STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

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

APPLICATION OF MITCHELL ENERGY CORPORATION

CASE NO. 10,858

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: JIM MORROW, Hearing Examiner

April 28, 1994

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Division on April 28, 1994, at Morgan Hall, State Land Office Building, 310 Old Santa Fe Trail, Santa Fe, New Mexico, before Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

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I N D E X

April 28, 1994
Examiner Hearing
CASE NO. 10,858

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A P P E A R A N C E S

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* * *

WHEREUPON, the following proceedings were had at 1:03 p.m.:

EXAMINER MORROW: We'll call the hearing back to order and call Case 10,858, which is the Application of Mitchell Energy Corporation for a waiver of the salt-protection string requirements of Order No. R-111-P for certain wells, Lea County, New Mexico.

Call for appearances at this time.

MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of the Santa Fe law firm of Kellahin and Kellahin, appearing on behalf of the Applicant, and I have six witnesses to be sworn.

EXAMINER MORROW: All right, will all of you please stand and be sworn?

(Thereupon, the witnesses were sworn.)

MR. KELLAHIN: Mr. Examiner, we have distributed the exhibit book. It's the white binder in front of you, and it contains in order all of the exhibits that each of the witnesses will discuss this afternoon.

We have larger copies of some of those displays before you.

The first one you're looking at is the BLM Potash Map. This is the 1994 version. And what that simply means is the interpretation of the Bureau of Land Management as of 1994, as the distribution of the potash resources in

southeastern New Mexico and their interpretation of that data.

There are several earlier versions of this map. The one in existence and the one that most of us are most familiar with is the 1984 map. The 1984 Potash Map is not substantially different as to the external boundary that you see on the 1994 Map.

The area in question that we're directing your attention to this afternoon is found in Section 4, Township 20 South, 33 East.

I'll put this sticker on the BLM map, and it shows a section that is almost all within what is identified on the Potash Map as a barren area. It's the pinkish shade of coloring on this display. And being in a barren area, it has substantial significance to us and to the experts that are going to explain those concepts to you.

The BLM Potash Map is an entirely different creature than the R-111 series of orders.

We are in R-111-P at this point, which was adopted by this Commission in April of 1988.

The first R-111 orders began at the request of the Oil Conservation -- the Commissioner of Public Lands when he petitioned the Oil Conservation Division to call some hearings, and those occurred back in January, 1951.

The reason was, the Land Commissioner was about to issue some oil and gas leases in this portion of southeastern New Mexico that the State owned, and the potash industry was concerned that the leasing of those lands for oil and gas purposes was going to adversely affect their potash resources.

The Commissioner of Public Lands held a hearing, and as a result of an industry study by the potash people and the oil and gas industry, the R-111 order was adopted.

That original order has periodically been extended and expanded to pick up additional acreage. Originally it was a very small area, and as oil and gas development expanded over the potash area, acreage was added into the R-111. And so almost always when you see a letter after R-111, it's because of a hearing to expand geographically the area that's controlled by those rules.

It will be of significance to us to have you know that prior to April of 1988, the barren area in Section 4 was not subject to R-111. None of the subsequent expansions of R-111 included that barren area in the northeast corner of the enclave until April of 1988.

The reason for the expansion and the subsequent changes of some of the rules are going to be part of my conversation with Mark Stephenson. Mr. Stephenson is our first witness. He's an expert in his company with regards

to the permitting and approval of Mitchell's wells in New Mexico and Texas, and particularly with regards to the potash area. He's been involved in those meetings and understands the rules, and I'm going to use him to help us all understand exactly what Mitchell's project is and what they're seeking to accomplish.

The exception we're asking is contained within the concepts and provisions of R-111-P, and we're not the first to ask. We are simply requesting approval to delete the potash-protection string in this barren area where other operators have already deleted that string.

Mr. Stephenson has a list of a substantial number of wells that have been put in this category, where they pose no risk to potash or miner safety and therefore do not need the potash-protection string.

We've had a choice here. Sometimes you will see an engineer that comes before you and he will talk about all the different aspects of his profession. We've chosen instead to bring the engineer that has the specific expertise with each of those disciplines.

We're going to show you a reservoir engineer who's done the reserve calculations and the economic analysis of the project.

We're going to bring you a completion, operation and production engineer whose specialty is to talk to you

about how he completes and produces these wells, so that you'll be assured that they're done in a safe and efficient fashion.

We've also brought the drilling expert of Mitchell Energy, an engineer who does nothing else but design well programs and assure that they're executed with mechanical integrity. He's done perhaps 500 of them. He's come here to show you what he's planned for Section 4.

In addition, we brought forward the geologic manager from the Midland office of Mitchell to talk to you about his exploitation concept, his geologic conclusions with regards to the opportunity to recovery shallow oil production out of the Yates interval in what's identified as the West Teas Yates-Seven Rivers Pool.

We're looking at shallow oil, 3000, 3500 feet, little if any gas production, low-volume production, low cum oil. It's a development he wants to extend into his section, and he wants to show you how he came up with his concept.

In addition, we have brought to you as a consultant a potash engineer who is an expert in potash resources. He testified extensively before the Commission in the Yates potash hearings. We've brought back Mr. Hutchinson to testify today with regards to validating the BLM's inference of this being a barren area, so that after

he concludes his testimony you will be assured that we're in fact in an area that's barren of commercial potash. And he can talk to you about the concerns the potash industry has displayed in other areas of the enclave that are not an issue for us this afternoon.

And so that's where we're going.

And if you'll permit me, I'll call Mr. Stephenson at this time.

MARK STEPHENSON,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. For the record, sir, would you please state your name and occupation?

A. My name is Mark Stephenson. I'm the manager of production, regulatory affairs, for Mitchell Energy Corporation.

Q. Mr. Stephenson, on past occasions have you testified before this Division as an expert and qualified in your capacity as a knowledgeable person with regards to regulatory affairs in New Mexico and with the permitting and compliance of rules and regulations for your company in operations not only in New Mexico but in west Texas?

A. Yes, sir, I have.

Q. In addition, sir, have you been involved in study groups, discussion groups and industry efforts with regards to the issues involved in what we've described as the R-111-P?

A. Yes, sir, for approximately the last two and a half years I've served on the Oil and Gas Potash Subcommittee of the New Mexico Oil and Gas Association, the Independent Petroleum Association of New Mexico.

Q. As part of your representation of your company, are you also familiar with the rules and regulations that the Bureau of Land Management has established for drilling wells on federal leases within the potash/oil area?

A. Yes, sir.

Q. In addition, have you made a study of and are you familiar with the aspects of Section 4 insofar as they deal with Commissioner of Public Lands, State of New Mexico, properties?

A. Yes, I am. Yes, I have.

Q. Have you made yourself aware of who, to the best of your knowledge, information and belief, are the potash lessees that are entitled to notification of this case?

A. Yes, sir.

MR. KELLAHIN: We tender Mr. Stephenson as an expert witness.

EXAMINER MORROW: We accept Mr. Stephenson.

Q. (By Mr. Kellahin) Let me have you, sir, turn to what is the first display that we have in the exhibit book. It's a foldout, if you will.

Before you describe to Examiner Morrow the Mitchell plan, tell us the source of the information that was used by you to generate what we've identified as this base map.

A. Okay. I asked Mr. Olive, who's our district geologist from Midland, to work with our drafting department and put together a base map which would serve as a frame of reference to give some background as to the area in question, particularly to show the location of the proposed wells from the nearest potash mines and to show the other oil and gas development in the area.

Q. Have you independently satisfied yourself that the information shown on this display is true and accurate?

A. Yes, sir, I have.

Q. Describe for us how you personally became involved in the project.

A. Okay, in my capacity as manager of production and regulatory affairs at Mitchell, it's my department's responsibility to obtain the drilling permits from the appropriate regulatory agencies.

At the time the decision was made to drill these wells, we submitted drilling permit applications with the

OCD.

When the drilling permit applications were submitted to the OCD office in Hobbs, they advised us that in order for us to obtain an exception to the salt-protection string provisions of R-111-P, it would be necessary to come to Santa Fe and have a hearing.

Q. All right. Let's look at the map for a moment. There's an area on the north side of the display that's got a combination of green and yellow and blue, contained within a section that looks like Section 4?

A. Yes, sir.

Q. What is that?

A. Okay, that is the leasehold in question here, and the color coded in there shows different statuses of ownership for the acreage in there.

Q. What's the orange dots?

A. The orange dots are the location of the proposed wells.

Q. All right. When the project comes to you, someone has made a decision in Section 4 that they propose these nine wells in Section 4?

A. Yes, sir.

Q. What kind of wells are we dealing with?

A. We're dealing with shallow oil wells, a total depth of approximately 3600 feet, and they're targeted for

the Yates formation.

Q. Based upon your information and knowledge of regulatory affairs, what in your opinion is the pool as designated by the Oil Conservation Division to which these wells will be dedicated?

A. It would be the West Teas Yates-Seven Rivers Pool.

Q. When we deal with that pool, what is the spacing for wells?

A. Forty-acre spacing.

Q. And what kind of gas/oil ratios are you dealing with?

A. 2000 to 1.

Q. What kind of producing rates?

A. 80 barrels a day allowable.

Q. All right. Your company has asked you to help them permit and obtain the necessary approvals for these wells, right?

A. Yes, sir.

Q. Some of the acreage is federal, part of it's fee, some of it's state. When we look at Section 4, how do we tell the difference?

A. Okay, in section 4 we've got a legend here at the bottom of the plat that's going to help us work through that.

The fee acreage is shown in the south half of the southeast quarter of section 4, and I've indicated on the map that -- I've handwritten in there, Fee Acreage, with a little arrow.

We do have a slight drafting error. In the legend where it shows a horizontal set of lines in there, which would be for fee acreage, actually, within Section 4 it's got diagonal lines. But that acreage in the south half of the southeast quarter is fee acreage.

The acreage that's shown by diagonal lines which -- part of it would be in the northeast quarter of the southwest quarter, and the remainder of it would be in the northeast quarter of Section 4, is shown by diagonal lines, that's federal acreage.

And the remainder is state acreage.

Q. On the federal acreage, you submit your applications for permits to drill to what agency?

A. To the Bureau of Land Management Office in Carlsbad, New Mexico.

Q. And has that been done?

A. Yes, sir, it has.

Q. And what is the status of approval of your APDs for those wells in Section 4 on federal acreage?

A. The BLM is currently holding those APDs, pending the outcome of this hearing.

Q. All right. Other than the outcome of this hearing, to the best of your knowledge are all of those applications in full compliance with the regulatory requirements of the BLM?

A. Yes, sir, I believe so.

Q. As to the state tracts, what have you done about your APDs?

A. Those APDs are also in the OCD district office, and again, they're waiting on the outcome of this hearing.

Q. Except for the decision by the Division concerning the deletion of the potash-protection string, to the best of your knowledge, information and belief are those APDs full and complete and ready to be approved?

A. I think so, yes, sir.

Q. All right, sir. Before we talk about the rest of the information on the display, let's talk about the regulatory framework of R-111-P, as you understand it, and what the mechanism is for your management of these APDs.

A. All right, sir.

Q. If the Examiner will turn behind -- Well, let's do another one first. I've got a better idea.

If you'll turn behind Exhibit Number 2 and look at the reference map, what is contained behind Reference Tab Number 2?

A. Reference Tab Number 2 contains a listing of

wells in three Yates-Seven Rivers pools in this area. They would be the Yates-Seven Rivers pools between the proposed wells and the nearest potash mines. And what we've done is, we've compiled a tabulation of the well casing summaries.

Q. Why have you done that?

A. By review of the OCD records, and we've attached a copy of the completion reports from the OCD or BLM offices as part of this exhibit.

Q. What does it show?

A. What this exhibit shows is that the vast majority of wells that have been drilled to the Yates-Seven Rivers formation in this area have been drilled without a salt-protection string. Some summary information indicates that only 10 of 53 wells in the Yates-Seven Rivers Pool in this area actually have had a salt-protection string set.

Q. Is there any way to relate the data behind Exhibit 2 to the base map, Exhibit 1?

A. Yes, sir, we've indicated the wells that have no salt-protection string set by a black circle around the wells.

There are three cases where we have a circle around a well, and that circle was put there in error, and those wells actually did have a salt-protection string. So what I've done is, beside each well I've written the

acronym "SPS" for salt-protection string.

One of those wells would be the southernmost well in Section 9, Section 9 being just south of Section 4. There's also two wells in Section 16, which is just south of Section 9, which I've written "SPS" by those wells, had salt-protection strings. And the Yates Teas -- or the West Teas Yates-Seven Rivers Pool, out of 20 wells in that pool only seven of those wells had a salt-protection string set.

Q. Mr. Stephenson, do you find in your research there is any instance in which an operator has petitioned anybody for deletion of the potash-protection string for a shallow Yates-Seven Rivers well and been denied?

A. No, sir.

Q. Let's turn now to Exhibit Tab Number 3. If you'll look behind that tab, what's contained in the Exhibit book at that point?

A. It's a copy of OCD Order R-111-P.

Q. Are you familiar with R-111-P?

A. Yes, sir, I am.

Q. I'm going to talk to you about the area that was affected between R-111-O and the Commission's adoption of R-111-P in April of 1988. And to do that, Mr. Stephenson, if you'll turn behind Exhibit Tab Number 4 and look at the first colored display --

A. Yes, sir.

Q. -- do you have that?

A. I do.

Q. That colored display is a reduced copy of what, sir?

A. It's a reduced copy of the 1984 BLM Potash Map.

Q. For purposes of my question, I'd like you to look at that map. There's a code or a legend on the lower right-hand corner. The last of those legends refers to a dark black line. Do you see that?

A. Yes, I do.

Q. What's that legend mean?

A. That indicates the outline of the R-111 area.

Q. Is that black line reproduced on the display of the Bureau of Land Management 1984 map?

A. Yes, sir, it is.

Q. All right. Find for us Section 4 on that map and tell us where it lies in relation to the R-111 orders prior to the entry of R-111-P.

A. Okay. Again, Section 4 is in the northeast portion of the potash enclave. I've written a "4" in what is shown to be that red barren area in the northeast portion of the enclave. That's section 4 in question and that's located east and north of the R-111 outline. So it's outside the R-111 area.

Q. Is it a correct interpretation of the R-111

process that prior to R-111-P your company could have drilled these wells in Section 4 without regard to any of the casing or cementing requirements of the R-111 orders?

A. Yes, sir, that's my understanding.

Q. All right. What happened in R-111-P then?

A. R-111-P expanded the designated potash area, and my understanding, the intent of the expansion was to make the R-111 area consistent or coterminus with the BLM-designated potash area --

Q. All right.

A. -- so you'd have one consistent outline.

Q. As best was possible or practicable then, R-111-P, at that point, the outer boundary of R-111-P was generally contiguous with what the BLM was using for the outer boundary of the potash area?

A. Yes, sir, that's correct.

Q. All right. In exchange for extending or expanding R-111, was there anything drafted into R-111-P that provided the operators of oil and gas wells from any kind of relief from the stringent requirements of the casing and cementing program, if they were closer to active mining operations in the enclave?

A. Yes, sir, there's specific provisions in the Order that allow operators to apply for a waiver of the salt-protection string.

Q. Show us where they are.

A. Okay. Let's turn back to Tab Number 3, and if you'll please turn to page 4 of the Order --

Q. All right, sir.

A. -- under paragraph (22) on page 4, that paragraph reads that "Expansion of the R-111 area to coincide with the KPLA will bring under the purview of this order areas where potash is either absent or non-commercial and such areas should be granted..." and I emphasize the word "should" "...be granted less stringent casing, cementing and plugging requirements, at the discretion of the OCD district supervisor."

Q. Is that the only place where that concept is introduced into the Order?

A. No, sir, it's not.

Q. Where else do we look?

A. If we'll turn to page 5 and look under C (4).

Q. All right, sir, what does that say?

A. That paragraph reads, "The Division's District Supervisor may waive the requirements of Sections D and F..." and those sections relate to the casing and cementing programs "...which are more rigorous than the general rules upon satisfactory showing that a location is outside the Life of Mine Reserves (LMR) and surrounding buffer zone as defined hereinbelow and that no commercial potash resources

will be unduly diminished."

Q. With that provision integrated into the Order, what did you do to determine whether or not your Section 4 and these shallow oil wells had the opportunity to be granted a waiver or an exception from the potash-protection string under R-111-P?

A. Okay, we contacted representatives of the Bureau of Land Management and the State Land Office, and we also contacted representatives of the potash lessees in the area.

Q. All right. Does R-111-P provide a process or a mechanism by which you make those contacts and set up a protocol or a procedure for providing notice to those people and an opportunity for objection?

A. Yes, sir, it does.

Q. Describe for us what the procedure is.

A. Okay. At the time you file your application for a permit to drill with the OCD, you're required to give notice of that application to all potash lessees within one mile of the proposed wells.

Q. How do you make that determination?

A. Well, you go to the records and check for ownership of the potash leases.

Q. All right. And did you have that done or cause that to be done?

A. Yes, sir, we did.

Q. And have you satisfied yourself that that was done accurately?

A. Yes, sir, we have.

Q. And you subsequently had maps that showed precisely who the potash lessees are in the area?

A. Yes, we do.

Q. All right. Did you notify pursuant to R-111-P the potash lessees within a mile?

A. Yes, sir, we did.

Q. And under R-111-P, after notification they're entitled to object, provided they do so within 20 days?

A. That's right.

Q. And did you receive any objection from any potash lessee within the time required under the rule?

A. We did receive one letter from Mississippi Chemical Corporation that initially indicated they had an objection, but upon subsequent conversation with them they withdrew that objection.

Q. All right, sir.

A. And we do have a cop of that letter that will be part of the record.

Q. Define for us what the concept is of an LMR, a life of the mine. What does that mean?

A. Okay, the basic concept behind the life of mine

reserve designation, as I understand it, is, the potash lessees will designate what they consider to be their minable potash reserves -- their crown jewels, if you will -- and they'll file maps with the OCD -- not the OCD, but with the State Land Office.

Q. As well as the BLM?

A. And the BLM, setting out those life-of-mine reserve areas which would be protected by the BLM and the OCD and the State Land Office.

Q. Does the filing of that technical data and the designation of an LMR set up any kind of confidentiality or proprietary arrangement between the potash operators and the Land Office and the BLM?

A. Yes, sir, it does.

Q. How, then, are you as an oil and gas operator to know if your proposed wells are in an LMR or within a buffer area?

A. All we can do is to make contact with representatives of the agencies and/or potash lessees and rely on them to tell us whether or not we're within that LMR or buffer zone.

When you contact the agencies, because of the confidentiality provisions, they're not at liberty to describe the area covered by an LMR or buffer zone, but they can tell you whether or not a proposed well location

would fall either within the LMR or its buffer zone.

Q. And did you make those contacts with the BLM and with the State Land Office?

A. Yes, sir.

Q. And what response did you receive?

A. That our locations are not within the buffer zone or LMR of any potash lessee.

Q. All right. There's two different buffer zones in R-111-P?

A. Yes, sir.

Q. Describe for us what each means.

A. Okay. There's two different buffer zones, and they're tied to the depth of the wells. There's a quarter-mile buffer zone that's been established for what is described as shallow wells, and those wells would be wells that are drilled above the base of the Delaware formation or 5000 feet, whichever is less. Anything below that depth would be considered a deep well, and you'd be subject to a half-mile buffer zone.

Q. In either instance, your proposal is more than a mile away from an LMR, is it?

A. More than a half mile from a buffer zone of an LMR, yes.

Q. A half mile, all right.

Let's go back to Exhibit 1. When we look at

Section 4, based upon the information that you have studied, how far do we have to travel before we get to a potash mine that's either active or inactive?

A. The closest mine would be five miles to the southwest. That would be the New Mexico Potash Mine.

Q. There's another portion of the display that references a Mississippi Chemical mine that's inactive?

A. Yes, sir, that would be 5.3 miles west of Section 4. That mine is currently inactive.

Q. Okay. Let's turn to the information behind Exhibit Tab Number 4 now.

A. All right, sir.

Q. You've talked about the first display, that's the 1984 map with the R-111-O line on it. What's the next display?

A. The next display is the 1993 BLM Potash Map, which is the same map we have up here, the large-scale map we have up here on the easel.

Q. All right, sir. Let's look at the information behind Exhibit Tab Number 5. Identify and describe what you've shown.

A. Okay, that is a plat showing the ownership of the potash minerals. It's a nine-section plat around Section 4, and it shows the ownership of the potash minerals.

Within Section 4 in the south half of the

southeast quarter we have unleased potashed minerals. In the northeast quarter of the section we have some unleased federal minerals. And also in the northeast quarter of the southwest quarter we have some unleased minerals. The remainder of the section is under lease to Mississippi Potash, also known as Mississippi Chemical Company.

Q. Behind the initial display, do you have confirming information obtained from Federal Abstract Company verifying the ownership of the various leases?

A. Yes, sir, we did -- On April the 20th, the Federal Abstract did a record check to verify that as of that date this ownership was correct.

Q. All right. Turn now to Exhibit Tab Number 6, and let's look at the first item of information behind Exhibit Number 6.

A. All right, sir.

Q. What's there?

A. That is a letter dated October 22, 1993. It's a letter I sent, it's a transmittal letter I sent with a copy of the applications for permit to drill to all the potash lessees.

We also sent notice to the mineral owners in the south half of the southeast quarter of Section 4, which actually probably goes beyond the requirements of R-111-P, as far as notice is concerned, but out of an abundance of

caution we gave notice to those mineral owners.

We also sent a copy to all the appropriate regulatory agencies, including the State Land Office, the -- both the district office and Santa Fe office of the OCD, and the Carlsbad office and Roswell office of the Bureau of Land Management.

Q. Did you mail these -- cause these notices to be mailed by certified mail, return receipt?

A. Yes, sir, we did.

Q. And this will comply with the notice requirements of R-111-P?

A. Yes, sir.

Q. All right. Behind that you have copies of the green cards showing receipts of some of the notices?

A. Yes, sir.

Q. All right. And after that, there is a letter of February 21st of 1994?

A. That's correct.

Q. Why is that included in the exhibit book?

A. The reason that we've included that letter is, if we can look back at Tab 5 for just a second, to the west of Section 4 and Section 5, the section below that, south of that, Section 8, Section 32, we show both IMC Fertilizer, Inc, and Noranda Exploration Corporation as a potash lessee.

And the reason being is that for some time the current potash lessee, Noranda Exploration, Inc., has been undergoing some negotiations with IMC to assign their leasehold to IMC. And based on a conversation I had with Mr. Frank Condon with Noranda Exploration concerning our proposed wells, Mr. Condon advised me of the status of their negotiations and referred me to Mr. Dan Morehouse with IMC. He said that they were now referring all inquiries relating to oil and gas activity in their potash area to IMC, based on their continuing efforts to assign that acreage to IMC.

So --

Q. All right. You could have stopped right there under R-111-P. You had no obligation under the rule to contact IMC, did you?

A. No, sir, we didn't.

Q. But you went ahead and did that, didn't you?

A. Yes, sir.

Q. All right. And what response?

A. We received a letter back from IMC, and it's -- If you'll turn in your exhibit book -- You'll have to pass a couple letters from the Mississippi Potash Company, but if you'll turn back in there, there's a letter dated April 22nd, 1994 from IMC. And the first paragraph of that letter from Mr. Dan Morehouse with IMC, the next to the

last sentence of the first paragraph indicates that "IMCF is in the process of acquiring potash leases in this area. The LMR of the existing orebody extends from the west to a line approximately one-half mile west of Section 4."

It also goes on to state, in the first sentence of the next paragraph, that Section 4 is within an area that allows for the consideration of removing the salt-protection string of casing, and it says, IMC has no expertise on casing integrity but will rely on the NMOCD's expertise and their mandate to ensure the safety of others from the hazards of oil and gas operations in area.

And I'd just like to point out, in my conversations with Mr. Morehouse, it was actually Mr. Morehouse that pointed out to me that Section 4 was outside the old R-111 area. And based on that fact, he did not believe that IMC would have any objection to this Application.

Q. Okay. Let's turn now to the permitting process with the State of New Mexico and the Bureau of Land Management.

When we look at the exhibit book after the IMC letter, there's a number of letters in here --

A. Yes, sir.

Q. -- over the signature of Mr. Sexton that indicate various notations. What do those mean?

A. Okay, those letters are letters that were sent to the State Land Office here in Santa Fe by the OCD office in Hobbs. And the purpose of the letters -- If you'll look down at the bottom of the letters, the purpose of the letters was to indicate whether or not the proposed well location is within either an LMR or the buffer zone of the LMR.

And in each one of these letters it indicates that none of the locations are within either the LMR or buffer zone.

And I should like to point out that there's seven wells within Section 4 that are either on state or federal acreage, so they would be subject to the approval of the OCD. We have letters from the State Land Office, OCD, indicating that we're not within the half-mile buffer zone or LMR in six out of those seven cases.

The one location that we were not able to get a letter on, apparently because they were not able to find it, would be the well located in Unit Letter O, Section 4, which is actually further away from the LMR than either Well Number 9 or Well Number 10 would be, so I think it's a very safe assumption to make that that well location also would not be within a half mile of either the buffer zone or LMR.

Q. During the course of processing your applications

with the OCD, a policy or practice change was made such that instead of having the district supervisor of the OCD grant a waiver of the potash-protection string, that situation was deferred to Santa Fe?

A. Yes, sir, that's correct.

Q. And the deference of that decision to Santa Fe has caused us to seek a hearing before the Examiner so we could present the technical data in that format?

A. That's right.

Q. All right. After the permit letters from the OCD showing that in each instance you're beyond the buffer and beyond the LMR, there's a certificate of mailing and compliance with the notice procedures for the OCD hearings. Do you find that in your exhibit book?

A. Yes, sir, I do.

Q. Have you had a chance to look at that and satisfy yourself that all the right people got all the right notices for this hearing?

A. Yes, sir, I have.

Q. As a result of notifications for this hearing, are you aware of any objection that has been filed by any party of interest to the approval by this Examiner of this Application?

A. No objection that has not been withdrawn.

MR. KELLAHIN: All right, sir. That concludes my

examination of Mr. Stephenson.

We move the introduction of his Exhibits 1 through 7 -- I'm sorry, 1 through 6.

THE WITNESS: Mr. Kellahin, if I may, there's one more --

MR. KELLAHIN: Did we miss one?

THE WITNESS: Yeah, there's one more point I'd like to make before we move on.

Mr. Examiner, if I could get you to turn back to Tab Number 2, which is the well casing summary --

EXAMINER MORROW: Is that the top page or all that mess behind it?

THE WITNESS: Just the top page is all I want to refer you to.

There are four wells listed at the top of the exhibit that were drilled by Stevens and Tull, and each of those four wells was drilled subsequent to the adoption of Order R-111-P, the expanded area. The most recent of those wells was spudded on April 1st of 1994, this month.

All those wells are located on federal acreage, so they're subject to BLM approval. None of those wells have had a salt-protection string set in those.

So here we have a situation where very recently another operator in the section due south of us who has two wells that are 330 feet off our lease line has drilled

wells one -- very recently without the salt-protection string.

EXAMINER MORROW: Now, are those on Exhibit 1?

THE WITNESS: One of those wells would be located 990 feet from the east line and 330 feet from the north line of the section. That's the most recent well that was spudded April 1st.

There's also another well that's located 330 feet from the north line and 2310 from the west line, and that well was drilled in May of last year.

EXAMINER MORROW: You're in the West Teas Pool?

THE WITNESS: Yes, sir, there in Section 9.

EXAMINER MORROW: Well, all those have a black circle around them, most of them.

THE WITNESS: Yes, sir.

EXAMINER MORROW: What does that mean?

THE WITNESS: The black circle indicating that they were drilled without a salt-protection string.

EXAMINER MORROW: Okay, without. Okay. Salt-protection string would be about 2500 feet or so?

THE WITNESS: Yes, sir, that's correct.

EXAMINER MORROW: And all of that is on the BLM?

THE WITNESS: All of that is federal acreage, yes, sir.

EXAMINER MORROW: Some of them, at least, have

been drilled this year?

THE WITNESS: That's right.

EXAMINER MORROW: Was there anything else? I got started asking questions before I should have, probably.

THE WITNESS: No, sir, that was it. That's the only point I wanted to make.

MR. KELLAHIN: I would like to move the introduction of Mr. Stephenson's Exhibits 1 through 6.

EXAMINER MORROW: One through 6 will be admitted into the record.

THE WITNESS: Thank you.

EXAMINER MORROW: Now, let's see, I had some questions.

EXAMINATION

BY EXAMINER MORROW:

Q. You had -- You've already gotten some APDs approved in Section 4 by BLM; is that correct?

A. No, sir. Those APDs we filed with the BLM are pending the outcome of this hearing. We have drilled one well in Section 4, which is in unit letter O, and it's got a number "5" by it.

Q. Yeah.

A. That well was originally a deep well, and it did have a salt-protection string in it, so we were able to drill that well. It has recently been recompleted to the

Yates formation.

Q. Now, several of these wells on Exhibit Number 2, the first page, were older wells, it looks like, that were drilled maybe before there were any requirements. Is that -- Some of them in 1941 and 1940 and...

When did R-111-P come into existence? Do you know? Or R-111, rather?

A. The original R-111 order?

Q. Yes, sir.

A. I'll have to defer to Mr. Kellahin on that.

MR. KELLAHIN: November 9th of --

EXAMINER MORROW: We found a July of 1955, that's --

MR. KELLAHIN: Yeah, it's 1955, yes, sir.

EXAMINER MORROW: -- Rand did. Okay.

MR. KELLAHIN: And then R-111-A was October of 1955, so we did two of them real quick.

Q. (By Examiner Morrow) So let's see. How far -- Do you know how far these would be from the buffer zone? I guess --

A. My understanding --

Q. -- actually it's about half a mile?

A. Yes, sir, Section 4, the west line of Section 4, would be approximately one-half mile from the buffer zone or one mile from the LMR proper.

Q. Okay. Well, now, this is a barren area in Section 4, I believe. Is it -- This new map even indicates that.

A. Yes, sir, there's been essentially no change as far as the status of the barren area from the 1984 Potash Map to the 1993 Potash Map.

Q. Did any of them indicate to you why they wanted the leases on that or...

A. Many of those leases are very old.

EXAMINER MORROW: Old leases. Do you have any questions?

MR. CARROLL: Shakes head.

EXAMINER MORROW: Thank you.

MR. KELLAHIN: Mr. Examiner, at this time we'll call Mr. Don Olive. Mr. Olive is the geologic manager from Midland that I described earlier.

EXAMINER MORROW: I did have one more question.

Q. (By Examiner Morrow) Mr. Stephenson, when did you learn that that policy had changed in regard to district approval of these exceptions, or district consideration of these exceptions?

A. I believe it was in September of 1993, Mr. Morrow.

Q. September of 1993. And you were advised verbally by Mr. Sexton; is that correct?

A. Yes, sir, we did receive a letter from Mr. Sexton also. We'd be happy to give you a copy of that if you require it.

EXAMINER MORROW: Okay.

DON OLIVE,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Olive, for the record, would you please state your name and occupation?

A. My name is Don Olive. I'm district development geologist for Mitchell Energy Corporation.

Q. Mr. Olive, you're going to have to speak up. This microphone doesn't amplify your voice; it just helps the court reporter with his --

A. Okay. Don Olive --

Q. -- preservation of your words and wisdom, and so you'll have to jump the volume.

A. Don Olive, district development geologist for Mitchell Energy.

Q. Summarize for us your education, sir.

A. I graduated from Texas Tech University in 1979 with a BS in geology.

Q. Give us a summary of your employment experience

as a petroleum geologist.

A. I worked for two and a half years for Manzano Oil Company, and I have worked 12 1/2 years for Mitchell Energy Corporation, for a total of 15 years in the oil and gas industry.

Q. What is it that you do now?

A. I am supervisor of all development, geological development work in the Midland office.

Q. Does that work include the project we've identified that Mitchell proposes in Section 4?

A. Yes, sir.

Q. How did you become personally involved in that project?

A. We had drilled several wells in the area. We originally drilled in Section 4 the Scharbauer 4 State Number 1, and geological work was done on all formations from -- all potential producing formations from the Morrow all the way up through the Yates.

We felt like in the Yates we had excellent possibilities to extend commercial production from the Teas West Yates-Seven Rivers field to the -- should be able to extend commercial production to the north into Section 4.

Q. That work was either done by you personally or in your supervision of the other geologists that work for you within that division of your company?

A. Yes, sir.

Q. And based upon that work, have you been able to reach certain geologic conclusions about the feasibility of this project?

A. Yes, sir, we have quite a bit of well control. We have a producing well, now, from the pool. It appears to be commercial. And we feel like, based on all of this, that we think we have an excellent opportunity here to drill multiple wells in Section 4.

MR. KELLAHIN: We tender at this time Mr. Olive as an expert petroleum geologist.

EXAMINER MORROW: Yes, sir, we accept Mr. Olive's qualifications.

Q. (By Mr. Kellahin) At the time you're studying this project, is there existing production out of the West Teas Pool?

A. Yes, sir.

Q. And that production lies to the south in Section 16?

A. Yes, sir.

Q. Is Section 4 totally within your control or Mitchell's control as an operator?

A. Yes, sir.

Q. When we're looking at the West Teas Pool, describe for us geologically the creature we're looking at.

What is it?

A. We have production from the Seven Rivers formation, up high on the structure to the south.

We additionally see production from the Yates -- actually throughout the Yates, from the lower Yates, middle Yates, upper -- to the very upper part of the Yates.

The Seven Rivers production appears to be structurally controlled.

The Yates production -- lower Yates is structurally controlled for the most part, I think. And the upper Yates, the interval that we're dealing with here, is stratigraphically controlled.

Q. All right. So when you're looking for your geologic opportunity in Section 4, despite the fact that the West Teas Pool includes not only the Yates and the lower portion, being the Seven Rivers, you have determined geologically that your only opportunity is going to be in the Yates portion of the pool?

A. Yes, sir. When we drilled the Scharbauer Number 4, we did not encounter any shows in the Seven Rivers. We had a show in one of the lower Yates sands which produces structurally higher up. We production-tested this, and it swabbed water.

Q. What's the depth of this formation -- or these zones in the Yates?

A. Approximately 3200 feet.

Q. When we begin to look at the details that support your conclusion, are we going to look at the Yates as a single zone or unit?

A. No, sir, we have broken this into three separate producing intervals, separated by permeability barriers, all three of which are productive in the area, but various ones -- at some places two produce, some places all three. But they appear to be separate reservoirs.

Q. Is this wildcat oil exploration?

A. No, sir, this is development.

Q. The existing pool is immediately to the south, and you're seeking to extend it into Section 4?

A. Yes, sir.

MR. KELLAHIN: All right, sir.

Mr. Examiner, we've taken Mr. Olive's montage, which is Exhibit Number 7, and we're going to talk about its individual parts. You have in your exhibit book another copy of that same display. Some of the details, I think, are too hard to see with the distance involved, but you do have another copy.

EXAMINER MORROW: Okay.

Q. (By Mr. Kellahin) Let's talk about the range of expectation. As a geologist, are you working with reservoir engineers in your company to determine what is

the expectation of the ultimate recovery that you might achieve from this Yates portion of the pool?

A. Yes, sir, we work very closely together.

Q. Give us a number that we can use for now until we talk to the reservoir engineer, so that we can understand the magnitude of potential recovery that you're trying to achieve in Section 4.

A. Based on my experience in this area, as well as other Yates areas, I like to see at least 50,000 barrels cumulative per well to be considered economic.

Q. In terms of oil potential in the Yates, we're looking at 50,000 barrels of oil, total cumulative production per well?

A. Yes, sir.

Q. That's the framework in which you've made your study?

A. Yes, sir.

Q. All right. Let me have you go to the montage now, and let's talk about the cross-section.

If you'll stand to the side of it there, so that the Examiner can see where you're pointing to, and if you'll wait just a second we'll let the court reporter change his paper. Are you okay, Steve?

Let's start with the cross-section. And before we look at that display, take us to the structure map on

the montage and show us the line of cross-section, starting with the north and going south.

A. This is a cross-section on the top of the Yates formation, which is this heavy black line that you see right here, and this cross-section runs from south to north. From this well right here -- it's probably hard for you to see -- it runs right across through the middle of the field, down the nose of the structure all the way up to our Scharbauer Number 4.

Q. All right. Let's go to the cross-section now and find one of the logs on the cross-section that we can use as an example. Which one do you want to pick?

A. The one in the middle.

Q. And what's the well name, so we know what we're looking at?

A. The Stevens and Tull Federal "9" Number 2. This is located in proration unit B of Section 9.

Q. All right. Start at the top of the log for that well and go down and tell us what the color codes mean.

A. The purple that you see on top is interpreted to be the Tansil formation. This should be for the most part anhydrite.

Q. Why does that have any significance?

A. Because anhydrite is a very dense formation, very tight formation. It acts in a -- Well, let's say very low

permeability. This is interpreted to be the seal for the entire producing interval. This should be the very uppermost limit of any production in the area.

Q. At the base of that color code, you've drawn a horizontal line in black and labeled it. What's the label?

A. This is the top of the Yates formation.

Q. All right. In that wellbore now, starting at the top of the Yates, take us down to the next horizontal line and tell us what that area defines.

A. We have broken this, as I said earlier, the upper Yates, into three producing intervals. We have the upper zone, the smaller black line you see just below the top of the Yates is the top of the middle zone, and then the next one is the top of the lower zone.

In this particular wellbore we have all three sands represented, and the middle and the lower produce, are perforated.

Q. That's your target?

A. Yes, sir.

Q. Those three zones of the Yates?

A. Yes, sir.

Q. As a geologist, how do you evaluate the log to determine where in that log lies your best opportunity for production?

A. We rely heavily when we drill these wells on the

mud log, but probably our most important tool in determining quality reservoir is the porosity. We look for at least 16-percent density porosity or better. This has been determined, again, through our experience in the area. Anything much less than at least 16 percent tends to be too tight. We're looking at a few millidarcies or less in permeability.

As you get to 16 percent and above, the permeability goes up orders of magnitude. And this has been demonstrated throughout the cross-section. Everything colored, everything in red you see is 16 percent or better. And in some of these wells where you see very little red, we have very poor production, such as here is 10,000 barrels, and the well is two and a half years old.

Q. When you look at what the operators have done with these wells in the upper Yates, particularly for those displayed on the cross-section, have they perforated where you would have perforated these wells in order to achieve the maximum production out of the Yates?

A. Yes, sir, they have. As you can see, wherever there is what we interpret to be quality reservoir, we see perforations across from every one of those zones.

Q. We're not dealing with a reservoir for purposes of your analysis that has any behind-the-pipe potential that is not contributing yet to the productivity that the

reservoir engineer needs to deal with?

A. I believe every bit of it has been established, production has been established.

Q. We're looking at only the Yates portion of the pool. Now, on the display show what happens when we get production contribution from the Seven Rivers. Where do we have to go on the display to find wells that will do that?

A. The wells that produce from the Seven Rivers are, for the most part, in Section 16. In fact, I believe all Seven Rivers comes from the high point on the structure here in 16. This well right here is located on a very high point of the structure. This would be Unit F of Section 16.

Q. Sixteen, for the most part, has got the Seven Rivers?

A. Yes, sir.

Q. And we move towards Section 4, get to Section 9, and the wells in Section 9, then, you've examined to see if they're contributing production out of the Seven Rivers?

A. Yes, sir.

Q. And what did you find?

A. We find no Seven Rivers. This production comes from the lowermost Yates, right at the base of the Yates.

This line right down here is the top of the Seven Rivers formation, and there are some basal sands right on

top of the Seven Rivers that produce.

Q. Did you assist the reservoir engineer so that he could make reservoir calculations of ultimate recoveries, so that he's dealing with only the Seven Rivers portion of production?

A. Yes, sir.

Q. You've discussed with him, then, those wells that may be producing oil from another portion of the pool that's not available to you in Section 4?

A. Yes, sir.

Q. So when we talk to him, we're going to be able to confine his discussion to what you would expect to achieve in Section 4 from the upper Yates?

A. His calculations are based on production that we have seen from the interval being presented here.

Q. All right. Give us a quick summary of the correlation or the continuity of those zones in the Yates as you see them depicted on the cross-section.

A. Well, as you can see, the yellow here are the individual sands, and they correlate all the way across the Teas West structure.

Q. Let's go through the isopachs now. You've isopach'd each of the individual members of the Yates.

A. Yes, sir, this -- On your left is the aspect of the upper zone, the middle zone, and on the right is the

Yates lower zone.

The contours are based on 16 percent or better density porosity. So what is represented here should be pay-quality reservoir only.

And what we're seeing is, on the top of the structure there is very, very thin, or almost nonexistent upper Yates sand. As we move downdip and down the structure, we are encountering more and more sand.

And the depositional model here, we feel, is a beach ridge deposit. They're linear, narrow trending northeast-southwest, near-shore, very fine-grain sand. And as we go north again, we're dealing with more and more sand.

So we feel like this is a structural trap -- excuse me, a stratigraphic trap. There are some structural implications, but for the most part reservoir quality is increasing as we go towards Section 4.

MR. KELLAHIN: That concludes my examination, Mr. Morrow, of Mr. Olive.

We move the introduction of his Exhibit Number 7.

EXAMINER MORROW: Exhibit 7 will be admitted into the record.

EXAMINATION

BY EXAMINER MORROW:

Q. You said what approximate depth the upper Yates

would be encountered at or TD'd at. What depth was that? I didn't get that down.

A. I can tell you exactly. In our Scharbauer Number 4 it was at 3150. Base of the total interval would be about 3280.

Q. On the cross-section you've indicated initial potential and cumulative production for the wells that are depicted here, and on at least one you've got -- on your well you have some subsequent tests. Are those 1994 tests?

A. Yes, sir, this well was recompleted early this year, actually January, and these are actually bi-monthly tests indicating the progress. Actually, the well has improved somewhat from this last test.

Q. Oh, it has?

A. So it's a very, very low decline. It's not as high a decline rate as we're seeing from some of the wells to the south.

Q. How are these other wells holding up? Are those initial potentials?

A. The --

Q. More -- Well, go ahead.

A. I'm sorry. Well, on the average, I think we're seeing a 60- to 70-percent decline rate, initial decline rate. And we haven't experienced that; this is what we're kind of excited about. And I think it's due to higher

quality reservoir. We have more high-quality sand in our wellbore than most of the rest of these wells. The wells closest to us are all very recent since 1990.

Q. But even on those you've seen that high decline rate?

A. Yes, sir.

EXAMINER MORROW: Okay, sir. Thank you.

We'll probably have to have that map as we consider what --

MR. KELLAHIN: Sir?

EXAMINER MORROW: We'll probably have to keep that map.

MR. KELLAHIN: I think it's a reference point. We have a couple other witnesses who will talk about it.

EXAMINER MORROW: Well, I mean keep it for good.

MR. KELLAHIN: Mr. Stogner has one upstairs.

EXAMINER MORROW: Oh, does he?

MR. KELLAHIN: I gave it to him last week --

EXAMINER MORROW: Good.

MR. KELLAHIN: -- so he has one. You're welcome to have this one.

EXAMINER MORROW: Oh, no. Might want one for Artesia, though.

MR. KELLAHIN: It will take just a minute. We're going to have the drilling engineer talk about the drilling

program. If we could have five minutes, we'll get set up.

EXAMINER MORROW: All right.

(Thereupon, a recess was taken at 2:11 p.m.)

(The following proceedings had at 2:20 p.m.)

EXAMINER MORROW: We're ready when you are, Tom.

MR. KELLAHIN: Thank you, Mr. Examiner. We'll call at this time, Mr. Bill Thoroughman. He spells his last name T-h-o-r-o-u-g-h-m-a-n.

EXAMINER MORROW: Thoroughman; is that right?

THE WITNESS: Yes, sir.

BILL THOROUGHMAN,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you please state your name and occupation?

A. Yes, sir. My name is Bill Thoroughman. I'm a staff drilling engineer for Mitchell Energy Corporation.

Q. Mr. Thoroughman, where do you reside, sir?

A. The Woodlands, Texas.

MR. KELLAHIN: I have Mr. Thoroughman's résumé here, Mr. Examiner, and it's very small print and it's some four pages long, and I'm going to share it with you. Then we'll just hit the high spots.

EXAMINER MORROW: Okay.

Q. (By Mr. Kellahin) Summarize for us your education, sir.

A. Graduated high school in St. Charles, Missouri, my hometown, in 1966. From that point I went to the University of Missouri, Rolla campus, graduated with a BS in mechanical engineering in 1971.

Q. Describe for us, sir, your first employment experience.

A. My first employment was with Consolidation Coal Company, Pittsburgh, Pennsylvania. I was --

Q. Did that have to do with any of the aspects of oil and gas drilling as you now perform it for your company?

A. No, sir, it did not.

Q. As a mechanical engineer, what did you do with coal mines?

A. I was assigned to Lee Engineering Division. We were a wholly-owned subsidiary. We were consultants for our parent company.

My job specifically was to trouble-shoot underground heavy equipment, continuous miners, coal-hauling devices and such and so forth.

The Jeffrey equipment that I would investigate was all used underground. This culminated with various engineering reports that were supplied to Jeffrey

Manufacturing Company and management at the coal company, and culminated with a quarterly report that was both given to my management and the Consolidation Coal Company, and also to Jeffrey Manufacturing.

Q. What part of the country were you working in?

A. Pittsburgh was my home office, McMurray to south Pittsburgh, and I covered the states of West Virginia, Kentucky, Illinois, Ohio and very little of Virginia.

Q. Let's talk about your experiences with drilling in oil and gas production.

A. Okay, I left the coal mines in 1973 and took employment with A.W. Thompson, Incorporated, in Midland and Odessa, Texas.

Q. Now, what did they do?

A. They were drilling contractors, very deep drilling contractors. Our rigs -- The majority of our rigs were capable of going to 30,000 foot.

Q. Working for a drilling contractor, what was it that you did?

A. My training period involved six weeks as a roustabout, seven months as a roughneck where I worked all positions at the drilling rig except for derrickman. From there, I was an electrician's helper for a number of weeks, going into two months, I believe. I went -- attended a trade school.

Finally, a year later, after doing all these background-type of employment jobs, I was anointed an engineer foreman.

Q. All right. When you're promoted to an engineer forum [*sic*], is there any kind of association that you can belong to where you get a certificate or a plaque saying that I'm now a drilling engineer?

A. No, there is not.

Q. All right. You go to schools, seminars?

A. That's correct.

Q. Learn on the job?

A. Yes.

Q. How long did you stay in that particular company?

A. I stayed with A.W. Thompson through their purchase by Santa Fe International Corporation out of Orange, California. I stayed an additional six months with Santa Fe, and I took employment with MND Drilling Corporation, which was a wholly-owned subsidiary at the time.

Q. What did you do for that company?

A. Staff drilling engineer.

Q. Same thing?

A. Yes, sir.

Q. All right. What's your next employment?

A. I transferred from their northern division in

Bridgeport where we drilled a number of Shell wells, to their southern division, which was active in the Gulf Coast, the higher-pressured wells, transferred down as their engineering manager and subsequently, with some name changes we did, became division engineer for them.

Q. That entire experience within your profession has been as a drilling engineer with regards to a drilling contractor?

A. That is correct.

Q. When did you make the change to the other side of that deal?

A. I left employment with MND, took a position with a friend's company in Hobbs, New Mexico, as manager of a small chemical company. We attempted to get through the tough times in the oil field.

At a point in time he decided he would rather go ahead and declare bankruptcy, and the company folded at that point in time.

Q. How long have you been working for Mitchell Energy?

A. In this present position, I started with them again in October 17th of 1983, so that would be 11 1/2 years, I believe.

Q. You're now in the position where you review and supervise, analyze, study for your company arrangements

with drilling contractors?

A. That is correct.

Q. In addition, you look at well programs, revise well programs, create your own well programs for the drilling of wells?

A. That is correct.

Q. What is your geographic area of responsibility for your company?

A. Currently it includes Alabama, Mississippi, Gulf Coast, west Texas, eastern -- southeastern New Mexico.

Q. Surface down, what kind of creatures do you deal with?

A. From the geopressured wells of the Gulf Coast, being Wilcox wells typically, to offshore wells -- we've done a few of those -- to the Morrow in southeast New Mexico, which would occur somewhere around 13,000 foot, thereabouts, and to the shallow wells we're talking about today, the Yates wells.

Q. Give us an estimate of the number of well designs or well programs that you have been involved with during the course of your professional experience as a drilling engineer?

A. I would say close to 500.

Q. With regards to the projects involved in your company --

A. Uh-huh.

Q. -- these wells and other wells in the Permian Basin, to what extent are you involved?

A. The well plans are my plans. I -- We have an office in Midland, we have a man who runs the day-to-day operations. He's the drilling manager. I am his drilling engineer.

Q. So there is not a drilling plan that's generated by your company within your geographic area that doesn't come across your desk?

A. For the southeastern New Mexico area and west Texas, I do all the well plans. They are my plans.

Q. Have you been personally involved in the well plans for the wells in Section 4?

A. Yes, I have.

MR. KELLAHIN: We tender Mr. Thoroughman as an expert drilling engineer.

EXAMINER MORROW: We accept Mr. Thoroughman's qualifications.

THE WITNESS: Thank you.

Q. (By Mr. Kellahin) Let's talk about your personal involvement. How did this project come to your attention?

A. It came to my attention from Mr. Stephenson, our manager of regulatory affairs.

We had made application to drill a well we called

the Anasazi State -- I'm sorry, Anasazi "4" State Number 1, anticipating it getting approval, which we subsequently did.

Soon after that, the approval was withdrawn, and we were notified that all wells in Section 4 would require the potash string be incorporated in the plan, which was not originally the case.

Q. At that point did you look at, review and study the well plans for each of the wells?

A. Yes.

Q. All right. Did you come to any conclusions as a drilling engineer about the necessity of the salt-protection string for any of these wells?

A. As a drilling engineer, it would not be required.

Q. Did Mr. Stephenson advise you that your choices were to either put the salt-protection string in the wells and in the plan or to seek an exception from the Oil Conservation Division?

A. That is correct.

Q. Based upon your study and experience, what did you determine was the appropriate way to drill these wells?

A. The appropriate way to drill these wells was within the guidelines of R-111-P. There are a number of options available.

It was my direction to Mark to let me look at

this, let's investigate the problem and see where the Division was going or the Commission was going, wanting us to install a salt-protection string, and see if we could come up with a better way to protect the salt in this case.

Q. And have you found, in your opinion, a preferable way to drilling and completing these wells so that we can eliminate the salt-protection string?

A. Yes, I have.

Q. Let's talk about the options or choices that exist for you as the drilling engineer when we look at R-111-P.

A. Uh-huh.

Q. I think it will help us for a point of reference if you'll look at R-111-P.

There are some portions of R-111-P, Mr. Thoroughman -- If we look at page 7 of the order, it deals with the salt-protection string protocol. And then that is repeated again on page 9 of the order.

Are you familiar with R-111-P?

A. Yes, sir, I am.

Q. And in fact, you have studied in detail the provisions of those casing and cementing requirements, have you not?

A. That is correct.

Q. All right. Let's look at R-111-P, and tell us

what your options are.

A. My options are to go ahead and run the salt-protection string. My -- I would have to set this at a depth of 100 foot to -- I believe it's 600 foot, maybe 500, but anyway below the salt as we define the salt.

Q. If we look behind Exhibit Tab Number 8 --

A. Yes.

Q. -- the first display or illustration is how to set up the well program if you were to put the salt-protection string in the well?

A. That is correct.

MR. KELLAHIN: Mr. Examiner, we have a larger copy of that illustration before you on the display board.

Q. (By Mr. Kellahin) Mr. Thoroughman, lead us through the process.

A. Okay. What we would do is drill the well with a 17-1/2-inch hole to a depth of 1350, which would be approximately 10 to 20 feet into the Rustler formation as defined by R-111-P.

At that point in time we would run a 13 3/8 casing. We would cement this back to surface. My company guidelines, which I ascribe to, are that we would use 100 percent excess to make sure that we did get a good cement job and cement returns to surface.

At that point in time we would continue drilling

the well. We would drill a 12-1/4-inch hole to a depth equivalent to 100 to 600 foot below the salt protection string. Normally we use the guideline of about 150 foot. Or below the salt, I'm sorry.

And at that point in time we would run an 8 5/8 salt-protection string to a total depth. We would cement the string by the conventional method of circulating around the shoe, bringing the cement back to surface, and once again use 100-percent excess to make sure that we did get returns to the surface.

At that point in time, after testing and performing other functions that we need to do, we would continue to drill the well, 7-7/8-inch hole, normally. We would drill this to TD.

And at that point in time we would run a 4-1/2-inch production string, we set this casing on TD, or at TD, we would circulate cement back until we had a top of cement 500 foot above the salt section inside the salt-protection string.

Q. That's one of the choices under R-111-P?

A. Yes, sir, that is.

Q. Does the operator have any other choices within his sole discretion on how to set up this well?

A. Yes, he does.

Q. Let me flip the display here, and let's talk

about the alternative option, and it's also in the exhibit book behind Exhibit Tab Number 8, and it's the next display.

A. I don't think we have that one up there, Tom.

Q. No, we don't. We'll have to use the little book.

A. Let's go off the book. We put these together as an exhibit yesterday.

Q. Let's start, it says Figure A-1 at the bottom?

A. Yes, sir.

Q. Before we look at the illustrations, let's look at the rule. If we go back to page 7 of R-111-P --

A. Yes, sir.

Q. -- and if you'll look at subparagraph 3 (b), Roman numeral (i) --

A. That is correct.

Q. -- tell us what we're looking at. What's the rule?

A. "For wells drilled to the shallow zone, the string may be cemented..." we're discussing the salt-protection string now "...the string may be cemented with a nominal volume of cement for testing purposes only. If the exploratory test well is completed as a productive well, the string shall be re-cemented with sufficient cement to fill the annular space back of the pipe from the top of the first cement into to the surface or to the bottom of the

cellar, or may be cut..." speaking of the salt-protection string "...and pulled if the production string is cemented to the surface as provided in sub-section D...below."

Q. All right, let's go back to the book now. Look at Figure A-1 and lead us through the procedure by which you would have the choice of cutting and pulling the production string and then cementing the wellbore back to the surface.

A. Okay. What we would do in this instance -- and I believe it is our option, according to the guidelines of R-111-P -- we could drill the same surface hole, set the same surface string, cement it the same way as we discussed earlier, drill a 12-1/4-inch hole to a depth of 100 to 600 foot below the base of the salt. My company and I like to go 150 foot below the salt.

At that point in time we could run our salt-protection string, being 8 5/8, we could circulate the cement around the bottom, and I would suggest and would recommend that we cement it and bring it 500 foot above the base of the salt, just as we would do with the production string in the previous diagram. This should isolate the salt from anything we would encounter.

If we turn now to Figure A-2, the drilling would continue, then, as before. We drill a 7 7/8 hole to TD. This schematic shows what happens once we reach TD. We

have our Yates formation open.

We go into the salt-protection string, and at some point just above where the cement top was placed, we would use mechanical or other types of cutters to cut the casing and remove the 8 5/8 from the wellbore, leaving a stub of 8 5/8 casing sticking up above the cement.

At this point in time, the wellbore would have saturated brine water in both the 12-1/4-inch hole that's been re-opened and also the 7-7/8-inch hole to the Yates.

If we could go on now to Figure A-3 [*sic*], the next schematic, at this point n time, as I interpret the rule or the order, we could at this point run 4-1/2-inch casing all the way to TD. We could cement by conventional methods around the shoe and bring cement back to surface and be in full compliance with R-111-P.

Q. We've talked about option 1 and 2 under the R-111-P. Those are your choices.

Now, there's a third option, subject to the approval of the Examiner, that you can simply delete the potash-protection string, provided you're outside the LMR, the buffer area, and within an area barren of potash?

A. That is correct.

Q. All right. Have you determined what in your opinion is the best way to do this?

A. Yes, I have.

Q. Tell us what you propose to do, and then we will describe it to the Examiner.

A. Okay, what I think we can do, and fulfill a lot of -- everyone's concerns in this instance, is, we could drill a smaller hole to the Rustler formation, set this 8 5/8 casing at 1350, bring cement back to surface.

At that point in time we would enter the wellbore and drill a 7-7/8-inch hole all the way to TD, run a 4-1/2-inch casing. It has to be four, the difference being now that we want to -- would like to put a combination tool, which includes an external casing packer and a DV tool in the system.

Q. So we're all with you, let's look at the first illustration behind Exhibit Tab Number 9. That, I think, is a nice illustration of what you're just describing to us. And let me have you continue --

A. Okay.

Q. -- at that point.

A. This depicts -- This schematic depicts how the casing would look with the first-stage cement in place. Once we have our 4-1/2-inch run, we would circulate cement around the shoe, back up to a point where the ports of the DV tool are covered with cement. The DV tool will be placed this 100 to 600 feet below the salt. We would place it somewhere around 150 foot below the salt to be in

compliance.

If you follow with me then, we have brought our cement around to the next -- I'm sorry, the next --

Q. You wanted to describe the external casing packer?

A. Yes, the next three pages depict one manufacturing company's external casing packer. It happens to be a Davis-Lynch, and if you follow with me, if you go to the -- which would be the third page, it's their page number 24, it shows some shear pin, lock rings, drillable closing seats.

Of interest to us would be the drillable split-type opening seat. That is held in place by a shear pin. Once we had our first-stage cement in place, we would drop an opening bomb. It's a free-fall bomb. If you look at the next illustration on that same page, it shows the bomb in place.

By increasing the pressure some -- for 4-1/2-inch casing it has to be 1200 p.s.i. -- we would shear the first set of pins, allowing the opening seat to slide down, opening up a port to the inflatable packer. This packer for this particular company has an outer area of sealing material. It's backed up by steel bands and then has an inner bladder, if you will.

The 1200 p.s.i. pressure would enter in the form

of our displacement fluid, inflating the packer, sealing the annulus. Now, remember we still have the cement around it, but it would seal the annulus in and of itself.

Once 1500 p.s.i. pressure was reached, the second set of shear pins, shown in that second picture, would shear, the opening seat would slide down, sealing off the entry port into the packer, opening the ports to the -- cementing ports to the DV tool portion of the combination tool, and allow our displacement fluid to enter the annulus.

At that point in time we would continue circulating through these ports and clear the annulus of any excess cement left in place by a stage-number-one cement.

Q. What do you accomplish with the use of a DV tool?

A. DV tool is there to divert our flow at our discretion and when we want it to divert. This allows us to, in effect, have another casing shoe at the point we're talking about. These are one-inch ports, and there are six of them.

Q. Is the use of a DV tool required under R-111-P?

A. No, sir, it is not.

Q. You have proposed the use of an external casing packer?

A. Yes, I do.

Q. And is that a requirement or a condition of R-111-P?

A. No, it is not.

Q. What's accomplished by using that?

A. I think what is accomplished is, we've developed a mechanical seal. We talk quite often about the cement seals we put behind pipe. At least as far as we've gotten with the schematics now, we have a cement seal across the Yates. We have performed a mechanical packer, if you will, inflated packer seal above the cement, and effectively have two seals now isolating any formations above that packer from the Yates production.

Q. You've got your well drilled, you've got the first stage cement in place. What happens next?

A. Now it's time to -- we've -- inflate our packer, if you go to my Figure 2 --

Q. Okay.

A. -- which would be, I think, the fifth page or something.

Q. All right, let's turn. You have a wellbore schematic and it says Figure 2. It's captioned "Displacing Second Stage Cement"?

A. That is correct.

Q. All right. What do we do?

A. All right. Now we have placed our cement into

the wellbore. I'm showing the DV ports by schematic open, I'm showing a following plug, which we already talked about.

MR. KELLAHIN: Hang on just a minute, make sure we all get the same page.

We should have numbered these, Mr. Examiner. I'm sorry. The pages aren't numbered. We're still behind Exhibit Tab Number 9. It's the first illustration beyond the --

EXAMINER MORROW: Two or three, one of those?

MR. KELLAHIN: Yeah. Here's what it looks like.

EXAMINER MORROW: Yeah, got it.

Q. (By Mr. Kellahin) All right, sir. Go ahead.

A. All right. What I'm trying to depict there is as we have the cement moving through the DV-tool portion of the combination tool ports, how the system is working. Once again, we have excess cement calculated in, in an attempt to bring this back to the surface, which shouldn't be a problem.

I show and depicted here a following plug. That is placed just behind the cement slurry and serves as a buffer between my displacement fluid.

I also show the round ball with the little pattern in it. That was the plug that we dropped to open and inflate the packer.

If we go on now to the next page, which is Figure 3, this closing plug we just discussed following the cement slurry has reached what was referred to earlier in the specific companies -- the drillable closing seat is what Davis-Lynch calls it. For us it's a sliding sleeve, and we're going to slide this sleeve with this Chevron packing across the DV tool ports. This locks into position, and it's ready now to -- the integrity of the entire system is there. We will hold a minimum amount of pressure on it, and we're ready to release the rig.

Q. Having completed that procedure, then you're ready to await the completion of the well?

A. That is correct.

Q. Do you have an opinion as to why your proposed well program is better than the options contained within R-111-P

A. Yes, I do.

Q. What is that opinion?

A. If you look at the schematic that is on the board down there, I see two cement columns that will effectively isolate any annulus outside of the casing from the salt. They are the -- They are this cement slurry that's around the 4-1/2-inch pipe, coming up 500 foot above the salt.

Q. You're going to have to turn and speak slower for the court reporter.

A. Okay. It's this cement slurry that's around 4-1/2-inch pipe, coming up to 400 foot above the salt, the lower section of salt, and then the original cement will go up, back to surface, around the salt-protection string. This seal across the Yates or hydrocarbon-bearing zone, and this seal here.

Q. Okay.

A. This would be how the wellbore would look after drill-out.

Q. Under your plan?

A. That's correct.

Q. All right.

A. Now that we have Yates down here, we have cement up to the external casing packer. That seals the Yates off. Now we apply the mechanical seal here at this point, and now we have the cement above that, all the way across the salt, one, two three.

Q. Is your wellbore integrity, under your plan, the equivalent of the wellbore integrity if you had to use the salt-protection string?

A. Yes.

Q. During the drilling of the well --

A. Yes, sir.

Q. -- identify for us what you see, as the drilling engineer, to be risks whereby gas might migrate into the

salt section and what if anything you do to manage or avoid that risk.

A. These formations are considered to have, at best, a freshwater gradient of 8.33 pounds per gallon. By just the nature and also by definition of R-111-P, we will drill these sections with saturated brine water, which has a mud weight, as we call it, of 10 pounds per gallon.

So we're, in essence, 1.7 pounds per gallon overbalanced at all times. That should not allow any incursion of any hydrocarbon, water, anything else from any formation.

Q. What is the opportunity or the expectation for losing control of the well?

A. None. We've drilled 50 wells in this area that have gone through the Yates -- some of them deep, some of them were actually Yates wells -- and we have never had a well-control problem.

Q. Do you have an opinion, recommendations with regards to the quantity or the quality of the cement that's going to be used in any of the processes?

A. Yes, it's state of the art, it's -- What I presented to you in this well plan or in a subsequently introduced well plan is Halliburton's version. It's called Premium Plus. It's a class-C high -- cement. It's designed by Grine to achieve 50 p.s.i. in just -- like an

hour, half an hour, 45 minutes. Very quickly. It does establish some compressive strength.

Q. Do you have an opinion or recommendations with regards to the quantity or quality of the casing or tubing materials placed in the well?

A. Yes, they're J55 -- or, I'm sorry, K55 materials. That's 55,000 tensile strength steel.

Q. You've designed a well program specifically addressing the issues of concern in R-111-P?

A. That is correct.

Q. Have you reduced that well program or that well plan to a detailed written summary of what that plan is?

A. Yes, sir, it's my Exhibit Number 10, or our exhibit.

Q. All right. Let's turn to Exhibit Number 10, and without going through it in detail, tell us what is contained within the well plan.

A. This is a plan that was prepared for everyone that was concerned in the drilling of the well, specifically, the well-site supervisor up through his supervisor and any other persons concerned.

It takes you through a number of steps. If I may just lead you down through it, just a cover sheet with approvals on it, some data, where the well is and the table of contents, and on the third page we have a drilling

prognosis. This is a schematic we prepared to give everyone involved just a quick look at various items we're going to be doing.

If you'll notice on here, we discuss the external casing packer, DV tool, combination tool, alerting our people this is what we're going to do.

If you go to the next page, we start a detailed program step by step to lead our supervisors through their execution of the drilling of this well.

A number of items listed going on down through the cementing and testing of the surface casing, number 10 -- Point 10, number 1, discusses the testing and how long we should hold the pressure on there, according to R-111-P.

If you would go to the next page, section number 14 or step number 14 begins the discussion of how we would like to run this 4-1/2-inch casing and install the combination tool. It's rather detailed. It goes through a step-by-step setup for our supervisors so they know what we want them to do, how they should do it, just as I've discussed with you, sir.

On through the -- One item that's different than I discussed with you is, we require -- and I think it's addressed in here -- that the company that supplies us with this combination tool have a representative on location so

that if there's any confusion he's available to discuss with our people and make sure the plugs go in the proper place and the tool is activated properly.

On through the completion on the next page where we discuss meeting our contractual obligations with the rig and release the rig, and then we'll net the pits.

And I've supplied the next few steps, since this is something out of the ordinary for a field supervisor, I have the schematics that we discussed here on how to run the tool, where to put the first-stage cement.

Moving on, in my "Section 4" at the bottom of the page, "Page 1 of 1", shows a mud program for drilling this well. The typical spud mud is required to 1350 where we set the surface casing, and at that point in time we'll continue with the saturated brine water. If we were to need viscosity for logs, we would add prehydrated gel to this system, nothing more than that.

Then on "Section 5 - Page 1 of 2" is casing design. It has all the performance parameters that we consider.

Page 2 of that section has the 4-1/2-inch casing, its design parameters, along with the comments again to our field supervisors, alerting them that do we want to -- this is how we want to put our DV tool, external casing packer, what sequence it goes in the casing string, telling them

where we want to put centralizers.

On to Section 6, which details the cementing program we want to use, it tells our supervisors the slurry that we anticipate using, its performance parameters, weight and so forth.

Page 2 starts with a detailed explanation of how we want to cement the 4-1/2-inch production string, first stage, second stage, the procedure, what they're to do while they're doing the cementing. That continues on to page 3. These steps, B, C, D and E, are similar to what we read in the first drilling program section we went through.

Then I include for those people that need it and would like to know it, the geological prognosis that originated this well plan, two pages of that normally. A schematic diagram of our plan for a blowout preventer and how we anticipate that being used.

Various other of things that are attached are permits, different things that these people need in the field, a vendor's list which was not appropriate to bring here today.

Q. How does your proposed well plan compare to the well plans that were executed by operators to the south of you in Section 9 who are granted permission to delete the salt-protection string?

A. The only difference that I'm aware of would be

that I propose that we put the external casing packer at the same point where we would normally have a salt-protection string.

Q. Let's turn now to costs.

A. Okay.

Q. If you'll turn behind Exhibit Tab Number 11 --

A. Yes, sir.

Q. -- there are two different AFEs within that tab section?

A. That is correct.

Q. Okay? I think we cleverly stapled these together so we can't compare them side by side.

A. No, sir, we did not.

Q. No? Only mine was done that way.

A. The first two refer to a well that would meet R-111-P's guidelines and include a potash string. You'll see that mentioned at the bottom of the page under "Tangibles". It's line item number 41.

We estimate that the dryhole cost for this well, including a potash string, would be $185,000

Q. Who prepared the AFE?

A. I did.

Q. What's the other AFE?

A. If we go to -- Do we want to cover the production cost estimate next, I believe?

Q. All right.

A. The second page in there is a cost estimate for what transpires as we get ready to complete the well. We call it a completion cost estimate. Its total is $156,000, and it considers that under their guidelines they would -- their cost estimate involves the 4-1/2-inch casing, "they" being our production group. It includes the money that would be necessary to pay for an external casing packer, DV tool, combination tool. That comes up with a total price for the completed well of $341,000.

Now, if we go to page 3 in that section, that is a cost estimate, AFE if you will, that I have prepared for the dryhole cost of drilling this well without the potash string.

Let me back up just a second, if I may, sir. I made a mistake.

The production side, the original AFE that went into the $341,000 total, the $156,000 does not include the external casing packer. Consequently, the $185,000 and $156,000, yielding a net of $341,000, would be for a system that meets R-111-P with the potash string in place, no external casing packer.

Now page 3 --

Q. I'm sorry, I didn't hear you. With the external casing packer?

A. Without the external casing packer.

Q. All right. You're doing the salt-protection string --

A. That is correct.

Q. -- R-111-P, without the external casing string protector. And what is that total cost?

A. $341,000.

Q. All right.

A. Now, page 3 starts our consideration of doing it the way I propose, which would be without the salt-protection string and with an external casing packer.

The AFE I prepared for this, you'll notice on line item number 41, does not include any mention of a salt-protection string. It comes to a total dryhole cost of $117,500.

The completion estimate follows, annotated at the top without the potash string, and its total comes to $173,000, and that does include the money for an external casing packer, DV tool, combination tool.

That comes to a total cost for the completed well, without the salt-protection string but incorporating the combination tool, of $290,500.

Q. Do you have an opinion, Mr. Thoroughman, as whether these AFEs and your calculations of the various costs are current, accurate and reliable?

A. Yes, sir, as best we can, we verified all of these at the time that they were prepared. The date is at the bottom of the AFEs.

Q. Summarize for us, Mr. Thoroughman, your recommendations to the Examiner.

A. It's my recommendation that he allow us to drill this well in the barren area, as so defined previously, without the salt-protection string, and allow us to incorporate still yet a third seal which would protect the salt zones from any hydrocarbon encountered in the Yates formations or any formations below the salt section.

Q. Do you have an opinion as to whether if he grants approval to do that procedure under that well plan, we would be protecting any potash resources in the area and also protecting miner safety for the potash mining operations that are undertaken in the enclave?

A. Yes, I believe it would, at least as well as R-111-P would allow us to.

MR. KELLAHIN: That concludes my examination, Mr. Examiner, of Mr. Thoroughman.

We move the introduction of his Exhibits 8 through -- 12, I believe it is.

EXAMINER MORROW: Eight through 11.

MR. KELLAHIN: Yes, 8 through 11.

EXAMINER MORROW: Eight through 11 are admitted

into the record.

EXAMINATION

BY EXAMINER MORROW:

Q. Mr. Thoroughman, in that interval where you're going to set your -- where you propose to set the packer, between the base of the salt and the top of the Yates, I assume it would be in that interval between 2810 and 3170?

A. Yes, sir.

Q. What formation is that that you'd be setting that packer in?

A. I'd have to defer to one of our geologists. I do not have that information now. The packer setting depth was based upon R-111-P in that it requires us to set between 100 and 600 foot below the salt.

Q. Do you know if you would have a pretty good hole in there or if it would be washed out or what the situation would be there? Would you run a caliper, or how would determine that your --

A. Yes, sir, we could --

Q. -- packer would reach the walls of the hole?

A. That is correct, we would run a caliper and we would try and select the best section of hole to set this packer in.

Q. And I assume that would be something that wouldn't wash out like salt would or --

A. No, it will not.

Q. Maybe somebody could tell us.

Do you know if in the wells you've drilled in the area or that others have drilled in the area, if they've encountered any lost circulation, either in the salt or in the Yates formations?

A. No, sir, I'm not aware of any lost-circulation problems in the salt section. There are some zones that are below the Yates where there is a problem. In our drilling of these wells we have not encountered any problems at TD of a Yates well.

Q. So the packer and the DV tool would be more for the seal, I guess, then, than they would for any expected lost-circulation problems --

A. That is correct, sir.

Q. -- when you're cementing?

A. Yes, sir.

Q. Have you used this DV-tool-and-packer arrangement before?

A. Yes, sir, I have. We've used it --

Q. Have you used it in the area, anywhere?

A. West Texas, in the University area. We have a situation there where we would not like to put cement across our producing zone. That was our introduction to this combination tool. And we started running it in our

casing string, production string, where with displacement fluid or fluid, we go ahead and set the external casing packer, open up the DV tool and circulate all of our cement above our producing zone and end up with a barefoot completion.

Q. So I guess you'd get some benefit here from that too, wouldn't you?

A. I would think with the Yates formation and having to fracture it, that might be a problem for us.

Q. In your dryhole costs, two AFEs, do you include plugging costs in those, or is that just the cost to drill the well prior to either plugging or completing?

A. It's prior to plugging or completing. We have chosen not to include our plugging costs in there.

Q. Okay. I wanted to ask you what your interpretation of one of the plugging requirements is in R-111-P. It's on page 10, Section F. If you would read that number (1), especially the last two or three lines there, or the whole -- read the whole -- Just read it to yourself, but the entire paragraph. Tell me what you think that's saying to us.

A. That says that we should set a cement plug through the entire section of salt. By earlier definition, that's basically from the base of the Rustler formation down to the base of the salt.

Q. Okay. And it goes further to include fresh water, I believe. In these water-bearing -- right.

A. It talks about --

Q. Yes, sir.

A. -- water, yes, sir, it does. And I believe we have that covered with our surface casing.

Q. Well, that's the reason I needed some help on reading that, in case you did set surface pipe and then went in there and drilled the well and decided you didn't want to run pipe on it.

A. What we would do is cover the salt as per what we just read. We would place a plug at the base of our surface casing. We would have 9-1/2-pound mud up above that, and at the surface we would have a 50-foot plug.

Q. Okay. But you read this, at least, to include a solid plug across -- or all that through that --

A. That is my interpretation of it --

Q. -- potash-salt section?

A. -- yes, sir.

EXAMINER MORROW: Anything, Rand?

MR. CARROLL: (No audible response)

EXAMINER MORROW: Thank you, Mr. Thoroughman.

THE WITNESS: You're welcome.

EXAMINER MORROW: Appreciate your testimony.

MR. KELLAHIN: Mr. Examiner, at this time we'll

call Pat Noyes. Mr. Noyes spells his last name N-o-y-e-s. He is a completion/production/operations engineer with Mitchell Energy Company.

PAT NOYES,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. For the record, sir, would you please state your name and occupation?

A. My name is Pat Noyes. I'm regional engineering manager for Mitchell Energy Corporation.

Q. Summarize for us your education and employment experience, sir.

A. I have a degree in mechanical engineering, a bachelor of science from Rose-Hulman Institute of Technology in Terra Haute, Indiana, in 1976.

Upon graduation I was employed by Exxon for four years in various assignments in drilling, production and natural gas engineering.

In 1980 I accepted a position with Mitchell Energy Corporation in basically the same disciplines of production and drilling engineering.

Q. And where do you reside, sir?

A. I live in The Woodlands, Texas.

Q. What is your involvement with this particular project by your company?

A. My involvement simply follows what's been done by our drilling engineer in the sense that we design the completion procedures to complete the well and produce it in a safe and efficient manner.

Q. And have you done so in this case?

A. Yes, sir.

Q. In designing that procedure, have you made yourself aware of the requirements of R-111-P?

A. Yes, sir, we have.

MR. KELLAHIN: We tender Mr. Noyes as an expert completion and production engineer.

EXAMINER MORROW: Yes, sir, we certainly accept his qualifications.

I didn't hear what your degree was in?

THE WITNESS: Bachelor of science, mechanical engineering.

EXAMINER MORROW: Okay. Yes, sir, his qualifications are fine.

Q. (By Mr. Kellahin) What are the issues of concern for you, sir, with regards to the particular wells we're trying to drill in Section 4?

A. The issues of concern are basically twofold with respect to, as I said, producing safely and efficiently.

The first issue would be to prevent the migration of gas behind that 4-1/2-inch casing that we're going to run. I feel like we've adequately done that with the explanation that Mr. Thoroughman has given with the first-stage cement, the inflatable packer and the second stage cement.

We will also verify the integrity of that cement by running a cement bond log as part of the completion procedure.

The second item of concern, from a standpoint of protecting the salt from any natural gas intrusion, would be corrosion of that 4-1/2-inch casing. In this case we would be concerned about corrosion from an external and an internal phase. The external corrosion, I believe, is adequately addressed, because we have cement behind the entire length of that 4-1/2-inch casing. That cement will protect the steel from any reservoir fluids.

Internally, we look at the corrosion of the 4-1/2-inch casing from a standpoint of what wellbore fluids will that pipe see? In this case, because the well will be put on rod pump, it will only see the casinghead gas that's being produced from the Yates reservoir.

The gas does have an H_2S concentration to it which varies anywhere from a nominal of 10 to 15 parts per million up to 2000 to 3000 parts per million. A design

engineer would need to look at that, as we have done, and take into consideration the possibilities of any sulfide stress cracking.

When you look at the partial pressures of the H_2S in this environment, they can exceed the .05 p.s.i.a. which NACE recommends as a guideline for sulfide stress cracking. In other words, you have to deal with it.

The absolute pressures, though, that are encountered here will be less than the 65 p.s.i.a. total pressures that NACE also specifies as being a guideline or a limit to consider sulfide stress cracking.

We have addressed those issues in the way that we have picked our pipe to run for production casing here. NACE requires that in any environment where sulfide stress cracking might be apparent, that you run steels with Rockwell hardnesses less than 22. In this case, the K55 is a mild steel, and it would have a Rockwell hardness of somewhere 18 to 19.

Q. Let me have you turn your attention, sir, to the displays behind Exhibit Tab 12, the first of which has been enlarged and on the display board.

This is the configuration of the well as you receive it. Now, tell us what you do to complete it.

A. Okay, exactly what we would do, we'd go into this wellbore. As you see it right here on the board is not

quite how we see it. We have the DV tool that Mr. Thoroughman discussed. We move in a completion unit.

The first thing we'll do is run in and drill out that DV tool. After that DV tool is drilled up, you'll have a configuration that looks very similar to what you see on the board and is the first handout behind Section 12 in your book.

The wellbore is cleaned out, the drilling mud is displaced, and two-percent KCl would be put in the wellbore at that time.

We would then run the cement bond log that I talked about. We would interpret and verify the integrity of the cement at that time. The 4 1/2 production casing is then tested, in this case to 3800 p.s.i.a.

After testing the production casing, verifying its integrity and the cement also, we would then go in and perforate the potential productive zone, in this case the Yates.

Once the well is perforated, we will then run tubing on a packer, acidize that interval, swab the load back to verify the oil cut that we have. Once we determine that we have a zone we want to go ahead and complete, we will then go ahead and frac that interval.

After the well is frac'd, flowed back and tied in, we would then run a rod pump hookup, which if I could

refer your attention to the second page behind Tab Number 12, you see "Wellbore Schematic, Rod Pump Setup". This is basically what the wellbore will look like in a production mode.

Q. What do you do to monitor the integrity of the well?

A. The production from the well is monitored on a day-to-day basis by a pumper. And what we've found out over the years in dealing with wells, that when you have a problem with a well, it's going to be reflected in the production that you get out of the well.

For instance, if we would have a rod part in a well, we would know that almost immediately because the production would be down. So our monitoring efforts from that standpoint are on a day-to-day basis by the pumper.

We also do some things with the produced water in terms of securing that for analysis, checking iron counts, which would be an indicator again of corrosion that might be going on in the wellbore.

Q. Do you address any monitoring or prevention program for casing leaks?

A. In particular what we do, when we might detect a casing leak we would see an increase in water production because again, 95 percent of the ones I've been involved with have been due to a corrosive water behind the pipe,

and it would be readily apparent that you would have that situation again due to the increase in water that you would see on your daily production.

Q. What's the setup on the surface?

A. The setup on the surface is shown on the very next page, again, behind Tab 12. The schematic is entitled, "Generic Site Diagram", and I refer you to that.

You can see the wellhead in the upper-right hand portion of that schematic, the flow of the three-phase wellbore fluids going into the heater treater. From the heater treater the gas comes off the top to the very north of the page as it's set up through the gas sales meter. The crude oil will come off the heater treater dump, go into one of two 300-barrel stock tanks. The produced salt water will come out of the bottom of the heater treater and go into the 300-barrel fiberglass water tank.

Q. Do you as a production and operations engineer have any pressure concerns, any concerns about pressure or pressure relationships in this well?

A. Certainly not from the standpoint of protection of miner safety. What we typically do is, we produce what little casinghead gas is made into a low-pressure system. The maximum pressure that we might hold on that casing would be approximately 35 p.s.i.a. And the reason to do that is simply to get it into the sales line.

Q. Behind the schematic of the surface configuration you have written the details for the completion procedure?

A. Yes, sir.

Q. And then following that, what's the last display in this section?

A. The very last display is the wellbore as you would see it after the well has been P-and-A'd in accordance with R-111-P.

Q. How many existing wells do you operate in this area?

A. Currently we have 11 Yates producers in this area.

Q. Are there any problems with any of those Yates producers?

A. We have not seen any corrosion problems at all with any of these Yates producers. The biggest problem we have is dealing with paraffin.

Q. Do you have a forecast or an estimate of the life of the well, the integrity of the well if you will? How long is this thing going to stay together?

A. From the standpoint of mechanical integrity of the well, the way we have it set up here, I would be willing to say that that wellbore could withstand 20 or 25 years of carefully monitored production.

Q. Is that more than sufficient to allow your

company to recover the hydrocarbons available to you in the Yates formation of the pool?

A. Yes, sir.

Q. What's the last display in the section, then? You've got your procedure written out, and then there's a pumping well configuration. What are we looking at here?

A. Okay, we talked about the pumping well configuration as being the second handout in this section.

Q. Yes, sir.

A. I believe we've already discussed that one.

Q. Yes, we did. We've covered them all.

Did we include in your section, Mr. Noyes, a plugging procedure?

A. The procedure itself is not in here in written form.

Q. But an illustration?

A. But the illustration is, and that's what we mentioned as the last handout in Section 12.

Q. Okay, all right. Let's describe it quickly. What's your plugging procedure?

A. Okay. Again, in accordance with R-111-P, when this well is deemed to be uneconomic, we will obviously pull the rods and tubing out of the wellbores, salvage those items, we would run in with a cast-iron bridge plug set at above the Yates perforations and put 35 feet of

cement on top of it.

We would then displace the hole with 9.5-pound-per-gallon mud.

The next step would be to put this salt-saturated cement plug across the entire potash interval. Above that, again, 9.5-pound-per-gallon mud would be displaced in the wellbore.

There would next be a cement plug placed across the surface casing shoe, 100 feet below the shoe to 100 feet above the shoe. Above that, again, 9.5-pound-per-gallon mud.

And lastly, a surface cement plug from 50 feet to the surface.

Q. Do you have an opinion whether or not we can delete the salt-protection string as we propose to do?

A. Yes, I do.

Q. And what is that opinion?

A. My opinion, in my professional judgment, is that it can be done. We can produce this well safely and efficiently in accordance with the rules and regulations.

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

We move the introduction of his Exhibit 12.

EXAMINER MORROW: Twelve and 13, right? Or --

THE WITNESS: No, sir --

EXAMINER MORROW: Twelve?

THE WITNESS: -- just 12.

EXAMINER MORROW: Okay, Exhibit 12 is admitted into the record.

EXAMINATION

BY EXAMINER MORROW:

Q. What kind of corrective measures would you take if you ran the bond log and found out you weren't adequately cemented?

A. Depending on what we saw, Mr. Examiner, we would go in there, try to isolate that interval, perforate and squeeze to re-establish the integrity of the cement in the area where we determined it was not efficient.

Q. Now, would that -- If you didn't circulate on the primary job, would the drilling people handle that, or would they just leave it for you?

A. If we did not circulate cement back to surface on this 4-1/2-inch casing, they would routinely go in there and top out after they had determined here the cement top might be.

And if that was sufficient, say within 100 feet or 300 feet of the surface, they would top it out then, and they would do that.

Q. Okay. So I guess they would run the bond log there when they --

A. We run the bond --

Q. -- still had the drilling rig on the well if --

A. We generally run the bond log after the drilling rig is off location.

Q. Oh, excuse me.

A. You specifically asked about circulating cement, and if that's not done they would still have the responsibility of looking after that aspect of it.

Q. Maybe a temperature survey or something?

A. Yes, sir.

Q. Do you know where the top of the potash zone is, the top of the salt would be?

A. The very top of the potash zone?

Q. Yes, sir.

A. I believe in this instance the top of the potash is somewhere around 1500 to 1600 feet.

I would very much like to get our geologist to verify that, though; we drill in different areas. I believe in this case that's about where it is.

Q. So there would be some interval between your 1350 and the top of that -- I guess the top of the salt and the top of the potash is synonymous there, isn't it? Is that --

A. We have set pipe into the Rustler, okay? in this case.

Q. Into the Rustler or through the Rustler?

A. That surface casing is set into the top of the Rustler, as Mr. Thoroughman has explained. And roughly 15 -- or excuse me, I think he said 50 feet into the top of the Rustler.

Q. So then you would have some more Rustler before you get into the Salado or whatever the -- potash -- ?

A. Yes, sir, that's true. The rest of the Rustler and then the Salado.

Q. And the Salado would be like the potash? That would be the potash?

A. Yes, sir.

Q. But on your plugging procedure, then, you would come up, say, 50 foot above the -- You'd cover the entire interval?

A. As a minimum, we would come at least 50 foot above that potash zone, or the Salado as you referred to it.

MR. KELLAHIN: Mr. Examiner, we will have a display under the potash expert's presentation that shows that relationship.

EXAMINER MORROW: Good.

Thank you, sir. Appreciate it.

MR. KELLAHIN: Okay?

Gary Hutchinson.

GARY L. HUTCHINSON,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

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

A. Gary Hutchinson. I'm a minerals management consultant.

Q. And where do you reside, sir?

A. I live in Golden, Colorado.

Q. Have you on prior occasions testified before the Oil Conservation Division as well as the Oil Conservation Commission and had your expertise as a potash expert recognized by this Division?

A. I believe that's the case. I think to say that I'm a potash engineering expert may be stretching it. I'm a mining engineer, a mineral economist and production expert in underground operations, and that's the credentials that have been approved before this body before.

Q. Is it within your knowledge, experience and expertise to make an evaluation of the barren area as inferred on the BLM Map that is issued in 1994 and to reach an independent conclusion about the size and shape of that

barren area?

A. Yes, it is.

Q. Is it within your expertise and experience of your profession to give us an assessment of the economics of the potash industry?

A. Yes, it is. I've done considerable work at that.

Q. In addition, is it within your expertise and opinion to make a determination of the effects of subsidence and how close subsidence may come to any wellbore that may be drilled in Section 4?

A. That's correct, I have done -- I have considerable subsidence experience with underground operations in addition to this area.

Q. And lastly, is it within your experience as an expert to make a determination of the relative integrity of the geologic formations from the surface down to the Yates?

A. Yes, I believe it is.

Q. And have you done so?

A. Yes, I have.

MR. KELLAHIN: We tender Mr. Hutchinson as an expert witness.

EXAMINER MORROW: All right, we accept Mr. Hutchinson.

Q. (By Mr. Kellahin) Let me ask you to turn, sir, to Exhibit 13. Let's not do that, let's do the base map.

The base map is the first exhibit that Mr. Stephenson described earlier.

Yes, sir, put this in perspective for us. Show us where potash mining activity is taking place as we speak, in relation to what Mitchell proposes to do in Section 4.

A. This particular exhibit shows the New Mexico Potash Mine as being five miles from Section 4. It also shows what I believe to be the northernmost limit of the New Mexico Potash Mine, and I know that they are mining far to the south, several miles south of that, and it was reported that their operations are not concentrating on that northern area, and they don't intend to do so for several years.

Q. New Mexico Potash mining operations are not moving toward Section 4?

A. That's correct.

Q. All right.

A. It's my information that the Mississippi Chemical Mine, once owned by National Potash, which is shown on this Exhibit, 5.3 miles from Section 4, has not been actively mined since 1982. The mill is in operation sporadically, but there has been no underground mining in that mine since 1982.

Q. Let's go to the next display. We gave it earlier

in the book. It is a copy of the BLM 1994 Map?

A. 1984 map.

Q. All right. The 1984 map is the one that Mr. Stephenson described had the R-111-O black line depicting what the extensions were in R-111 up to that time?

A. That's correct.

Q. All right. Do you have that display before you?

A. Yes.

Q. We've not yet described to the Examiner how to read the Potash Maps. You know, they've got a bunch of different colors on there.

A. Yes, they do.

Q. How were the colors generated and what do they mean?

A. According to the BLM terminology, they have colored in red those areas they believe to be barren of potash mineralization or of minor or uneconomic potash mineralization. You can see several of those areas throughout the map.

Unfortunately, this particular copy also shows mining in a slightly -- off-color to the red. It's more orange, but not to be confused. Those are areas that have already been mined, if you will.

Q. The different color codes are indicated on the legend, and you can read down the codes and see the values

and determine what they were trying to interpret?

A. Yes, they color what they believe to be economic reserves. I disagree with them. And they color those blue.

They make no differentiation between the ten or so potash zones, just if one zone happens to be economic in their opinion in an area, they color it blue.

Q. All right. How many potential potash zones are we dealing with when you look at the potash area?

A. Geologically there seem to be ten or eleven in this area. Only about four or five of them throughout the entire area have been mined in the past. So I would say that the number of potash zones that are commercial are limited to that -- perhaps five of the ten.

Q. I don't know the vocabulary of your business. If I was an oil and gas guy I would call this something like a gross isopach, if you will. They have lumped together all ten or eleven zones and tried to make a map on that gross interval?

A. Yes, they've done so based on quality alone, and with no consideration whatsoever for quantity.

They go on here to provide color codes for indicated potash reserves and inferred potash reserves. In the oil business, those would be roughly equivalent to probable and possible.

I believe that they are stretching those economic limits somewhat by their coloring, personally.

Q. Okay, because of those reservations and concerns, we've asked you to independently verify the size and the shape of the barren area as inferred on the BLM map in relation to Section 4?

A. Yes, you have. I've performed that evaluation.

Q. Let's turn to Exhibit 13 and look at the display sheet. It says "Figure 2 -- "

A. Yes.

Q. " -- Informal members of the Castile Formation". I think we're looking at the same thing.

A. Yes, we are.

Q. All right. To set up the discussion, investigation of the barren area, give us a reference from the surface down. And when we get into the Delaware Basin, particularly in this area, what are the formations we're dealing with?

A. Generally this is a hypothetical cross-section from the shelf area, which would be to the north, into the Delaware Basin to the south.

Included in the critical formations, of course, the Rustler formation at the top, which you're familiar with.

The next below that is the Salado formation,

which does contain the potash deposits in the area.

Below that, on the right side of the cross-section, is the Castile formation, which is limited by the Capitan Reef and its structural position on the north edge of the basin.

Below that is the Bell Canyon, and below that the Cherry Canyon formations, which are of a different age, the Guadalupian, whereas the Ochoan, if that's a good pronunciation, are the evaporite deposits. And the Rustler formation that we're concerned with here.

On the left side, on the shelf area, are the formations that are expected to be encountered, in this instance the Tansil formation, the Yates and Seven Rivers.

Q. With that perspective now, do you have a type log or a section, an illustration so we can see how the Salado is subdivided into these various potash zones?

A. Yes, I do. The next sheet in Tab 13 shows a stratigraphic column.

If you'll look in the upper left-hand corner you'll see the Ochoan members, what we've just described in the previous cross-section. And to the first column to the right of the formation descriptions, you'll find the Rustler, the word "upper", below that "McNutt", and then "lower". The upper, McNutt and lower members all refer to the Salado formation.

If you go to the Ochoan column near the middle of the page you will see that the McNutt member is bounded at the top by the -- I think it's Vaca Triste zone -- and at the bottom by Marker Bed, MB, Number 126.

That area is expanded further to the right, in the column furthest to the right, and it shows in decreasing number, with the top number being 11, in a circle, the potential ore zones with 1 being at the bottom.

Of those zones, 11 is not commercial.

The 10th ore zone is being mined in the New Mexico Potash Mine, which you will recall is some five miles away at its closest point. And it contains several clay seams.

Number 9 is not commercial.

Number 8, I don't believe, has ever been mined. It does contain clay seams.

Number 7 contains clay seams, and Number 6, together, are not considered commercial.

Down to Number 5. That zone occurs in the southern part of the potash area and is one of the two principal sources of langbeinite, another mineral that is used -- is mined and from which potash is produced. It does not occur in the northern part of the basin that we're concerned with here.

Some distance below that is the 4th zone. It

also is a principal source of langbeinite. And again, it's only found in the southern part of the basin, or mined in the southern part of the basin.

Zone Number 3 has been found to be low-grade, was mined for a short period of time by a mine that is now closed permanently.

Number 2 is not commercial.

And down at the bottom is Number 1, which has by far been the biggest source of potash to come out of this potash basin. But most of those mines are on the western edge of the potash basin and were some of the first mines developed because of the quality of that zone and its proximity to the surface.

Q. Have you and the Mitchell geologists prepared a structure map so that we will have an illustration --

A. Yes.

Q. -- to demonstrate to the Examiner the depth of the potash in the area as we move towards Section 4?

A. I believe there's a pocket that follows the stratigraphic column sketch. And for --

Q. So we don't get confused on values, show us how to read the map.

A. For ease in reading this map, if you would look at the subject Section 4 that has some yellow coloring in it --

EXAMINER MORROW: All right.

THE WITNESS: It's in the lower right-hand corner of the map. If you would write on that contour that goes through Section 4, if you would write "1500".

And if you would then go to the west, to the "Mississippi Chemical (Inactive)" notation, that contour there should be labeled "1900", just for ease of our demonstrating something here.

And the next contour to the right would be 1800, and the next one to the right that goes through the New Mexico Potash Mine is 1700.

Q. (By Mr. Kellahin) What do those values mean?

A. Those are the elevations. In this case, they're not subsea elevations, they're positive elevations above sea level.

The interesting thing about this map shows that at the New Mexico Potash Mine the top of the McNutt -- This is a McNutt structure map. The McNutt, you will recall, is the zone that contains all the potash areas. The McNutt is the middle section of the Salado, which is the salt zone, commonly referred to as the salt zone.

The center portion of that is the McNutt formation. All of the potash zones are contained within the McNutt. So here's a structure on top of the McNutt showing its elevation at different points.

I indicated earlier that the 10th ore zone is being mined by New Mexico Potash. That's the only zone that they mine. It shows -- This map is designed to show you that -- and we know earlier that the 10th ore zone contains clay zones in it.

The distance from the New Mexico Potash Mine down to the Section 4 is 1700 minus 1500 or an additional 200 feet on the top of the McNutt. This means that the top of the McNutt is 200 feet lower. That means the 10th ore zone is at least 200 feet lower.

And we know that in the New Mexico Potash Mine they have had problems with pressures at that depth. To go deeper would give them, most likely, higher problems -- or higher pressure, and therefore greater problems with their mining operation.

Q. Let's turn now to the topic of having you verify and validate the size and the shape of the barren area.

A. All right.

Q. If you'll look at the next illustration, does that represent your work product?

A. Yes, this next sheet, an 8-1/2-by-11 sheet in your packet behind Tab 13, two days ago --

Q. Let's talk about the conclusion first, and then we'll talk about how you got there.

A. All right.

Q. What's the conclusion, and how do we reach it?

A. There are two cross-hatched areas, one in the upper left-hand corner, which would be northwest, and then a large area in the center of this nine-section plat, that are believed to be barren of any potash mineralization at any zone.

Q. Okay. What is the source of the data that caused you to reach that conclusion?

A. I went to the BLM office in Carlsbad two days ago and met with their potash administrator, and he is not allowed to give out quantitative information on core holes that are contained within the potash leases. The potash companies don't want anyone to know what their grade is.

He does have a cutoff grade for commercial and subcommercial, which is, for this particular mineral, sylvite, ten percent of K_2O. It's just a measurement of the grade of potassium in the core hole.

On this particular map, for example, in Section 32, in the northwest corner, is a core hole, I-157. This indicates that in the 10th ore zone the BLM believes it to be of commercial value.

However, on -- in Section 34 in the northeast corner, core hole number P-160 is not under lease. The BLM shows it to be commercial in the 10th zone where they have four feet of 11.6-percent K_2O as sylvite, which is the

indication of the "S" in parentheses.

I was able to get the information that he was allowed to give me on all the core holes, which are shown by the approximately one-quarter-inch-diameter circles on the map.

If you would look in Section 5, on the left side, middle, of the nine-section plat, I-137 is indicated to be barren of any mineral -- potash mineralization.

To the south, hole number I-144 is similarly thought to be barren in all zones. To the south, under the words "R33E", I added a hole, U-115, and it is indicated to be barren in the 10th zone. It is shown by the BLM to be economic in the 3rd zone, but there's no 3rd zone being mined anywhere in the basin.

So that is an example of how the BLM will take a percent K_2O, draw a circle around it, and it becomes blue on their map, whereas in reality there isn't enough quantity there to justify any sort of mining activity.

Q. Did you have available to you sufficient public information where you would have control points by which to make your interpretation of the size and shape of the barren area?

A. Yes, the information that they gave me has been duplicated using their interpretation of economic ore on this map.

From my point of view, however, where I was able to get the actual grades, which are in Section 34, 3 and just south of the south line in Section 10, they gave me grades that varied in the 10th zone from almost 15 percent K_2O to 13.8 percent K_2O. And in Section 34, 11.6 percent K_2O.

I believe those to be completely subeconomic. They're not even close to being economic ore that would justify the opening of a mine, principally because there just isn't enough quantity here of a high enough grade. That wouldn't even make their costs.

Q. Do you have an opinion as to whether or not if the Examiner approved this Application it would result in the undue waste of commercial potash?

A. I believe there is no commercial potash north of the New Mexico Potash Mine in the basin.

Q. Approval of this Application of Mitchell would not, then, cause the undue waste of commercial potash?

A. Yes, it is my considered opinion that there will be no new mines opened up, other than the mines that exist, in the north end of this basin.

If there are no new mines -- and this is a long -- this is a far distance from any existing mines -- then there would be no waste of potash.

Q. Let's talk about a hypothetical.

A. All right.

Q. Apart from the reality that mining operations are not going to occur in this immediate area, let's talk about what -- The potash industry has described to the Division on numerous occasions this concept of subsidence?

A. Yes, sir.

Q. What if mining operations were to take place? How close would those operations have to come before there is a cause-and-effect relationship between the oil well and the mining operation?

A. In the hypothetical, if you would look at the next 11-by-18 foldout sheet, this is a -- This was done by Dr. Deere back in 1961. It's very good. It was done for a study in the potash basin. It's very good to explain what happens with subsidence.

In the lower of the three diagrams, it shows on the right-hand side the end of mining and a vertical line. It shows a series of four angles, all named alpha 1, alpha 2, alpha 3 and alpha 4.

To answer your question, the most important situation that we want to look at here is where the geologic formations might break through to the surface with subsidence of the mined area below, and that happens at the point called T_{max}, T_m-$_a$-$_x$.

That coincides in the top diagram with the point

where the tension measured on the surface, through very scientific surveys with concrete monuments in the ground, the distance between two monuments has changed the most. And with subsidence, the area very, in this case, slowly collapses and the monuments pull apart most dramatically at that point.

That's a point of maximum tensile stress on the earth, and if there were a structure there it would be the maximum tensile stress on that structure.

If you go further to the right, on the lower diagram you'll come to the notation, T_0. That's the point where the distance between the monuments, through considerable studies and surveys, have indicated that the tensile effect or tensile stress is near zero. So any structure that would be outside that point would not be affected by subsidence stresses.

Going further to answer the question in the hypothetical, what would be a safe distance?, I have studied all of the public, published documents of subsidence in the potash basin.

If I may show you where they are on this large Potash Map that's been put into the record before, this is called the Wills-Weaver Mine. It's the northernmost, westernmost potash mine. It's now closed, has been for some years.

In the process of closing it, the USGS, who was in charge of this area before the BLM, commissioned an engineering study to make sure that they could seal the shafts so water would not go down the shafts and would not put the potash that had been mined or in those salt areas -- dissolve them and make a big void.

What they determined through studies is that the potash zone would -- slope that had been mined would slowly collapse, because the salt is very plastic, and it would seal that off.

And they studied those subsidence situations to make sure that the shafts that were sunk here would not be tilted because of the subsidence, and then made their recommendations to the USGS how to seal off those shafts, or, in terms of the oil business, to plug them.

They discovered during this investigation that there were three active oil wells within the mine that had been drilled through pillars. A pillar is a big block left to support the mining operation. These pillars had approximately 150-foot radii, and there were three of them in an area that had been mined to the extent of maybe 75-percent extraction of the potash below.

Those wells, to my knowledge, still operate today, and they've had no adverse effects on those -- There have been no adverse effects because of potash subsidence

on those wells.

The other area that was extensively studied for subsidence was the westernmost mine, once belonging to U.S. Borax. Back in 1965 they published an article. They were asking for permission to allow them to let the potash subside by taking out the large pillars they had left in place and just letting the ground collapse.

The Bureau of Mines required them to do some extensive studies on the surface, where they put these monuments in, as I've described earlier, measured their elevation differences and the distances from monument to monument.

The next thing that happened was, in 1961 they hired Dr. Deere from the University of Illinois to come out there and tell them where they could locate the foundation for a new mill, large concrete structure to put a mill in, where the subsidence would not affect that mill. He did that study, and this is a sketch -- This exhibit is a sketch from that study.

I assimilated all that information and would like to define for you one other critical subsidence study angle, and that is the angle of critical deformation. Now, that has no basis in science, but it has a basis in substance.

If U.S. Borax wanted to build a mill, they would

not want that concrete structure to crack. So they would locate the mill -- or confine their mining below so that that mill foundation would not be affected.

In our case, and in response to Counsel's question, I believe that the angle of critical deformation for a double-cased hole with cement between the casing and cement outside the casing should be close to T_0. That would give a considerable amount of safety factor, because we do know that the structural integrity of the casing structure, the two casings with the cement, has some ability -- a considerable ability to resist tensile strength.

But if we set it at T_0, that would mean that for a 2000-foot-deep mining horizon, you could go 1150 feet horizontally. Now, that's approximately -- That would make angle alpha 2 on this diagram approximately 30 degrees.

I took all these studies and assembled them and determined that the lowest angle similar to alpha 2 was in the small Wills-Weaver Mine up here where the oil wells are not being affected, and that angle is only 10 degrees off of vertical.

In Dr. Deere's report, in finding a location for a mill, he came up with the highest being 35 degrees, and when I accumulated all of the data I came up with an average of 23 degrees.

So I feel comfortable in recommending a 30-degree in this hypothetical situation that we've just discussed, and that provides zero tension on any structure if you go out that far.

And so the formula would be that the safe horizontal distance would be the vertical distance to mining times the tangent of 30 degrees.

Q. When we apply that specifically to the depth of the ore in relationship to Section 4, what would that distance be, then, to have a buffer or a safe setback?

A. I determined that -- not knowing what the actual depths were -- I knew they were approximately 2000 feet. The 1150 feet is for 2000 feet.

However, if you back up one exhibit, you can look at the core hole locations and you'll see a number above and to the right of those that show the depth from the surface to the 10th ore zone -- not to the McNutt, but to the 10th ore zone -- and it shows that, for example, in I-144 the depth to the 10th ore zone is 2171 feet.

Are you --

Q. Yeah.

A. And so if you look at all of them, the average is over 2000 feet. Maybe closer to 2100 feet. So it would be slightly more -- The offset would be slightly more than 1150 feet.

Q. We talked earlier about the shallow oil wells and a buffer zone set back from the LMR. You know, the quarter mile? There's a --

A. Yes, I've read R-111-P.

Q. All right. You get to R-111-P and you see an LMR established, shallow oil well has to be greater than a quarter mile away from an LMR?

A. That's what it says.

Q. Yeah. Is there any relationship to that buffer zone and the effects of subsidence?

A. I believe it is totally arbitrary. I think if someone were to come in here and mine something much deeper, that the quarter mile might not be enough.

And there doesn't seem to be any science in the quarter of a mile, because over on the west side of the potash basin where they're mining 600 feet deep it's a quarter mile, and in this area, which would be 30 percent deeper than anybody has mined before, it would still read a quarter of a mile, but -- So there doesn't seem to be any science in it.

Q. All right. We're in an area that's barren, there's an absence of commercial potash, and in your opinion we're not going to see this potash mined.

However, I want to be really careful and I want to establish some scientific distance -- a real buffer, if

you will -- between my operations in Section 4 and whatever may ever happen with the potash. What is that horizontal distance?

A. I would recommend that you take -- as mining were to encroach within some reasonable distance of the oil field, that the mining company should be required to do what others have done: Make a study of blocks that they are allowing to cave in and, determining the distance to the potash, require that they not get closer than a 30-degree angle from the vertical over to the wellbore.

Q. And in this instance as we apply it to Section 4, that's approximately 1200 feet?

A. That's correct.

Q. All right. Let's go to another topic. Let's talk about what studies you have made to determine the -- I'll call it "permeability" because that's the word I know. I assume that you may call it something else. But I want to look at the integrity of the formations from the surface down to the Yates.

To start that discussion with you, is there a geologic illustration that you can give us?

A. Yes, the next sheet behind Tab 13 is another cross-section, somewhat similar to the one that we saw before. This comes from an extensive study done for the WIPP site. WIPP, on the large Potash Map, is located in

this area.

Q. In fact, it's identified on the map as "WIPP"?

A. W-I-P-P, yes, it is. And we're some distance away, but we're still within the geologic basin limits and the formations are quite similar.

At WIPP they were very, very careful to locate it to prevent the escape of any -- I think it's called transuranic waste. And they located it in the Salado formation, which is shown on this exhibit.

You'll also note on this exhibit, through the middle of it you'll see the McNutt potash zone. I believe the WIPP site actually would be below the McNutt but well in the Halite so that there's no chance of escape through this impermeable area, up.

And to make sure nothing comes up from below they studied the Castile formation, which I've proven to myself through research is similar in its composition of anhydrite and halite to the seal that was described earlier by Mr. Olive in the Tansil formation.

Q. Let's take this to the next illustration. Do you have an example of what the potash operator would encounter, geologically, from the surface down to the Salado as he attempts to operate his mining operation?

If you go to the next display I think that's the illustration I'm trying to point you to.

A. Okay. The next one is from this WIPP study that I examined.

And by the way, I think that the OCD here is very fortunate that such a tremendous amount of research was done in this particular area for the location of the WIPP site. They have exhaustive technical data. I have looked at quite a bit of it, and it's not something you would normally find in an oil and gas basin. It's very impressive.

Q. This came from the WIPP site, but it's illustrative of what the potash operator deals with from the surface down to his potash?

A. That's correct. And at the WIPP site they put a shaft down, which is shown on the next 8-1/2-by-11 sheet, and they lined it with concrete through the Dewey Lake Redbeds, all the way through the Rustler formation and into the upper part of the Salado formation.

They left the remainder of the shaft open so that they could study the Salado formation for its conductivity and permeability and presence of clay materials and gases and anything that they could think of to determine the geologic and structural characteristics of the Salado formation wherein they placed the WIPP site.

Q. What's the conclusion?

A. They didn't seem to be at all concerned with any

gases or liquids coming into that shaft while they studied it. And certainly their studies indicated that the Salado is impermeable, that when they have encountered gas, as New Mexico Potash did, it's totally contained and is of a depositional character within the formation, and it did not come from outside that formation.

Q. Have you and the Mitchell geologist taken one of Mr. Thoroughman's displays to give the Examiner an illustration of where he is in relation to the top of the salt and the base of the Salado and the top of the Yates?

A. Yes, we have, and it's on the next sheet behind Tab 13. It's entitled "Wellbore Schematic". And you've seen it before, but we've added some notes to it to show you where some of the -- where this wellbore in its recommended configuration would be in the formations.

The surface casing, the cemented surface casing, comes very close to the top of the salt, located in an impermeable area in the Rustler, which is required by R-111-P.

The base of the Salado is noted on there in an approximation of scale here.

And then the expandable plug that had been described earlier by Mr. Thoroughman is shown. And below that, the top of the Yates.

This shows they expect to go into the Yates, plus

or minus 500 feet. And that would conform to a distance that would be approximately 800 feet below the base of the Salado, which is shown on the left side of the diagram.

Q. From your perspective in the potash industry, do you have any opinions about drilling a well with this type of well program in the potash enclave?

A. Well, I have drilled some oil wells, not in this area, and this is a -- with the exception of the expandable plug -- fairly common practice. And since I don't believe there will be any potash mining anywhere near here, I think this is -- this is an adequate way to do it, taking into consideration that I'm not an expert drilling engineer.

Q. The next topic I want to describe with you is to see if you can give the Examiner some sense, some relationship as to the integrity or the character of the various formations that we deal with. In my industry you would try to run some type of test or analysis to determine the porosity or the permeability of a zone?

A. Yes, I have. And if I could ask you, Mr. Examiner, to back up two sheets to this cross-section, it will help you -- and put it next to the next sheet, which is just a typewritten sheet. If you would put those two together, it would be helpful in understanding what I've done.

I went to the technical studies of WIPP. And as

I said earlier, they performed some conductivity ranges. Now, this is for water and it's in feet per day. And I broke it down to try to summarize a very large amount of work into a summary sheet.

At the beginning of the typewritten sheet it shows the Bell Canyon, and I've said also the Yates and Seven Rivers. And if you look at the cross-section you'll see that the Yates formation is shown going into the Capitan limestone, and it comes out called the Bell Canyon formation down below.

Now, these are not identical formations, but geologists with the New Mexico School at Socorro have studied the fossils in each of them, and of course the structure for sandstone and shales and limestone, and found them to be similar in age and somewhat characteristic of one another.

So there's a relation. I don't think it's really close, but there is a relationship to them.

And I have data on the Bell Canyon or the -- Yes, the Bell Canyon formation, as to conductivity. And that is shown, and I -- These are strange numbers to work with. So to help us be able to compare, I put the conductivity ranges in terms of 10^{-3}, which means you can take any of the numbers to the left of the "times" sign and move the decimal point three places to the left to get the real

number.

But since they're all in 10^{-3} ranges, you can compare the sandstones and their conductivity of having a range of 30 times 10^{-3} to 200 times 10^{-3}, something that we could predict.

Also, the siltsones and shales are less permeable, are less -- have lower conductivities. And in the WIPP tests they ran several other tests which I summarized. And so for the entire Bell Canyon area the average conductivity turned out to be 33 times 10_{-3}.

Q. You've done that for the other zones in the area to come up with a range of conductivity?

A. Yes, I have, and --

Q. Let's -- Yeah, without reading them --

A. Right.

Q. -- get us to the punch line and tell us what the conclusion is --

A. All right.

Q. -- from the study.

A. The Castile, as I said earlier, they wanted to locate it so the Castile would be a seal. And it has -- It showed no conductivity, as did the halite zones, including the McNutt, as no conductivity.

However, there are some argillaceous halites, halite formations with clay in them, and there's Marker Bed

139 that they tested, and the data is there.

The average of the non-salt-zone tests, or those halites that were compromised with some clay, averaged out being .000543 times 10_{-3}. So that you can see that there's -- The conductivity, even in the clay zones, compared to the formation, the Bell Canyon, is very, very small.

To put this into perspective, if you want to assume unit areas, gradients and thicknesses and liquid viscosities that are the same, I tried to compare one inch of water penetration in the average non-halite bed in the Salado, of one inch, and what that would be in the Bell Canyon. It turns out to be 5000 feet.

You can see that any water -- and perhaps you can relate this to some degree to gas -- would have many places to go before it would go anywhere in the Salado.

The amount of time for water to travel one inch in the average Salado non-halite bed is 420 years, if you calculate it using the average that I've come up with.

So basically the Salado is impermeable, by any comparison that you'd like to make.

I would, in comparing subsidence to permeability, tell the Examiner that the subsidence is something that should be of concern and should be -- something should be done with it in knowing on the hypothetical that mining -- if it did encroach towards Section 4, that that would be

the critical item, not permeability.

EXAMINER MORROW: So 30 degrees away from your depth will be --

THE WITNESS: Yes, I think 30 degrees would give you a considerable safety factor.

Q. (By Mr. Kellahin) I want to deal with this last topic in a summary fashion, Mr. Hutchinson. It has to deal with supporting your conclusion you expressed a while ago, that the mining activity for potash recovery in the basin within this area is not going to happen concurrently with the extraction of the hydrocarbons that Mitchell proposed to accomplish in Section 4, it's simply not going to happen contemporaneously. Is that a fair characterization of your opinion?

A. I think that's absolutely correct.

Q. Let me have you take us through a quick summary of the economics that have caused you to reach that conclusion, and I'm going to let you start with the pie chart, the display that has -- that is next in your section.

A. There are seven sheets that I've put together to go through the status of potash in the United States and how the New Mexico potash industry is related. And I'll just do it quickly. You can have these exhibits to look at later; they're very simple.

But basically, on the first page it shows the US demand use is 95 percent fertilizer.

The next pie chart down shows that the US gets their -- 93 percent of their potash from Canada.

The next one down says that of that potash produced in the United States, 37 percent is exported.

On the following page there are two pie charts. One shows that 95 percent of the US fertilizer is in the form of muriate.

Now, when I spoke about langbeinite and sylvite earlier, sylvite occurs in the northern end, almost exclusively, of the potash basin. Or, better stated, langbeinite, which is a highly specialized product, only occurs in the southern part, far away from the subject area.

The sulfates are very expensive, so they're only used on specialty crops.

The US fertilizer demand comes -- 59 percent is consumed in the corn belt of the upper midwest, 2 percent in California, et cetera.

On the next sheet, concentrating on the corn belt demand, it shows that 89 percent of the corn belt demand comes from Canada, 11 percent from domestic sources.

If you would now turn the page for a moment, you'll see a map of the United States with the corn belt

colored in an orangy-yellow color, and those are the states that consume 60 percent of the potash, because corn takes a lot of potash apparently.

Q. Across that map, you've got a line that's almost horizontal. What does that mean?

A. If you'll look at the big purple area just across the Canadian border, that's where the Canadian potash reserves are located, in Saskatchewan. If you look down to the familiar southeast corner of New Mexico, you'll see the relative size of the New Mexico potash reserves.

That line is equidistant from those two sources. And you would expect that where New Mexico had a transportation advantage, their potash would go to that state, and certainly Missouri shows 65 percent of its potash comes from domestic sources.

Now, if you'll back up a page again to the pie chart that is in the middle of the page, it shows the corn belt without Missouri, and that indicates that 95 percent of the corn belt demand comes from Canada, five percent from domestic sources -- mainly, I would guess, New Mexico.

Now, the last pie chart shows the New Mexico production, 93 percent of it being muriate, seven percent being sulfates. So you can see that the big potato in New Mexico potash production comes from the mineral sylvite and not from those special langbeinite deposits down to the

south.

Q. Are there values, costs, criteria, information that explains why that relationship exists, the advantage that Canadian potash has for a significant portion of the US domestic consumption of potash versus what happens in New Mexico?

A. Yes, sir. If you'll recall the map of the corn belt states, it's clear because of the transportation situation, that the New Mexico sylvite mines are in competition with the Canadian mines.

Now, if you'll turn one more page past the map, you'll see a typewritten page in large letters called "New Mexico-Canadian Muriate Production from Sylvite", and I've taken some criteria that's been published in public information sources.

In 1991, the production in thousands of metric tons of K_2O, Canada produced almost 7.3 million. New Mexico produced 1.3 million.

The prices are the same. Cash costs in New Mexico are larger, and the reason for that comes in the next line. The grades mined in Canada exceed 25 percent K_2O per ton mined, in New Mexico less than 13.2 percent in 1991, and they're dropping drastically every year.

The mining thickness in Canada is 25 to 28 feet. They can get large equipment in there and mine

inexpensively. The average thickness mined in New Mexico is five to eight feet.

The production capacity in Canada is 11.5 million metric tons per year, whereas in New Mexico it's close to 1.5, and that was before the AMAX Horizon Mine closed permanently.

To show how big the reserves are in Canada, they control 47 percent of the world reserves, whereas New Mexico controls only -- less than one percent.

All this comes together to show that the Canadians have a comparative advantage of about 2.6 to 1. That means that in New Mexico they would have to mine 2.6 tons, mine it, process it and turn it into product, whereas the Canadians would only have to mine one ton. So there's a tremendous advantage. It's physical.

Canada is one of our greatest trading partners, and it just looks like it's not a competitive situation for the New Mexico mines to keep on producing in competition with Canada, where the Canadian -- or the New Mexico reserves are dropping, the number of mines is contracting, and the answer is inevitable.

And that's the basis for my saying there will be no more new mines to the north.

Q. Have you plotted the New Mexico potash production over the last number of years and shown that in the form of

a display?

A. Yes, on the following -- On the next sheet under Tab 13, I have plotted the actual amounts of thousands of metric tons of K_2O that have been produced back to 1966.

In 1965, that was the pinnacle, that's -- From 1930 until 1965, seven mines came on stream in New Mexico. And of course, the lowest-cost mine is going to come on first and the least efficient mine is going to come on last. And then they're going to come off-line probably in the reverse order, and they have.

And you can see that the actual production is dropping radically since the peak of 1965, and I've put a regression line, a trend line in there, if you will, to show that it's going to continue to drop.

And my last exhibit and my mining experience tells me that for the BLM Map to have expanded and therefore, because of R-111-P, the State R-111-P area expanded, doesn't make economic sense or commercial sense in an industry that is declining. I know that if a mining company had seven mines and two of them went out of production, their reserves available to be mined would decline.

But if you'll look at the very last sheet of my -- behind Tab 13, you'll see a chart showing the years 1980, 1984, 1992 and 1993, 1994 and then 1995 through 1996.

The production of potash is coming down. And in columns C, D and E, you can see that since 1980 potash production has dropped almost a third. But yet the map remains the same size. That doesn't make sense to me.

The number of mines in the three columns to the right show that there were seven mines operating in 1980. In 1994 there may -- I call it four plus because of the sporadic production out of one of the Mississippi Chemical mines for their internal use, I believe.

If we eliminate the langbeinite mines and just look at the sylvite mines in column G, they've gone from five down to two in 1994. And I believe in 1995 or 1996 there may only be one, and that will be New Mexico Potash.

So that the change in the number of mines in column H shows that since 1980 -- 1984, four years before R-111-P went into effect, the number of mines dropped 20 percent.

In 1993, when this big, large BLM Map was published, the number of mines had dropped 40 to 60 percent.

And I think that they might be down around 80 percent in the 1995-to-1996 range, 80-percent decrease in the number of mines.

So that explains why I don't think there's going to be any new mining north of where the mines are now and

the sylvite mines that are operating will confine themselves to the reserves that they have right now in their areas.

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

We move the introduction of his exhibits behind Tab Number 13.

EXAMINER MORROW: Exhibits 13 are admitted into the record.

EXAMINATION

BY EXAMINER MORROW:

Q. Mr. Hutchinson, I have just a few question to pick up some information I missed.

On the second page of Exhibit 13, what did you say about ore zones 11 and 10?

A. Okay, that's the --

Q. Are you talking --

A. That's the type-log-type -- That's the one you're referring to?

Q. Yes, sir. You said some were being mined and some were not.

A. Correct.

Q. And I didn't pick up on --

A. Number 11, I think you asked me about just now, is noncommercial. It has not been mined anywhere that I'm

aware of in the Basin.

Q. And 10 is being mined somewhere, but I didn't --

A. It's being mined by New Mexico Potash. And it has clay seams in it.

Q. All right. Is there any reef in Section 4?

A. Any what?

A. Capitan Reef formation underlying Section 4 where these wells are proposed?

A. That's a good question, and we think there will not be. If you'll look at the very first 8-1/2-by-11 that's in this -- immediately behind the Tab 13 -- I think you need to go backwards to the very first sheet in Tab 13.

Q. All right.

A. It shows the Capitan Reef.

Q. Yes.

A. Have you found that? And it shows the Castile formation.

By definition, the Castile formation is limited to the area above and south of that reef. It could be that if the well is drilled somewhere under the word "reef", you could hit some Castile. Most likely, Mr. Olive tells me, that we probably won't hit that, even though we're over the plan view of where the reef exists with this location in Section 4.

Q. That trace of the reef that you see on some maps

includes part of Section 4; is that correct?

A. Yes. It's not in the exhibits, but in the -- This is what you're familiar with seeing --

Q. Yes.

A. -- and we're just into it. So whether the Castile will be there or not is anybody's guess. From the other wells in the area, probably not. But the anhydrite is there in the formation called the Tansil, and that provides the seal, the same seal that the Capitan -- or that the Castile is made of, alternating beds of anhydrite and halite.

Q. What provides the seal above the reef? Is that what you're saying?

A. The seal above --

Q. The seal -- The reef, if it's there, would be where? Right on top of the Tansil or above the Tansil?

A. The -- I'm going to say from the cross-sections I'm familiar with that they won't get into the reef. The reef, as it's been described to me by geologists runs from the lower left-hand corner to the upper right, and as it was formed is in that direction. Of course, this is north and that's south, left to right. North is left, south is right. Probably won't get into the Capitan Reef proper.

MR. KELLAHIN: Mr. Examiner, if it will assist you, Mr. Olive tells me that the Scharbauer well they

drilled in the southwest of the southeast of 4 -- that was the deeper well -- didn't encounter the reef.

THE WITNESS: It did not.

EXAMINER MORROW: Now, where is that one again?

MR. KELLAHIN: All right, look in Section 4. See the well that says Number 5 --

EXAMINER MORROW: Right.

MR. KELLAHIN: -- to the southwest southeast? That originally was a Morrow test. They drilled it, and he says they didn't encounter the reef.

Q. (By Examiner Morrow) You talk about some problems with pressure at 1500 feet. How did that manifest itself?

A. The New Mexico Potash Mine predominantly, and one of the other mines to a lesser extent, had explosions underground. They were not detonations; there was nothing burned. But it was a pressure explosion.

And what MSHA, the Mine Health and Safety Administration, reports, indicated is that the pressure difference from the mine being opened up and an entrapped material that was laid down with -- at deposition, with that pressure drop, was able to dissolve the gas, much like coal-bed methane. The methane is dissolved from the coal. When the pressure differential gets to be great enough that gas dissolves out of the formation. And it was

predominantly nitrogen.

And the WIPP studies showed that to be material that was deposited with the potash and the halite and that with all the pressure from the formations above, the weight of the formations above kept it entrapped.

But when the mine opened up and got close to that area, here was ambient pressure, pressure very close to what we have on the surface, versus something at a depth of 1500 to 1700 feet, and that gas dissolved and rushed into that opening.

Q. Gas and solids both, or just gas?

A. Well, some of the solids that broke out caused some damage and, in one instance that I'm aware of, caused a fatality.

Q. Do you think there will be any mining east of the -- You said nothing north of here. I guess that would pretty well include nothing east of the Mississippi Chemical Mine also; is that correct?

A. That's correct. If the potash -- The 10th ore zone is dipping towards the east and a little bit to the north. As you go downdip, those pressures are going to be greater. So there's a physical constraint to developing this direction -- towards the east.

And then the -- we showed on one -- the Salado -- or, excuse me, the McNutt structure map, that you're

going -- the potash-bearing formation is going down in this direction. You've going to have higher pressures just from the formations above. So there's a physical reason.

And then I just described the economic reasons. New Mexico Potash is developing towards the south, and you can see from the large area of blue, whether or not it's correct, they have a lot to mine down here before they would go off into something that's deeper than they're mining now.

Q. Okay. The double-cased hole, you said -- I assume you were telling us that offered even more support than you would expect from your building, I think, that you were comparing it to or your mill?

A. No, the point I was trying to make is that many of the subsidence tests that have been done in the basin were done for different reasons: One for a concrete slab to keep it from being affected. One to determine whether a shaft in the small mine that was closed, the Wills-Weaver Mine, would be tilted by subsidence and thereby let groundwater down into the mine. And then the third case was, what will happen when we remove the pillars and let it subside?

So those were three different -- entirely different situations.

And here we have fourth situation that -- How do

we prevent undue stress coming on a vertical double-cased oil well by not allowing mining to come within a certain distance of it?

Q. And your 30-degree deal from the depth is --

A. Yes, I believe that's --

Q. -- acceptable?

A. -- completely safe.

Q. I didn't completely follow the conductivity study there. You simplified it so that we could see how far water would move in a certain time. And I believe you said that assumed unit pressures; is that what you said or -- ?

A. Yes. Let me explain the study. I've testified at -- it seems like, for many, many days at some of these hearings, and the subject of permeability and conductivity is always brought up but had never been quantified.

So I was looking for some data by which I could compare the rate at which the different formations would transmit gas or oil or water or whatever. And I found this study performed for WIPP whereby they were concerned about water traveling through the Salado, the Castile, the Bell Canyon and the formations above, and they did a hydrological study.

I just took some common information that I could understand to try to quantify the relative permeabilities of the formations that we're dealing with in this area,

based on that scientific information developed for that --

Q. On your bottom line there it says, the amount of time for water to travel one inch in the Salado is 420 years. Would that -- It seems like it would depend on what pressure was pushing that water.

A. I agree, and if -- In the first part I said, I you assume unit areas and gradients, thicknesses and liquid viscosities. There's not much scientific -- not much science in my study. It was accumulation of other people's data to try to look at the relativity.

Q. So it's just water gradient down to the depth of the Salado, would be the -- Would that be the way to -- ?

A. That would be a way to look at it.

Q. Pressure pushing it.

There was a spurt in 1982 on the production -- 1987 or 1988. What was the reason for that? New Mexico Production of --

A. There was a situation where the New Mexico producers thought that they were being taken advantage of by the Canadian producers. And the Canadian producers were...

Since they have such great capacity, they only operate about 60-percent capacity. They have such great capacity and such an economic advantage that they could lower the price and put the New Mexico mines out of

business.

And that's what -- That was the case that the New Mexico mines took to the US government.

As a result of that, in 1988 the Canadians made an agreement with the US government, I think the trade people, that they would not sell potash in the United States below a reasonable cost. It was a very vague agreement.

And what really happened in my research is that the cornbelt consumers of potash said, you know, Don't take away our advantage of buying inexpensive potash. And so a compromise was worked out.

Well, those years of 1988, 1989, 1990, the amount of potash produced in New Mexico went up. That was one of the reasons.

I also believe that there was more of an export demand.

And being so close to the Texas Gulf Coast and being able to ship potash out by water to South America, specifically, was also an advantage there.

EXAMINER MORROW: Okay, thank you, Mr. Hutchinson, appreciate it.

MR. KELLAHIN: Mr. Examiner, our last witness is Carl Richard.

EXAMINER MORROW: Okay.

MR. KELLAHIN: Mr. Richard is a reservoir engineer and he's done some reservoir calculations on recoverable reserves and compared those to his economic criteria and has some conclusions to share with you.

CARL RICHARD,

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Would you please state your name and occupation?

A. My name is Carl Richard. I'm a senior reservoir engineer in charge of the Permian Basin district. I work for Mitchell Energy.

Q. And where do you reside, sir?

A. The Woodlands, Texas.

Q. Mr. Richard, on prior occasions have you testified as a reservoir engineer before the Division?

A. Yes, I have.

Q. And pursuant to your employment in the capacity of a reservoir engineer, have you made calculations of recoverable reserves that you anticipate for Section 4 and made an economic evaluation of those reserves in comparison to costs?

A. Yes, I have.

MR. KELLAHIN: We tender Mr. Richard as an expert

reservoir engineer.

EXAMINER MORROW: Fine.

Q. (By Mr. Kellahin) Let me have you turn to Tab Number 14. Let's look at the first display.

I asked earlier if Mr. Olive had assisted you in trying to identify those wells in this pool which could be attributed only to the Yates interval, production from those wells attributed to that interval of the pool.

Were you the reservoir engineer that worked with Mr. Olive in that study?

A. Yes, I was.

Q. Were you able to determine from your study those wells in the pool to select so that you would be looking only at the Yates interval production from that pool?

A. Yes, sir.

Q. Okay. Let's look at the display. And before we describe the conclusions, tell us what you've illustrated. What's the information?

A. What I have here is a short list of Yates producers only, from the West Teas-Yates/Seven Rivers Pool.

What I've done is used a decline-curve analysis, because I had sufficient history for the majority of this Teas-Yates/Seven Rivers Pool to predict recoverable reserves with reasonable accuracy.

And I've summarized that, the cumulative

production, the last 12 months and the last month of production, along with the estimated ultimate that I extrapolated using decline curves.

Q. Behind the summary sheet, then, we're going to find decline curves that you have submitted for each of these wells?

A. Yes, sir.

Q. Let's take one just as an example. Let's look at the next one down. Federal 9 Number 2 --

A. Yes, sir.

Q. -- Stevens and Tull Well?

A. Yes, sir.

Q. Describe for us what you've done.

A. Well, this is the Stevens and Tull 9 Number 2. It's located in Section 9, adjacent to Mitchell's lease in Unit Letter B.

It came on production about August of 1992 and, as you can see, it declined.

What I've done for each one of these similarly is extrapolated a decline down to what I consider an economic limit of about 65 barrels of oil a day -- a month, excuse me.

Q. Your closest competitor offsetting the south edge of Section 4 looks like 20,000 barrels of oil?

A. Based on this decline I have extrapolated here,

yes, sir.

Q. He's not going to get enough production to pay for the cost of his well?

A. Based on my analysis, probably not.

Q. When we look at your tabulation --

A. Yes, sir.

Q. -- you have a range of estimated ultimate recoveries shown in the far right column. They range anywhere from 11,000 barrels -- Are you with me?

A. Yes, sir, I am.

Q. All right. Where is that well?

A. That well is in Section 16, Unit Letter D.

Q. And then we look at the highest range, there's 180,000 barrels of oil for the Arco State Well?

A. Yes, sir.

Q. Where is that well?

A. That's in Section 16, Unit Letter E.

Q. As part of your analysis, do you have any anticipation that in Section 4 you're going to achieve estimated ultimate recoveries of 180,000 barrels per well?

A. Each one -- I can't say each one, but several of these wells, I've verified with volumetric calculations to determine whether or not I could volumetrically produce this.

The Scharbauer 4 Number 1 well that Mitchell was

currently operating and producing, if I use the same parameters from that well and take the net footage that Mr. Olive has provided me with for Section 4 and anticipating encountering the same Yates formations, I can't volumetrically come up with 180,000 or 127,000 barrels.

Q. What number do you balance with volumetrically in looking at your projections of ultimate recoveries? What number do you think you're going to get?

A. Volumetrically, I'm calculating about 110,000 barrels.

Q. What is your best engineering judgment about the number to pick as we plan for the costs of our well? What do you think you're going to get out of the wells in Number 4?

A. What I've done in, I guess, comparing cost analysis and the economics is, used an arithmetic average for all these wells, the nine wells I have listed here. That arithmetic average is 63,000 barrels.

In addition to that, if you do a distribution, the geometric average for these nine wells is about 30,000 barrels. I've got 50 percent of the wells less than 30,000 barrels and 50 percent greater than 50,000 barrels.

So my arithmetic average of 63,000 barrels that I've used in these economics that I'm going to be presenting today, I think, is a reasonable expected

reserve.

Q. Is that consistent with the methodology that you normally apply to reserve evaluations as you and the others plan to drill wells such as these?

A. Yes, sir. In the case of this, where I have -- I'm extending a developed field, this is generally the procedure I use in determining a reserve for an economic evaluation.

Q. With this kind of reserve potential in Section 4, is it going to make a difference to you and to Mitchell if the salt-protection string is deleted from these wells?

A. The salt-protection string required by R-111-P does have a significant impact on the economic viability of this project.

Q. If the Examiner approves our request to have that salt-protection string waived, is there a resulting economic benefit?

A. Sure.

Q. Let's look at the next Tab, Section 15.

Have you made an economic analysis to try to quantify what the significance is of that cost differential, between having or not having the salt-protection string?

A. Yes, sir, that economic analysis is summarized on that -- in that presentation. It's an economic analysis of

the individual well.

What I've done here is run an economic case using the same reserves, the same production function and the same assumptions that I have listed down below, to come up with the resulting economics that I have, set side by side in this display.

Q. Discounted profitability index with the salt-protection string is what?

A. Discounted profitability index --

Q. The number, what is the number?

A. I'm sorry. With the protection string is .27.

Q. All right. And without, what's the number?

A. .48.

Q. Define for me what discounted profitability index is.

A. Discounted profitability is specifically the discounted profit divided by the capital investment, and what I'm doing is subtracting one.

A discounted profitability of zero would mean that I have achieved break-even, I would have gotten my capital investment back.

A discounted profitability index of one means that I would have a two-to-one return on my capital investment.

Q. What is the discounted profitability index that

Mitchell requires of projects in order to continue with those projects? Is there some criteria, some standard by which you judge the relative values of these discounted profitability indexes as you calculate them for various projects?

A. It varies, Mr. Kellahin. For our development prospects, we generally are willing to accept a lesser degree of probability when the risk, geologic risk, reserve risk and other risk is less.

In the case of this particular prospect, I have some significant risk.

Price volatility. Thirty days ago, we had a posted -- or we were getting a net price to Mitchell of $10.50 a barrel. We have sour oil produced in our Scharbauer Well. We have a gravity deduction.

This price I used in the economics is being more than optimistic as far as price goes. This is a price that our oil marketer provided me with last Thursday when this display was provided.

Thirty days ago we were debating whether to proceed with this hearing, based on the economics with $10.50 a barrel.

Q. So if we can delete the costs of the salt-protection string it's going to have significance to you and your company about whether this project goes forward?

A. Sure.

Q. When we look at the project life, what is your best forecast of the life of the project, in order to achieve the maximum ultimate recovery in primary production?

A. This production function that I've used in these two evaluations has a projected life of about 8.5 years.

Q. Discounted profitability index, if Mitchell gets its money back for the cost of the well plus one more time, then the profitability index would be 1.0?

A. Yes, sir. That's correct.

Q. All right. With the salt-protection string, you're about 25 percent of that threshold of getting your costs back plus one more time?

A. Yes, sir.

Q. In terms of budgeting resources to fund projects, how often -- or what time frame can we utilize to compare this project to other projects?

A. We do that on an ongoing basis. We have an annual budget, and then projects are rated on an ongoing basis.

Q. Well, for lack of a better way, let's just take an annual time period.

A. Sure.

Q. In an annual period what kind of geographic area

would this project compete with other projects for funds to get drilled?

A. I've got -- My district, Permian Basin district, is competing with five other districts for funds and funding for projects like this.

Q. When we look at projects and discounted profitability index, give us a sense of the range. What kind of ranges can we find within this geographic area?

A. This particular area, Mr. Kellahin?

Q. Well, this project competes in a geographic area --

A. Right.

Q. -- for funds to get drilled.

A. I understand your question.

In this area, for example, Morrow wells generally range -- Discounted profitability ranges from 1 to 1.5 DPI. Delaware wells, which we've been drilling quite a few in partnership with Santa Fe, range at about a 1 DPI range.

This, in both cases, is in the low end of profitability, acceptable profitability, when ranking this project against other projects.

Q. So if we can delete the costs of the salt-protection string, it almost doubles the opportunity that you have to get this project drilled as it competes with other projects in your geographic area?

A. Comparing the two scenarios, yes, sir.

Q. Have you made an analysis on a project basis to see what happens if out of the proposed 10 wells, one of them is noncommercial or is a dryhole?

A. (Nods)

Q. Can you tell us what happens?

A. Yes, sir. On Tab 16 what I've done is an economic analysis on a project basis, and I've done three separate scenarios, and they're listed as Case I, II and III on this presentation.

What I'm trying to show here is that, with the potash string, if I do drill one dry hole it significantly impacts the project economics.

If I drill two dry holes, it even -- it -- the profitability of that project is decreased significantly.

Q. Case III, if you have seven producers and two dry holes, if you have the burden of the cost-protection string [*sic*] expenses, it reduces your profitability index down to .1?

A. Yes, sir.

Q. What's your conclusion?

A. Well, I do have risk here. Geologically, we have a lot of control to the south. We do not have a lot of well control to the north.

I still think there is some significant geologic

risk to this project.

I do conclude that with the additional cost of the string, economics become more unacceptable. That's why we're here, to get a waiver to that string, make our economics more acceptable.

Q. What does it do to your ability to compete and your correlative rights if, immediately offsetting your section in the federal leases, your competing operators get the advantage of being able to drill their shallow oil wells without the expense of a salt-protection string?

A. Well, it's -- The salt-protection string is to our competitive disadvantage.

Q. Anything else, Mr. Richard?

A. No.

MR. KELLAHIN: That concludes my questions of Mr. Richard.

We move the introduction of his Exhibits 14, 15 and 16.

EXAMINER MORROW: Fourteen, 15 and 16 are admitted into the record.

EXAMINATION

BY EXAMINER MORROW:

Q. You based your recoveries, expected recovery, on the nine wells to the south; is that correct?

A. Yes, sir.

Q. The average of --
A. Yes, sir.
Q. -- what those -- Now, there's more than nine there?
A. There's 17 in West Teas field.
Q. And how did you select the nine again?
A. Based on the geologic criteria of those wells producing from the Yates formation only.
Q. Oh, okay.
A. In the Scharbauer Federal Number 4, which Mitchell is currently operating, we production-tested the Seven Rivers zone in that well and produced water.

We think, both geologically, stratigraphically, with a structural component in this area, that the Yates is not a prospective horizon.

We're getting structurally downdip at the Yates level; therefore we don't --

Q. I think Seven Rivers, is it not -- Did you say the Yates is not --
A. I said Yates mistakenly. I meant Seven Rivers, yes, sir.
Q. But I believe the geological testimony was, and probably yours too, that you expect somewhat better wells in --
A. Well, that's geologically. I still think there's

some risk.

We don't have well control to the north. There's a -- I guess a geologic scenario or a -- drawn up, but I still think there's some risk.

Q. The profitability index, you tried to explain that to me, but -- is that -- The profit is discounted at some rate in the future.

What rate do you use?

A. Ten-percent discounting, yes, sir.

EXAMINER MORROW: Do you have anything?

MR. CARROLL: That was my question.

EXAMINER MORROW: I'm sorry.

Thank you, sir.

THE WITNESS: Sure.

MR. KELLAHIN: Mr. Examiner, that completes our presentation.

When we started our Application back in October we had ten wells. There is a well that may be deleted at this time. I think for purposes of today's discussion we've defined nine.

The one missing is going to be listed as the ninth well on Mr. Stephenson's letter of October 22nd. I'll just hand it to you. It's the Scharbauer 4 Well Number 2 in Unit Letter O.

EXAMINER MORROW: It's going to be deleted?

MR. KELLAHIN: Yes, sir, we're taking that off the program.

EXAMINER MORROW: Well, we saved you some money there.

MR. KELLAHIN: We appreciate your patience with us today. We wanted to bring forward to you all the individual experts that touched the various parts of this case and had a significant participation in the project.

If you desire me to do so, I'm more than willing to prepare a draft order for your consideration. That would give you a vehicle by which you might edit and provide your own thoughts. But I'm happy to do so.

If you desire to have any of the witnesses recalled, there were earlier some geologic questions.

Hopefully, we answered them when Mr. Hutchinson testified, but if you would like to go back through the geology to make sure you're comfortable with the location of those formations, Mr. Olive is still present and available.

EXAMINER MORROW: Maybe on the reef thing we might --

MR. KELLAHIN: All right, sir, if you'd like to --

EXAMINER MORROW: -- whether or not the reef is present in the area.

MR. KELLAHIN: Yes, sir, let's do that. Let's recall Mr. Olive.

DON OLIVE (Recalled),

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

THE WITNESS: What I would like to show you, this that we do have colored here in purple --

EXAMINER MORROW: Yes, sir.

THE WITNESS: -- is anhydrite.

The log here is a neutron density, and it reacts differently in different types of rock. It's calibrated to a limestone, and we don't have any limestone present here -- I'll wait until you get that open.

The scales -- I'm sure you're familiar with well logs, but the zero-porosity line would be right here, the second line over from the right.

EXAMINER MORROW: Okay.

THE WITNESS: And if there was a limestone in here, both curves -- the neutron and the density -- would track together.

And more than likely, if there was limestone in here it would be tight lime, so it would be hovering around the zero line, and they would be tracking together.

In the sandstone you get -- In the porosity areas you get an increase, both increase, whether it's

hydrocarbon or an extensive amount of gas, you get crossover where the lines reverse in position.

But -- Let's see, in the dolomite you would get a separation. So one of the curves, density, reads highly pessimistic in the dolomite, the neutron reads about right.

But you get a separation, like you see here in these blue -- this rock that's colored blue, and you get this big separation. That indicates dolomite.

But up here in the anhydrite, both -- the density reads off scale, and the neutron is reading about right, about zero. It's not nearly as influenced as the density. Density is highly influenced by rock type, and the density is the one that is calibrated to lime.

And there are no indications on any parts of this log of limestone, which the Capitan would be, a limestone.

So this is interpreted to be the Tansil formation.

And the base of the salt -- Now, see, we set casing -- or casing is generally set. I have to -- I'm more familiar with this log. Casing was set in the potash string because this was a deep well, high-pressure gas.

We didn't run a potash string -- But that was set right up here, around 3000 feet. So everything up above that, the porosity log is totally invalid. It's reading through casing, and it's hard to determine any facies type

above the casing.

But from below the casing, all the way down to this point, there were no indications of limestone.

And this up here is what should be equivalent to the Capitan limestone. That's what would rest directly on top of the Yates.

In fact, the Yates itself is a back-reef facies, equivalent to the reef. In other words, it was sand deposited in a lagoon behind the reef. And in front of the reef you have the Delaware. And they're all equivalent in age, but the facies goes from sand to limestone to sand.

FURTHER EXAMINATION

BY EXAMINER MORROW:

Q. So if the Capitan Reef that you would have present in this area, then you'd expect it to be encountered in wells to the south; is that right?

A. Right, exactly. And the zone you saw the Capitan Reef in plan view is very subjective, and I think somebody interpreted it before maybe there was well data there, that the Reef might go that far north.

But we did not see any limestone in this well. And we did have a mud log, and I don't have that with me, but I didn't see any limestone in the mud log.

And something else I'd like to clarify while I'm up here, Carl alluded to.

What I meant when I said we saw sand quality increasing to the north, what I was really trying to indicate is, we felt -- Here, you can see the production here.

We have a well that's made 12,000 barrels of oil. We have a well that's made 5000 barrels of oil. 12,000 barrels of oil. Obviously, our management would not be willing to drill wells -- I mean, there's no way that would make our economics.

What I meant to say was, we expect here with a slightly better quality sand that we might be able to get in the economic range, because there are two wells here. There's a well that made 59,000 and 57,000.

And that's the only reason we really have for pursuing this, is hoping to get that quality and do a little bit better than what our competition has done.

But I certainly don't expect to see wells on the order of what we see down here, because this right here is not even producing.

EXAMINER MORROW: Okay. Thank you, sir.

MR. KELLAHIN: Would you like to recall any of the other witnesses, Mr. Morrow?

EXAMINER MORROW: No, that's good. We'll accept your offer to prepare a draft order.

MR. KELLAHIN: All right, sir.

EXAMINER MORROW: We'll take Case 10,858 under advisement.

(Thereupon, these proceedings were concluded at 5:12 p.m.)

* * *

CERTIFICATE OF REPORTER

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

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

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

WITNESS MY HAND AND SEAL May 16th, 1994.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1994

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 10858, heard by me on April 28 1994.

Examiner
Oil Conservation Division