage of the cementing or casing program, is that correct?

A. That was one of the major topics.

Q. Okay. That's our problem, isn't it?

A. No, our problem is whether we get gas in the potash zone.

Q. All right. And the only way you get gas in the potash zone is through leakage, then? I have the cart ahead of the horse then?

A. That's the only way we could put it there.

Q. The report that you introduced as Exhibit 71 is just such a study, isn't it?

A. Yes.

Q. And what were the conclusions of that study?

A. They concluded that regardless of anything that had happened before, they could cement these wells and abandon them and that they would not leak.

Q. Let's move on to the area that seems to be giving Mr. High some concern, and that's blowouts of wells. Now, we've defined our problem as getting gas into the potash zone. Will blowouts, are they a creation or a cause of that kind of problem?

A. They would not be in this well. The only thing, there would be no blowout until after the 8-5/8 is set because there's nothing there; except I noticed in one well record where they had a nitrogen blowout where they drilled into one of these nitrogen pockets that miners drill into. But that doesn't hurt anything other than your feelings.

You set the 8-5/8, and then, from that point on, it's conceivable that a blowout might occur. Because you have the 8-5/8 set and cemented and because of the strength of the salt itself, the blowout will not produce enough pressure to put gas in through that casing and into the salt. Some of these porous, permeable zones in the Delaware series will take gas before anything in the salt will take it. So, if you had a blowout and gas went anywhere, it would go into one of those other zones and not go into the salt.

Q. If the surface is open, it's going to go there? That's the first place it's going to go?

A. That's correct.

Q. And you get to the other area of concern, and that's what Mr. High was trying to address, I think, when he started talking about killing the well. What do you mean by killing the well?

A. That's to stop the flow. This can occur two or three ways. Primarily, the first way is, if you drill into something and it blows out and you have drill pipe in the hole. The method for killing it is to pump mud down the drill pipe and back up the other side while holding some measure of back pressure on the annulus. You get heavy enough mud in it and you stop the blowout.

Q. Where are you stopping the gas? Are you stopping it--

A. I'm stopping it where it's entering the borehole from the formation where it originates.

Q. Down in the Delaware?

A. Down in the Delaware where it comes from. Now, if the drill pipe were out of the hole, then it would be necessary to, what we call lubricate, that is to put some mud in the casing and let it fall and gradually fill the pipe up that way.

Q. Now, if we've already set our intermediate casing, which you said would be the case before you could conceivably have this blowout, then the only other place for this gas to escape would be into these weaker formations? Is that what you're saying?

A. That's right.

Q. Blowouts are not going to create or cause a problem that we're talking about, or concerned about, and that's putting gas in the potash zone?

A. That is absolutely correct.

Q. When talking about your exhibits, Mr. High was questioning about Exhibits 69 and 70 and these were dealing with the core holes, Mr. High questioned you about whether or not you could compare, and I believe your statement was that there is no comparison between core holes and Delaware wells.

Now, were you trying to compare core holes to Delaware wells, or what was the point you were trying to make?

A. I was not comparing the drilling or the plugging of these wells. The only thing that I was trying to do was that the mining industry relies on the cement that is in these core holes to isolate the mine working area from these aquifers up the hole. We do the same thing with water, oil, gas and that sort of thing. We rely on cement of a very similar nature.

Furthermore, the concern, of course, has to do also with subsidence and the effects of subsidence. If this well or this core hole is in a place where subsidence occurs, then the same thing would happen to the cement in that hole that would happen in an oil well. If there would be flow down from the cement area in this hole, you would be just as likely to have waterflood the mine workings for that reason as--more so than you would ever have from gas.

Q. The issue here, then, are the properties of the sealing mechanism that's performed by this cement?

A. The isolating--the ability to isolate these and maintain its integrity under the conditions that exist.

Q. These core holes actually exist within the mine workings?

A. That's what I'm told.

Q. So you don't explain this away or want to just ignore it by saying that if the water isn't under enough pressure to force itself into the salt, we're not talking about leaking into the salt, we're just talking about leaking into the mine workings?

A. That's correct, with no resistance.

Q. Turning to Mr. High's discussion about this reservoir with respect to this report in Exhibit 71, the coal mine report that you discussed with us, Mr. High indicated that this reservoir that we're talking about in that report was a pressure depleted reservoir?

A. Yes.

Q. Well, when you plug your Delaware well, aren't you also talking about a pressure depleted reservoir?

A. Yes, sir.

Q. Now, Mr. High also made a point that there's no empirical data concerning, I guess, mining through wells or mining within close proximity of the wells in Southeastern New Mexico. It is true that there are mines mining within 150 feet or so of wells, is that not true?

A. I understand that's correct.

Q. Isn't that empirical data?

A. Yes, sir.

Q. By your definition, anyway?

A. Yes, sir.

Q. Another question was directed to you by Mr. High, again talking about the coal mining situation, and he asked you to answer this question. If you're not prepared to deal with methane, wouldn't you be more cautious, and I think he was trying to compare the potash people to the coal miners and you answered "certainly." Is caution here the issue that we're talking about when we look at the experience in these coal mines?

MR. HIGH: I don't know what relevance

this has to do with anything. We all know what the issues are here.

CHAIRMAN LEMAY: Can you be more specific with your question? It sounded pretty general to me, Counselor.

Q. The question that Mr. High asked was a very general question. Do you, in your mind, give it any relevance?

A. Give what relevance? The coal mining experiment? I don't follow.

Q. With respect to the statement that if you're a potash miner and you don't normally deal with methane on a daily basis, you should probably be more cautious. Does that have any relevance to the issues that are concerning this Commission, whether or not we should be more cautious or not?

MR. HIGH: Again, Mr. Chairman, if we asked every witness that, that's for you people to decide, not this witness. We're just wasting time here.

MR. CARROLL: He's an expert and has a right to offer his opinion.

CHAIRMAN LEMAY: He's entitled to give his opinion, like all of us are. He an give his opinion.

A. The question is, of course, whether we get gas into the mine or the potash zone that is to be mined. Certainly if I was mining in proximity to a pillar that had a well in it, I certainly would be careful. And I would have gas sniffers out there all the time right up at the front to make sure that if I did encounter some gas, I would know about it before it got to be a serious problem. In that regard, yes, I certainly would be more careful.

Q. The fact that the miners are more careful has no relevance to whether or not that plugged well is going to leak, does it?

A. No, sir.

Q. The issue again is, is leakage going to occur, and no matter how prepared you are to detect methane gas, that's not going to make that well any less likely or more likely to leak, if plugged properly?

A. That's correct. My interest in this thing, and I think the issue should be the fact that they did have a process for plugging wells that was efficient and effective.

Q. Mr. High asked you a question about the tensile strength of cement, and you said it was something comparable to rock. The tensile strength of cement, does it have any relationship to the concepts that we've been discussing here?

A. No, sir.

Q. Why doesn't it?

A. Because the only place it would come into play at all would be a point in the subsidence area where there was a fracturing of rocks. If it did fracture the cement, the rock would have to be fractured first and it wouldn't make any difference whether the cement fractured or not.

Q. Why is that?

A. Well, you have another fracture already created and if you had cement fractured, it would be a small extension of the fracture that was already created.

Q. Mr. High then asked you the question, will subsidence increase the risk of migration, especially if you don't know where it will go. Now, you made a statement there and you said "I know places it won't go." Could you elaborate on that statement?

A. Well, you should have gas, the only

place you would have it would be above the angle of break and below that point it wouldn't occur. The only way anything could go down would be along that angle of break. When it got to the salt, the salt being plastic, it would be sealed up and wouldn't have a fracture in it, so it wouldn't go past there.

Furthermore, any fracture that occurred would be larger towards the surface, so it would go out through path of least resistance which would be towards the surface, so it would not go down.

Q. One of the places it's not going to go is in the mine--

A. Precisely.

Q. --through the seal, or the potash zone?

A. [Indicated.]

Q. Mr. High questioned you concerning the microannuli and several other phenomena. The issue here is whether or not these things exist or whether or not they will cause gas leakage that will get into the potash zone?

A. The problem is whether the gas will get into the potash zone, and with all of those that we've discussed, and none of them will put gas into the potash zone.

Q. When you got into the area with directional drilling costs, you indicated that you did require a comparison of the cost of the submersible pumps with the beam pumping and found that the beam pumping would been higher. What is that reason?

A. The reason is that the upkeep of the unit due to rod failures and tubing failures would be greater, and the cost of pulling in and replacing both tubing and rods would make up the difference.

Q. Rods have to be changed periodically in any well?

A. Yes.

Q. Do they have to be changed more or less in a deviated hole situation?

A. More.

Q. Why is that?

A. Because they're bent and they fatigue.

Q. That fatigue, that stress that they're put under is what necessitates the removal?

A. Well, they break.

Q. What happens when they break?

A. You have to fish them out.

Q. In the situations that you've encountered when you have these rods under those kind of situations, do you have cases where they will be breaking on you?

A. Certainly.

Q. You have to incorporate fishing costs, down time and those things as an additional cost of operating these wells, don't you?

A. That's right.

Q. Now, Mr. High asked you if you performed a detailed time study before you said that it's going to take longer to drill one of these kinds of wells, and you replied "No." You did look at Mr. Mitchell's report where he predicted it would take 30 days to drill this particular kind of deviated hole where we're deviating 2600 feet?

A. Yes, I looked at it. I only remarked that he had a factor of, like, 1.3, and my experience indicates, for a well like this, the cost comparison would be about one and a half times, and that's--I may drill them a little faster or slower. I can drill a directional well faster if I spend more money per day. Or it takes longer to drill it if I don't spend so much. The time study isn't the ultimate answer. The ultimate answer is the dollar figure that it's going to cost you is $900,000 as compared to $600,000. You can get to that number half a dozen ways. You can pick out what it costs for trucks or for bits, or I can take this well and apply this factor that's an experienced factor and say it will cost about one and a half times, and that's the way I did it.

Q. Mr. Mitchell did use 30 days as his time period on his exhibits?

A. I read it, but I didn't pay that much attention to the number he had as compared to something else.

Q. You reviewed the Bonneville experience which only drilled 700 feet, and you're aware that that took 31 days to drill?

A. I don't remember that but I'll take your word for it.

Q. When we're talking about the necessity of a protective pillar of 150 to 300 feet, that's only in the case of an active, producing well, isn't that true?

A. That is correct.

Q. Once that well is P & A'd, it's your

opinion that you can come in and remove that potash?

A. That's correct.

Q. And it's not lost or wasted?

A. That's correct.

Q. Now, Mr. High questioned you at the very end and you indicated to him that there's no way you could force a mine company to mine potash in an area that they thought was unsafe, is that correct?

A. As far as I know, that's true.

Q. And it's also true that you can't make a potash company mine potash that has a higher royalty on one lease as opposed to another?

A. I can't make them do anything.

Q. In other words, if that potash ore isn't economic, you can't make them mine it, can you?

A. As I say, I can't make them mine anything.

MR. CARROLL: That's all I have.

CHAIRMAN LEMAY: Additional questions of the witness?

MR. HIGH: Yes, sir, I have one. Actually, two.

FURTHER EXAMINATION

BY MR. HIGH.

Q. Mr. O'Brien, you don't have any information other than what you have heard sitting out in the audience during this hearing, that New Mexico Potash has intentionally not mined any lease because of royalties, have you?

A. As I said, I can't make them do anything. I don't know anything about that. That's somebody else's bailiwick.

Q. You're not accusing New Mexico Potash of not mining state leases because of royalties, are you?

A. I'm not accusing them of anything.

Q. The only other thing I want to ask you is, when you said that gas will go to the place of least resistance and you referred to the surface, do you think there's any difference in the atmospheric pressure on the surface and down in the mine?

A. There is a difference in that you have the salt to seal off at the bottom, and it is a little higher down there, not much. It is a little higher because atmospheric pressure increases as you go towards the center of the earth, it's small. But the point that makes it go up is that you have salt, about a thousand feet of salt that is plastic, and it will seal and will not fracture any. It will distort rather than have a fracture in it, so there will be no passage down there.

Q. I'm not trying to argue with you. The point I'm trying to make is to get your testimony about the difference in the atmospheric pressure between the surface and down in the mine.

A. I don't think I testified to that.

Q. I think you testified that there was a difference.

A. There is a difference.

Q. Is that a big difference or a small difference?

A. There is a very small difference.

Q. But it is small?

A. It is small. I don't know how much it is.

CHAIRMAN LEMAY: All right. That's all I have.

CHAIRMAN LEMAY: Thank you, Mr. High. Additional questions of the witness? Commissioner Carlson.

COMMISSIONER CARLSON: Just a couple about Exhibit 72. Could we get those numbers on a piece of paper sometime in the next couple of days?

MR. CARROLL: I can certainly furnish that to you.

MR. HIGH: We can mark his notes.

COMMISSIONER CARLSON: Something that's legible would help.

EXAMINATION

BY COMMISSIONER CARLSON:

Q. I guess that's my question. I can't understand some of those. Your second row in there, TVD, what is that?

A. True vertical depth as opposed to measured depth. As you go out, you have to drill farther to get to the same measured depth.

Q. Your number at the bottom, value of the hole, that's $850,000?

A. That is a number that I got that's approximately the volume of the present worth of one of these wells when it's completed. The reservoir engineer will probably disagree with me, but this is a round number.

Q. How did you arrive at that number?

A. I looked at some of his calculated values and picked that out as kind of an average.

Q. That's the total value of the production, present value?

A. Present value, that's correct, less the cost to drill and operate. It's the net value of the production present value, taking out taxes, operating costs and New Mexico's taxes.

Q. And the incremental cost, that's $610,000?

A. It's the sum of $300,000 and that should be a "1" instead of a "2," it was so late at night, that's still pretty close, it's $310,000, so you add those together and the added cost is $610,000.

Q. You say it's that ratio that determines that?

A. This is your ratio here, the net value of the well. This is the value of the straight hole, we spent that much more to get the directional hole, so this is the net value, the $240,000 is the net value of the hole and you don't spend $900,000 to get $240,000.

COMMISSIONER CARLSON: Okay. I understand. Thank you. That's all I have.

CHAIRMAN LEMAY: Commissioner Weiss?

COMMISSIONER WEISS: I have some preliminary cross-examination.

EXAMINATION

BY COMMISSIONER WEISS:

Q. There have been over a thousand wells drilled down there and no reported incidence of gas behind the pipe?

A. That's correct.

Q. In the drilling business, what are the safety practices there? Do you have safety people?

A. Certainly. The amount of safety effort varies widely. The major oil companies are more concerned with two things than they are with making money, and that is safety and the environment. Yet they get sued for both of them all the time. But I deal with them in both regards, and now there are some companies that you have to watch, and I'm sure that both you and Mr. LeMay are well aware of some of those, but the people they operate for or work for, contractors that they work for, enforce these safety rules. And the industry I think in general, in the time that I've been involved, it's just incomparable, even in the worst of operators, as to the change that has taken place--I am going to say largely over the last 20 years--in the added concern for safety.

COMMISSIONER WEISS: Thank you.

CHAIRMAN LEMAY: A couple quick ones.

EXAMINATION

BY CHAIRMAN LEMAY:

Q. You mentioned, Mr. O'Brien, you mentioned centralizers. How about scratchers, do you use those anymore?

A. Sometimes.

Q. Would you use them in a Delaware well through the potash zone?

A. Probably not. The potash zone is drilled with water and we don't have anything to scratch. We do put centralizers, but we have found that with centralizers, and moving the pipe, either rotating it or moving it vertically, we have about the same cementing efficiency.

As a matter of fact, over a large number of tests, several hundred wells, we didn't have a failure when we did that, and we used a large volume of cement. This is in high pressure wells, low pressure wells, what have you. These are, I think, industry-wide, very standard procedures.

Q. How about rough coating the casing?

A. There are a few people that do that. I do not. In the cases where I think I need to protect a very short interval, I'll sandblast and spray with acid to make it rusty. Our experience is that rust is just about as good as rough coating.

Q. Does that mean that if you didn't rough-coat, you would try to get it rusty anyways, to get a better bond?

A. It's a lot cheaper.

Q. You mentioned the sonic bond log. Do they have something out better now than that?

A. There is a new one, and I can't recall the name of it offhand, that it is better, but it has some shortcomings also. The technology in these things and the theory in them is excellent. There's just a whole lot of things where we feel it's in our ability to interpret what they tell us.

Q. Your testimony, I'm assuming, concerned vertical holes, that if you had a deviated hole, a lot of what you were testifying to as to maybe the integrity of the cement job wouldn't apply or would it? How would a deviated hole differ from a straight hole, as far as cement jobs?

A. If you get the angle high enough, it's very difficult to get a full coverage of cement. There tends to be an isolation or segregation between the lighter fluid at the top of the hole and the heavier fluid at the bottom. This starts to happen somewhere over 50 degrees, maybe 45 sometimes, but the solution to it, when you're at a 45-degree angle, is just to use more cement.

Q. Would you say an angle of 24 degrees would carry the same integrity on a cement job as a straight hole would?

A. You might have to run a few more centralizers, but otherwise it would have the same integrity.

CHAIRMAN LEMAY: That's the only questions I have. Additional questions of Mr. O'Brien?

MR. HIGH: If I may, Mr. LeMay. I have just a few.

EXAMINATION

BY MR. HIGH:

Q. Mr. O'Brien, on the thousand or so

wells that are in the mined potash areas, how many of those wells have been tested by any operator you know of, any potash operator, member of the Commission or Oil Conservation Division or anybody in this world to see whether or not they have gas outside the casing?

A. Gas outside the casing is really not the problem, but to answer your question, I know of at least one.

Q. Who is that?

A. I don't know the name of the well, but I know Mr. Muncy plugged it. So he can tell it if you want to know the name of it.

Q. Other than that one, do you know of anyone that has gone out and done any tests to see whether or not any of these wells in the known potash area already have gas outside the casing?

A. I know they don't have enough out there to bother anybody.

Q. You don't know that because you haven't tested them, do you?

A. I know that they haven't bothered anybody.

Q. If people don't know about it, it

doesn't bother them, does it?

A. If it's significant, it doggone sure would.

Q. Are you assuming it's not there because you haven't tested to see if it's there?

A. No, I'm assuming it's not there because it never has bothered anybody.

Q. Okay. That's what I want to know. Do you know of any data that we can put our hands on, anywhere, that will show that somebody had the foresight to go out, before they put underground miners at risk, to check these wells and see if any of them had let gas out of the casing?

A. I don't know whether anybody ever did that but I do know that I do have data that indicates that it's not a problem. And if it's not a problem, we can go do an awful lot of testing for a lot of things that are inconsequential, but both you and I have better things to do.

Q. Is it your approach to safety, Mr. O'Brien, that you don't address the issue until you blow somebody out?

A. No.

Q. No one has been injured so far--
A. And there has been no indication if there was gas there, whether it would injure anybody or not.
Q. You've been in this area for a long time, 40-something years, right?
A. I haven't spent all of it here, but I've been around the oil field for that long.
Q. You realize, I assume, that the standard spacing between oil and gas wells and potash mining, at least since way back in the 60s and probably before that, has been a half-mile for gas wells and a quarter-mile for oil wells, is that correct?
A. Which is an arbitrary number.
MR. CARROLL: I object that that's standard spacing. I don't think that--
MR. HIGH: What word do you want me to use?
MR. CARROLL: Well, use what it is. Since 1986 you've had a buffer zone.
MR. HIGH: No, that's not what I'm asking.
A. You do have an arbitrary number which is based on nothing.

Q. You are aware that the BLM, whether it's based on nothing or not, the BLM has included, in each order it's issued since the 1960s, a prohibition against oil--gas wells within one-half mile of a potash enclave and one-quarter mile for oil wells. You're aware of that, aren't you?

A. No, but saying the BLM put it in their rulings doesn't make it any better in my view.

Q. Do you think maybe that the spacing distance of a quarter mile and a half-mile has something to do with the fact that we haven't killed anybody with methane gas?

A. If you didn't drill a well in the State of New Mexico, it would have about the same effect.

Q. My question is, do you think that spacing--

A. No, sir.

Q. --has nothing to do with the fact that no one has been killed?

A. No, sir.

Q. It's your approach to safety and to that long history of nothing happening, that it's okay to get closer and closer and closer, as long as you don't have evidence that something bad has happened?

A. No, sir, that's not my view.

Q. Your testimony was that nothing has happened?

A. There have been no indications that there is any leakage of gas from any of these wells.

Q. And, based upon that, you think you can get closer and closer, I guess, until the point that something is--

A. Let me give you another point. It's my understanding from some of the mining people and some of the people connected with the mines, that the methods that the miners use, and apparently it's quite effective to locate these gas pockets, that have killed people here, the way they do it, and apparently it's effective, is to drill a hole, a pilot hole or whatever they call it, 20 or 30 feet into the salt and, if they don't have anything, then it's good enough to go mine up to it.

Q. Okay.

A. Wait a minute. Let me finish. The pressure in there will be the same as the stress on the salt, so the pressure in there will be 2,000 pounds or more. So, based on that, if it's safe for them to do that, then it would likewise be safe to approach an oil well that had 2,000 pounds on it, within 20 feet, and drill your core hole up there or your pilot hole and find out whether there's any gas there, not pick some arbitrary number that has no sense at all except for a number that somebody came up with.

There's no science that went into a quarter a mile or half a mile or across in the next county. One of them would be as logical as the other. If you want to do something, then in your mining you drill these pilot holes and drill up to a well and find out whether there's anything there. And that will tell you whether there's any gas there or--

Q. And if you--

A. --even a potential hazard.

Q. Mr. O'Brien, you have answered my question in spades.

A. I think I have.

Q. If you drill up in there and see if there's methane and if there is, you are aware that it might explode, right?

A. No, sir, I am aware that there is methane, and just because there's methane there has no meaning at all that it might explode. There's a very narrow range of mixture, ratio of methane and oxygen that will explode and you have to get that--you can get a substantial amount of methane in one of these core holes or pilot holes with it creating no hazard whatsoever to anybody.

Q. That's the way you would approach safety of these miners we have working for us in this underground mine?

A. That's the way they do it.

Q. That's the way you would approach it?

A. And that's the way they do it; me and them, both.

MR. HIGH: That's all I have.

CHAIRMAN LEMAY: I have one follow-up on that.

FURTHER EXAMINATION

BY CHAIRMAN LEMAY:

Q. If you're talking about drilling pilot wells around a Delaware well, you're--

A. No, no, I'm not digging pilot holes, pilot wells. What I'm doing, in the mine, when they're mining, they drill a pilot hole ahead of the mining operation, in the mine, not vertical holes out here. They are holes in the mine to determine whether there are any of these pockets of high pressure gas. Obviously, if they run into one, it bleeds out of the hole before it blows the salt out on them.

Q. Well maybe I--

A. And I think that's a fine thing to do.

Q. I think I'm on another wavelength here, but if you were going to find out if there's gas escaping out of the zone, you could do the same thing with a pilot well drilled into the salt section around a producing Delaware well and measure it, and then how close and how many wells that you need?

A. That's a good question, one that I don't really have a good answer to, but I think it would be prohibitive. But to satisfy these folks, considering they were going to be a quarter of a mile away, they would want to drill those holes pretty close together.

Q. So have you thought about that? Have you thought about a way to do that?

A. You would just drill ahead. If there's methane there, and we're looking at finding methane in the order of parts per million, and if there is methane there, you will find it long before you get close enough to it to create any kind of hazard.

Q. Once you're in the well, what I'm trying to address if there's a way to verify the safety issue, that seems to be a highly debatable issue, would it be prudent to drill a number of pilot wells around a producing Delaware well to see if there was methane escaping, and then--

A. You could probably do it around one.

Q. Around one?

A. And if you did that, we would have to have everybody's agreement that they would accept what they found, and I can't imagine everybody agreeing to it.

CHAIRMAN LEMAY: I can't, either, but thank you for your answer. Mr. High?

MR. HIGH: Two follow-up questions.

FURTHER EXAMINATION

BY MR. HIGH:

Q. Mr. O'Brien, do you understand or do you know the type of gas that the mine is looking for when they drill the holes in the advancing face?

A. They're looking for nitrogen, basically air.

Q. Okay. They're looking for nitrogen?

A. That's right. Really what they're looking for is any gas under pressure. It happens that that gas, generally speaking, is nitrogen.

Q. You understand also that if the same approach were used here and the mine drilled these holes looking for this methane and found it, you understand at that very instant it's too late for the mine?

A. It is not.

Q. Do you know what happens to a mine that's classified gassy?

A. It doesn't have to be classified gassy.

MR. HIGH: Thank you. That's all I have.

A. If you have to, you could plug the hole back up. You plug the rest of these things. No, it's not.

CHAIRMAN LEMAY: Okay. I think you've had a long morning. I appreciate your testimony. Unless there's additional questions, I'll excuse you. Let's take a 10-minute break, and I assume we're on the other side now?

MR. CARROLL: Yes, sir.

CHAIRMAN LEMAY: All right. After the break it's your show, Charlie.

[A recess was taken.]

CHAIRMAN LEMAY: Okay, Mr. High, we're ready to continue.

MR. HIGH: Well call Mr. Tony Herrell. Mr. Herrell has not been sworn.

TONY J. HERRELL

Having been first duly sworn upon his oath, was examined and testified as follows:

EXAMINATION

BY MR. HIGH:

Q. Would you state your full name, please.

A. Tony J. Herrell.

Q. Where are you employed, Mr. Herrell?

A. Bureau of Land Management, Carlsbad Resource Area.

Q. Mr. Herrell, did you receive a subpoena I served on you in connection with this case?

A. Yes, I did.

Q. Did that subpoena ask you to bring some documents with you today?

A. Yes, it did.

Q. Did you bring some documents today?

A. Yes.

Q. I understand that you also have counsel present here today?

A. Yes.

Q. What is her name?

A. Margaret Brown.

Q. Are you under any limits with respect to the testimony that you're authorized to offer in this case?

A. Yes, I am.

Q. Who was it that put limits on what we can ask you?

A. My supervisor.

Q. Do you have that in writing?

A. Yes, I do.

MR. HIGH: May I approach the witness?

CHAIRMAN LEMAY: Certainly.

MR. HIGH: Mr. LeMay, I would like to have marked, perhaps as a Commission exhibit, if you prefer I can put it as one of mine, a letter Mr. Herrell has limiting the things he can testify to for purpose of the record.

CHAIRMAN LEMAY: Do you have a copy for us?

MR. HIGH: No, sir I don't. I just have what he brought.

CHAIRMAN LEMAY: Why don't you just read it into the record. That might be helpful.

Q. Mr. Herrell, the letter that you have is signed by Richard L. Manus, the area manager?

A. That's correct.

Q. I'll read that letter into the record, quote, To Whom it May Concern: This letter is in response to a subpoena for testimony from Tony J. Herrell by Mr. Charles High of Kemp, Smith, Duncan & Hammond, P.C. Mr. Herrell will be allowed to present testimony on the following issues:

"1. The grade of potash ore being mined in the basin.

"2. The standards used by the Bureau of Land Management to determine if an area contains commercial grade potash.

"3. If commercial grade ore exists in Section 2 of Township 22 South, Range 31 East.

"Mr. Herrell will only be allowed to testify as to matters of fact and not discuss departmental policy, regulations, or orders. Additionally Mr. Herrell will not be allowed to reveal any proprietary information."

Signed, "Sincerely, Richard L. Manus, Area Manager," and it's dated October 20, 1992.

CHAIRMAN LEMAY: Thank you very much.

MR. CARROLL: Mr. LeMay, at this time, then, I am going to object to placing any testimony of record with this witness because, as I see it, these questions are very loaded questions. They're loaded towards the potash industry and it looks like I'm going to be foreclosed any kind of effective cross-examination.

I think that, one, let's deal with Question 3, if commercial grade ore exists in Section 2, Township 22, Range 31. He works for the BLM, this land does not belong to the BLM, and I think that's proper testimony that should come from his client, not from somebody that I can't effectively cross-examine.

Number 2 says, standards used by the Bureau of Land Management to determine if an area contains commercial grade potash. Again, the New Mexico Potash people can testify to that. The

BLM does not tell the OCD what's commercial grade potash. The BLM does not operate under the statutes that the BLM has. In fact, I'm not even aware of a statute that's even comparable to the New Mexico state statutes.

And then the grade of potash ore mined in the Basin, we don't care about what--this question is a restricted issue as to the New Mexico Potash Corporation and its possibility of mining economic grade ore in Section 2. All that's relevant is what New Mexico Potash is mining.

Therefore, all three of these issues are totally irrelevant to the issues before the Commission at this time, and the restrictions that are being placed on this witness make it totally impossible and unfair, if nothing else, for this witness to be allowed to testify.

And, quite frankly, it looks to me like these three areas were drawn up by the potash company, not the BLM counsel.

CHAIRMAN LEMAY: Let me have a copy of that. Is that the only copy you have?

MR. HIGH: I would like to respond to what Mr. Carroll said, in fact his accusation. I represent to you and this entire Commission, I had absolutely nothing to do with those restrictions; in fact, I fought against them. Margaret Brown, the lawyer from the Department of the Interior is here. She will tell you, I don't want any restrictions on this witness. They weren't even going to let him appear.

So I had nothing to do with it and I resent counsel's suggestion that I did.

CHAIRMAN LEMAY: This is why we have our own counsel. Do you have something to say? Go ahead, Commissioner.

COMMISSIONER CARLSON: What is the purpose of this testimony? Why did you subpoena this witness?

MR. HIGH: I subpoenaed this witness, Mr. Carlson, because the Bureau of Land Management has a wealth of data. You've heard Mr. Hutchinson and a lot of people testify that it's not commercial grade ore in Section 2. They can't mine it. You won't waste it because there's no potash down there.

I want this Commission to see what the Bureau of Land Management says is down there. I'll tell you quite frankly, I don't know what they're going to say. I want to know what the BLM says. They have records on all the potash deposits down there. They have all the records from what's mined and what's not. They know what each mine can mine and what it can't.

COMMISSIONER CARLSON: But that's proprietary, which he can't disclose anyway.

MR. HIGH: That's correct, but he can tell us what the average grade of ore is that is mined in the potash basin. You know already what the grade is in Section 2. The core hole showed it's 16 percent.

Now, Hutchinson has said that nobody can mine it. I want to know what this man has to say about it. Let them tell us what their records show as far as the commercial nature of the potash in Section 2. They may get up here and say, "There's not ore down there" or they may say, "There is ore down there."

I have a pretty good idea, because I know what data they have, and so does Mr. Carroll. He knows what they're going to say and he doesn't want to hear what they're going to say. But let's hear what the federal government is going to say. They control 90 percent of the potash down there and the State only 10 percent.

Let's hear what their records show. I want nothing but facts. I don't need Mr. Herrell's opinions or anything else. All I want to know is, what does the government have. What Mr. Carroll wants to do is disagree with the standards used by the BLM. I don't care what standards they follow. I don't agree with some of them. I want to know what facts do the BLM have that reflect on issues you people have to decide. That's all.

MR. CARROLL: Commissioner Carlson, if I might address that question, Mr. High is trying to elevate the BLM to a position they don't own. That's for an expert in the field of mining. The BLM is not in the business to mine. They only regulate land.

Mr. Herrell is not a miner, he's a geologist. If we're trying to get in mining testimony, there's only one source that's relevant and that comes from New Mexico Potash and not the BLM.

Then, when you put it in this-- I don't know what Mr. Herrell is going to testify, but I do know that you're already binding my hands, handcuffing me, if you will, with respect to cross-examination. You're telling me up front that I can't get into what he knows or why he's making certain statements.

You have to remember, each one of those things are opinions. Is there commercial ore in Section 2? That is an opinion, sir. There has never been any mining in Section 2. Section 2 isn't even owned by the BLM, and yet this man is going to testify as to whether or not there's commercial ore. He's going to render an expert opinion, a nonminer rendering an opinion which I can't get into the basis, because, we have to assume, since they're not mining, the only basis of their information always goes back to proprietary information which is gained from the potash mines which are doing the mining.

Therefore, every time I ask a question I'm prevented from going into it. That's the onus of this thing. It's totally unfair and improper. I'm not trying to deny Mr. High developing testimony about whether there's commercial ore or not. His client is the best source of that. Whether or not it's minable, his client is the best source of that. And they should be allowed, they should be forced, what I can see is that he puts on Mr. Herrell, he gets the answers he wants. I don't get to question. There's no need to even put on his witnesses. That's the unfairness. I can't question the basis of what he's making opinions as an expert on and he's talking about issues that are critical here and that I have got to be able to look at, determine the basis for and question, or I can't perform my job.

MR. HIGH: Let me make a statement. There's a long history of cooperation, Mr. Chairman, between the State Land Office, the OCD, the OCC and the BLM. In fact, if anyone else in this audience wants to stand up and offer testimony, the Commission has always taken it.

MR. RAND CARROLL: Mr. High, do you have a copy of the subpoena you issued to the BLM?

MR. HIGH: I think I probably do. It's on file here with the Commission. It's part of the file. I don't know if I can put my hands on it right away or not.

COMMISSIONER WEISS: Is it in your exhibit book here?

MR. HIGH: I don't believe it is, Mr. Weiss.

MR. RAND CARROLL: Do you recall what you asked for in your subpoena?

MR. HIGH: I asked for a whole lot more than what he brought. Here it is.

MR. RAND CARROLL: Thank you.

CHAIRMAN LEMAY: We're going to take a couple of minutes here and discuss it among ourselves.

[Discussion off the record.]

CHAIRMAN LEMAY: Under the circumstances, this is what the Commission will allow. It will allow the testimony taken in form of information only. We won't qualify you as an expert, Mr. Herrell, which means that what you're giving to us is presenting something like we have accepted in the past, in statement form.

Because you're limited on what you can say on cross-examination, we have to downgrade your effectiveness as an expert. You understand that, I hope. And therefore your testimony will be accepted into the record for what it is, which is informational to us only, and you're not qualified as an expert. You may continue under those stipulations, Mr. High.

MR. HIGH: That's fine, Mr. Chairman. Thank you very much.

Q. (BY MR. HIGH) How long have you been with the BLM, Mr. Herrell?

A. A little over five years.

Q. Do you have the records that you were willing to produce for me in response to my subpoena to you?

A. Yes, I do.

Q. Do you have the documents in front of you? Let me ask you, Mr. Herrell, what documents have you brought in response to my Subpoena Duces Tecum?

A. Basically we brought the average grade of all the sylvite producers in the Basin. We didn't include langbeinite in it. I brought it for fiscal years 91 through 87. The information just comes from the monthly reports that are submitted to us every month. We just averaged them out and totaled them up.

Q. What is the average grade of sylvite that has been mined in the Basin as shown on whatever the information is that you brought here today?

A. The last fiscal year I tabulated on, we won't do fiscal year 92 for a while, but fiscal year 1991 was 13.7 percent average grade in the Basin.

Q. Does the document you have have the average grade for years other than 91?

A. Yes. It goes fiscal years 1991 back to fiscal year 1987. A fiscal year is October through September.

Q. And what were the grades for each year, please?

A. Starting in 1987, the grades were 16.36 percent; 1988, 15.99 percent; 1989, 15.02 percent; 1990, 14.4 and 1991, 13.74.

Q. What does it mean or what do your records consist of, Mr. Herrell, in terms of the average grade of sylvite? What does that mean?

A. The average grade is just the total of all the panels throughout the Basin from each of the mines. We just take the number of tons times the grade for all the panels that come out from the mines to come up with these statistics. We have these statistics going back to the 40s.

Q. So if the average grade mined in the Basin in 1991 was 13.7 percent, would your records show that some mines were mining ore at less than 13.7 percent?

A. Yes, there are some mined below 13.7 and some mined above 13.7. It just averages out at 13.7.

Q. The other document, and am I correct you brought two documents here today in response to my subpoena?

A. That's correct.

Q. What is the second document?

A. The second document is a small portion of a map that we have for that area in Section 2, and it just has the core hole K-162 posted on it and basically, as he said earlier, you have that information.

Q. What do the BLM records show with respect to whether or not there is or is not commercial grade potash in Section 2?

A. We think that most of Section 2 would probably meet the commercial grade ore criteria, which we would call measured ore.

Q. Do you know what information that's based upon?

A. It's based on the core hole data, minimum quality and thickness of four feet of ten-percent sylvite, four feet of four-percent langbeinite.

Q. Will this map eventually be published by the BLM?

A. Yes. It will probably come out January, February, sometime around there. We've been working on it for a while, but we're having a few computer problems with it.

Q. Do your records show what grade of potash is in Section 2?

A. Yes.

Q. Do you know what the grade is in Section 2?

A. We have 5.1 feet of 16 percent sylvite in the 10th ore zone only. I've only done the 10th ore zone here, and 4.8 feet of 5.8 percent langbeinite.

Q. Do you know how many tons of ore have been mined less than 10 percent, let's say, or 11 percent?

A. Below 11 percent, among just the sylvite producers--because I didn't do langbeinite or mixed ore, which mixed ore is a different thing altogether--but just among the sylvite producers, it roughly calculates out to

2.5 million below 11 percent, and 1.2 million below 10 percent that was mined during the last fiscal year.

COMMISSIONER CARLSON: Could you repeat those, please?

THE WITNESS: 2.5 million tons mined below 11 percent K_2O sylvite. And 1.2 million tons mined below 10 percent K_2O sylvite.

MR. HIGH: Mr. Chairman, I would like marked as an exhibit and I don't have copies, but I would like the subpoena that I served on Mr. Herrell along with the two documents he brought today, all marked as one exhibit and we can letter them A, B and C, and I would like those marked as Exhibit No. 34. May I see those two documents, please?

A. Yes. On the map, that's an unchecked version. I did not have time to go ahead and do any editorial on it.

Q. Let me ask you a couple of questions about the map. These blue lines on it--

A. The blue lines are the 10th ore zones.

Q. What is between the blue lines?

A. Other ore zones.

Q. So if we were looking at--

A. Which are labeled here for the most part.

Q. But the map you brought with you here, if we were looking on this document to see whether there is or is not commercial grade ore, we would look between the blue lines?

A. Yes. And this map here is pretty much only accurate for the 10th, because I have not updated the 4th ore zone on it yet.

Q. You understand that New Mexico Potash mines in the 10th ore shown?

A. That's the only reason why I did the 10th, because that's the only one they do mine.

MR. HIGH: I would like these marked as Exhibits 34(a), (b) and (c), with (a) being the Subpoena Duces Tecum. And, Mr. Chairman I would offer them at this time.

CHAIRMAN LEMAY: Without objection, 34(a), (b) and (c) will be admitted into the record.

MR. CARROLL: I would ask that the record reflect that the exhibits are coming in under the same stipulation as the testimony.

CHAIRMAN LEMAY: Yes, the exhibits come in under the same general stipulation.

MR. RAND CARROLL: Mr. High, the letter from the BLM, will that be an exhibit?

MR. HIGH: Yes. In fact, we can make that Exhibit 34(d). That would be fine with me. Thank you. I forgot about that.

Q. (BY MR. HIGH) According to the information then that you have, Mr. Herrell, Section 2 would be what some of us know as blue on the BLM map?

A. Yes.

MR. HIGH: We pass the witness, Mr. Chairman.

MR. CARROLL: May I review the exhibits?

CHAIRMAN LEMAY: You want to look at them?

MR. CARROLL: Yes, sir, I really do.

MR. HIGH: Could I ask that I get those exhibits back and make copies and bring them back to you tommorrow so that we all have copies?

CHAIRMAN LEMAY: Are you going to refer to them in later testimony?

MR. HIGH: I'm not.

MR. CARROLL: Could I have just a few minutes, please? I apologize.

CHAIRMAN LEMAY: Mr. Carroll, you may continue.

MR. CARROLL: Thank you. May I approach the witness so I can have some explanation from the witness?

CHAIRMAN LEMAY: Certainly.

EXAMINATION

BY MR. CARROLL:

Q. Mr. Herrell, I'm showing you the map that you prepared and brought with you today. And the map that Mr. High was referring to having blue lines. Now, I'm a little unclear here. There are solid blue lines that I see. What is the purpose of the solid blue lines?

A. This is just a working map. This isn't really our area. We're in the process of updating this map and it's not finalized yet. It's kind of showing a little bit of old and a little bit of new.

I outlined the solid blue line to outline the 10th ore zone. That's the only reason it's solid. The dashed lines through here are just a question based that it could possibly trend up through there. We show it ending, but it could possibly trend up through there because it is such a thin zone. These blue lines were extended up just based on straight, linear projections between core holes.

Q. All right, so you have shown this solid blue line that begins up in the northern part of Section 2 and it goes into Section 35 and around in 34 and then back down in Section 3. You're telling me that you have extended that line, this blue line, on the basis of the data of core hole K-162 and FC-65, is that correct?

A. That's correct.

Q. Did you just draw a line in between the two?

A. Well, yeah, you see the line there? I just did a linear projection which is just the weight times grade of one hole times the weight, times grade, which this core hole here doesn't meet the criteria in the 10th but it still had some ore in the 10th, so we went ahead and we did a projection to it. And then you just divide by the total distance and that gives you the gradiant change toward that direction, and you'll get your 10-percent cutoff grade right there.

Q. I see. Now, you also show a core hole over here in Section 35 which is ERDA-6, is that correct?

A. Yes.

Q. And the distance from K-162 to ERDA-6, as opposed to the distance of K-162 to FC-65, is it greater or less?

A. It's less.

Q. So ERDA-6 is actually closer to K-162?

A. That's correct.

Q. And ERDA-6, you are aware that it shows, as far as the 10th ore zone, it's barren, is that correct?

A. That's correct.

Q. Now, this area you have marked up here in Section 34 and 35 that has the dashed blue lines, are you saying the dark blue line up in the northeastern part of Section 34, that is at least grade that the BLM considers as being measured ore?

A. That's correct.

Q. And you will not connect that deposit of ore with that that's coming out of Section 2. Is that because of the distance between this core hole 162 and the one I can't read--looks like an FC-something, is too great?

A. That's correct. And, too, our linear

projections didn't reach out far enough. You'll notice that I did a linear projection to ERDA-6 at that little point right there.

Q. In fact, it's quite possible that the projection of measured ore, according to BLM terms, does not even exist out of Section 2 like you've drawn it here, it could be even closer to 162 because you have no control of that?

A. The linear projection is just a basic fundamental method. You know, anyone's projections is just a best guess.

Q. The projections that you're using, is there a criteria that you're using?

A. It's just a standard form in the Handbook of Mining Engineers.

Q. Is that just a linear projection between two points?

A. Just a linear projection between two points.

Q. The way this line is drawn, then, did you just copy this off of another map that the BLM has prepared, or did you prepare this especially for today's hearing?

A. No, this is actually part of a bigger map. We were having to update our map that we publish based on the new core hole data and this is part of that work here. It hasn't been reviewed yet because we haven't finished the map yet, but that's what our indications at this moment are.

Q. Had you already drawn this line prior to your getting the subpoena, or was this something that you had to work up for the purposes of the subpoena?

A. No. The only thing that I did on this map for purposes of the subpoena was just draw this little blue line, which I just traced over one existing line, but this map we've had for years and years and years. And when we got the core hole data months back, we started updating this map.

Q. Did you update this and change it back at the time you received core hole data 162?

A. Not immediately after, because of workload, but sometime back we did because we had other APDs in the area that we had to come up with, because federal sections surround it, so we had to come up with our rationale for it.

Q. When you testified for Mr. High as to the grade of ore in Section 2, that's really the grade of ore in core hole 162; is that correct?

A. That's correct.

Q. Now, when you talk about mining this averaging that you're doing, are you taking samples that--when you say that this is an averaging process, the sampling, is that coming off of the faces that are being mined or is this a sampling that is done at the time the ore is being milled?

A. It's a little bit of both. We take it off the monthly reports that come in to us. They take it off of a belt sample that comes from the mining panel, and the belt sample is actually corrected to the average grade going into the mill. Most mines have an automatic sampler going into the mill that makes a sample every 30 minutes.

Q. When you say this data is corrected, because I'm not--I haven't seen this procedure, could you explain what's going on? How is it being corrected?

A. That's all before the mine reports get to us. My stuff, I just took it straight from the mine reports but they do have a way to allocate the product back to the lease. And that's how it's corrected, it's corrected for royalty purposes. It's a very detailed explanation.

Q. So the BLM performs no independent sampling of its own or monitoring of what the companies are reporting to it?

A. No, that's not correct.

Q. All right. Are you telling me that the BLM does do its own monitoring?

A. Yes, we do.

Q. Does the BLM then compare what its monitoring reports reflect to the reports that the potash companies are giving?

A. We do inspections of the mines and we go into the different panels and we take measurements of what's being mined and get a good feel for the grade and that type of thing.

Q. Do you do that with respect to State of New Mexico potash, or is it just to the BLM leasehold acreage?

A. We inspect on state acreage, too, because that affects federal acreage.

Q. When you say there were some 2.5 million tons mined that were less than 11 percent, did this all come from one mine or from all the mines?

A. Just an average of the sylvite mines, and it was more than one mine. It was a few different mines.

Q. One or two?

A. It was three.

Q. Three mines?

A. Yes.

Q. Three of what?

A. Three of four.

Q. Three of four?

A. Sylvite mines, yes.

Q. Would that be the same number for the 1.2 million tons of 10 percent figure that you gave?

A. Yes, it's the same for both figures.

Q. With respect to the ore that's being mined, what's the highest grade of ore that's being mined?

A. I would have to go back and look at individual company reports, but there's quite a bit that's higher and there's some that's lower, but I don't have a specific number for it.

Q. It's this higher grade ore that brings the average up to whatever the average that

you've arrived at on this exhibit?
    A.   That's correct. It's an average of all the ore.
    Q.   Now, what you're talking about, I guess it's the criteria that the BLM uses, the term "measured ore" and the four feet of 10 percent sylvite, that's the criteria that we've had for the BLM 1984 map as an exhibit and what have you. But that's what we're talking about?
    A.   Yes.
    Q.   Now, back on that 1984, a goodly portion of Section 2 was shown as barren, wasn't it, Mr. Herrell?
    A.   That's correct.
    Q.   And the only new information between then and now is just this one core hole 162, is that correct?
    A.   That's correct.
    Q.   How many total million tons of ore have been mined or were mined last year in fiscal year 1991 that you report?
    A.   I believe around 15 million tons. That includes langbeinite ore, too. That's not sylvite, that's langbeinite. I didn't put any of those into my figures. I just left it with

sylvite ore.
Q. The langbeinite is a significantly smaller amount of ore being mined, is it not?
A. I would have to look at my records. I'm not so sure that's true.
Q. Now, Mr. Herrell, the BLM does not operate a potash mine, does it?
A. No, it does not. In fact, it's not in the mining business.
Q. It's a royalty owner?
A. It goes beyond that. It's the land manager.
Q. It manages the land from which it draws a royalty?
A. That's correct.
Q. Now, I'm not sure, and correct me, in your questioning with Mr. High, did you use the term commercial grade of ore existing in Section 2? Did you use the term "commercial grade"?
A. I believe I used the term "measured." He may have used commercial.
Q. Your testimony, then, with respect to what kinds of ore out here are based upon the BLM standards that are set and have been used to create the 1984 map and, I take it, the new map

which you're telling us is in process?

A. Yes.

Q. And those criteria, your information, they were not used or there was not data or input data of a commercial or an economic nature, were there, to arrive at those?

A. Yes, there was.

Q. Market studies, those kinds of economic data, or what?

A. No, just based on what we currently observed in the Basin being mined, what we've observed for years, and on the individual company's profits and losses. It's just that simple. We didn't get into detailed economic studies.

Q. So basically what you're saying, if it's being mined, you draw the conclusion that it's commercial.

A. Not quite. In our royalty determinations, we actually check into income tax records and make sure that people are mining, and that's kind of getting beyond the scope of this, but as a defense of measured ore.

Q. The fact is that measured ore, though, the four feet of 10 percent was actually a leasing standard that was established when the BLM went out and decided that the KPLA would be leased for potash, is that correct?

A. That's correct, but leasing standard is also based on an economic mining standard. It has to be at least feasible.

Q. But you did not--the BLM has not performed any detailed studies as to that, have they, Mr. Herrell?

A. No. We just look at profits and loss, what's being mined. We don't think there's any better way to determine what's profitable, except to have an existing mine.

Q. And that's about as far as you go in your evaluation, isn't it, Mr. Herrell?

A. That's correct.

Q. If a mine, on its income tax is reporting profit, then you say everything it's mining is profitable, is that correct?

A. I'm not sure I understand the question.

Q. What you're saying, then, is that you look at the income tax return and if a mine today is mining this ore and is showing a profit, then you draw the conclusion that that's commercial, is that correct?

A. Basically, that's how we defend the standard. Of course, the standard was set up a long time ago and was a little bit more detailed than that, but that's why we think it's still a valid standard.

Q. You don't go in and conduct any analysis as to what new capital costs, if they had to be incurred to open up a new mining area, what that cost would be or how they would affect the profit-and-loss picture of these mines, do you?

A. No. I just read the different consultants' reports.

Q. And if it took a capital outlay to mine some ore somewhere else other than at the face of a mine, you can't make any kind of projection right now based on the information that you see, can you?

A. No. We don't really try to get into that.

Q. Now, the mapping that the BLM does, which is the big colored map and the depiction of what's called measured ore, that mapping is done on the basis of a certain criteria, is that correct?

A. That's correct.

Q. What is that criteria or how do you determine where you draw the blue lines? I guess you may be on the same wavelength.

A. The basic criteria is what we mentioned earlier, the four feet of 10 and four feet of four and the core hole density criteria. And then to get the distance that you draw your lines and project it from a hole is just done by geologic methods, such as linear projections. Or if you don't have another core hole to project to, you just use a half a mile.

Q. Now how, to give credence to a body of ore, how much core holes do you require and within what distance?

A. We require three core holes in any one ore zone no more than a mile and a half apart between any of the core holes.

Q. Now, Mr. Herrell, you are aware that the mines themselves actually drill more core holes in a closer proximity to each other when they have been or have utilized a closer density of drilling core holes closer than that historically when they've mined out here or explored for potash?

A. That's correct, yes. We're very aware of that.

Q. Really, the criteria you're using, the three core holes within a mile and a half, is not the same criteria you've seen evidenced as being used by the potash companies?

MR. HIGH: Excuse me. I'm going to object to the broad characterization of "potash company." I don't know that we've had any evidence about what the other people or mines other than New Mexico Potash have used.

MR. CARROLL: This whole testimony is generally to the Basin.

CHAIRMAN LEMAY: That would be good for another witness. If he's informational only, you're asking him to get into what other potash companies use.

MR. CARROLL: I'm just asking what he observed, and again that's all--

CHAIRMAN LEMAY: He can answer as an observation, I'm sure.

MR. CARROLL: And that's all I'm asking.

A. As an observation, commonly potash companies will drill a number of core holes and establish the ore. But before they mine it, they may start advancing out to an area, but they may drill more core holes for mining purposes, other than just what they establish ore with. That's pretty much what happened with New Mexico Potash this year, and there have been other companies in the Basin that have drilled core holes this year, too, that were not in conflict with, but it's a common thing that happens.

Q. Before the money is spent in mining, they get better or they get more--I say better, better information, then, of a closer nature, so that they can predict whether or not there's enough ore out there to be economic to advance the face in that direction?

A. I agree with part of the question. The other part is, it helps them define like if there are small salt horses and things like that. If you have three and hit one core hole that's bad, you really don't think they're all bad, so they'll know what to mine around and that type of thing.

Q. That's one of the major criticisms of the linear method, is that these salt horses could actually exist between New Mexico Potash's core hole 162 and FC-65, couldn't it?

A. Yes, there are a lot of methods to do the projections. The linear method is just a basic and simple one. They have other methods you can use, too, that are defined in textbooks. A lot of times you try more than one and take your best guess.

MR. CARROLL: I think that's all.

CHAIRMAN LEMAY: Mr. High?

FURTHER EXAMINATION

BY MR. HIGH:

Q. Mr. Herrell, I want to ask you to look at that book in front of you please, sir, and turn back to Exhibit No. 23. Do you have that document in front of you, Mr. Herrell?

A. Yes, I do.

Q. Can you tell me what that is?

A. This map came out of our old U.S.G.S. Report that was done on the WIPP area a long time ago, to determine if there was commercial potash out there in the WIPP area.

Q. Do you know when this map was prepared?

A. 1978, I was thinking. I don't see a date on it right at the moment.

Q. It was prepared by the BLM?

A. U.S.G.S., actually.
Q. Okay. Look up in the top right-hand side of Section 2. Do you see Section 2?
A. Yes, I do.
Q. Do you see Section 2 on that map?
A. Yes.
Q. What part of Section 2 is shown on the map as having measured ore?
A. The south part and the southwest part.
Q. Okay. And that was listed as of 1978?
A. Yes, I believe that's when that report came out was 1978.
Q. What part of Section 2 was shown as having indicated ore?
A. Trending to the northeast basically, up past the half point of the section and up through near the northeast corner of it.
Q. It would be along the east side, up towards the northeast corner?
A. On my map it has two very thin lines here. You can't read them too well, but that was the indicated ore.
Q. And what part of Section 2 as shown on Exhibit 23 as being barren?
A. The very northwest quarter, kind of at

a slant and an angle.

MR. HIGH: Mr. Chairman, we would offer Exhibit 23 into evidence.

CHAIRMAN LEMAY: Without objection, Exhibit 23 will be admitted into evidence.

MR. CARROLL: No objection.

Q. What standard, if any, Mr. Herrell, does the BLM have in terms of the area of influence it will give a core hole?

A. If a core hole is by itself and there's no other core hole there, what's always been used is a half mile. If you have core holes to project to, then you go ahead and do a linear projection or some type of other projection, if you think that the linear is off.

Q. If core hole 162 was by itself, it sat in the middle of nowhere by itself, or as Mr. Weiss said, in the middle of a million acres by itself, the BLM would give the influence of a half a mile around the hole?

A. You can observe that on the map, too. It was a standard set up by the U.S.G.S. a long time ago, and we have just followed it.

Q. If there are other core holes in the area, does that change the standard used by the

BLM with respect to the influence that it will give a core hole like 162?

A. Usually when we're doing our stuff, we'll try to project some type of linear projection to it, and we'll just use linear because it's probably the easiest. It's not necessarily the most accurate, but then you get into debates of which one to use.

MR. HIGH: That's all I have, Mr. Chairman. Thank you very much.

FURTHER EXAMINATION

BY MR. CARROLL:

Q. Mr. Herrell, the use of the one-half mile circle of influence to a single core hole, that's just an arbitrary designation isn't it, Mr. Herrell?

A. No, not really.

Q. What science then was used to develop that half-mile sphere of influence?

A. It gets back to your minimum density core holes of three core holes within a mile and a half, half of a mile and a half is three-quarters of a mile, and then they went and broke it down one additional quarter.

Q. But again, the use of three core holes within a mile and a half, that's an arbitrary decision too, isn't it, Mr. Herrell?

A. No, there was quite a bit more science going into it a long time ago. It was a consensus of opinion of engineers that was adopted, but there has been no variograms to test it except for the mining of the areas.

We still think it's valid, because if you go into an area that's been mined, pretend like there's no mining that has occurred there, and throw out your core holes and look at any three, usually it will meet this quality and thickness criteria.

Q. You're saying that that half-mile sphere of influence was the conventional wisdom of mining engineers a long time ago, is that correct?

A. Yes, it was.

Q. But that conventional wisdom, as you've told us, is not relied upon by the mines when they sit there and start to go out into an area, because they don't rely on that one-half mile zone, do they?

A. Not totally, Ernie.

MR. CARROLL: That's all. No further

questions.

MR. HIGH: I object to Counsel asking this witness, after his argument today, asking this witness what the mines do. We agreed that Mr. Herrell would testify about statements and gaps to fill in, and not about potash.

MR. CARROLL: Just to correct his observations of the mines.

CHAIRMAN LEMAY: I think we could accept that as his observation.

A. The most recent one I could give you--

MR. CARROLL: I would object to just self-serving statements being put of record by Mr. Herrell.

CHAIRMAN LEMAY: Could you expand upon that a little bit for the record, as far as your observation?

THE WITNESS: Yes. As an observation, one example is New Mexico Potash. They did quite a bit of development work before they ever drilled those core holes down in that area. They have been trending south, as you can see on that map, for quite some time before they drilled the additional core holes.

Another one just this last year is

Western Ag, where they had done quite a bit of development work before they drilled two additional core holes, which are not being contested right now but, as an observation, that commonly happens and it always has.

CHAIRMAN LEMAY: Thank you. Questions of the witness? Commissioner Carlson?

COMMISSIONER CARLSON: Yes. Could I see the exhibits?

MR. HIGH: Yes.

EXAMINATION

BY COMMISSIONER CARLSON:

Q. Why does the BLM make determinations like this of commercial deposits?

A. For one, it's to determine leasing standards. For two, we have to do the inspections to determine, to make sure that they're paying us the proper amount of royalty. There's actually no better way of checking on what they're submitting than to go through that core hole data. And three has been the oil and gas potash problem. That has been around for many, many years.

Q. But you don't use these as dictating to a company, for example, on where to mine or how to do its mining plan?

A. No, we do review mining plans. Some of them are fairly extensive, but we review mining plans every year. We get a three-year mining plan from the mines. You have to look at it at multiple ore zones. There have been cases where we've issued orders to a company to mine off a lease. For some reason or other you get to the mining face and where the lease ends and the ore continues, and that's something that we do occasionally, anyway.

Q. You require mine plans from each potash lessee annually? Three-year plans updated annually?

A. Yes, we get a three-year mine plan updated annually, and then we also have an extensive mine plan that was done back in 1978 that's very voluminous.

Q. For each company?

A. Yes.

Q. Is that updated?

A. We update it through the inspections and then we update it through like the three-year mining plan submittals. Every now and then it includes things on the surface such as tailings, dams and things we'll have to build, and those will be submitted as a mine plan modification.

Q. You require that companies follow their mining plan as a condition of the lease?

A. Yes, they have to follow--

MS. BROWN: Mr. Chairman, excuse me, but with all due respect, I think we're getting a little bit off the subject that was authorized that this witness could testify on, and I would hate to expand the scope of his testimony into mine plans at this time.

CHAIRMAN LEMAY: Thank you, Counsel.

COMMISSIONER WEISS: Is that the meaning, that mining plans have no meaning, that we can't ask a question on them?

MR. CARROLL: Now you understand my dilemma.

CHAIRMAN LEMAY: That's why he was informational only. That's why this is not an expert.

Q. You say you use the ore grade submitted by companies in determining royalties. How does that affect royalties?

A. It determines how you allocate it back to a lease. Obviously, if you have 20 percent ore grade coming off one lease and you have 10 percent coming off another lease, then half as many tons--or, let me put it this way, you have to mine twice as many tons from the 10 percent lease to get up to the equivalent of the one ore grade that has 20 percent lease. If you don't keep track of that, you can't allocate back to the lease.

Q. What is the royalty rate on federal leases?

A. We're at two percent.

Q. That used to be on a sliding scale between two and five percent, correct?

A. That's correct.

Q. That five percent, wasn't that at 10 percent, the cutoff? What was it? When did the sliding scale go into effect? There was a 10-percent cutoff in there if I remember correctly, is that right?

A. I don't remember, to tell you the truth. There was a certain percent in there that it would be a full five and a certain percent that it would be down to 10. I can't remember what the cutoff was. I would have to look it up.

Q. Were you employed by the BLM when the sliding scale was in effect?

A. Yes, I was.

Q. Did you ever see any evidence of the company's mining, choosing where to mine depending on the royalty rate at a given lease?

A. No. No, I don't know if they even--I didn't never really consider it, to tell you the truth. I was never looking for it.

COMMISSIONER CARLSON: That's all I have.

CHAIRMAN LEMAY: Commissioner Weiss?

COMMISSIONER WEISS: Yes, I have just one or two.

EXAMINATION

BY COMMISSIONER WEISS:

Q. Do potash companies provide you with all their core hole data?

A. Yes. Potash companies, we have some old core hole data from oil and gas companies and some from other companies that were thinking about getting involved.

Q. So you could construct good variograms?

A. I wouldn't want to construct variograms, but we could. That would be a tough job to do it.

Q. But you have the data? I'm just curious as to why the BLM doesn't use modern methods rather than linear interpretation.

A. I wish we did have a few variograms. I thought about doing it myself, but I just haven't had the time.

COMMISSIONER WEISS: That was my only question.

EXAMINATION

BY CHAIRMAN LEMAY:

Q. What's a variogram?

A. A variogram determines if your ore--like, it can be very usable for determining how many core holes you'll need to represent your ore in an area. If you have a lot of large, fluctuating core holes, of course, with any ore zone you need more core holes. Basically that's all it is, is more like histogram.

Q. Was your comment on the consensus of the engineers, in order for you to have validity you require three wells within a section, was it, no more than a mile and a half between wells, or what was that criteria?

A. Three core holes within a mile and a half.

Q. Within a mile and a half radius, or what?

A. No, one of the core holes will have to contain two others within a mile and a half of that radius, and then those three core holes become valid.

COMMISSIONER WEISS: That was my point that with variograms you can say that's a valid technique.

A. Another thing you can do by looking at just what's been mined, you could construct good variograms and that would be a good way of doing it.

Q. (BY CHAIRMAN LEMAY) Do you use other kinds of information at all? I guess in particular, were you here when Mr. Lammers testified as to the gamma ray interpretation that some companies will use to predict barren zones in mineralization?

A. That has been done by the BLM. We have a lot of electric logs, and that's how we get the green area is from that. I haven't done that and that's kind of outside my field of expertise.

Q. That's the technique that the BLM uses in their ore determination methods?

A. For the inferred, which it's not for measured or indicated, but for inferred. A few of the electric logs are like that.

Q. Would it be helpful to the BLM if additional information was forthcoming through oil and gas tests? Is that something that would help?

A. In some areas, yes. We've worked out, in many instances with the oil and gas companies, you know, we've worked out where they've drilled some core holes and done some extra logging, that type of thing. It's something that happens on an occasional basis, but we work it out just kind of informally to do that.

CHAIRMAN LEMAY: That's all the questions I have. Additional questions? If not, the witness may be excused.

Mr. High? You're on with witness number two.

MR. HIGH: We would call Mr. Floyd Prando.

FLOYD PRANDO

Having been first duly sworn upon his oath, was examined and testified as follows:

EXAMINATION

BY MR. HIGH:

Q. Mr. Prando, would you state your full name, please, sir?

A. Floyd Prando.

Q. What's your current position, Mr. Prando?

A. Director, Oil, Gas and Mineral Division.

Q. Did you receive a subpoena served on you, Mr. Prando?

A. Yes, I did.

Q. That subpoena had a list of documents that I asked you to bring with you, is that correct?

A. Yes.

Q. Have you brought some documents here today?

A. We have none of the documents requested available.

Q. None available? Does that mean you have no documents?

A. We don't have them.

Q. So, you have no documents responsive to the ones I asked you to bring?

A. That's right.

MR. HIGH: I would like to mark, Mr. Chairman then, as Exhibit 35, the Subpoena Duces Tecum I served on Mr. Prando, and I would offer it at this time.

CHAIRMAN LEMAY: Without objection, it will be admitted into the record.

MR. CARROLL: Do you want to get me a copy of that, Charlie?

MR. HIGH: Yes, I will.

Q. Mr. Prando, as the director of the Oil, Gas and Minerals Division, what are your duties and responsibilities, please, sir?

A. I direct the activities of the Oil, Gas and Minerals Division. I conduct monthly oil and gas lease sales, and administer the leases. I have a staff deputy director and a staff that helps me in those duties. I oversee the operation of the Oil and Gas and Mineral Division.

Q. The minerals, would that include potash?

A. Yes.

Q. Do you have sections or departments within the Division?

A. There is a staff. About two and a half years ago, the Mineral Division was merged with the Oil and Gas Division. It used to be a separate division. That Division consisted of two clerks, and we have been working to upgrade the Division. But we still don't have it up to where we would like to have it at this point.
Q. How many management-type people do you have reporting to you?
A. I have one deputy director, and I have my geologist, Ernest Szabo, and I have the manager of the Mineral Division, Karen Spies.
Q. She reports to you?
A. Yes.
Q. And to whom does Mr. Szabo report, the geologist?
A. To me.
Q. He doesn't report to the manager of the Minerals Division?
A. No.
Q. Do you have any other professional people in your Division, other than Mr. Szabo?
A. My deputy director is a geologist, and we just hired another geologist about two weeks ago. We have a position vacant for a petroleum

engineer that we haven't filled at this time.
Q. But you are seeking to fill that petroleum engineer position?
A. Yes.
Q. How many people in the Division have degrees in mining engineering?
A. None, to my knowledge.
Q. Do you have any people in the Division that have prior experience in the mining industry?
A. Not to my knowledge.
Q. Do you know of any plans by the Division to go out and get someone that has experience in the mining industry?
A. We are looking at the possibility of upgrading the Division, but I don't know how soon.
Q. Since order R-111-P was adopted--and I take it you are familiar with R-111-P, are you not?
A. Yes.
Q. --has your Division adopted and implemented any new procedures in connection with R-111-P?
A. No. I designated Mr. Ernest Szabo, my

geclogist, to handle all the documents in connection with that Order that are kept confidential, and he has been the sole custodian of all that data that has been submitted to the Commissioner of Public Lands. And he has been handling everything.

Q. He's the one that receives the data under R-111-P and the one who is charged with keeping it confidential?

A. That's right.

Q. What rules, and let me start with written rules, Mr. Prando, has your Division adopted to make sure those documents are kept confidential?

A. We don't have any rules. We had a memorandum from the Legal Division specifying what we should keep confidential, you know, what documents would be of a confidential matter.

Q. But you have no written rules or guidelines other than this memorandum from counsel on treating records with confidence that you get in R-111-P?

A. We don't.

Q. That's correct?

A. Yes.

Q. Now, is it the Division's position, Mr. Prando, that it has the right to approve or disapprove the designation of an LMR by a potash operator?

A. Yes.

Q. And when was it that the Division reached that determination?

A. I think it was around March of--that was in a letter of March 27, 1992, around that time.

Q. That's when the Division decided that we have the authority to either approve or disapprove LMRs?

A. Yes. There was a request to approve an extension of an LMR, and I assigned that to Mr. Szabo. He informed me that we did not have enough data, so he wrote for the additional data; and when we got the data, we wrote that letter of March 27, 1992.

Q. And I want to talk about that in just a few minutes. Once the Division made this decision on March 27, 1992, that you had the right to approve or disapprove LMRs, had you previously provided any notice to potash operators that you were undergoing or thinking

about adopting such a rule?
A. No.
Q. I take it, then, there was no public notice or public hearings of any kind held on that decision, is that correct?
A. That's correct.
Q. After you reached this decision on March 27, 1992 to either approve or disapprove LMRs, did you send out notice to any potash operator, other than the letter you referred to?
A. No, that's the only one.
Q. So a potash operator that had an LMR or has one even today, wouldn't know about your decision on March 27, 1992, unless perhaps somebody goes out now and tells them?
A. That's correct.
Q. Other than the letter that you referred to of March 27, 1992, is there any other written document that sets forth that decision to either approve or disapprove LMRs?
A. No.
Q. Now, when you made this decision that you had the authority to either approve or disapprove LMRs, have you adopted, either informally or formally, any standards that will

be applied to determine whether or not an LMR should or should not be approved?

A. Not at this point.

Q. Would it be a fair statement to say, then, that to get an LMR approved today or any time after March 27, 1992, a potash operator wouldn't know what they had to do to satisfy the State Land Office, is that correct?

A. Yes. At this point, yes.

Q. I take it there has not been any notice given to the public or any public hearings held with respect to what standards should or should not be applied in either approving or disapproving an LMR?

A. No.

Q. Now look, if you will, Mr. Prando at Exhibit No. 11 and it's in the book in front of you. It's Exhibit No. 11, and I want to ask you a few questions about that.

This is the letter you just told me about, right?

A. Yes.

Q. This is the March 27, 1992 letter?

A. That's correct.

Q. At the very bottom, this letter went

out over your signature, correct?

A. Yes.

Q. Now, in paragraph one, the second sentence says, "It is our conclusion that core hole No. 162 did encounter an economical accumulation of sylvite."

That, I take it, is the decision of your Division, correct?

A. This letter was prepared by Mr. Ernest Szabo.

Q. It didn't go out from Mr. Szabo, did it? It went out from you?

A. I signed it.

Q. It went out with your full authority in your position as Director of the Oil, Gas and Minerals Division?

A. Yes.

Q. You go on to say in the last sentence of paragraph one, "The quality of ore is such that the southeast quarter of Section 2, Township 22 South, Range 31 East, contains a commercial deposit"?

A. Yes. That was the opinion of my geologist.

Q. Is there any scientific, any

mathematical, any engineering standard at all that you can point to upon which you base the decision to limit the influence of core hole 162 to the southeast quarter of Section 2?

A. Mr. Szabo just utilized his experience as a geologist.

Q. And you, as director of the Division, required nothing more than Mr. Szabo's decision, correct?

A. We didn't have any information that was provided to us by the potash company. We didn't have anything to work with.

Q. On March 27th you had something to work with, because you concluded it was commercial grade potash in Section 2, didn't you, Mr. Prando?

A. That was his conclusion.

Q. So you did have some information by this day?

A. Yes.

Q. What I'm asking you to do is, what did you consider in the conclusion that only the southeast quarter section had commercial potash?

A. Mr. Szabo made that conclusion based upon the informaton submitted by the potash company.

Q. All right. And, in your position as director, did you consider anything other than Mr. Szabo's recommendation to you?

A. No.

Q. Your Division has no written standards, I take it, that Mr. Szabo was or wasn't supposed to follow?

A. No.

Q. So anything that Mr. Szabo considered in coming up with his recommendation to you--which you accepted, I take it?

A. Yes, I did.

Q. You don't have any idea what he considered, do you?

A. No.

Q. Do you have any standards in the Oil, Gas and Minerals Division on how much influence should be given to a single core hole?

A. No.

Q. Look at Exhibit No. 10(a), if you would.

A. No. 10?

Q. I'm sorry, 10(a). Have you had a chance to look at it?

A. Yes.
Q. That's also a letter that you sent out to New Mexico Potash dated February 10, 1992?
A. That's correct.
Q. I'll ask you the same kinds of questions with respect to this one, Mr. Prando, and I'll try to ask you a global one so we don't keep you any longer than we have to.
When you sent what I've marked as Exhibit 10(a), the letter dated February 10, 1992, did the Oil, Gas and Minerals Division have any standards against which it would judge to either approve or disapprove an LMR?
A. No.
Q. Did you believe on February 10, 1992, that the Division had the right to either approve or disapprove an LMR?
A. Yes.
Q. Had you already made the decision by February 10, 1992, that the Division had the right to either approve or disapprove LMRs?
A. That's why we requested the additional information.
Q. Okay. The reason I asked that is because you told me a minute ago that on March

27, 1992, the decision was made. My question to you is, is that when New Mexico Potash was notified of the decision or is that when the decision was made?
A. That's when they were notified.
Q. So the decision itself would have been made on or before February 10, 1992, correct?
A. We didn't make the decision. Mr. Szabo didn't make the decision until we were provided with the information that we requested in the letter of February 10, 1992.
Q. Let me clarify my question. I'm talking not about the decision on whether there's commercial potash or not. My question is, on the date on which the decision was made, your Division had the right to either approve or disapprove the designation of an LMR by a potash lessee? That's the date I'm looking for.
A. Yes.
Q. You told me a minute ago it was March 27th, and I'm asking you whether or not that's correct, or instead--
A. February the 10th.
Q. And that's why you sent out the letter marked 10(a), is because you wanted data on which

to exercise your right to make the decision to approve or not approve?

A. That's correct.

Q. Now, on February 10, 1992 and then I'll leave this subject, Mr. Prando, and from that date forward until we sit here today, there's not a piece of paper on which we can look to see what you will consider in deciding whether to approve or disapprove an LMR?

A. No.

Q. Is that correct?

A. That's correct.

Q. Are there any guidelines or standards set up, Mr. Prando, pursuant to what your Division will advise the Oil Conservation Division about whether or not a proposed drilling location is or is not within an LMR or its buffer zone?

A. No.

MR. HIGH: We'll pass the witness, Mr. Chairman. Thank you very much.

CHAIRMAN LEMAY: Your witness, Mr. Carroll.

EXAMINATION

BY MR. CARROLL:

Q. Just one quick question, Mr. Prando. Does the State Land Office at this time have any means or have they even attempted to monitor whether or not state sections are being avoided by any mine out in the potash, avoiding mining state leased minerals as opposed to some other federal minerals?

A. Not at this time.

Q. So you, at least at this time or prior to this time, the State has not even been performing an investigation along those lines?

A. No.

MR. CARROLL: That's all I have.

MR. HIGH: Let me ask one question.

FURTHER EXAMINATION

BY MR. HIGH:

Q. Do you have any information, evidence, suspicions or anything else, Mr. Prando, that New Mexico Potash has ever avoided mining a lease or a state lease to avoid paying state royalties?

A. Not to my knowledge.

MR. HIGH: Thank you. That's all I have.

CHAIRMAN LEMAY: Commissioner Carlson?

EXAMINATION

BY COMMISSIONER CARLSON:

Q. Floyd, how many leases do you administer, oil and gas leases or mineral leases?

A. We have 8,000 oil and gas leases and about 288 mineral leases.

Q. And how many regulations apply to your Division?

A. We have about 10.

Q. And many pages in each?

A. Right.

Q. Aren't you asked for interpretations of lease provisions and regulation provisions quite frequently by lessees and other parties?

A. Yes.

Q. So that for example the letters, Exhibit 10(a) and I think it was Exhibit 11, those types of letters are frequently written by you, is that correct?

A. That's right.

Q. And if you had to follow guidelines in making a decision concerning every one of your thousands of leases, that would be impossible to do, is that correct?

A. That's right.

COMMISSIONER CARLSON: That's all I have.

CHAIRMAN LEMAY: Commissioner Weiss?

COMMISSIONER WEISS: Yes.

EXAMINATION

BY COMMISSIONER WEISS:

Q. I don't know if you're the right man to ask, but as I recall in the course of these hearings, there was one document that got out to the public that shouldn't have. It was confidential. Was that out of your office?

A. No.

Q. Did that becoming public result in any increase in the interest in potash leases in your Division?

A. Not to my knowledge.

COMMISSIONER WEISS: Thank you.

EXAMINATION

BY CHAIRMAN LEMAY:

Q. Mr. Prando, what's your state royalty rate on potash?

A. It varies from two to five percent on potassium chlorides, and it's two and a half percent on the sulfates.

Q. Is that a sliding scale depending on

the concentration?

A. Right.

Q. Do you require any mine plans on state lands?

A. We haven't been requiring them up to this point, but we will in the future.

CHAIRMAN LEMAY: For the record, now, you're notified.

Q. Do you cooperate with the BLM in developing any of the mine plans, or do you have any cooperative committees, informal, formal, working with the BLM?

A. Mr. Szabo has been attending the meetings that are held by BLM, and that's about the extent of the cooperation.

Q. There aren't any formal committees that work together in outlining LMRs or anything like that?

A. No.

CHAIRMAN LEMAY: I have no further questions. Anything else?

MR. HIGH: We have nothing.

CHAIRMAN LEMAY: He may be excused. Call your next witness, Mr. High.

MR. HIGH: Call Mr. Walt Case.

WALTER S. CASE, JR.

Having been first duly sworn upon his oath, was examined and testified as follows:

EXAMINATION

BY MR. HIGH:

Q. Would you state your name, please, sir.

A. Walter S. Case, Jr.

Q. Where are you employed, Mr. Case?

A. New Mexico Potash Corporation.

Q. In what position?

A. General manager.

Q. How long have you held that position?

A. Since 1980.

Q. Tell us, Mr. Case, a little bit about your educational background, please, sir.

A. I have a degree in metallurgical engineering, essentially a mineral processing specialty, from Colorado School of Mines in 1959.

Q. Any other school beyond your degree in metallurgical engineering?

A. Nothing other than occasional short courses or perhaps a college course or two. Nothing like formal education.

Q. All right. Tell us, if you will, your employment since obtaining your metallurgical engineering degree.

A. I worked for approximately nine months in 1959 and 1960 for Asarco at their El Paso smelting works as a junior metallurgist in the lead department.

I spent two years in the service following that.

I started with Kerr-McGee in mid-1962 as a junior metallurgical engineer in Oklahoma City. I was with them in Oklahoma City until 1971. Worked on varying projects including potash and vanadium as perhaps the two largest areas of effort. I've also worked on copper, gypsum and several other heavy minerals, separation processes, and also held several staff positions within their technical division.

In 1971, I moved to the Hobbs potash facility of Kerr-McGee Chemical Corporation as technical services superintendent. Later that year I was promoted to superintendent of surface operations and held that position until December of 1980, when I became the facility manager.

I was facility manager for Kerr-McGee until 1985, April of 1985, when our operation was bought by New Mexico Potash Corporation, and at that point I became general manager.

Q. You have been at the New Mexico Potash facility since you started with Kerr-McGee in 1971?

A. That's correct.

Q. And it's all been at the facility there between Hobbs and Carlsbad?

A. Yes.

Q. Do you maintain any professional activities, Mr. Case?

A. Yes, sir. I have a certificate recognizing a 25-year membership in the American Institute of Mining, Metallurgical and Petroleum Engineers.

I am a member of the citizens advisory panel for the Roswell District of the BLM.

I also serve as a director of the Southeast New Mexico Transportation Development District, all of which are professionally related duties.

Q. And the Carlsbad facility is an underground potash mine?

A. That's correct.

MR. HIGH: Mr. Chairman, we would ask

that the Commission accept Mr. Case's credentials.

CHAIRMAN LEMAY: His qualifications are accepted.

Q. Mr. Case, tell us a little bit about the New Mexico Potash facility in terms of how big it is, how many employees you have. Give us some idea of what it is we're talking about here.

A. Okay. We currently produce nominally 400,000 tons a year of a myriad of potash, potassium chloride, as opposed to what you've heard. The sulfate minerals, we do not produce them. We're basically mining and processing the mineral sylvite.

We employ 280 people at the local facility. In addition, New Mexico Potash employs perhaps another half dozen people in the sales and general administrative levels above the facility operation there.

The mine is nominally 10 miles from end to end. We have 10 acting working faces in the mine. We attempt to blend ore from those various faces to average ore that is economically feasible to process.

We employ approximately 140 of our people underground, and the other 140 nominally are topside people.

A. How does New Mexico Potash get the ore out of its place and move it underground and then to the surface?

A. We use electrically driven continuous miners to mine the ore. They place the ore either into eight-ton ram cars; for lack of a better descriptive term, horizontal dump trucks. The ore is pushed out the back, because we're mining nominally at a five-foot height, sometimes as low as four foot.

The continuous miner will place ore into either one of these ram cars or onto a long air dock continuous hauling system, which is, essentially, six short nominally 30- to 40-foot long chain conveyors that have the ability to snake into a face and then dump onto the beginning of a fixed belt system.

The ore from either the end of the continuous haulage system or from the ram cars is placed onto a conveyor system that brings the ore to the central area of the mine.

There are three 1,000-ton capacity

holding pockets below ground. From these pockets we draw the ore on a control basis into the hoist. The hoist raises the material some 1,650 feet to the surface.

Q. If you went right out to the--let me back up. You used the word face a minute ago.

A. Okay.

Q. Let's make sure the record reflects what it is when you refer to a face or a working face.

A. A working face is an area in the mine that is currently being mined. The term face, ribs, back, go back to the time when miners laid on their stomachs to mine, and what was in front of them was the face, what was on the side of them was the ribs and what was above them was their back. And that's where those terms come from. An active face is one of the 10 areas in the mine that we are currently mining.

Q. And if you went right up to these working faces to see one of them, what would be the height from the ground to the top of the ceiling?

A. It would depend on the height of the ore that we were mining. We develop what we call development entries, entries that we intend to be in for a long time, as high as six feet. If we're down to what we call panel mining, which is actually the act of getting ore out of the face without regard to how long we have to stay in the area, those areas will range from four to five feet high, depending on the actual height of the ore seen.

Q. How wide would the entries be?

A. The miner cuts 12-and-a-half to 13-feet wide, and we normally take what we call a double pass, which will amount to about 25 feet.

Q. If this room we're in today, let's call it a development entry, and we are progressing from my location towards the Commissioners, with the wall behind them being the working face, the height of this development entry would be about six feet?

A. That's correct.

Q. About how wide would it be?

A. About 25 feet.

Q. Then off of this development entry we would have the panel entries, where we're actually pulling out the ore to take it, to send it to the surface, then to mine?

A. There are sub entries that go in the length of a panel nominally 2500 feet, and there are mining operations that take place on either side of those entries, and they're retreated back toward the main entry system.

Q. And that's the point where the entries go down to four or five feet in height?

A. That's correct.

Q. And what would be the width of those?

A. Those will also be 25 feet.

Q. Now, you say there are 10 working faces. How many continuous miners do you have that takes the ore out of its place to move it on to the conveyor system?

A. 10.

Q. And have you bought any new ones recently?

A. Oh, we have bought some used coal mining equipment within the last three to five years and converted it to be more suitable to potash mining. Potash is a little bit harder to dig than coal, and you upgrade the varying fits and make basically a beefier machine, if you will, out of a coal miner, and turn it loose on the potash.

Q. How about the shafts? How many shafts do you have?
A. There are two shafts.
Q. How many miles of belt conveyor system would you estimate that you have, Mr. Case?
A. I would estimate about 10 miles at this point.
Mr. High, it might be interesting to the Commission, one of my engineers had little to do one afternoon and sat down and figured that if everything that we had mined since 1965, when the mine went into operation, we would have a tunnel 12-and-a-half feet wide, which is the cut of the miner, five feet high, and 3,700 miles long. That's from Miami to Vancouver, basically.
When we talk about incursion of gases into the mine, for example, we're not only concerned with incursion of gases in the face that we're mining, but also in all of that area that has been exhausted because we do not seal those areas as to gassy mines, once we come out of them.
So we're not only concerned with what's immediately in front of us but also what's happened in that nominally 3,500 miles behind us.

Q. After you started mining in these panels off of the development entries, Mr. Case, when you mine in, about how much of the ore would you estimate you take out?

A. 30 to 50 percent.

Q. And then you leave the other ore in place, I assume, for support?

A. That's correct.

Q. So they won't cave in on you or subside while you're in there working?

A. That's correct.

Q. But you don't leave that ore in place, I take it?

A. No, sir. Mr. High, the acceptable way of developing an ore body is to drive entries to the edge of the ore body and then begin retreating your mine backward, toward the central part of the mine from that point.

So what we'll do is take nominally 30 to 50 percent of the ore going in, until we get to the limits of either a panel or to the edge of the ore, the edge of the lease, whatever the constraining factor is, and then begin retreating.

Overall we'll take 75 to 80 percent of

the ore that's in place between the first mining and the second mining as we come back out. As we come out, we're not concerned about the longevity of the back staying up. Once we get out we're ready for it to come in, and that's part of the rock mechanics business of which I'm not an expert.

Q. Would it be a fair statement to say that when you're mining in the first time, leaving the pillars for support, that's called first mining?

A. That's correct.

Q. And once you get to where you stop and you turn around and you're getting the ore on the way back, that's called second mining?

A. That's correct.

Q. As you're second mining, taking out these pillars that support the ceiling, what happens to the overburden?

A. Well, you get higher and higher pressures on the little bit of ore that's remaining. The remaining pillars will crush, they will bow. The back or the roof of the mine may either close by sagging of the floor wall, sag upward, if you will, or heave upward.

Normally, if you have a competent salt member above you, it will be a swag that looks like this. If you have mineralization, bedded strata above you of small stringers, it may break at those stringers and the salt will actually drop and fall. So, if we look into an area that's been mined, we may see several scenarios.

Q. Would it be a fair statement to say, Mr. Case, in terms of a description here for the Commissioners, as you're second mining and pulling out of a section, you are taking out potash support?

A. That's correct.

Q. And you're doing that knowing that once you take that support out, the area from which you are retreating will start collapsing and coming together?

A. That's correct.

Q. You are, in effect, setting in motion a planned coming together of the top and the bottom to close back up?

A. That's correct.

Q. That involves some falling of the overburden down to the floor?

A. Yes.

Q. Now, how is the New Mexico Potash mine ventilated?

A. It is ventilated by two fans that draw air through the mine. The fans are located at the exhaust of the air circulation system, so air is drawn in what we call our production shaft, circulated by using barriers or curtains throughout the mine. It's essentially split in two parts of the mine, but it goes from one working area to another working area to another working area, what we call series ventilation. Then those two strings recombine and are exhausted out what we call our man and material shaft.

Q. What creates the movement of air that flows through the mine?

A. The two fans.

Q. Do they have a name?

A. The main fans. They're assisted by booster fans throughout the mine that direct the air flow and insist on changing direction of air flow where that's necessary.

Q. Where are the main fans located? On the surface or underground?

A. Underground.

Q. What would you, Mr. Case, estimate the replacement value of the New Mexico Potash facility to be, if you know?

A. The entire facility would range between $100 and $150 million, new equipment, grass roots facility built today.

Q. If we wanted to go out and duplicate the New Mexico Potash facility, it would take, in your opinion, between $100 and $120 million?

A. That's correct. Between $100 and $150 million.

Q. I mean, $150. What, Mr. Case, is the estimated life of reserves that New Mexico Potash has?

A. Mr. High, at the request of senior management, within the past year we've had an independent third party assess our ore reserves and our mining plans, and at our current mining rates we estimate 35 years of remaining reserves.

Q. And all the reserves that New Mexico Potash has, I take it, are right there, either adjacent to or in close proximity to the facility as it sits there today?

A. That's correct.

Q. Now, let's talk a little bit, Mr. Case, about safety. Your mine is subject to safety regulations, is it not?

A. Yes, sir. We're under the administration of the Mine Safety and Health Administration.

Q. How quickly are you inspected, from a safety standpoint?

A. At least quarterly.

Q. Is that something just because the government has the people to do it, or is that something that's required by some law?

A. No, that's required by the Mine Safety and Health Act of, I believe, 1978.

Q. The federal law says the government has to come out and inspect your potash mine at least once every quarter?

A. That's correct.

Q. What authority do these MSHA inspectors have when they come out if they find something that's wrong, in their judgment, from a safety standpoint?

A. The range of their authority goes from fix it, to shut it down and don't operate it until it is fixed.

Q. So an MSHA inspector can, literally,

are you telling us, force you to shut down a portion of the mine simply on his word, even before you've had a hearing?

A. That is correct. A portion or all of the mine, depending on his word.

Q. And what is that piece of paper called that he would issue that would tell you to shut down something even before you had a hearing on it?

A. It's called an order, and it has a number to it, but I can't tell you off the top of my head what that number is.

Q. Is that what some of us may call a withdrawal order?

A. Yes.

Q. Has New Mexico Potash ever received a withdrawal order?

A. No, sir.

Q. Now, has New Mexico Potash developed any mining plans, Mr. Case?

A. Yes.

Q. Give us some idea of what kind of a mining plan it is that New Mexico Potash has prepared or has in place?

A. The general philosophy is extraction of the reserves to the maximum extent possible, in controlled manners, to where you don't spread yourself out all over the world and have, essentially, three or four different mines operating under a three-to-one shaft. So we concentrate on two or three areas with two or three or four machines in each one of those areas.

Q. And is that type approach to mining consistent with what you understand to be a proper conservation of mineral resources like potassium?

A. Yes, sir.

Q. Let me.

Q. Mr. Case, look at what I've marked as Exhibit No. 36. Tell me if you recognize the book that that's from?

A. Yes, sir, it's from the Society of Mining Engineers' Mining Engineering Handbook.

Q. Looking at page 2 and tell me if you can tell me what that page is all about.

A. The second page of the exhibit is numbered I-12, and the two major topics covered on that page are "Conservation In Mining" under heading 1.6, and "Environmental Influences and

Mining" under paragraph 1.7.

Q. And is your mine planning at New Mexico Potash consistent with Exhibit No. 36?

A. Let me take a moment to read this.

Q. Sure. Please. Go right ahead.

A. Generally, yes, I would say we follow the philosophy listed here. It seems to be talking primarily about metal mining, but I don't see a lot there that I would disagree with in terms of industrial mining such as we are conducting.

MR. HIGH: We would offer Exhibit 36, Mr. LeMay.

CHAIRMAN LEMAY: Without objection, Exhibit 36 will be admitted into the record.

Q. Are any of these mine plans in writing, Mr. Case?

A. Yes, sir. The one that the third party prepared this last year is in considerable detail.

Q. Do you prepare and submit mine plans to any federal or state agencies?

A. Yes, sir.

Q. What agencies are those?

A. To BLM.

Q. Do you submit any mine plans to the State?

A. I'm not certain on that. I have a person on my staff that handles that.

Q. How is it that you go about deciding, Mr. Case, in which areas or which part of these 10 faces that you'll mine from at any particular point in time?

A. There are several factors. Most of them have to do with logistics of moving people to and from the various areas in the mine; the grade of ore in various parts of the mine; trying to keep a balance on the main line conveyor belt system so that we can operate them to their maximum capacity.

We cannot put all 10 areas on one conveyor belt and get it to the central portion of the mine. Normally the main conveying system will handle--some main systems will handle three areas to four areas. The main system will handle four to six areas.

Q. Why is it you have 10 working faces instead of just one?

A. Primarily to minimize the risk or opportunity of either poor grading or high grading the deposit. You try and blend--

Q. Tell me what that means.

A. You try and blend ore from the various areas to come to what is nominally your life of mine average ore grade. That's the intent; not always the outcome.

Q. So, if you're mining in an area of particularly high grade ore, you'll want to mix that with some other lower grade ore to maximize the extraction from that body of ore?

A. That's correct. And the low grade panel by itself may not be, quote, economic ore, but when it is blended with the higher grade panel, both of them, or the higher one brings the lower one up to economic consideration.

Q. And how frequently are decisions made that you would change from working at one particular working face to instead move to another one that might have a different grade of ore?

A. There are a number of factors that influence that. Again, the major factor being, before you complete a panel, you have to have a home for that machine to move to. Normally, you don't move a machine all the way across the mine but move it to an area that's in near proximity. That's generally the major consideration.

In other words, we're working in areas of the mine and try and mine out this area and mine out this area and mine out this one, rather than do one panel here and suddenly decide it needs to be moved over here or moved up here. We try and do it in an orderly manner to optimize costs.

Q. Now, this third party that you said came in and did a study, what kind of a study was it that they did?

A. They were contracted to look at, primarily, our estimate of ore reserves and confirm those. And, as it turned out, to prepare a new mining plan for us based on those reserves.

They also looked at the surface operation, the viability of it for lasting the length of reserves that we determined we had, what did they see major in terms of capital costs down the road, to ensure that the surface operation was kept in readiness for the mining operation.

But the major emphasis and 60 percent

of the study concentrated on ore reserves and the mine plan.

Q. And did that third party report come up with a recommended mining plan for New Mexico Potash?

A. Yes, sir, they did.

Q. And did that study involve, in any way, this lawsuit or this case, this proceeding?

A. No, sir. It was requested completely independent of this case.

Q. Was there anything in that report concerning the mining of Section 2 that's involved in this dispute here?

A. Yes.

Q. And did the mining plan that was recommended by this outside company include the mining of Section 2?

A. It did.

Q. Before we get into that, Mr. Case, look at Exhibit 1(a), please, sir.

A. 1(a)?

Q. Yes, sir. That's in the book there in front of you. If you will, just take a minute and look at Exhibits 1(a), (b) and (c), and then tell me what those are, please, sir.

A. Exhibit 1(a) is a potash mining lease numbered M14957. Exhibit 1(b) is an assignment of mineral lease from Kerr-McGee Corporation to New Mexico Potash Corporation dated or signed the 5th of April, 1985. And then my copy is hard to read, but Exhibit 1(c) is issued by the New Mexico State Land Office, potash mining lease dated the 2nd of May, 1988.

Q. Do you understand those documents to be the lease documents with respect to Section 2 that's involved in this proceeding?

A. Mr. High, Exhibits 1(a) and 1(b) contain direct references to Section 2. I do not find those references in Exhibit 1(c). I see Sections 22, 23, 24, 25, 26, 27, 34 and 35 on my copy.

Q. New Mexico Potash currently holds the lease on Section 2, does it not?

A. That's correct.

Q. How long has it held that lease?

A. Through New Mexico Potash Corporation and Kerr-McGee Corporation, to the best of my knowledge, since the plant went into operation in 1965.

Q. And I take it during that period of

time that to hang on to that lease, New Mexico Potash and/or Kerr-McGee paid whatever payments were required to keep the lease in effect?

A. I have not received notice to the contrary.

Q. Now, there was some testimony earlier about Section 2 and the langbeinite there and the discussion between New Mexico Potash and IMC.

Tell us how it came about that IMC became interested in obtaining Section 2 from New Mexico Potash.

A. I don't know what goes on in the heads of other managers, but it's my understanding that International Minerals and Chemical had requested langbeinite leases or potash leases on two or three sections south of Section 2. These are federal sections, and on at least half of two or three sections to the west of Section 2.

Until about this time last year, it was our opinion, based on information contained in the documents prepared to support the WIPP project, specifically Hole AEC 8, that there was a trend of langbeinite shown in AEC 8 which trended to the northeast, which a reasonable person would conclude that that extension of

langbeinite would go up into Section 2.
Q. What strategic benefit did IMC see, if you know, in obtaining Section 2, in connection with its interest in those other leases?
A. Mr. High, this is speculation on my part, but from the mining that I have learned by osmosis, if would seem if you have leases here and leases here, that the logical conclusion would be that you would join those leases and probably that section would be of value as a location for a shaft.
As a matter of fact, I have been somewhat surprised, since I understand that Yates was the successful bidder on those leases, that they have not come to us seeking the same sort of information.
Q. For the same reason, because of its strategic location in the section?
A. That's correct.
Q. Did it ever come to pass that IMC took possession of the title of Section 2?
A. It did not. IMC did not take possession. A lease was not assigned to IMC.
Q. Look at Exhibit No. 12. You've heard this document referred to as an agreement, have

you not?

A. I have, in earlier testimony.

Q. Is that correct?

A. It is not. The fourth word on the first line of the text is key. It says, "Enclosed is a proposed IMC and NMPC," IMC being International Minerals and Chemical fertilizer and NMPC being New Mexico Potash Corporation, "agreement for the assignment of" dah dah dah dah.

Again, the key and operative word is "proposed" and that remains a proposal today.

Q. Was this part of the effort of IMC to acquire Section 2 from New Mexico Potash?

A. That is correct.

Q. An agreement on that was never reached?

A. That is correct.

Q. You still own it today?

A. Yes. We still hold the lease, Mr. High.

Q. All right. I misspoke. You still hold the lease. All right.

MR. HIGH: Mr. Chairman, we would offer Exhibit No. 12, Mr. Chairman.

CHAIRMAN LEMAY: Exhibit 12 will be

entered into the record without objection.

MR. HIGH: We would also offer Exhibits 1(a), (b) and (c).

CHAIRMAN LEMAY: Exhibits 1(a), (b) and (c) are entered into the record without objection.

Q. Now when was it, Mr. Case, that IMC became interested in Section 2? Can you put a time on that?

A. Fourth quarter--well, expressed interest to us, fourth quarter of 1991.

Q. That's when discussions started on your possibly acquiring that section?

A. That's correct. And there were discussions, informal discussions preceding the issuance of this letter. The letter didn't hit us cold, out of the blue.

Q. During the time that you were discussing with IMC its interest in the langbeinite in Section 2, was there any attempt to drill oil and gas wells in Section 2?

A. Yes, sir. As a matter of fact we approved four holes, negotiated with the operators on those holes to move them to a--I think the term is a nonstandard location 330 feet from the east line, rather than the normal 660, with, again, the feeling that there might be a langbeinite trend up through Section 2 that was of potential interest to others.

Q. And at the time these wells--these wells you just referred to were allowed along the east side, did you have any knowledge concerning the possibility of sylvite being in Section 2?

A. We did not. But at about the time that we approved those leases, we also got requests for other wells to be drilled--APDs, if you will--and between them being one factor, the interest expressed by IMC being another factor, and the fact that we had a core drilling program, the first in probably five to seven years active, we thought before we made any final disposition of Section 2, that it would behoove us to learn what was there.

And, consequently, Mr. Lane, who was on my staff at that time, was asked by me to add one hole to what we had planned to be a nine-hole core drilling program, that hole being located in Section 2.

Q. And that's the core hole that we refer to as No. 162 in this case?

A. That's correct.

Q. Were the additional wells that you're talking about that were being proposed in Section 2, is that the four that we're now litigating here?

A. Yes, sir.

Q. And were there some discussions between the State and New Mexico Potash regarding those wells?

A. Mr. High, let me respond and see if this is where you would like me to go. Basically, it appeared that both the federal government and the state government, whatever the approval entity was for approving APDs, was doing that if there was no LMR involved.

At the time, our LMR extended to the north boundary of Section 2 with the buffer zone that dropped down into Section 2. With the strong possibility of langbenite being there and langbenite basically not being of interest to us, I had somewhat of a dilemma as to how to approach this just because I felt like there would be a waste of potash, albeit outside of my LMR, because of this strong langbeinite trend, and it was certainly my understanding of the agreement between the industries which led to R-111-P, that both the federal and state entities had an obligation to protect, or keep from wasting, potash outside of the LMRs.

In other words, the companies had to designate their LMRs and then it was our understanding--and again this is my understanding from discussions I've had with people that worked directly on that industry task force, that the federal people, at least, acknowledged a responsibility for some of the areas outside the LMRs, which appeared to me to be more or less blanket approvals of APDs outside of those LMRs.

Working through the executive director of the New Mexico Mining Association, I requested a meeting with Secretary Lockwood of the Energy, Minerals and Natural Resources Department. That meeting took place, Ms. Lockwood was not able to attend but Mr. LeMay attended, Ms. Leach attended, Ms. Graham attended, all of them being EMNRD people. And, from the mining site, myself, Walt Thayer and Charles Roybal. Walt Thayer is the manager of IMC, Charles Roybal is the executive director of the New Mexico Mining Association.

We met and expressed informally that concern to those representing the Energy, Minerals and Natural Resources Department. My recollection was early- to mid-December of 1991.
Q. When you say you met and expressed that concern, you're talking about the concern over your understanding that it was the state's responsibility, as well as the BLM's responsibility, to protect potash deposits that were not currently designated as being part of an LMR?
A. That's correct.
Q. Now, you said a minute ago, Mr. Case, that langbeinite was of no interest to you. During the time you had this discussion that turned out to be with Mr. LeMay, what kind of ore did you understand was in Section 2?
A. We understood it to be langbeinite until such time as we drilled K-162 and basically surprised ourselves by finding mineralization, and good mineralization, in the 10th ore zone.
Q. Was it your concern that the wells being proposed at this time would waste this langbeinite that you believed was in Section 2?
A. Yes, sir, and destroy what I considered

to be a key area to developing a nice size langbeinite deposit.

Q. New Mexico Potash can't process langbeinite, can it?

A. Cannot.

Q. Does a lease that contains langbenite reserves still have value to New Mexico Potash?

A. Certainly. With the proposed assignment, there were some monetary considerations between us and IMC that went on with those proposals.

Q. IMC was willing to pay you money to get that lease, right?

A. That's correct.

Q. Following this meeting that you referred to a moment ago, were there any other discussions held about the state's obligation and the BLM, as you understand it, to protect this potash?

A. Mr. High, I recall one further meeting that was held nominally mid-January of this year, that was, I believe, convened by Mr. LeMay, to get the oil and potash interests together to see if there was any common ground where we might work out an agreement. That meeting was certainly held, yes, sir.

Q. There came a time where core hole 162 was drilled and you said it did show the presence of sylvite in the 10th ore zone?

A. That's correct.

Q. How was that decision made to drill core hole 162?

A. Again, it was added on to an already planned drilling program to give us information, better information to work from, in terms of what we would do with regard to such a tool, that we retain it with the intent of mining it in the future, would we sublet it or assign it to IMC for their development of the langbeinite.

Q. And core hole 162 showed a little over 16 percent K_2O as sylvite? Is that your understanding?

A. Yes, sir.

Q. Can New Mexico Potash mine ore at that grade, Mr. Case?

A. I would love to have a mine full of it, yes.

Q. Can you mine ore less than 16 percent?

A. Yes, sir.

Q. You heard Mr. Hutchinson's testimony

about this economic model that he's come up with that says you have to have 16 percent ore or it's not commercial. And I'm paraphrasing, but you sat in here and heard his testimony, didn't you?

A. Yes.

Q. What did you understand Mr. Hutchinson saying that you had to have out there before you're going to be profitable or be of commercial benefit?

A. I understood Mr. Hutchinson's testimony to be a minimum height of six feet of ore at a minimum grade of 16 percent K_2O.

Q. What do you think about that kind of a program or whatever you want to call it?

A. We have not mined 16 percent ore on an annual basis or even a monthly basis, to my knowledge, since I've been involved with the operation.

Q. And you're staying in business?

A. That's correct. And we're also mining, most of our panel mining or retreat mining is done at four to four and a half feet, not six feet.

Q. I think Mr. Hutchinson also said you're not any good unless you have a 14 percent spread between manufacturing cost and selling price to be profitable. Did Mr. Hutchinson ask you for your manufacturing costs?

A. Mr. High, I don't recall. I recall the discussion that Mr. Hutchinson and I had about his request to come and visit the mine, and he may have asked for it at that point, but certainly that was not available to him at that point, and I would be even more reluctant to give it to him today because it appears that Yates is not only a petroleum company, but interested in becoming one of our competitors in the potash business.

Q. There has been some testimony about the confidentiality of a great deal of information that the potash industry has?

A. Yes. I believe Commissioner Carlson, at least, raised a question about that at one of our earlier meetings.

Q. Is manufacturing cost one of the things that you consider very confidential?

A. Yes, sir.

Q. Give us some background explanation, Mr. Case, as to why that is. In fact, you can identify some things if you want to, as to why it is that in the potash business you have to keep certain things confidential.

A. There are several facets there. One of them is that there are six companies in a 400,000-acre area in strong competition. Most of our products find their way into the agricultural end use in one way or another, and we're in competition with each other.

So we have six companies competing, basically, in a very limited area, where we're very close together and certainly have the opportunity to discuss with each other costs and production and prices and this sort of thing.

Apparently that transpired, and I say "apparently" because I was not aware of it or involved in the potash business at the time, in the late 60s, and all of the managers currently have fallen to some rather strict guidelines because of some very prolonged, costly and harsh antitrust investigations that took place in the late 1960s, I believe, in the federal court in Chicago. Not only were some of the managers called to testify in that case but also a number of corporate officers. I believe that some of Kerr-McGee's officers were included in that good group.

Coming from that was a strict prohibition when these groups met, and we do have a formal group of potash managers which meet on a monthly basis to discuss mutual problems, but we do operate with antitrust regulation foremost in our mind. And the guidelines are, you do not discuss marketing, prices, you do not discuss manufacturing costs, and you do not discuss specific details about manufacturing costs or other items that would lead one of the competitors to learn a substantial amount of information about your manufacturing costs.

Because of the harsh nature of these antitrust hearings and the strict guidelines that were passed down, perhaps this industry is more closed-mouth about its business and its cost than perhaps the oil industry would be, and I certainly understand that because from listening to the earlier testimony, it seems to me that most of the oil business is conducted by subcontractors that may work for Yates one day and Exxon another day and Phillips another day; i.e., a drilling contractor, a mud man, a cementer, or whatever the specialty may be. And, consequently, the costs of those services are very well-known.

The potash people operate in a basically autonomous manner with very few outside contractors and very, very few beyond vendors, if you will, or material suppliers that serve the same company.

So, Commissioner Carlson, I don't know if that addresses your concern, but that's the history as I know it. And we continue to operate with those guidelines, and it's primarily antitrust driven.

Q. Are there business dealings, Mr. Case, between the potash leaseholders in Southeastern New Mexico?

A. Occasionally there are arm-length dealings.

Q. Would the disclosure of some of the data that you've told us about impact, in any way, those business discussions?

A. Certainly.

Q. Can you give us some specific examples of how that may come about?

A. From time to time, one or the other of the companies come up for sale, as Mr. Hutchinson observed, and intimate knowledge beforehand of that information may influence a person's or a company's decision as to whether to make a pass at the company that's up for sale.

It would be contrary to the best interest of the company that is for sale, for other members of the local potash industry who are the logical purchasers, to have detailed information ahead of time. Certainly that information from time to time is developed in due diligence studies with the attendant secrecy requirements and agreements executed.

CHAIRMAN LEMAY: Any time you would care to break, feel free to do so.

MR. HIGH: Just let me finish this one point.

Q. This data that you're talking about being confidential, Mr. Case, is it filed with any public agency?

A. The results of that data are, Mr. High. The details generally are not. For example, detailed line item budgets and so forth are not filed with any outside agency.

Q. Would the BLM know your selling price?

A. Yes.

Q. So even though you treat that as confidential, the BLM knows it?

A. That's correct, and it's provided to them in a confidential manner. Any time that that information is used or disclosed, it is only when it is combined with other industry statistics so that no individual corporation can be drawn out.

Q. Does the BLM know your manufacturing cost?

A. To my knowledge, no.

Q. Does the BLM know how low a grade of ore you can mine?

A. Yes.

Q. Is that something you think is confidential?

A. Yes.

Q. Is that submitted to them under a confidential privilege?

A. To the best of my knowledge, yes. It's part of the mining plan.

Q. So even though a lot of this data is treated in a confidential manner, it's still on file with a governmental agency?

A. That's correct.

Q. But, of course, not available to the public?

A. That's correct.

Q. Now, this economic plan that Mr. Hutchinson told us about, this model that he came up with, what is your opinion about the validity of that model as applied to New Mexico Potash?

A. It does not fit.

Q. Do you think that that model that he laid out for us has any validity for consideration by this Commission in deciding whether or not to approve or disapprove the four wells in this case?

A. Mr. High, I believe it does not. If it does not fit our operation, it should not be considered.

MR. HIGH: Mr. Chairman, that does complete a section, and it's a good breaking point for me.

CHAIRMAN LEMAY: Then we'll continue at this point tomorrow morning at 8:30. Thank you.

MR. HIGH: Thank you very much.

(And the proceedings adjourned.)

CERTIFICATE OF REPORTER

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

I, Carla Diane Rodriguez, Certified Shorthand Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Commission was reported by me; that I caused my notes to be transcribed under my personal supervision; 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 2, 1992.

Carla Diane Rodriguez

CARLA DIANE RODRIGUEZ, RPR
CSR No. 4