PUBLIC HEARING

STATE OF NEW MEXICO

OIL CONSERVATION COMMISSION

Pecos Hall, 1st Floor, Wendell Chino Building

1220 S. Saint Francis Drive

Santa Fe, New Mexico

TRANSCRIPT OF PROCEEDINGS

February 26, 2025

VOLUME IV

HEARD BEFORE:

HEARING OFFICER RIPLEY HARWOOD

COMMISSION MEMBERS:

GERASIMOS ROZATOS, Chair

BAYLEN LAMKIN, Member

DR. WILLIAM AMPOMAH, Member

COUNSEL TO THE COMMISSION:

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I N D E X

(On the record at 9:00 a.m.)

TRANSCRIPT OF PROCEEDINGS

CHAIR ROZATOS: Good morning to everybody. Happy Wednesday. Today is Wednesday the 26th of February. This is the continuation of our case that we have been ongoing thus far. It is the hearing for the consolidated cases by Goodnight Midstream and Empire New Mexico. It's the various case numbers. I'll just read them again real quickly. Case Numbers 24123, 23614 through 17, 23775, 24018 through 24020, and 24025.

Yesterday when we left, we went into closed session. Our closed session is over; we are now back in open session. And I know we have some things we need to discuss, so I'll hand it over to Mr. Rubin.

MR. RUBIN: Thank you, Mr. Chair.

Let the record reflect that the only things discussed in closed session were those stated in the motion, and that no final actions were taken.

So, yeah, we came back at about 5 o'clock. We had lost our video feed and our court reporter, so it was like a tree falling in the woods. So we are officially now back in open session.

Today, this morning, I suppose, if

someone accused the Commission of sleeping during the closed session, they would technically be right.

So, two issues this morning. The first deals with the -- and this was a matter of some contention by Empire, and most recently in their renewed motion regarding the scope of the hearing. And we have revisited and reconsidered that, especially in light of the testimony and evidence we have heard in these first two days.

And so, as a brief refresher, the July order, signed by former Chairman Fuge, had the scope of the hearing regarding evidence, testimony and legal argument on the issue of the existence, extent of and possible interference with the residual oil zone in the EMSU by produced water injections activities undertaken by Goodnight.

Well, that is clearly not the proper scope in my view of this hearing. And I'm looking -- I want to, in a few moments, as for a motion to that effect.

But as stated by counsel for both sides, the issues are more broad than just what is in the ROZ. Any correlative of rights that Empire or any other operator would claim as an heir would be something that this Commission should consider, as

well as waste, and it should not be limited to the ROZ.

Also, in light of OCD's position regarding the potential concerns about drinking water, we are also mindful that the scope of this hearing should encompass what, by statute, directs the Commission to consider with respect to the disposition of produced water. And I'll get to the practicalities of this in a few minutes with each of the parties.

But if I could have a motion by the Commission to amend Paragraph 2 of the order I just read from, dated July 2nd, to say: At said hearing, the parties shall submit all evidence, testimony and legal argument on whether the granting of the application by Goodnight would -- applications by Goodnight would, 1, impair correlative rights or cause waste, pursuant to Section 70-2-11; or 2, result in the disposition of produced water in violation of the Federal Safe Drinking Water Act or otherwise fail to protect public health, the environment, and fresh water resource, pursuant to Section 70-2-12.B(15), and whether the granting of the applications by Empire would prevent the impairment of correlative rights or waste pursuant to

Section 70-2-11; or 2, prevent the disposition of produced water in violation of the Federal Safe Drinking Water Act or contrary to public health, the environment and fresh water resources pursuant to Section 70-2-12.B(15).

And to the extent that this revisits and modifies the previous denial of Empire's order, so be it. Empire's motion rather.

So if I could have such a motion.

CHAIR ROZATOS: I move.

COMMISSIONER AMPOMAH: I second.

MR. RUBIN: And if I could have a vote. All those in favor?

ALL MEMBERS: Aye.

MR. RUBIN: Okay. Any opposed?

(Motion approved.)

MR. RUBIN: So with that, I want to be very mindful and considerate of what the parties have done up till now and make sure that what we are proceeding with is going to not -- to the extent we are changing course, I don't want to prejudice anyone.

My sense of it is that the witnesses we've heard are laying a foundation for what should be the proper scope as opposed to what we had had before. And the case we're hearing really, I

think -- I think the case that all the parties are preparing is the case that is better captured by what we now have as the proper scope. But that is not for me to say. That is for you all to say.

I know we have our witness for this morning, and I'm hoping that perhaps at least, not to put Empire on the spot, but what I'd like to do is have you all think about this, and perhaps after lunch, we want to hear if there needs to be any, God forbid, recalling of witnesses, if necessary, but reordering of witnesses or so forth.

But for now, Ms. Shaheen, I believe this was your witness.

MS. SHAHEEN: I'm sorry, Mr. Rubin.

MR. RUBIN: It's okay.

MS. SHAHEEN: I was distracted there for a moment.

MR. RUBIN: No, I'm sorry. I should have waited for you to finish. I believe this is the witness you are handling the direct on?

MS. SHAHEEN: That is correct. And we did have one question about the motion.

MR. RUBIN: Yes.

MS. SHAHEEN: -- and the scope. And is it still limited to the EMSU?

MR. RUBIN: No. If there are -- I mean, the statute does not limit this Commission in any such way. If there are some other correlative rights that are being impaired or waste, we need to hear it.

I think we'd be surprised if it reached outside the EMSU, but certainly we're hearing potential testimony about drinking water in the Capitan Reef, for example, that's outside the EMSU. So certainly that would be the case.

MS. SHAHEEN: Okay. Thank you.

MR. RUBIN: So with that, I don't know if you are in a position to say at this point whether we can continue with this witness as we had been up till now, or if, based upon what you're hearing this morning, you want to -- again, if there needs to be some sort of reordering or reassessment of what witnesses are called and when.

You weren't going to finish by Friday anyway. And so I don't think we're changing horses in midstream too dramatically, but I want to hear from the parties on that. Do you have any initial thoughts or anything?

MS. SHAHEEN: If I may have a minute to confer with the client.

MR. RUBIN: Sure. Absolutely.

MS. SHAHEEN: Okay. Thank you.

MR. RUBIN: And then when we come back, we do have the second issue of the pending motion to quash the subpoena.

MS. SHAHEEN: I apologize, Mr. Rubin. Is it possible for us to have a 10-minute break to discuss further with our client?

MR. RUBIN: Of course. No, I apologize for having to make a motion after two days of testimony. So absolutely.

MS. SHAHEEN: Thank you.

MR. RUBIN: If that's okay with Mr. Harwood.

HEARING OFFICER HARWOOD: Absolutely.

MR. RUBIN: So we'll take a 10-minute break.

(Recess held from 9:08 to 9:18 a.m.)

CHAIR ROZATOS: Mr. Rubin, go ahead.

MR. RUBIN: Well, okay. So we would like to hear from the parties, and we'll start with Empire.

MS. SHAHEEN: We would be interested in Goodnight's position, but what I can say at this point, one is, we would like to have clarification as to whether the applications relating to the other wells that have been stayed are now being incorporated into this proceeding.

MR. RUBIN: That is not the intent of this order, no.

MS. SHAHEEN: And so we are prepared to go forward with what we have, but we will supplement our testimony to include information related to the EMSU-B and the AGU.

MR. RUBIN: Understood. Okay. And we will start that out in a reasonable process with all the parties.

So then if I could hear from -- I guess we'll come to Goodnight.

MR. RANKIN: Mr. Rubin, I don't know that I can possibly state my position right now because I don't understand what the Commission's position is or what the announcement on -- I just don't know what our position is because I don't understand the potential scope.

I know what the applications are that have been filed. I know what the issues were up to this point. But I don't know what the implications are of what I just heard.

You know, I put up a map of the three units, or this unit and all the offsetting disposal wells. We're talking about more than 60 disposal wells. None of those operators had any idea that

their injection in the San Andres is potentially at risk. And this is the issue that I raised back in May or June when we had this initial scope hearing. The reason to limit it to the EMSU was to manage the scope.

And I understand there may be broader implications. And, of course, with respect to the Safe Drinking Water Act, there are outside potential impacts.

But I'm gravely concerned about how this redirection in the scope of the hearing could play out. And I don't understand it. Frankly, I just don't understand what is being changed and what the implications are.

MR. RUBIN: Thank you, Mr. Rankin. And I can tell you this. We are limited still to the applications that are before this Commission, not the state applications. I believe your opening comments, your opening arguments stated: Do these applications impair correlative rights or cause waste? That's the issue, as you put it. That remains the issue.

Now, we are not un-staying anything else. All the parties who wanted to be in this hearing are in this hearing, I presume. And this is not -- nothing in what's happening this morning

changes that at all.

MR. RANKIN: Let me just give you an example of why I'm concerned.

MR. RUBIN: Okay.

MR. RANKIN: Up to today, this morning, we understood that there's four applications to revoke that Empire has filed, Goodnight's saltwater injection, and those were limited -- those wells are limited to the EMSU. Okay?

The applications to revoke assert only that the EMSU is being impacted. Okay? What we've been hearing, and we haven't been addressing because we don't think it's relevant, is that there are these other wells miles away in the EMSU-B and AGU that are potentially, you know, in communication.

We haven't been addressing that because it's not within the scope of their application. It's not within the scope of the order before the Commission. And I don't want -- I cannot allow that to be broadened without addressing it.

Now, if that becomes part of the scope, I need to go get our guys to go do another, you know, months of research to evaluate these additional allegations that are just, you know, being tossed into the hearing. And that's greatly concerning to

me, and I cannot allow our case to go forward with that on the table.

MR. RUBIN: Well, Mr. Rankin, as I understood the applications, the applications that are being heard, they are generally limited to the EMSU. And if there were any -- if the parties have -- I mean, it would be surprising to me, based on what I've heard, that this somehow changes the complexion of the case.

To the extent you there are other rights outside the EMSU that should have been -- that were implicated by these applications, that should have been part of this case. If you feel like these applications that are being heard now affect rights outside the EMSU, shouldn't the Commission hear them? That is what their statutory obligation is.

So I am concerned about what you're saying. I'm not sure if it's just a lack of -- if we're just simply not on the same page yet about this.

So, let's move on and let's at least hear from the other parties for now.

MR. RANKIN: To maybe just make a fine point of it, because I would like to know -- I'm very sensitive to -- I want to know what their plans are,

what they're going to allege. And if they're saying that based on the evidence presented today, that they're going to come around and say, "Well, we've demonstrated that there's impairment of correlative rights in the EMSU-B and the AGU, without showing any -- I just want to know what's on the table, because I don't know right now anymore. And I want to be very clear about what the dispute is over.

MR. RUBIN: And my concern is that if Empire is somehow not allowed to put on any evidence of the impairment to its correlative rights caused by the granting of your client's applications, that is a problem. And I think you'll acknowledge that.

And the scope was incorrect in that respect. We had previously limited this. We had limited it not just to the EMSU, but to the ROZ, as the parties are going to hopefully define it for us. I did not see an issue between taking it outside the EMSU to the extent that it's still limited to whatever these applications would or would not cause harm to.

So, okay, let's -- I don't know if we'll resolve this at the moment.

We could hear from -- let's go to OCD.

MR. MOANDER: Thank you, Mr. Rubin,

Commissioners.

So it's OCD's understanding of this case that it involves injection and production from the EMSU, and then the impacts of that, which covers OCD's interest in the Safe Drinking Water Act, that's why we got in the case, was our interest in the EMSU.

I am also concerned about enlarging the scope. I am far from naive about the ability to conform pleadings to evidence and other legal doctrines that can certainly apply to these things. But this has been, frankly, a slog, and this would also require at this point, and I don't really don't want to do this, further evaluation by OCD, too, if we're going to start incorporating multiple other units.

I do think on one hand there's room for this discussion on appeal. I also think that if we're going to expand beyond the EMSU, it would have stood to reason for it to see amended applications and other documents along that line. So OCD has concerns about expanding the scope outside the EMSU, especially because even if there were -- some of the documents I know that probably birthed this issue visibly were ones that came out rather late in the entire process. I believe it came through some of

Empire's rebuttal witnesses, and that starts to look a little sneaky, to be quite honest.

OCD has already pointed out tactical disadvantages that -- there's no blame to be cast here, that's not OCD's position. But the way procedure has gone, it created problems for OCD to be able to accurately and effectively rebut the cases of the respective parties. And I think this goes beyond that potentially.

And so there's a level here of concern, because I do think, not to be the bearer of bad tidings, I'm not sure there's a good decision either way here, because ultimately this is going to result in another appellate issue on top of what I'm thinking are legion at this point.

So that's OCD's position for the record on this determination.

MR. RUBIN: Before we go back to Empire, anything from Rice?

MR. BECK: Yes, Chair, Commissioners. I agree with most of what Goodnight and the OCD said. I think this is just a huge invitation for error.

You know, for the last six to eight months, everyone has been operating under the order that you just amended, that this is limited to the

ROZ, the existence of the ROZ, evidence of the ROZ.

Now, the parties certainly have changed that position over the six to eight months, and everyone anticipated we were going to talk about the Safe Water Drinking Act and the impact of injection and production in EMSU, the possible impact to that on the Capitan Reef under the Safe Water Drinking Act.

So as Mr. Moander said, I mean, there are certain times where you can conform the pleadings to the evidence. What no one anticipated before 30 minutes ago, and what I don't think anyone can have any idea the impact of, is changing the order that was put in place in June or July that this is limited to the EMSU.

Certainly Rice and Permian would have a different position. They would have had the ability to bring in evidence, they would have the ability to go get their own experts, because they do have interests, as I mentioned in the opening, outside of the EMSU, that they may want to protect.

And as Mr. Rankin brought up, I anticipate that some of those other 60 injection well operators in the region would have the same thing.

I think that everyone anticipated, just

like Mr. Rankin said at the beginning in his opening, that we would be talking about correlative rights and waste. That's this Commission's prerogative, everyone recognized that, despite what was limited in the scope of the order.

But, I mean, as Mr. Moander brings up, you're creating a huge appellate issue without everyone agreeing at the outset to an amendment. And Rice and Permian certainly can't agree to an amendment that extends this beyond EMSU.

So that's Rice and Permian's position. We would certainly object to what I understand is the second part of this order, that it's changing the limitation of this to the EMSU.

MR. RUBIN: Okay. Appreciate that, Mr. Beck. Is someone here from Pilot?

MR. SUAZO: Yes, Mr. Rubin. Good morning. Miguel Suazo with Beatty & Wozniak on behalf of Pilot.

I'd like to echo the concerns expressed by Goodnight and Rice and OCD.

I think, you know, we would need time to assess the new order. As Rice has said, we've been operating under the order that was issued this past summer. I think that Pilot would need time to, you

know, process the language in this amended order and then determine how its interests are impacted.

You know, Pilot has significant interests outside the EMSU with only a marginal interest in the EMSU itself. If this order is amended, Pilot would need to, you know, very seriously reevaluate and likely take a much larger, you know, role in this case because its interests would be impacted.

And so I'd ask that, you know, as quickly as possible, the Commission could circulate the order that it proposes amending the scope of this hearing under so that we could evaluate how this impacts our interests and changes the nature of our position and role in this hearing.

MR. RUBIN: Let me ask this of Empire.

Is it the position of Empire that these applications by Goodnight, if granted, would impair any of Empire's rights outside the EMSU?

MS. SHAHEEN: Yes.

MR. RUBIN: Okay. Given that, is there -- I'm sorry. Go ahead, Ms. Shaheen.

MS. SHAHEEN: Just to clarify, Empire objects to expanding the scope of the hearing at this time because it brings in further delay, and the more

delay we have -- we've had two years of delay now, if we have more delay this is only going to result in the damage to the reservoir continuing and effectively impacting Empire's correlative rights if we wait any longer.

And to that end, we're willing to go forward now with what we have so long as we can come back soon with additional information related to the EMSU-B and the AGU.

If there's any further delay, we respectfully request that the Commission suspend the authority of Goodnight to continue injecting in the existing wells.

MR. RUBIN: Okay. What I'm hearing first and foremost is taking this outside the EMSU is what is the problem. That seems to be what I'm hearing.

My concern was we were hearing lots of evidence about impairment of above the San Andres and the Grayburg and there would be non-ROZ rights that would be impaired by this. That was my focus.

So if the parties are still good with limiting this to the EMSU, then that was my misunderstanding. Let me ask, Mr. Rankin.

Is that a fair statement?

MR. RANKIN: Mr. Rubin, thank you for

clarifying that being your concern. Because I believe that the parties have always understood that whether or not injection into the San Andres was causing impairment or potentially waste in the Grayburg was always understood to be a core element of this case --

MR. RUBIN: Okay.

MR. RANKIN: -- in the EMSU. That was always understood to be a direct issue.

MR. RUBIN: Okay. Well, that is good to hear, because I was trying to conform the order to that understanding. And my ignorance that I thought the application, the scope of this, was by the nature of the applications, limited to the EMSU.

But if that is the case, it may be -- it sounds like it's appropriate for the Commission to continue to limit this to the EMSU. If we do that, but otherwise amend the scope as stated, are the parties copacetic with that?

MR. RANKIN: I guess I need to see the language of the order. I would need to see the language of the order. But my understanding being that the scope is being clarified to define the scope of the hearing to include potential impacts within the EMSU, correlative rights, waste, not limited to

whether there's an ROZ or hydrocarbons in the San Andres, but any impacts or waste within the EMSU.

MR. RUBIN: Yes, that was my intent. Also not to forget the concerns of OCD also being incorporated into the scope of the order, with respect to the disposition of produced water.

MR. RANKIN: Understood. And from my perspective, Mr. Rubin, Commissioners, is that whenever there's a UIC application, the scope of the consideration is always on -- impacts to USDW is always on the table. So that's not a material modification, in my view, of the scope of the hearing.

MR. RUBIN: Thank you, Mr. Rankin.

Before we got back to Empire, Mr. Moander, is that consistent?

MR. MOANDER: I think that's right. I mean, I understand the desire to see the language of the order, but if there's agreement that the subject matter stays within the EMSU and then the impacts of production and injection, which I think is what we're doing here, OCD would be perfectly fine with that.

Something else that I did want to note here is that if there's any further effort to expand the scope, that I think that also wanders into due

process violations and notice requirements for other operators, which actually snowballs this into something considerably larger almost instantaneously. So I wanted to throw that out there.

But I will pass the mic over to Mr. Beck.

MR. BECK: Chair, Commissioners, I echo exactly what Mr. Rankin and Mr. Moander said. I think that if that's the limitation of the change of scope, as long as we see the language, I think that's something that Rice and Permian can consent to.

MR. RUBIN: Excellent.

Ms. Shaheen.

MS. SHAHEEN: We are fine with the scope as described by Goodnight. I would just note for the record that this is only about Goodnight's injection, and it does not relate to any other saltwater disposal operator.

MR. RUBIN: That is correct, yeah. It's Empire's applications to revoke those, so yes, that is understood.

MS. SHAHEEN: Thank you.

MR. RUBIN: Yes, not to forget about Pilot. Mr. Suazo, any further thoughts?

MR. SUAZO: Pilot can agree to the

limitation that this all pertains only to those wells in the EMSU and these specific applications, with a caveat that we would like to review the amended order language and have the opportunity to come back before the Commission to express any additional concerns or issues that the client might identify.

So I think, yeah, with this limitation, it should be fine, but we just want to see the language.

MR. RUBIN: Okay. With that, anything further? I'd like to restructure a motion for the Commission, unless you have anything further, Ms. Shaheen.

MS. SHAHEEN: Not from Empire.

MR. RUBIN: Commissioners, it appears that the previous motion, I need to ask for a motion to modify that to limit it to the EMSU. So let me restate.

MR. MOANDER: I want to make sure that the impacts from injection and production of the EMSU is included in that, because that's OCD's case.

MR. RUBIN: Yes. So, Mr. Moander, you're asking us to fix what we needed to fix anyway.

Okay. So, Mr. Chair and Members of the Commission, let me restate what should be the proper

scope of this hearing as an amended Paragraph 2 to the July order.

As said herein, the parties shall submit all evidence, testimony and legal argument on whether the granting of the applications by Goodnight would, 1, impair correlative rights or cause waste in the EMSU, pursuant to Section 70-2-11; or 2, result in the disposition of produced water violation of the Federal Safe Drinking Water Act, or otherwise fail to protect public health, the environment and fresh water resources, pursuant to Section 70-2-12.B(15); and whether the granting of the applications by Empire would prevent the impairment of correlative rights or waste in the EMSU, pursuant to Section 70-2-11; or 2, prevent the disposition of produced water in violation of the Federal Safe Drinking Water Act, or contrary to public health, the environment and fresh water resources, pursuant to Section 70-2-12.B(15).

With that, before I put this motion -- see if I have a motion, is that consistent with what we've just discussed?

MR. RANKIN: I believe so, Mr. Rubin. I believe so. Again, I would like to just -- I would like to see the order, but I believe that's the case.

CHAIR ROZATOS: I'm going to step in here just one second. I say we take a 15-minute break, we write something up, the motion, so everybody can see it, it's not just verbal. Then you all can confer on that. I think that would be the best.

And I think it may ease a little bit of the tension in the room right at the moment. So why don't we take about -- actually, we're going to do a half-hour break. Let's reconvene at 10:30, and we'll have something written up for you all, and then we can all discuss. Thank you.

(Recess held from 9:57 to 10:30 a.m.)

CHAIR ROZATOS: So we took a 30-minute break. I believe the order was submitted to everybody and you've had a few minutes to review it. I'll turn it over back to Mr. Rubin and the conversation can continue.

MR. RUBIN: Thank you, folks. I do see that there is one typo. There should be a number 1 in the fourth line from the bottom before the word "prevents," to be consistent with the 1 and 2 tracking in the first part of Paragraph 2.

So with that, I'd like to hear from the parties if I got this right. Let's start with Mr. Rankin.

MR. RANKIN: Yes, I think starting at the beginning here, I think the way that it's been drafted, "At said hearing, the parties shall submit all evidence, testimony and legal argument on whether the granting of the applications of Goodnight would, Number 1, impair correlative rights or cause waste in the EMSU pursuant to Section 70-2-11," encapsulates our understanding.

So any evidence on communication or impairment or waste potentially outside of the EMSU, I think my understanding is cannot be used to demonstrate waste, impairment outside of the EMSU. Okay? Number 1.

Number 2, "or result in the disposition of produced water in violation of the Federal Safe Drinking Water Act, or otherwise fail to protect public health, the environment and freshwater resources pursuant to 70-2-12.B(15)," that also reflects our understanding of the Commission's ultimate authority and jurisdiction to always address the Safe Drinking Water Act under its jurisdiction and primacy, as well as these other requirements under the Oil and Gas Act.

The next section here, and whether the granting of the applications by Empire would, with

the modification, include Number 1, "prevent the impairment of correlative rights or waste in the EMSU pursuant to the Oil and Gas Act," again, that's our understanding because it's limited to the EMSU. Okay?

Now, the other part, the last part here, "or prevent disposition of produced water," to the end, I don't believe that's in Empire's applications. And I was just in the middle of pulling them up because I don't believe they're seeking that relief or made those allegations. I believe that, and Mr. Moander can correct me if I'm wrong, but I believe that the Division's concerns about potential impairment of Safe Drinking Water, I think also applies to Empire as well as it does to us.

But I'd like to -- I'd defer to Mr. Moander. I'm in the middle of pulling up their applications, but I don't believe that they're alleging that in their applications.

MR. RUBIN: Okay. Mr. Moander, what are your thoughts on that point?

MR. MOANDER: So I've taken a look at this, and I appreciate the effort. I recognize that you were trying to get this taken care of quickly.

I can say that yeah, Paragraph 2 and --

I guess it would be the second Paragraph 2, that does not appear in the application.

MR. RANKIN: Okay.

MR. MOANDER: I'm not seeing that in the Goodnight applications either, just the drinking water reference at all. So that's contained within the orders that Goodnight relied upon. So I feel like that's not necessarily an accurate presentation, because we don't have evidence or that wasn't pled.

But I think ultimately the intention, I'm assuming here, on behalf of the OCC is to outline what basically the claims are, obligations are of the party, whatever the claims of each respective party. So those could potentially stand alone in here.

So I've had a little reservation on the second paragraph, too, because that wasn't pled or part of that record. But that would be my only gripe at this point, Mr. Rubin.

MR. RUBIN: So what I'm hearing from both of you, that taking out the second, after Number 2 at the end there, would be to your satisfaction, both of you?

MR. RANKIN: Yes. My proposal would be to delete, and I'm happy to put it on the screen, but yeah, delete the second Number 2 in reference to

Empire's applications. Because yeah, they do not allege -- they alleged solely that they should be revoked -- revocation will prevent the waste of recoverable hydrocarbons and will protect correlative rights.

There's no allegations that there's any impact to the Safe Drinking Water Act.

MR. RUBIN: Okay. I'm certainly glad we visited the order of July 2nd regardless, because this is not what that said, clearly. And there are avenues for appeal if we did not fix this.

So, okay, I think I have some consensus there. Before I get to the Pilot and Rice, Empire?

MS. SHAHEEN: Thank you, Mr. Rubin, Commissioners. I'm still wrapping my head around the implications of removing Number 2 from the scope of our applications to revoke. I think that the issue is pertinent and that if there is disposition of water that is contrary to the Safe Drinking Water Act, that our applications to revoke should be granted. So I hesitate to suggest that that issue does not pertain to our applications to revoke.

Regardless of whether it's pled or not, I think, under the obligations that are imposed on the Commission to protect drinking water, that that

issue would go to whether our applications to revoke should be granted.

MR. RUBIN: Fair enough. Okay. Then I'm trying to get a consent order here, if I can. But I tend to agree with Ms. Shaheen.

MR. RANKIN: Yeah, I just want to raise the point that I don't know how they're going to get a CO2 recovery project if there's communication with underground sources of drinking water.

You know, they're going to have the same problem. Okay? They want to inject under a UIC program into the San Andres for EOR recovery, and they're at the same time saying that there's communication with a protectable aquifer. It makes no sense.

So I think they do need to understand, and maybe they need to take the time to understand what the implications are. But it's not in their application. And the Division, as I understand, has the same concerns about what Empire is doing in the same formations as what Goodnight is doing.

MR. RUBIN: It seems to me, without getting into the substance, that if Empire's applications are to revoke, they should encompass the same issues, the ones being sought by Midnight. It seems as a logical

conclusion that they should mirror each other.

If Goodnight and Empire, one seeking to revoke, the other one seeking approval of the same thing, and we are doing this -- I included this mostly in deference to OCD. This was an 11th hour issue. And we do want to make sure that if the Commission rules on that basis, that a District Court can't say, "Hey, that was outside the scope of what the parties were preparing."

So I'm inclined to leave it in, but I'll ask again, will I get consent, or do I need to just do the motion without consent?

MR. RANKIN: I don't know. I don't know that I can agree --

MR. RUBIN: Okay.

MR. RANKIN: -- because it's not in their applications. So, I mean, I think it's covered in the order, in the scope of the hearing, because that's something that's required to be shown by our applications. But I don't know that I can agree that it should come in as proposed because it's not part of Empire's applications.

MR. RUBIN: Okay. Fair enough. Appreciate all your cooperation and courtesy on this.

We'll hear from Mr. Beck and Mr. Suazo.

MR. BECK: Rice and Permian are aligned with the OCD and Goodnight.

MR. RUBIN: Okay. And by OCD -- Mr. Moander, I take it that you agree with Mr. Rankin that that should not be included at the end?

MR. MOANDER: Well, the issue is, is that a revocation is distinct from granting an application, and that the Safe Drinking Water Act, that's part and parcel of the granting of the permit.

That being said, the more we discuss this, which of course is always dangerous with a roomful of lawyers, is that what we're looking for in this case, spreads across all the operators, almost regardless of what's going on.

We need to determine what is actually happening vis-a-vis the San Andres and the EMSU and the Capitan Reef.

I think that perhaps what needs to happen is splitting off that second Number 2 into an independent angle on the scope, where the OCD is looking to protect or evaluate the protection of safe drinking water and underground sources of drinking water, something like that. Because Empire's application is for revocation.

Now, they could demonstrate a violation

of the Safe Drinking Water Act. That's perfectly within their purview. But I'm not seeing where that is inherently necessary to the revocation. You see what I'm saying, Mr. Rubin?

MR. RUBIN: Yes. You'd like this to read where that Paragraph 2, with respect to both the Goodnight and Empire application, be separate?

MR. MOANDER: Yes. I think that should resolve it. And I'm happy to have that sort of appended to OCD and what they -- basically, OCD needs to investigate and then potentially enforce the Safe Drinking Water Act in a form like that.

MR. RUBIN: Ms. Shaheen.

MS. SHAHEEN: Thank you, Mr. Rubin, Commissioners.

I think that Empire is in agreement with Mr. Moander's proposal.

MR. RUBIN: Good. Okay. That wasn't too hard.

Mr. Suazo, I don't believe we've heard from you.

MR. SUAZO: Yeah, thank you, Mr. Rubin.

I've reviewed. I haven't had the chance to confer with my client on whether or not specifically including the Safe Drinking Water Act in

the context of the order covering the proceeding gives them any concerns. So I would like to take the time to do that. I think for purposes of today in terms of the witnesses that we have in front of us, that it is fine to proceed.

But, you know, without giving my client the chance to really review and assess how this change might impact Pilot's interests, I'm inclined not to take a position on the order as proposed.

MR. RUBIN: Then let me do this. Let me suggest that we continue with the hearing. I think we have an agreement, close to the agreement, in principle. I will rework this and e-mail it to the parties over the break. And then we will revisit this to make sure -- because I want you all to have something in writing before you say yay or nay; that's fair, certainly.

And in the meantime, may I suggest we then continue with -- we do have one other matter this morning to take up, and then we would continue with this witness.

Yes, Mr. Chair.

CHAIR ROZATOS: Mr. Rankin, I apologize. I just wanted to see and hear from you. We heard from Empire that the modification that the OCD suggested

is something that Empire could potentially work with. I don't think we circled back to you.

If the modification that the OCD suggested to this motion, was something viable to Goodnight, obviously, I'm sure you need a second to think about it, but I just wanted to make sure that we caught your thoughts about that modifications.

MR. RANKIN: Yeah, I mean, maybe -- I'm sorry to belabor it, and I don't mean to. I wonder if it may be helpful -- well, my impression, my understanding is that as part of Goodnight's requirement to make a showing under itself, an application, the way that the proposed order is drafted is correct. Because we both have to show that it won't impair correlative rights or cause waste, and that it's protective of safe drinking water or drinking water supplies.

So I do think the way it's drafted is probably incorrect, but I guess I'll wait to see how it looks based on Mr. Rubin's proposed modifications. So without belaboring that point, I guess I'll just wait and see what it looks like, and then we can confer after we see the language.

CHAIR ROZATOS: Okay. But you don't have massive objections right at this point?

MR. RANKIN: No, I don't. I think we all agree that that assessment needs to be part of this scope of the hearing, and the question is just how it's properly portrayed under the order.

CHAIR ROZATOS: Okay. I was just making sure that we didn't have any massive objections on that aspect.

Then I think we should proceed as you stated, Mr. Rubin, and then we go further.

MR. RUBIN: Thank you. So I will look to your e-mails over the lunch break, and I will have a new version to you then.

In the meantime, Mr. Harwood, as I think we stated, he had to step out probably till the lunch hour. He had to attend to another matter in district court. So I will hopefully run this as the well-oiled machine, no pun intended, that he has been doing.

So with that, the next order of business is there was a motion filed by Empire to quash the subpoena that we issued by request of Goodnight for the CEO of Rice. I don't want to advise the Commission on this until there's been an opportunity for some to be heard on it.

It's your motion, I believe, Ms. Hardy.

MS. HARDY: Yes. Thank you, Mr. Rubin and Commissioners.

We did file a motion to quash Goodnight's subpoena to the CEO of Rice. It was issued late last week, after all of the deadlines passed for disclosure of witnesses and testimony.

The rule on pre-hearing statements, which I've cited in the adjudication provision, expressly requires a party to provide, and this is a quote, "the names of witnesses the party will call to testify at the hearing, and in the case of expert witnesses, their fields of expertise."

Goodnight never identified any witness from Rice as a potential witness in this hearing, and so it's late. The request was also submitted to the Commission ex parte without notice to the parties. We weren't aware of the subpoena request until the subpoena was issued.

And finally, the testimony of a Rice representative is not relevant to the issues here as we've just discussed the scope. Rice operates wells that are not the subject of this hearing, and those are not at issue. Rice also is a party in this case and has not identified any of their own experts or witnesses to testify.

So it's an improper subpoena request. It violates the scheduling order. It violates the adjudication rule. It's untimely. And Empire would be prejudiced, because at this point, we have no idea what this witness proposes to say or what testimony Goodnight seeks to elicit. So we would ask that the subpoena be quashed.

MR. RUBIN: Thank you, Ms. Hardy.

Mr. Rankin.

MR. RANKIN: I haven't had a chance to even read their motion. So I haven't even had a chance to read it, but I can respond to what she's saying.

The adjudication rule that we're operating under here says, quote, "The director or the director's authorized representative shall, upon a party's request, issue a subpoena for production of books" -- I'm sorry, I'm reading the wrong portion of that provision. Here we are.

"The director or the director's authorized representative shall issue a subpoena for attendance at a hearing upon a party's request." "Shall."

We provided a notice to all parties in our prehearing statement that we intended to seek and issue a subpoena for the appearance of witnesses at

this hearing. We included Rice, Pilot, Empire. There were four potential parties that we identified that we would likely seek subpoena for appearance of at this hearing.

So we gave them notice that we were likely to do so. That came about -- it became apparent that we wanted -- it was important to do so based on Mr. Beck's opening statement and the documents that he provided as part of his prehearing statement.

The evidence that we intend to elicit from Mr. Curtis is highly relevant to the issues in this case. They've been operating in this unit for 60 years. And he has some documents that reflect what the early pressures are for the unit, which are important, I think, for the Commission to hear and see.

So while their wells are not directly implicated by Empire's efforts to revoke, the evidence and testimony that he would provide are highly relevant. And so we think it's absolutely important. And it's the obligation of the Commission in its quest to determine whether there's impairment of correlative rights, or waste, to hear that evidence and to see it.

MR. RUBIN: A question for you. You said that you did provide notice to the other parties of your intent to subpoena witnesses, including -- did you specify Mr. Curtis?

MR. RANKIN: I didn't know who it would be, but I found out from their prehearing statement that it would be Mr. Curtis, based on their documents. So I didn't know who the witness would be.

MR. RUBIN: And was that notice to the parties provided before or after the deadlines in the scheduling order?

MR. RANKIN: Well, it was provided with the prehearing statement, when we filed that, because -- so we did not include him as a potential witness in our initial witness disclosures or rebuttal witness disclosures, no.

MR. RUBIN: Okay. Which came afterwards?

MR. RANKIN: I'm sorry, what was the question?

MR. RUBIN: The disclosures pursuant to the scheduling order of your witnesses and rebuttal witnesses came after.

MR. RANKIN: After what?

MR. RUBIN: You claimed after -- you state that you did provide some notice that you were

intending to call a witness.

MR. RANKIN: I'll just be real clear. So the initial witness disclosures were -- what were they, in August?

MR. RUBIN: Okay. That's what I thought. Yeah.

MR. RANKIN: And then the rebuttal witness disclosures were in January. The prehearing statement was in February.

As the case has evolved, you know, I couldn't, you know, force Mr. Curtis to come except by a subpoena. So I determined that it was necessary to do so based on my understanding of the evidence.

Now, the rule provides that the Commission shall issue a subpoena for attendance at a hearing upon a party's request. And that's what I believe should be done.

MR. RUBIN: Mr. Chair, Members of the Commission, before I offer any advice, should you want it on this, you do have the obligation, of course, to go into closed session to debate the merits of this motion. I don't know if that is the sense that the parties are -- and I've noticed this Commission tends to not go into closed session unless it has to. So what are your thoughts?

We'll start with the Chair. Do you wish to go into closed session? Do you want my advice on the motion? Have you heard enough?

MR. RANKIN: May I also just make a point? I mean, I have not had a chance to review Ms. Hardy's motion. I've been preparing for this hearing day to day. If there's any indication that you're likely to grant the motion, I would ask for an opportunity to respond.

It's not imminent that this witness is going to appear. We've requested for him to appear only at the end of Goodnight's case in chief.

So if the Commission is interested in hearing or would prefer a full argument on the issue, I'm happy to oblige and provide a full response so that we can properly respond to it. I haven't even had a chance to review it or read what her arguments are.

MR. RUBIN: Mr. Rankin, what would it take for you to offer a response?

MR. RANKIN: I may look to my colleague on my right here to help me put it together, because day to day, I'm working on cross and our case. So yeah, I mean, next week would work. We can do it sometime by next week, middle of next week.

MR. RUBIN: Okay. And it sounds like we're not going to get to your witnesses before then anyway.

MR. RANKIN: Right.

MR. RUBIN: Okay. Fair enough.

CHAIR ROZATOS: I think that's the best.

So, Mr. Rankin, go ahead, write your response. And then we, as a Commission, will consider it at such time, in addition to -- we'll have both so we can make our decision with full information. So if you wouldn't mind doing that.

MR. RUBIN: All right. I see that Mr. Harwood is back as our hearing officer. Mr. Harwood, are you ready to reassume the reins?

HEARING OFFICER HARWOOD: Yes. I'm not sure where we are.

CHAIR ROZATOS: I will fill you in. We didn't get very far, Mr. Harwood. We got a lot done, but not exactly on the case. And poor Mr. Birkhead has been sitting on this witness stand waiting for all of us to deliberate.

The only thing that I did want to mention to you, Mr. Harwood, I did mention it to you earlier, but everybody, I do have a hard stop at around 4:00, the latest, 4:15 today. So keep that in

the back of your minds with the questions and stuff.

So, Mr. Harwood, now we turn it over to you, and we're basically just picking up where we left off yesterday before we went to closed hearing.

HEARING OFFICER HARWOOD: All right. I just remind the witness you're under oath, as you were yesterday, Mr. Birkhead. I'm not sure who was questioning the witness when we broke yesterday.

I guess I should have guessed it was you, Mr. Rankin. So go ahead and pick up where you left off.

MR. RANKIN: That's a good question. Where did I leave off?

STANLEY SCOTT BIRKHEAD,

having first been previously duly sworn,

testified as follows:

CROSS-EXAMINATION (Cont'd)

BY MR. RANKIN:

Q. Okay. Good morning, Mr. Birkhead. It's been quite a morning.

A. Is it still morning?

Q. It's been quite a morning. My head's still spinning.

So I think we had left off, you know, back and forth discussing some different aspects of

your opinion and underlying issues relating to your opinion in petrophysics, in general, and Mother Nature's Waterflood and so forth. So I'm going to do my best, I think, to pick up -- I think what I'm going to do is just kind of pick up where we had discussed or touched on some issues or questions.

And I, in the intervening time, have wanted to just follow up with you on a couple questions, mostly related to the inputs and assumptions that went into some of your petrophysics work. And then we'll go back into your testimony.

I asked you yesterday about whether or not you had prepared any permeability curves as part of your analysis. And you told me that you did, that you used standardized curves that are in the literature. And I don't even recall the author who had developed them, but there were three, I believe three different permeability curves that you had used in your analysis, that you didn't generate them yourself. Right?

A. So the perm curves that I created were based upon Dr. Jerry Lucia's model, who Dr. Davidson references a lot within his testimony. And yes, I did generate the curves using my interpretation, but they were standardized curves that Jerry Lucia created

based on separate rock types within carbonates.

Q. Now, I'm asking about this because I don't know that the output of the application of those curves was provided to us as part of the materials provided to Goodnight.

Is that something that you would be able to export and provide to us?

A. Easily. If it wasn't exported, it was just an oversight. I would provide that.

Q. Then I would ask that Empire counsel coordinate with you to ensure that we have those curves and the outputs so we can review them. Because we haven't been able to do that to date.

A. Okay.

Q. We talked yesterday about the oil formation, volume factor, of B sub o. I probably got that butchered. B sub o, now, we talked around that a little bit, that it was provided to you by Empire.

If you already know, off the top of your head, do you know what the value was that you used.

A. As I said yesterday, 1.3.

Q. A 1.3?

A. Yes.

Q. Okay. And that was the same B sub o factor that you used throughout your interpretations,

throughout all depths, correct?

A. The B sub o is only used within the roll-up of the oil-in-place calculation?

Q. Right. Okay. We talked yesterday about how you were calculating the baffles, right, in your petrophysics?

A. Mm-hmm.

Q. I wrote this down, but I wanted to make sure I understood it. It was a summation of the horizontal porosity, is what allowed you to calculate the vertical perm; is that right? Close or not? Not even?

A. Not even.

Q. Okay. Give me another shot, and tell me how the porosity is used to calculate your vertical perm and your baffles.

A. So I did not calculate the vertical perm from this. So what I did was, using the Lucia model, I calculated three different permeabilities based upon the porosity.

The baffle was created using a simple cutoff of 1.5 effective porosity, and that was to be as generous as possible, because we do see continuous porosity across the majority of the section.

Q. And is that applied within a certain range

of depth? In other words, is that an average effective porosity over a certain range of depth? How are you --

A. It's a flag.

Q. Yeah.

A. It's a flag that's shown wherever it is below 1.5 percent, 1.5 or below.

Q. At any, like, half-foot increments, or how --

A. It's at the step of the well data, which is generally a half foot.

Q. Half foot. Okay. So whenever a half-foot interval meets your effective porosity cutoff, then you'd get a baffle flag?

A. Yes.

Q. Okay. On the matrix, you assigned a 2.9 matrix value, is that right, in your --

A. That's incorrect. So Mr. Bailey was partially correct when he said that. I used a variable grain density in order to account for the addition of anhydrite cements.

For the dolomite portion of the ternary diagram we used to calculate the mineralogy, I used a 2.9 grain density there to account for up to 20 percent anhydrite cement as, again, being generous.

And the rest of it was -- I believe the limestone was left at 2.71 and sandstone at 2.65.

So the way it was a variable grain density, and what you'll note is -- or what you can note looking at my curves versus Dr. Davidson's, is that the fit is very good.

Q. Okay. So it wasn't a uniform 2.9. It was 2.9 and then 2.7 for the --

A. It's a variable grain density. It's using the neutron density and PE curves to calculate a variable mineralogy. And then also a variable grain density for the porosity.

Q. Before I get back into your testimony, I wanted to kind of cover something else as well, sort of as a preliminary matter. And this kind of relates to some of what Mr. Bailey was testifying about yesterday.

Because I heard him say several times that the base case, your base case, your low case is your petrophysical model tied to the core, right?

A. Yes. The core data is a cloud, so it is the best tie to the most reflective core data.

Q. Explain to me what you mean by "the core data is a cloud."

A. There is a distribution of core saturations

as you go vertically from depth to depth that does not match the log data.

So because we know that oil and water are both flushed out of the system and that the water is replaced into the core and then flushed again, in some cases, when it gets to the surface, we get a large variability, especially when we have residual oil or residual water in the measured oil saturations, measured water saturations, which I think everyone will -- I imagine, rhetorically, everyone would agree we're seeing a large variation.

So what you look at is the -- because we -- as Mr. Bailey stated yesterday, and I think Dr. Lindsay said it as well, the measured oil saturation in the core is the lowest possible oil saturation in the reservoir. It's probably going to be something higher than that.

So what I did was I used the outer limit of the measured core oil saturations to tie the data to. It doesn't always fit, but that's your petrophysics. You fit it the best you can to the maximum of the minimum data for the low case.

Q. Now, my question then is, because you only have limited core data into the San Andres, upper part of what Empire identifies as the San Andres, how do

you then correlate your logs to other deeper intervals where you don't have core?

A. What do you mean?

Q. How are you calibrating? How are you interpreting your logs when you don't have that core in corresponding depths?

A. The information -- the typical petrophysical method in looking at this data is to use the calibration data you have and the mud log data and all the data I showed during my rebuttal. It helps to inform your decision.

So in the wells that I showed, they have oil saturations and trace oil streaming cuts, oil on the pits. There's recognition of oil below the Lovington Sand, which is generally where the core was taken, was Lovington Sand and above.

So beyond that, what petrophysicists do, is they don't make big assumptions on changing the model if they don't know that it changes. So where we have core, we match the model. Where we don't have core, we use the same model unless we learn something different.

Q. So in addition to mud logs, you would also look at well tests, production tests, other empirical data that would help inform your analysis, correct?

A. I think I looked at one production bit of information. Because we're talking about residual oil, right? The definition of residual oil is it doesn't move.

Q. Well, yesterday we talked about the definition of residual oil being within a range of 20 percent to 40 percent oil saturation.

A. No, no, we didn't. We talked about it being between 20 -- somewhere below 20, we don't know what that value is exactly, and around 50 percent as a gauge, as a guide. We don't know exactly what it is until we know what the fluid is and the pore types and the wettability.

Q. But we understood that the wettability was mixed wet to oil wet?

A. Yes, correct.

Q. Okay. Moving back to you Exhibit L, I'm looking down Page 3 in Paragraph 10. And I've highlighted a passage here or a sentence that I want to just discuss with you.

A. I'm sorry, could you share your screen?

Q. Yes. Thank you. I was having some problems with my Adobe again so I had to reopen my -- okay. Here we go. Can you see it on your screen now?

A. I can.

Q. So in Paragraph 10, I've highlighted a sentence here that I wanted to just discuss with you that relates to what we were just discussing.

You state here that, "Core residual oil saturations are lower than the in situ value due to degassing and flushing by water-based mud," and then you have citations.

And I think I just want to clarify a couple things. Number one, when you talk to in situ value, you mean whatever the actual value is in the reservoir prior to extraction, right?

A. That is the in-place reservoir volume. Yes.

Q. Yeah. And my question then is, if you -- as I understood you just to say that residual oil by definition is immobile, how much do core saturations actually need to be adjusted for an ROZ where residual oil is by definition immobile?

A. It's immobile in its current state. When it changes its state, then all bets are off as to what mobility -- how the mobility will change. There is a small amount of gas associated with the fluid. As you're moving it up, it would start to degas. And as Dr. Davidson put it, it will help to eject the water and it will help to eject some of the oil, too.

Q. Have you undertaken a study to evaluate how

much conventional core needs to be corrected in a ROZ?

A. I have not, nor has Dr. Davidson. He just used a rule of thumb from ARCO.

Q. Have you reviewed Mr. Davidson's rebuttal testimony?

A. Yes, I have.

Q. And did he use a rule of thumb in his rebuttal testimony?

A. He did.

Q. Did he verify his rule of thumb in his rebuttal testimony?

A. He stated he used some data from another field in a different well, a cored well, to try and justify his correction.

Q. And did that correction fall within the rule of thumb that he applied?

A. I did not look into that correction that deeply.

Q. Okay.

A. It was a very long document that I got two days ago.

Q. Oh, just two days ago?

A. Yes.

Q. Okay. So you have no opinion on Mr. Davidson's --

A. I know he used data, like I did. He used a rule of thumb, as I did, for an area -- the paper that I referenced talks about residual oil matching. His talks about residual oil matching. And I don't see much of a difference.

Q. Do you have an opinion how much conventional core needs to be corrected in the EMSU here?

A. I believe it was probably around -- this is, by the seat of my pants, a guess at what my normal correction was. But it was probably around 10 saturation units.

Q. What do you mean by -- can you put that in a different context?

A. If we talk in percent, it's going to get really confusing, because we talk about saturation as a percentage anyway. So a saturation unit is 1 Sw percent. So, for example, it would be an increase from 20 percent SO to 30 percent SO.

Q. That would be a 10 saturation unit?

A. Yes.

Q. Okay.

A. Yeah, as I showed in my testimony with the diagram from Core Lab from 1973 in the depleted oil reservoir, the corrections can be quite a bit higher than that. So up to 18 to 20 percent -- 18 to 20

saturation units.

Q. Remind me what you were referring to there. In what instances would it be that great?

A. That was when the in situ core saturation, according to the diagram from 1973 -- so I'm taking into account -- this is not the area that we're talking about. The saturations of the depleted oil were 30 percent, and when it was brought to the surface, the saturations were 12 percent.

Q. And in that context, was in addressing a residual oil zone?

A. Depleted oil would be the closest thing you could get to a depleted -- to an ROZ.

Q. Depleted oil from a waterflood or from primary production?

A. That'd be probably from primary production.

Q. Okay. And that's actually very different than a waterflooded field, correct?

A. If it's residual oil, it's residual oil.

Q. I thought that the whole concept about Mother Nature's Waterflood, that it was analogous to a post-secondary waterflood reservoir not at the end of primary production.

A. It is the residual oil that is left in the pores. So what I'm saying is that the diagram from

1973 showing the correction is a possible correction that was shown by them. That's what happens when you bring it up to surface.

But the correction I used was based on residual oil from that paper, which was less the correction than what they showed.

Q. But just to be clear, the correction from that paper was at the end of primary production?

A. I will have to go back and look at that. They just corrected it as residual.

Q. Okay. But I thought you were telling me it was at the end of primary production at --

A. No. The paper from 1973.

Q. Yeah.

A. I'm assuming it was possibly from primary production. The one from this one mentioned -- I do not know if it mentioned primary production or waterflood. I would have to go back and look.

Q. I'm sorry. I'm just getting confused by what papers were referenced.

So it sounds like there were two papers, and one was from 1973 that addressed a conventional core correction that, in that case, it was at the end of -- it was in a depleted field, correct?

A. So that said depleted, yes. That was the

information that was given.

Q. But it's not clear, as you see here today, that it was in a field that had been subjected to any period of time of waterflood secondary recovery?

A. That information was not available, or I don't recall it.

Q. Okay.

A. I will go to Seminole Field and all those studies with sponge core, pressure core and just the conventional core and show that those corrections are well within -- sorry, speed. Those corrections are well within line of the kind of corrections I'm doing. And mine are probably slightly conservative to what they're showing in the Seminole papers.

Q. On that, what's the range of your corrections for your high case, if you can give them to me? What is your correction that you're applying?

A. So the high case is based upon the corrections.

Q. I understand that, and so my --

A. So as I mentioned, to throw a number out there, because it is going to vary, it's going to be about probably 10 saturation units.

Q. So the correction that your model applies on the high case, it varies, but it's in the range of 10

saturation units; is that correct?

A. Yes.

Q. How much higher than 10 saturation units do your corrections go on your high case model?

A. I would have to look at statistics for that.

Q. But that would be in the information that was provided to Goodnight to evaluate, correct?

A. Yeah. You have my high case and my low case water saturation. That would be what you would refer to.

Q. Okay.

A. As well as -- I'm not sure if I included the core data or not, but the equation is definitely available for use, along with using a B sub o of 1.3.

Q. Yeah. Forgive me, I don't mean to retread, and it's probably because you were talking fast and probably because I'm a layperson and not a petrophysicist. But I know I did ask this question, but I want to make sure that I understand it.

And the question is, because you don't have core down to the base of your logs, right, how are you varying m and n where you don't have the core?

And I know I asked that question already, but I want to make sure I understand, because I don't actually recall what your answer was on that.

I want to make sure I understand it.

A. You didn't ask about m and n.

Q. Okay. Okay.

A. I'm happy to -- happy to talk about it.

Q. Very good. So as to m and n specifically, how are you varying m and n in the deeper intervals where you do not have the core?

A. So the Focke and Munn equation, I can present the equation for it. They're based on three different rock types based upon permeability ranges. So I gave a fairly conservative permeability range. I applied a 2.3 minimum m based upon data that has already been collected or used by other entities to do petrophysics in the San Andres. Then it varied upwards from there, which is typically based upon porosity.

Q. How about the n value?

A. The n is a little bit more complicated because that is entirely based upon wettability, saturations, saturation history, things like that.

The way that I varied it was by finding a good match, starting off with a baseline. The variation can go from about 3 to upwards of 9. In reality, the saturation exponent can go up to about 21 in some carbonates. So this is a somewhat

conservative value as well.

Then I applied to -- made a porosity algorithm to matched it to -- that matched with the core data. And then I adjusted that algorithm to a nonlinear function to match to the corrected core data. So the range is still the same regardless.

Q. And now, you did have the NuTech data analysis in front of you, and you understand -- you did have the NuTech analysis, right?

A. I did have it. It wasn't -- yes.

Q. Okay. Do you understand that they varied their m and n with depth based on a Department of Energy study that identified the ranges of m and n values in four counties in Texas?

A. I believe so, yes. I seem to recall that.

Q. Okay. And you agree with me that your approach here is different than what NuTech did?

A. Different, yes.

Q. And that results in different oil saturations with depth in your analysis compared to NuTech's analysis?

A. It would.

Q. And next page here, I think in this paragraph, Paragraph 12, you're talking about evaluating and assessing Dr. Davidson's approach. And

in general, you're criticizing Dr. Davidson for his interpretations with depth.

And here I'm going to just -- I'll read into the record the cite and the portion that I'm highlighting here. "In other wells, we continue to see a suspicious interpretation change happen just above Goodnight's top of San Andres. Interpretation of the ROZ as shown by Dr. Davidson shows a change in interpretation methods driven by their deeper pick of the Grayburg base and a presumption of much poorer reservoir quality (rock types) over most of the San Andres." And then you cite to your exhibits, L-5 through L-8. Did I read that right?

A. Yes.

Q. Okay. When you say "suspicious," what do you mean by suspicious?

A. You usually don't see blocky shifts and saturation changes through reservoirs when you have continuous porosity and resistivity, especially not from ROZ-level saturations to non-ROZ-level saturations within just a few feet.

Q. Okay. What is your understanding of the basis for Dr. Davidson's shift in his petrophysical analysis where you see that change?

A. Although he was somewhat vague within his

description of what he did, but from what I understand, he described a facie type based upon a slight shift, a very slight shift in gamma ray. And that slight shift in gamma ray showed that it tried -- choose a stock value of what the resistivity index should be for that rock and placed it in the wackestone range, wackestone/packstone range, or at least the non-ROZ range of saturations.

From that point on, the resistivity -- from that point on, the resistivity doesn't matter. It will just calculate a very high water saturation regardless.

Q. What do you understand the basis for the shift in gamma ray to be, or the change in gamma ray to be?

A. From speaking to Bob Lindsay and from his experience in the field, I understand it to be arkosic sands.

Q. Do you have an understanding what would change in the sands throughout those depth intervals?

A. There's generally potassium that would occur with some of the feldspars that are within the rock. Gamma rays also seem to vary for multiple different reasons. It is unfortunate we didn't have a spectral gamma ray in the field.

Q. But that's your understanding of Dr. Davidson's model. Do you have any understanding for what would influence the gamma ray with depth, other than arkosic sands?

A. You have three options. You have uranium, thorium or potassium, so any combination of those can adjust it. All those sources can come from many different things.

Q. I kind of want to just touch on this table, but I think you did address this to some extent in your summary. I think I took me a little bit, but I think I understand what you're doing here. If you wouldn't mind, just take a quick moment to explain again what this table is showing.

A. I'll definitely give it a shot. So I believe that what I did was I took my low case numbers and calculated an original oil in place and MMBO, millions of barrels per section, and that's what's shown on the left-most numeric column.

To the right is the high case for that, meaning that the answer is most likely somewhere between the low and the high case.

To the right of that, I have the Goodnight numbers that were given within Dr. Davidson's testimony. Within that testimony, he

gave the -- which I presume is based upon his curves, were 6.9, 13.3, so on and so forth. These were based upon the tops that Goodnight provided us for their top of San Andres.

When looking from a perspective that their top of San Andres is incorrect, we see that the oil in place for even Goodnight's interpretation increases significantly.

Q. And that's in this column here, right?

A. That is in that column there.

Q. And the difference for that increase is simply because you're moving the top up to Ops's top, right?

A. Yes.

Q. Okay. And because you didn't apply -- you break up Goodnight's -- this interpretation. You just put it all in San Andres because -- I'm butchering that question, so I'm not going to pursue it.

But I think I understand what you did. Because Goodnight did not follow Ops's topics, you couldn't partition Upper and Lower San Andres as you did?

A. I did want to presume that.

Q. Okay. But your understanding is that Goodnight is not injecting into -- well, you didn't

address that, so I won't bother asking that question.

In this next section here, Paragraph 15, I think you start getting in to your analysis here. You state that, "We see in the interpretation of the wireline, as well as shows in mudlogs and core with available wells that the ROZ zone consistently appears in the same intervals with oil saturations greater than 20 percent. This suggests large amounts of continuity across the interval."

Did I say that right?

A. Yes.

Q. Okay. I guess my question to you is, I don't see -- I'm talking about your exhibits here. I don't see where in your exhibits you've demonstrated that the oil accumulations that you've identified are correlated across the interval.

A. I was asked to read about Dr. Davidson's testimony. I was not asked to present evidence for that.

Q. Okay.

A. So what I can say, is that when you migrate oil into a system, that's a great sign of continuity. Having water everywhere is just status quo. When you have oil in several wells across a large area, you can assume that there is some level of continuity across

the migration pathway.

Q. Are you saying that you're finding oil saturations -- that those oil accumulations are mappable across those intervals within the San Andres?

A. I have not gone through that step that we can say that we see -- we commonly see within the San Andres oil saturations.

Q. Okay. Then I guess I misunderstood what you're saying here. Because I thought I understood you to say that you're finding consistent oil accumulations across -- I guess when you say "across the interval," you're talking about the entire San Andres?

A. Yes.

Q. How many feet thick is the San Andres?

A. It can vary, but up to 1500 feet in some places. Where we have core, it's the Upper San Andres, which is, of course, not as thick as that.

Q. So you're saying that you haven't yourself then gone in to identify whether the discrete oil accumulations that you identify that exceed 20 percent are actually across the same correlatable intervals within the San Andres?

A. Yes, I have not gone through and done that. What you can see, though, is just above the Lovington

sand, you commonly see the same expression of an ROZ.

Q. Okay. And now you're talking about above the Lovington Sand?

A. Above the Lovington Sand?

Q. Yes.

A. I can't speak to the large amount of ROZ I found below as to how that correlates across the field.

Q. Okay. So here in Paragraph 19, you state that, "There are several pieces of evidence pointing towards the existence of multiple continuous ROZs in the Upper and Lower San Andres as discussed in this document."

Of course, you're referring to your statement, right?

A. Yes. And the context of that is in a vertical sense.

Q. Understood. Now, on that point, are you -- I believe you heard -- you were here for Dr. Lindsay's testimony?

A. Yes, all of it.

Q. All of it. Did you hear Dr. Lindsay testify that it would be unique to have a situation where we have more than one ROZ or a single ROZ extending across composite boundary intervals?

A. I remember there being a long discussion where that was, I believe, discussed that there could be, towards the end. The discussion changed where he agreed that there could be.

Q. Are you aware of any ROZs anywhere in the Permian Basin or elsewhere where there's multiple ROZs across different formations?

A. I have not looked at the data with that in mind.

Q. So as you sit here, you're not aware of any that you can point to?

A. No, because I haven't looked at those wells.

Q. I'm just going to share with you what Empire's marked as Exhibit C-1. This is from Mr. Melzer's testimony. And it's what I think -- Mr. Melzer, he can correct me when he gets up, perhaps, but my understanding is that this is presented as the sort of classic residual oil zone profile, showing where you have the main pay zone above, and then you have the residual oil zone below the oil-water contact. And as you go down through the residual oil zone, you get decreasing oil saturations until you get to the base oil saturation.

Is this your understanding, generally, of sort of a classic ROZ profile?

A. That is the typical expression. And I just would remind you that this is exactly what's displayed in the depleted oil zone case in the plot I was showing.

Q. What exactly was as displayed?

A. It's when you showed the -- when I showed the 30 percent to 12 percent. So just as a reminder that this is likely expressing something similar to that.

Q. 30 percent to 12 percent. I'm not --

A. Going back to the core corrections, and it was from earlier, a few minutes ago.

Q. Okay. Just so I'm clear, because I'm not exactly following you. Explain to me how that's the case with this exhibit.

A. It's showing a residual oil zone below a conventionally produced oil zone. So you will have -- as it's produced, you will create residual oil. You'll produce it down to a level where the oil cannot move anymore.

Q. It's your understanding that what's in this ROZ is what has been produced, what's remaining post-primary production?

A. Yeah. And according to this plot, I do see now that it says a naturally swept interval. So that

would be naturally swept as in water moving through it as the oil was produced from the top, would be my interpretation of the chart.

Q. Yeah, that's my understanding, too.

A. Okay.

Q. Okay. So this is naturally swept. And my understanding from the literature and Mr. Melzer's testimony and Dr. Trentham's testimony is that a residual oil zone following Mother Nature's Waterflood is comparable to what you would see at the end of a secondary waterflood. Is that your understanding?

A. It could be. I'm not an expert in that.

Q. Okay. So you're not familiar with the ROZ literature or how to compare Mother Nature's Waterflood ROZ to a post-secondary recovery waterflood?

A. I have the data that I have from the calibration of the core saturations and from reading the literature of Trentham and Lindsay and those.

Can I speak to that there is increased production after a secondary waterfloods? Yes. How much is it, I can't speak to.

Q. Okay. Would you agree that this classic ROZ profile is not -- that your oil saturations that you've identified in your wells in aggregate do not

match this classic ROZ profile?

A. If it's a conventionally produced oil zone, then it shouldn't. This would be a much higher porosity, typical -- well, actually, if it's the San Andres, then it would be. No, because this is for one porosity. This is not for an entire -- this kind of plot is made for one porosity with one capillary pressure, or many capillary pressures along depth.

So this may not be for the same kind of rock that we have in the ROZ that we have here. This could be for a 14 percent porosity rock. If I look at it again, and if it's, say, a 5 percent porosity rock, it would look significantly different.

Q. How about if I cut off this conventionally productive ozone portion of this and just ask you whether your oil saturations in the logs that you've interpreted, would you expect them to match this portion of the ROZ curve?

A. In the high case, they would be around that level. In the low case, they would average around the 30 percent range.

Q. Let me rephrase my question then and ask you to ignore the saturations at the bottom, and just concentrate on the profile. Okay?

I'm asking you, wouldn't you expect in

an ROZ to see higher saturations at the top of your ROZ interval and lower at the bottom?

A. With Mother Nature's Waterflood, not necessarily. And I'm not sure that we have the resolution, the resistivity to actually see that with the variable n that we have. There is potential that since there's multiple charges, that a lot of things can be happening.

Q. You told me that you haven't reviewed extensively the literature around Mother Nature's Waterflood ROZs, correct?

A. I've read through it. I can't say I'm an expert on it. Dr. Trentham and Dr. Lindsay have been doing it for a very, very long time.

So it might be a good point to bring up, if you can go back to that same chart that you had before, that I'm getting asked several times about the oil saturations and why they get up to 50 percent.

Residual oil saturation is inverse to porosity. The lower porosity you have, the harder it is to produce, the more oil sticks to the pores, and the high percentage of the oil is in the pore. The higher porosity it is, the more it gets flushed and the lower your saturation is.

So if you look at my curves, what you'll

see is that saturations above 50 percent are all below about 10 -- 8 to 10 percent porosity. The saturations that are above 10 percent are all around -- above 10 to 20 percent porosity.

Q. So how does that work if you want to go in and flood it with CO2? How are you going to get the CO2 to go in those tight pores when you've got lots of other preferential pathways?

A. That's not my expertise. But I know in waterflooding, they can mitigate that pretty easily.

Q. Have they been able to do that in the EMSU?

A. The Love paper -- I'm trying to go back to the Love paper because I'm not an expert on that either. But I believe the purpose of that paper was to show the increase in oil production after mitigating that.

Q. You're not aware what the projected high case or low case or what the actual waterflood recovery is for the field, are you?

A. Absolutely not.

Q. So you don't know how successful any of that was, do you?

A. From the conclusions of the paper, they said that it was improved significantly, is what they said.

Q. Okay. But you're not an expert in

evaluating recovery of oil saturations from CO2 injection, are you?

A. Absolutely not.

Q. No. But you know, based on what you understand, that in these ROZ plays, ROZ zones, that you tend to see the higher oil saturations with the lowest porosity?

A. That would be, by definition, residual oil, yes.

Q. Yeah. And the reason for that, just to be clear, is because despite the multiple, multiple pore volume sweeps and the move to oil-wet systems, and because probably moving to an oil-wet system, you're stripping all the high ends and the oil is becoming more mobile and the oil that is left after those multiple pore volumes is the oil that's the farthest to reach, right?

A. Yes.

Q. All right. Let's see. Page 8 here, I'm going to look at this second highlighted portion here. "The Ops Geologic solution continues to follow the resistivity and porosity while Goodnight water saturation immediately increases to largely above 80 percent with no defined seal or change in resistivity to support the assertion."

And I guess we're talking about the EMSU 746 here, right?

A. Yes, such as that.

Q. Yes. Okay. I think the question I had around this, I think we discussed. Because I wanted to ask you more about what you understood Dr. Davidson's model to be and why you thought he might be interpreting changes at those points. But I guess I might ask that question again.

Do you have an understanding for what exactly Dr. Davidson's model is and why he's interpreting changes at those points?

A. I do. Because he's interpreting a very small shift in gamma ray at that point.

Q. All right. Okay. I've asked you about what your understanding was for that gamma ray shift, and I think you've given me what you understand it to be.

A. I know that there are arkosic sands there. I know that the other indication -- like, I haven't -- we don't have spectral gamma ray to say what the actual cause of the gamma ray shift is.

Q. Okay. Now I'm going to pull up I think it's your L-26, which addresses this particular log.

MR. RANKIN: Mr. Hearing Officer, this next section is a little bit more extensive. I would like

to not get into it before taking a lunch break. It's a little early, and if it's okay with the Commission and parties, I might suggest that we take a break a little early today so that I don't have to interrupt my flow of cross on the next section of this portion of my examination.

HEARING OFFICER HARWOOD: Chairman Rozatos.

CHAIR ROZATOS: I'm okay with it. We'll meet back at 1:00.

HEARING OFFICER HARWOOD: That would be an hour and 20 minutes.

CHAIR ROZATOS: We've been giving an hour and 15.

HEARING OFFICER HARWOOD: Fair enough. Should we take a vote?

MR. MOANDER: OCD does not object because I'm happy to eat lunch any time.

CHAIR ROZATOS: Ms. Shaheen.

MS. SHAHEEN: I would just note that Mr. Birkhead is here today and he leaves tomorrow, so we need to finish up with him today.

CHAIR ROZATOS: How much longer?

MR. RANKIN: I don't expect to have any problems with that. I think I probably would have, I don't know, an hour at most after lunch. So I don't

think it would be a problem.

I just don't want to interrupt my line of questioning.

CHAIR ROZATOS: Mr. Moander?

MR. MOANDER: I'm not anticipating crossing this witness unless something comes up in Mr. Rankin's cross-examination.

CHAIR ROZATOS: Mr. Beck.

MR. BECK: No objection.

CHAIR ROZATOS: Thank you.

Mr. Suazo.

MR. SUAZO: No objections from Pilot.

CHAIR ROZATOS: So, I think, Ms. Shaheen, from what I hear, it will be kind of wrapped up for Mr. Birkhead today. The day has been classic. Anything that can go wrong will go wrong. But it seems like we'll probably be able to wrap it up. We'll have a solid three hours afterwards, and we could just kind of go through it.

MS. SHAHEEN: Thank you, Mr. Chair.

CHAIR ROZATOS: Thank you.

HEARING OFFICER HARWOOD: Ms. Hardy, do you have another witness in the queue after Mr. Birkhead? Is it Dr. Buchwalter?

MS. HENRY: Yes, that's correct.

HEARING OFFICER HARWOOD: He would be available if we have time this afternoon.

MS. HENRY: Yeah.

HEARING OFFICER HARWOOD: Okay. Well, all right. We're cutting into our lunch hour already. Let's go off the record and get to the important stuff.

(Lunch recess was held from 11:43 a.m. to 1:00 p.m.)

THE HEARING OFFICER: Are you ready to proceed, Mr. Rankin?

MR. RANKIN: Yes, I am, Mr. Hearing Officer. Thank you.

THE HEARING OFFICER: Were there any preliminary matters before we get right back into testimony? Do you have something, Ms. Hardy?

MS. HENRY: I just had an update on our witness order due to schedules. I advised Mr. Rankin.

After Mr. Birkhead, we are still planning to call Mr. Buchwalter. But then tomorrow, we would call next Bob Trentham, because he has limited availability.

HEARING OFFICER HARWOOD: Okay.

MS. HENRY: And then after that, we would

call Steve Melzer, and then Joe McShane, Galen Dillewyn, Jack Wheeler.

THE HEARING OFFICER: You're being pretty optimistic.

MS. HARDY: I know. Hope springs eternal. Deacon Marek, and then William West.

THE HEARING OFFICER: All right.

MS. HENRY: Thank you.

HEARING OFFICER HARWOOD: Thank you.

Okay, Mr. Rankin. Pick it back up with Mr. Birkhead.

BY MR. RANKIN:

Q. Good afternoon, Mr. Birkhead.

A. Good afternoon.

Q. We had left off and I was going to get into another section of your testimony where you had done some analysis on a particular well. That's the 746. And I guess you don't have a map, do you, showing where all these wells are located, in your testimony?

A. No. But Ryan Bailey does.

Q. Ryan does. Okay. Maybe it would be helpful to have that just so everyone can figure out where we are, as I'm just thinking about it right now. Do you happen to know which exhibit it is, by any chance?

A. With Ryan's testimony, no.

Q. Okay. Let's see if I can find it real quick. Okay. Got it.

So, Mr. Birkhead, I think the next section or topic that I'd like to discuss with you is your specific interpretation of this one well, this EMSU 746. And here I've got up Mr. Bailey's Exhibit K-2, and it shows the outline of the EMSU unit.

And the wells that have been interpreted by Ops Geologic are the wells with the green stars, correct?

A. As far as I know, yes. I didn't make a map, but yes, that looks like that is what Ryan said yesterday.

Q. Okay. And the well I'm talking about here, that we're going to engage in, is the EMSU 746, and it's this well. I can't tell whether it's in Section 14 or 15, but it's sort of on the eastern side of the -- southeastern side or eastern side of the unit?

A. Yes.

Q. Okay. Back to your Exhibit L-26. This is the interpretation or final solution that you have provided for this particular well, right?

A. Yes.

Q. Okay. So there's one particular area that I'm most interested in here, but just to orient the commissioners, if you would, just explain to us, because I don't think we've seen one of your interpretations yet, your interpretive logs, if you would just get us oriented left to right on this well log.

A. Certainly. So they are numbered, each track, or named by the kind of track that it is. So in the first track, it is the depth track. It just shows measured depth, not subsea, unfortunately. It also shows the picks of the tops as done by Ops Geologic.

The second track is the tops as provided by Ryan from Ops Geologic.

The next track is the gamma ray, which is going to be an indication of lithology, along with a caliper.

The next track, Track 6, is the LOD and LOS. That is the lateral log. It's the resistivity curve, scaled from .2 to 2000 on a logarithmic scale.

Next we have neutron and density, with the PE curve included. Then we have the low case pay flags to the left and the pay flag high case to the right. So you'll notice in several cases they're

similar because the saturations change slightly.

On the next track over, the porosity track, we see the total porosity and effective porosity, BVW, which is just the Sw times porosity. And then my baffle curve to indicate where there could be baffles.

The next place is lithology, where over the San Andres, lithology was interpreted using neutron density and PE.

And then the last track, what's called 19, what we'll call 19, is the permeability that I calculated from .01 to 100, using the Lucia method.

Q. Thank you. I may need reminders once we get down below the header when we can't see them. Okay? Thank you.

Just so I'm clear, the green bars over here, are these the baffle flags?

A. Those are the -- yes, possible baffle flags.

Q. Okay. Yeah, all right. And, again, these are the pay flags, right, or -- yeah, the pay flags. High, right, low, left, right?

A. Correct.

Q. Okay. And then you've got your tops, and these are the tops that Ops Geologic picked for each of these intervals?

A. Yes.

Q. Okay. Let's see. So, just kind of cruising through here, we were talking a little bit about the gamma ray issue or, you know, gamma ray signal. And the gamma ray is the first -- well, this is the gamma ray track, right? I guess the third sort of track from the left, right?

A. Yes.

Q. Okay. So this green line is the gamma ray, and there's a slight shift in the gamma ray. As you work your way through the Grayburg, you get this bit of a spike of gamma ray, and then there's a shift in the gamma ray below that depth, right?

A. Right, at the Lovington Sand.

Q. Okay. And just so I understand, it's your understanding that that is the gamma ray shift that Dr. Davidson is focusing on in his analysis, correct?

A. That or slightly above it.

Q. Yes.

A. And it's the -- sorry. It's not that huge shift. It's the minor shift between, say, 4200 and 4000.

Q. Okay. That's your understanding of what he's looking at?

A. Yes.

Q. Okay. All right. Now, I'm just going to scroll down a little bit farther, because this is where I'm particularly interested in your analysis down here, okay, in the lower portion of the Lower San Andres. Okay?

And here I see, you know, around 5,000 feet, and a little deeper, I'm seeing -- you know, you're interpreting fairly high oil saturations, right?

A. Yes.

Q. Okay. So I would like to engage with you and talk through your interpretations for the different inputs and factors that you've interpreted here. So I don't know if you have anything to say to me about the gamma ray over here or not, but, you know, is there something that you have interpreted or something that you have to say about the gamma ray, how it influenced your interpretation in this portion of the log?

A. It is fairly clean. It looks like it's a cyclical environment, or like it's a -- yeah, looks like there's a time component to it.

Q. There's a what?

A. Different depositional -- thin depositional environments, thin deposition.

Q. Okay. Now, I guess I'm going to skip over to the porosity, which I think is this log, this interval, this track here, right, that I'm highlighting?

A. Correct.

Q. Okay. So I guess I'd like for you to talk to me a little bit about your porosity track here, especially in this interval where you're interpreting higher oil saturations.

And just for reference, again, I think we've covered this, but it's a new day, each of these tick marks is a 20 percent oil saturation or 20 percent; is that right?

A. Yes.

Q. And so from left to right on this track is low oil saturation to high?

A. Yes, correct.

Q. And the blue is your low case and the red is your high case?

A. Yes.

Q. Okay. Now, in this interval where you've interpreted and flagged both in your high and low case net pay, I'd like for you to talk to me a little bit about what you're seeing in the porosity curve here.

A. We see that porosity goes from a fairly high

value on each of those. Each of those incisions, each of those grid lines are 10 PU. So it's actually not 20 in those, it's 10 PU.

So we go from about 15 percent porosity above, where we expect to see a fairly low oil saturation residual, to slightly -- to a place where the porosity drops down fairly low to around 4 percent, a little bit greater than 4 percent, where the residual oil saturation goes high because it's low porosity.

Q. Okay. Now, in your interpretation for porosity, what are some of the input parameters or factors that would influence how you're interpreting your porosity in this curve?

A. It's density, neutron and PE.

Q. And when we talked about this earlier, I think I asked you what your -- because in terms of your density and neutron, I mean, how does your dolomite matrix affect your influence here -- affect your interpretation?

A. Can you rephrase the question?

Q. How does the dolomite matrix that you've selected influence your interpretation here on the porosity curve?

A. The dolomite matrix affects -- it gives

slightly higher porosities, given an already tight bulk density.

Q. Okay. Now, I understood that you were using 2.9 as your factor for dolomite in your interpretation; is that right?

A. Yes.

Q. And as I understood, with a 20 percent value for dolomite?

A. About a 20 percent inclusion for anhydritic cements.

Q. A 20 percent inclusion for anhydritic cements, yeah.

A. Or heavy minerals. Unfortunately, it's a ternary diagram. There's not a fourth leg to it.

Q. Say that word again.

A. It's a ternary diagram. You have three points to it, one for limestone, dolomite and sandstone. Those minerals are not arbitrary, but that's what they're based on. Sometimes you have to make adjustments for certain other heavier minerals.

Q. Okay. So what is your dolomite, then, matrix density that you're using?

A. I just mentioned. Within this element of a variable grain density, I'm using 2.9, assuming the anhydrite cement, 2.65 for the quartz element, and

2.71 for the limestone element.

Q. Okay.

A. It takes all three of those to come up with a variable grain density. So the grain density of the rock itself is somewhere in between all of those.

Q. So my understanding, it's very cursory here, but my understanding is that for dolomites, there's a range in the literature, a range of the matrix, that is generally assigned between 2.83 and 2.87. Is that generally the case?

A. Yes. And that's why I added the other three-tenths to get to the -- solve for the slightly heavier minerals.

Q. Okay. And how did you come to use that higher 2.9 value for your dolomite matrix?

A. From the literature, understanding that there is going to be a certain amount of anhydritic cement throughout it, and that the porosity -- the Umaa-RHOmaa cross-plot plotted a little bit higher than dolomite, indicating that there was something heavier in there.

In order to match that, you have to adjust the matrix density of the point that is closest to, to include and to get a correct grain density across it.

Q. So, I mean, because you don't have core down here, right, there's some uncertainty about what values you're going to be selecting for your porosity, right?

A. Even with -- well, there's time and tested models. As I've said many times, in petrophysics, there is uncertainty. So I use tried and tested models for how to calculate the mineralogy through this, using literature to come up with my solution.

Q. Okay. Now, on the anhydrite, did you calculate for ranges of anhydrite, or did you just use a 20 percent for that?

A. Using a variable grain density would be jumping the shark to make a guess on the anhydrite volume throughout the entire thing. It's much better and much more reasonable to pick a baseline value, because it's going to have a very little impact anyway, because it's such a small percentage of what is such a small percentage.

Q. So based on this porosity log -- let's maybe walk through it. So from 4800 feet down, you've got higher from right to left, right? So the higher porosities, this is a higher value, and this is a lower value, closer to this line on the right?

A. Yes, that is higher to lower.

Q. Okay. So the bigger, the more blue, the more porosity?

A. The more to the left, the more porosity, yes.

Q. Okay. So the more to the left, the more porosity. Okay. So going from 4800 feet down the track, I'm seeing relatively higher porosities. And then as I approach your higher oil saturations, I'm seeing the porosities decline, right?

A. Yes.

Q. And my understanding is, you're telling me that lower porosity is indicative of where the oil is going to be because the oil was trapped in those lower porosity zones?

A. That's the physics.

Q. Got it. And what's causing the shift here to lower porosity in this track?

A. There could be an increase in cements.

Q. What gives you the read -- I mean, in other words, what are you reading that gives you the lower porosity? How are you reading -- I mean, what's telling you there's lower porosity?

A. The density increases.

Q. Okay. All right. Now I'm going to talk next about the resistivity curve. Remind me which

curve is resistivity.

A. That would be the fourth one from the left.

Q. Including the depth track and the formation track.

A. Yes.

Q. One, two -- that's your gamma ray, so this one here?

A. Yes.

Q. Okay. So it's the one with the aqua and the blue?

A. Yes.

Q. Okay. So my understanding is that your interpretation, your curves or your petrophysical model is more sensitive to resistivity than Dr. Davidson's; is that fair to say?

A. Yes.

Q. Okay. On the resistivity, I would like for you to do the same as we just did for the porosity, and starting at about 4800 feet. And I guess, which is the high case and which is the low case?

A. One is a shallower resistivity, and one of them is a deeper resistivity.

Q. Okay. Which is shallow and which is deep?

A. The shallow should be the blue one.

Q. So, if you would, just narrate for me what

you're seeing in the resistivity curve as you go from 4800 feet down through the higher oil saturation zone.

A. We're seeing lower resistivities through that, spiking at certain intervals, and to a fairly moderate value.

What I would take this to be is an indication of a zone that is mostly water-bearing.

Q. Okay. Before we get into how you came to that conclusion, I would like you to just explain for me, and perhaps at least one or two of the commissioners, how resistivity is used to interpret the fluids in the log.

A. Okay. I'd be happy to. And if I go on too long, let me know.

So resistivity is incredibly important, because it's one of the few ways through history to see what the amount of fluid is you have downhole.

We do not see oil saturations downhole. We see water saturations. Because oil is infinitely resistive. So what we can tell is the volume of something that is conductive within the system. So knowing the porosity, the resistivity and the salinity, we can actually figure out what is pay or non-pay or hydrocarbon bearing or non-hydrocarbon bearing.

So we basically have to have something that is conductive within the system to have a resistivity. And typically, if you have porosity, the more resistivity you have, the better chance you have of having hydrocarbons.

Q. There's a lot there. And I'm going to have to just ask you to break it down, and I'm going to ask you questions. I may ask you to repeat, but I'm going to work on each of those elements. Okay?

A. That's fine.

Q. So things that are resistive -- in other words, you're trying to pass electrical current through the formation, right?

A. Yes.

Q. And things that are resistive don't do that as well, right?

A. Correct.

Q. So higher resistivity means that they're not conducting electricity through the formation, right?

A. Well, it -- yes.

Q. Yeah. In very simple terms, yeah.

Okay. And oil does not conduct electricity well, does it?

A. At all, yes.

Q. But saline water does?

A. That's true. Correct.

Q. And does rock?

A. Depending on the rock. It depends on the rock.

Q. Okay. So here, what's your lithology in this zone?

A. This is dolomite and limestone, and there's a little bit of sand in some parts of it. And what I'm interpreting as to be a moderate amount of clay.

Q. Okay. So dolomite, limestone. And what else?

A. There's a little bit of sandstone showing up as the yellow. And then the rest is what's currently being interpreted as clay.

Q. Which is the clay?

A. That would be the one to the outside.

Q. That would be the what?

A. Sorry. The dashed green. There's the dashed green that's more to the left side than to the right side.

So if you look at the lithology track, it would be the one that's to the left side of the track, shaded.

Q. This little band here is to the left side of the track?

A. I can't see your cursor. Where is it? Yes.

Q. I guess it spikes up here a little bit, huh?

A. Yeah, where the gamma ray goes to a higher value, that's where there's a little bit more clay interpreted.

Q. So up here. So you're interpreting some clay above about 4800 feet?

A. Yes.

Q. Okay. Now, given that lithology in this zone between where the higher oil saturations are, what is your interpretation about the conductivity or resistivity of the rock there?

A. With the higher oil saturations?

Q. In that zone where there is a higher oil saturation, yes.

A. Okay. My interpretation is that since I am computing porosity across it, although low, and because we are looking at ROZs, and we do have very, very high resistivity, that with porosity and resistivity can be nothing else other than something that's non -- unless it was infinitely freshwater, we would not see a reflection like that, and it would be off the charts if it was. So this has to be some moderate amount of hydrocarbon. And because it's low

porosity, it has a higher oil saturation per unit volume.

Q. I don't think that answered my question. I was asking about the rock, the resistivity of the rock here.

Based on your interpretation of the lithology, what's your understanding of the resistivity of the rock, the lithology, in this zone?

A. Yes, so -- I'm sorry. Whenever you look at the rock, and there's a low porosity, this rock, dolomite limestone, it is very, very resistive.

Q. Right.

A. Clays are not very resistive. When you look at the dolomite and see the highly resistive rock with minor porosity, porosity tools still work. So we have a resistive rock, and we have a resistive fluid within the formation.

Q. Okay. I'm sticking with the rock here for a bit.

A. So we deal with bulk volumes, and that's -- it's hard to deal with it. You're asking about the resistivity of the rock. The resistivity of the rock is high.

Q. Thank you. Okay. So we know it's a fairly resistive rock, right?

A. Mainly because it's low porosity.

Q. Now I'd like to talk about the permeability. Okay? And I think that's the far curve. That's your Lucia curve, right?

A. Yes.

Q. So that's the farthest curve here, the farthest right. And, again, this one's a little more messy, at least for my eyes. If you would, just walk through for me what the colors are here for each curve and what they mean and --

A. The ones to the furthest -- I'm sorry for cutting you off.

Q. It's okay. Yeah, I just want you to explain to me what the two -- I think there are just two curves in there, red and blue.

A. There's three. I, unfortunately, colored two of them very close to the same color.

So the curve to the left is the porous rock type. The Rock Type 2 -- the middle curve, the red curve, is Rock Type 2, which is the next best or moderately good. The one to the outside, to the furthest right, is the best rock type.

Q. The furthest left, is that Rock Type 1?

A. I believe the Rock Type 3 is the one that I called the worst. It's the one that gives the longest

number. So we can go from porous rock type to best rock type from left to right.

Q. So it would be 3, 2, 1?

A. We could go from porous rock type to best rock type. But yes, I believe that's the way it goes.

Q. Okay. Now that we know what curves we're looking at, which is a little hard, explain to me what we're looking at as we go from 4800 feet down through the high oil saturation zone here.

A. Can you rephrase the question?

Q. Yeah. Now that we know what these curves are, I'm just asking you to do the same thing we did for the other two curves and just walk us through from 4800 feet down through the higher oil saturation zones. Explain to me what's happening with these curves.

A. With the permeability curves?

Q. Permeability.

A. Yeah. Sorry, that's what --

Q. Yeah, yeah.

A. So yes, these permeability curves were added into the interpretation to give a range. Permeability is based on literature. So classically what you would do is you would have the data to do rock typing and core description throughout this entire thing. We

don't have that in this case and we don't have the data to do rock typing using these curves as well. So I provided all three perm curves to show what the possibilities were.

And what it shows, very directly, is that as your -- it's a relationship with porosity that as porosity decreases, permeability decreases.

Q. Okay. And so high perm is to the right; is that correct?

A. Correct.

Q. And low perm is to the left?

A. Yes.

Q. Okay. That's the only other option. So as we go through the high oil saturation, we see permeability going sort of off -- for most of the curves, going off the chart to the right. Then, as you approach the higher oil saturations, you're getting a substantial decrease in permeability, for the most part, with some higher levels intermixed. Is that fair?

A. The Rock Type 1 goes off the charts. The chart is 100 millidarcies. The other two don't seem to. But yes, in general, as you get into lower porosities, the permeability goes down by nature of the equations.

Q. Okay. You kind of touched on it, but I guess I want to ask you to explain it. How is permeability then related to porosity?

A. Tenuously. And it usually needs more information. So you actually need to know what the pore distribution is and you know what kind of pores you have. You need to know how big the pores are. You need to know how connected they are. There's a million and one elements that go into it.

But in general, you can figure out trends with porosity versus permeability when you have other identifiers to produce them by.

Q. I guess this kind of gets into tortuosity, understanding exactly the nature of the --

A. A bit of that. So certain rock types behave different ways than others, so they'll show up on different parts of the porosity permeability cross-plot.

Q. Okay. So my understanding is, then, as we consider this zone from the 4800-foot depth down through the higher oil saturations, and I'm considering the relationship between permeability and porosity, I understand you to say that it's a tenuous relationship.

A. Which is why I provided three curves.

Q. Okay. And so the three curves are intended to provide a range of interpretations or outputs; is that right?

A. Yes. Just keeping the along the theme it's working with ranges.

Q. Okay. Got it. So based on that uncertainty about the relationship here between permeability and porosity, there's some uncertainty, as you've been saying over and over again, and that's why you're giving us the three rock-type curves?

A. Yes. And a low and high case saturation.

Q. Now, on the saturations, just if you would, let's go ahead and walk through that curve, too.

Now it's this curve here. I guess it's the seventh from the left, right?

A. Yes, the one next to the pay flag trend.

Q. And the high, again, is the red, the low is blue. If you would just walk through -- if you would explain to us your oil saturation interpretations as it relates to the key factors that would inform your determination of oil saturation.

A. Key factors?

Q. Well, I mean, yes. Tell me, what are the inputs that most influence, that have the greatest driver of the oil saturation.

A. In the upper part, where there's low resistivity, the main factor that would probably impact this would be Rw, the resistivity of the water.

Q. Okay. And explain how that relates to high or low oil saturations as we go through the curve from 4800 feet down through the higher oil saturation.

A. It's a -- sorry, I interrupted you again.

It's the main part of the Archie equation. So it's A over porosity to the n power times Rw over Rt. So Rw is a big component of that.

Q. Okay. But then explain, as we go from 4800 feet down, how that plays into your interpretation of the oil saturations.

A. As you increase resistivity, the Rw matters less and the m and n values start to matter more.

So if I was going to do a classic interpretation with this and use a typical value of m or n, that would be around 2, which is what some people do for clastic rocks, or something somewhat lower, you would end up with about 5 percent water saturation, about 95 percent oil saturation.

That's not realistic. But we have resistivities that are in some cases exceeding 2000 ohms. So we have to adjust the n to bring down the oil saturation to reasonable values, using the core

data that we have.

Q. Now I want to loop back again, I think, here. So based on that, in a nutshell, when you said that very quickly, there's a lot of material and information there, but my understanding is that's how you came up with your oil saturations, kind of considering all those factors?

A. Correct.

Q. Now, we talked a bit about the importance of resistivity in your analysis, right?

A. Mm-hmm.

Q. And we talked a bit about how resistivity is affected by porosity and the rock type. And as we get lower porosity, resistivity matters less, right?

A. Sorry?

Q. Did you say that as you get lower porosity, that resistivity matters less?

A. No.

Q. What did you say? How did you phrase it, that we're -- so Rw matters less. I'm sorry.

A. Yeah. I said as resistivity increases to infinite values, Rw matters less.

Q. I meant to say -- okay. Sorry. I apologize. Okay.

So now I want to then focus on -- again,

continue to discuss resistivity here. And this is coming from a layperson. I'm trying to understand. Okay? So I appreciate your patience with me. Because I understand that these interpretations can be very sensitive to what factors are being employed and how you're interpreting the importance of those factors, right? Such as resistivity, right?

A. Yes.

Q. Okay. So here, you know, my very basic understanding of petrophysics is that you're looking for fluids, right? I mean, trying to understand what the fluid content is of the rock, right?

A. Yes. The fluid distribution, what the fluid types are.

Q. And with the more fluid you have, as I understand, it's easier to interpret what's in the matrix or what's in the rock; is that fair to say?

A. I'm sorry. Can you rephrase the question?

Q. In other words, if you have high porosity, okay, and there's more fluid in the system, would you agree with me that it's easier to interpret through petrophysics what is in the rock, whether it's oil or saltwater?

A. No, I wouldn't say that.

Q. Okay.

A. In low porosity, filled with water, it's pretty easy to tell.

Q. Okay. So let me ask you then. Let me think about how to phrase the question I want to ask. I guess I'll reframe it this way.

So in higher porosity systems, where we read higher porosity, there's more fluid available to analyze, right?

A. Yes.

Q. Okay. And I guess my question, which I think is, you don't agree with me that with less fluid, it's harder to analyze, petrophysical analysis, if there's less fluid in the system, if there's lower porosity?

A. Taking, for example, let's say 4850, that is a lower resistivity, lower porosity zone.

Q. Just so I'm on the right track.

A. Yes, you're on exactly the right spot.

Q. Okay.

A. You have a lower porosity of about 5 or 6 percent.

Q. Okay.

A. It is really easy to tell that that is water-bearing. So it's also easy to tell that the zones right above and below it are also water-bearing.

And contextually, within the height of that, it's really easy to tell that all of them are water-bearing.

Q. Basically, how do you tell the difference then? If both rock and oil are resistive, right, how do you tell the difference between oil and rock?

A. By knowing the porosity and knowing the salinity of the fluid.

Q. Okay. And if you know the porosity, if the porosity is low, then how does that help you interpret whether it's oil or rock?

A. Because the resistivity tool is sensitive enough and the equations are sensitive enough to be able to tell the difference. And with the m and n to guide what the impacts of the rock are, which is how you basically impact the -- how the rock is affecting the resistivity, you can figure out the volumes of the fluids pretty easily.

Q. But you're manipulating the m and n values based on the literature?

A. Based on literature, as I said before. And the n value is based upon trying to stay within reasonable values, based on literature, and on mixed-wet, oil-wet systems, and based upon the core data.

Q. Okay. But we don't have any core data down here, right?

A. We sure don't.

Q. Okay. I mean, you've agreed with me all along on the uncertainty. There's some level of uncertainty here, right?

A. Of course.

Q. Yeah. And does that uncertainty increase with lower porosity intervals, with less fluid?

A. So I'll put it in this perspective. It is not uncertain that the zone at 4850 is wet, regardless of the porosity, because the resistivity is incredibly low. There is slightly more uncertainty when you get up into several hundred ohms and it's lower porosity.

Q. So I guess let me ask you this way. In this zone here, where you calculated 20, 40, 60, 80, upwards -- on your high side, above 80 percent oil saturations, right?

A. Yes. And 4 percent porosity rock.

Q. Okay. So in this interval of -- how many feet is this here?

A. Each one is, I believe, 50 feet.

Q. So about 100 feet of rock? You're calculating upwards of 20, 40, 60, so on the high side, above 60 percent, and in your low case, well

above 40 percent?

A. With you looking just at the high case, yes.

Q. Well, I'm looking at the low case, the blue case, right?

A. No. Because then you'd be going down close to 20 percent.

If I'm looking at this correctly over the entire interval, the blue curve goes down to about 25 percent oil saturation, possibly 30 percent oil saturation. The red curve starts at about 40. The red curve on the right goes a little bit over 80, as you suggested, and goes down to around 40 -- actually, to about 25, as well, in one part, giving an average of around 30 to 40 percent oil saturation.

Q. And 30 to 40 percent oil saturation for which case?

A. It's 30 to 40 for the low case, and just a little bit higher than that for the high case. Because the majority of the volume is in the big pores, and that adds more -- the oil saturation, although lower, offers more hydrocarbon pore volume.

Q. So if I draw a line right down the middle, I see a fair number of spikes on the high side, above 50 percent, right?

A. I see a few, yes. I would say that the

lion's share of those, again, just eyeballing it, that there's a larger percentage that are to the left.

Q. Okay.

A. Especially with the blue curve. The blue curve, most of them are.

Q. I mean, how certain are you, Mr. Birkhead, that there's even any oil in this interval?

A. I'm pretty certain. If we go back to the 679 core data, we'll see at the very top of the log where there are very, very low porosities and the measured oil saturations in those are, like, 70, 80 percent.

Q. Is it possible, Mr. Birkhead, that there may not even be any oil in this zone?

A. If there is porosity and resistivity, there is oil.

Q. There's lower porosity and there's highly resistant rock. And you're confident that you can distinguish between the high resistivity rock and oil in this low porosity system?

A. Because of the high resistivities and because there is porosity, you have to fight this to make it not the biggest find of the year.

Q. So I understand that often in carbonate systems, there's often a false positive where you have

low porosity because of that very issue. Is that --

A. No.

Q. -- your understanding as well?

A. No, that's not my understanding at all.

Q. Okay.

A. That that works in low porosity carbonates. It's not that, yeah. Please, yeah.

Q. Okay. Now, we talked previously about -- and you talked at length in your written testimony and in your summary about the importance of reviewing all the available data when you're making your petrophysical interpretations, right?

A. Yes.

Q. And we talked about mud logs, we talked about, you know, whatever may be available, including well tests, production tests, to determine, you know, whether or not your petrophysical analysis is reasonable and makes sense, right?

A. Yes.

Q. Okay. And here we do have a mud log, and I'm going to pull it up. We can talk through it and I'd like you to explain to me -- so the mud log is long. Okay? And I didn't include the whole mud log, but I'm including the section here that we were just reviewing. And this is from the Division's well file.

I've included a snippet from the top of the mud log so we can identify, confirm that it's the same well.

See that it says "XTO EMSU 746" --

A. Yes.

Q. -- in the Eunice Monument South. It's got the API number. Do you agree with me that that -- and I think you have reviewed this mud log as well, right?

A. Yes.

Q. And does that look like the mud log for this well, as far as you can tell?

A. As far as I can tell.

Q. Yeah. No reason to dispute it as you sit here today?

A. Right.

Q. So I've taken a snippet out of the mud log for the interval that we were looking at, which is just a little bit above 5,000 feet down to a little below 5100 feet. And I've highlighted the language just to point out that throughout this interval, the mud logger has identified that there's no fluorescence, no cut, no fluorescence, no cut, no fluorescence, no cut, no fluorescence, no cut, no fluorescence, no cut, all the way down through the entire interval here.

So I'm wondering how, when I go back to

your interpretation of as high as 80 percent in the high case, how did that mud log help you interpret high oil saturations in that particular interval?

A. For one, lack of shows is not evidence of no shows at all. You can have lack of shows with a mud logger. Can we go back to the connection gas and go back to the gas log, please.

Q. Yeah.

A. Aside from the connection gas, which, again, is related to whenever they're putting the pipes together, we see increases in gas throughout this entire thing. So just because they didn't see it doesn't mean it's not there.

We have other elements and evidence, which is what -- all I was saying about the physical integration, we have logs, we have porosity and we have resistivity, we have gases that are moving on this. And if there's not oil down there or gas, then what is making it read that? So we have direct evidence of hydrocarbons in this mud log.

Q. Okay. So this is a gas chromatograph on the right; is that right?

A. Yes.

Q. And the gas chromatograph is reading some high levels of -- or are there high levels of gas,

that you're talking about?

A. For a residual oil zone, you do not expect a high level of gas; you'd expect some level of gas. If you're overbalanced, you would expect no level of gas.

Q. So as you looked at this mud log, you were informed by the gas chromatograph?

A. I can't speak to this log directly, but I was thinking whenever I interpreted the 746, that's what -- looking at it now, it has clear indications of gas. I've drilled through wells that are in billion barrel fields that have no gas shows -- or no -- sorry. They do have some gas shows, are overbalanced and don't have any fluorescence.

Q. So let me just make it clear. I mean, you don't recall how this mud log influenced your interpretation. But looking at it now, you're looking at the gas, and that -- I just want to make sure that --

A. Yeah.

Q. Did you specifically review this mud log and evaluate it --

A. I -- I --

Q. Hold on. Let me just finish.

Did you specifically evaluate this mud log and evaluate it as part of your interpretation of

your petrophysical analysis?

A. I interpreted 29 wells.

Q. Yeah.

A. I cannot speak directly to exactly which mud logs I have looked at, just from the top of my head. So given time to go back and see which ones I had access to, I could easily answer that question.

Q. Well, I guess it's just curious to me that when you interpret oil saturations that high, that far down, and isolated from any other saturations, that it wouldn't have caused you to look specifically at the mud log to determine whether that made sense.

A. From what I understand, and you can speak to Mr. Bailey or some others about this, but there is a well-known pay sand that is down close to the bottom of the San Andres that does occur. So this is not completely unique in its occurrence.

Aside from the fact that, yes, we use the data we have, resistivity, porosity, and in this case what you've shown me is the mud logs, which also support it.

Q. Now, obviously, XTO had this mud log as well, right? And they reviewed it and they considered it and they went ahead and, when they drilled this well, they went ahead and perfed the zone, right?

A. Mm-hmm.

Q. Did you, as you were preparing this mud log, making your interpretation, evaluate the well file and the test information from this well?

A. No. But I have seen you put it up here in the past two days.

Q. Yeah. So I'll go ahead and pull it up again, and we can just talk through it. And I'm going to pull up a slightly different version of it.

This is in Goodnight's Exhibit -- I think this is B-33 from Preston McGuire's. I believe this is direct testimony.

Just to confirm, I'm going to scroll down and just show you that -- oh, you can't see that. But in any event, this exhibit sticker down here just says it's Goodnight's Exhibit B-33. Okay.

So now, this slide, Mr. Birkhead, is not your interpretation, but it's NuTech's original interpretation that they filed in August of 2024, because that's what we had and we understood was Empire's interpretation of the zone, until you filed your rebuttal testimony.

So as I scroll through NuTech's interpretation here, I believe this -- and I'll confirm this in a moment. This is what I believe is

Goodnight's interpreted San Andres top. Okay? I believe that to be the case.

A. Okay.

Q. That is the case. So I'll represent to you that is Goodnight's interpreted San Andres top. Okay?

A. I'll take your --

Q. Okay.

MS. SHAHEEN: Excuse me. Adam, I'm not clear as to what exhibit you're looking at. Can you tell us?

MR. RANKIN: It's Exhibit B-33.

MS. SHAHEEN: It's 33. Okay. And that's for the well log?

MR. RANKIN: This is NuTech's interpretation of the 746.

MS. SHAHEEN: Right. And the previous one that was filed with OCD?

MR. RANKIN: Oh, thank you. I haven't moved for the admission of that yet.

MS. SHAHEEN: Well, I'm just wondering where it came from, because I don't find it in the OCD well file.

MR. RANKIN: It's in the OCD log file. It's the mud -- no, actually, it's from you guys. You gave it to us. It is Bates Number 23614-170397. You

provided that to us in discovery.

MS. SHAHEEN: Thank you.

BY MR. RANKIN:

Q. Okay. So this is Exhibit B-33 from Goodnight's direct testimony. And as I mentioned, this is he Goodnight's interpreted San Andres top. And in blue are the perforated intervals from the OCD well log. Okay?

So the portion of the interval that we're most interested in is not this one, but I'm going to scroll down to the -- it's a little hard to see the depth track, so I'm going to zoom in so we can see it. Okay? 4500, 4700, 4800. So here we are in the area of interest.

Now, you see NuTech also interpreted fairly high oil saturations through this zone as well. And these are the calculated average oil saturations on the left-hand side for each of those intervals that were perforated by XTO, according to the well log -- according to the well file.

On the right-hand side, between the bracket here, which indicates the top and bottom perfs that were tested, is the well tests from the well file. You see on September 19, 2005, XTO perfed from 5130 to 5138, perfed 24 holes. And then from 5100 to

5110, I think that's 30 holes. And then from 5030 to 5050, 60 holes, 4990 to 5000, 30 holes. And then they acidized the perfs with 3000 gallons 50 percent acid, and they flowed and swabbed 110 barrels of water in two days and had no gas reported. Then they went ahead and cemented -- set a cast iron bridge plug.

I understand that the gas chromatograph showed there may have been some gas, but it sounds like there was no gas produced as a result of this test.

Based on these saturations that you have here, and I think I know your answer, I can anticipate it, I can feel it coming, but based on these high saturations, wouldn't you have expected that with this swabbing, you would have gotten some oil to flow?

A. So they acidized perfs with 3000 gallons of fluid, then flowed and swabbed 110 barrels back in two days. Yeah, I'm not seeing that the residual oil and the low porosity equates to a large volume of oil. But it sounds like they didn't produce it very long to get most of their load back.

So 3000 gallons ends up being quite a bit of flowback, 110 barrels. So I'd say they probably should have flowed it for longer, just to be sure.

Q. Okay.

A. Residual gas doesn't give up very easily unless it's being drilled through. So if you're not drilling through it, it's kind of hard to see it.

Q. The 110 barrels -- okay. So you're saying that you don't think that there was deep pressure -- the in situ reservoir conditions were not altered sufficiently to permit that oil in that tight porosity to flow?

A. If we're talking about a residual oil zone, absolutely. They did not provide enough pressure on the -- yes, that would be the clear result of the test. Again, residual oil.

Q. On the mud log, just -- you know, I've never actually been to watch a mud logger work; someday I hope to. But my understanding, right, is when a mud log is being taken, essentially, the mud logger is set up and the gas chromatograph is set up and the drillings are coming back uphole and the mud logger is reviewing the materials. And then it's also being processed through the gas chromatograph, right?

A. The gas is coming across. That's through the mud system, yes.

Q. Okay. And because it's being done while the hole is open, is it not possible that -- or is it

possible that some of the other shallower zones in which there are hydrocarbons, because they're open to the wellbore, some of the gas being read here could be from those other zones?

A. Absolutely. But the resistivity can't be from above those zones. The resistivity is from there and the porosity is from there. There is recycled gas, which back then, they didn't really -- weren't really measuring.

Q. Right. And we talked about how this rock in particular in this zone is resistive, right?

A. Absolutely, yes. All rocks, unless their clay is conductive, are resistive.

Q. Okay. Now, in your testimony, I'm going to move back up here to -- sorry.

MR. RANKIN: Oh, yeah. Mr. Hearing Officer, before I forget, I'd like to move the admission of what will be Goodnight Midstream Cross Exhibit Number 4, which is this 746 mud log. And I have a few -- I'm a little backlogged and I have a few of these exhibits I need to circulate to all the parties, and I'll try to get to that this evening.

THE HEARING OFFICER: That's a one-page document, 00397 Bates stamp?

MR. RANKIN: Correct.

HEARING OFFICER HARWOOD: Any objection from the Empire?

MS. SHAHEEN: No, so long as it is a one-page document. And if it's not, that the entire document be submitted as an exhibit.

MR. RANKIN: Well, it's in the -- I mean, if you like, I guess you can come back and submit the whole thing, but this is my exhibit. So I'm going to move in this exhibit, which is a part of the mud log that we were discussing in particular, reviewing Mr. Birkhead's analysis of this particular section of the zone.

HEARING OFFICER HARWOOD: Okay. So it's one page?

MS. SHAHEEN: Empire would --

MR. RANKIN: It's one page. What Empire produced is a very long mud log of the whole entire wellbore.

MS. SHAHEEN: An Empire would request that the entire mud log be included as an exhibit rather than an excerpt from the mud log.

MR. RANKIN: They can introduce it if they'd like.

THE HEARING OFFICER: Well, I mean, there is a rule on it. I mean, you introduce part, they get

to introduce the rest of it.

MR. RANKIN: That's fine.

HEARING OFFICER HARWOOD: So, with that understanding, OCD, do you oppose the introduction of this page and the remainder of the mud log?

MR. MOANDER: No, Mr. Hearing Officer. And I agree with your ruling, from the standpoint of the rule of completeness, that Empire can put the whole document in later, if they so choose.

HEARING OFFICER HARWOOD: All right. Mr. Beck.

MR. BECK: No objection.

HEARING OFFICER HARWOOD: And Mr. -- I never know who it is for Pilot.

MR. SUAZO: No objection, Mr. Hearing Officer?

THE HEARING OFFICER: Is that Mr. Suazo's voice?

MR. SUAZO: Yes, it is.

HEARING OFFICER HARWOOD: Okay. All right. Thank you.

MR. SUAZO: Yes, sir.

HEARING OFFICER HARWOOD: All right. It'll be admitted.

(Admitted: Goodnight Midstream Cross Exhibit Number 4.)

BY MR. RANKIN:

Q. So before I leave the 746, Mr. Birkhead, I'm going to pull up Mr. Davidson's interpretation of the 746. This is from his testimony. And you've reviewed Mr. Davidson's analysis of this well?

A. Yes.

Q. I'm going to scroll down to the interval that we were looking at here. Along the depth track here, we've got the portion of the wellbore that has been perforated by XTO. That's represented by this blue bar. And then we've got -- I think this is lithology, and then his oil saturation interpretations.

Based on what we've reviewed from the mud log and the well test data, with his oil saturations largely below 20 percent, with some elevated levels, do you not agree that this is a more reasonable interpretation of this particular zone, based on what we know, based on all the data and information that we've reviewed and have available to us, including the mud log and the well file from the well test data?

A. Absolutely not. If you look at the

resistivity just above that, we see a low resistivity and we see some of the same porosities across that. We see a low resistivity there, and we see the same porosities below with much, much higher resistivities.

If you're going to choose an Rw, you can only pick one for one interval. So if that's not changing between the two sands, then there has to be a fluid difference between the two.

The fact that they flowed water out of the perforation just shows that it does have porosity and permeability and that it should have the same resistivity as what the above section does.

Q. So that's your basis for believing or taking the position that his is not as reasonable an interpretation as yours?

A. He's not following the data.

Q. And the specific data you're pointing to is the resistivity curve?

A. The resistivity and the porosity.

Q. Now, going back to your testimony, you did choose to select a portion of the 746 log to highlight in Exhibit L-20, right?

A. Looks like I did, yes.

Q. But you didn't choose the portion that we were just talking about, right?

A. I was mostly focused in this description on the upper part and looking at the difference in tops. So that's why I chose this part.

Q. Okay. So this portion was selected not necessarily to address the oil saturations, but to show the tops?

A. To show the tops and how the difference in interpretation between, yeah, like I said, the low and high. And it does have Dr. Davidson's interpretation on it as well. So yes, that was the main purpose.

Q. Just so I'm clear, because I don't think I quite understood it and I didn't ask you before, what is the Swt?

A. That is the total water saturation. That's the one that we're using to calculate the oil saturation.

Q. Okay. And the difference between Track 20 from Track 19?

A. Track 19 has a calculated Swe from IP. The only reason I included that is because Dr. Davidson never explained what his Sw was from. He never explained whether it was total or effective, so I included my calculated effective just as a comparison.

Q. And, you know, we talked about this from the mud log portion that we looked at for our interval,

but, you know, I think in this previous slide or one or two slides above, I think you included some excerpts or a page which is from, I think, Mr. Melzer's ROZ cookbook, which identifies potential indicators of an ROZ, right?

A. Yes.

Q. I mean, the lack of fluorescence and no cut in the mud log, how does that fit into Mr. Melzer's ROZ cookbook?

A. It's a checklist. It's not an absolute thing. But it doesn't -- those things are indicators and is positive indicators in his checklist.

Q. So a lack of those things would be a potential negative indicator, right?

A. Not necessarily.

Q. I guess, trying to use the language, it's a potential negative indicator. Not necessarily doesn't mean it's not there.

A. It's a neutral indicator.

Q. A neutral indicator. Okay. I guess that's fair, because almost everything on Mr. Melzer's chart seems to suggest you find ROZ somewhere, right? So there's very few things that say negative, right?

MS. SHAHEEN: Objection to Mr. Rankin testifying.

THE HEARING OFFICER: It doesn't seem like a question.

MR. RANKIN: Yeah, that's fair.

HEARING OFFICER HARWOOD: It's more of a comment.

MR. RANKIN: That's fair. I'll have a chance to talk to Mr. Melzer about it in a little bit.

BY MR. RANKIN:

Q. Going back to your testimony, you suggest here that, and I'm going to talk to the first highlighting here, that, "The testimony from Dr. Davidson's deposition clearly states that they did not look into uncertainty."

Why do you say that? What's your basis for that position?

A. I would have to go back and look at the quote, but that is one of the things I looked at that he said he didn't look into. So I'd have to go back and look at the -- re-read that to find the quote.

Q. You didn't have a chance to really look at his rebuttal testimony, did you?

A. Not very long, no.

Q. Now, the next one here, on the same page, this is Page 9 of your testimony, "Regardless of the

San Andres, the agreement of oil saturation in the Grayburg clearly suggests successful migration through the San Andres at a minimum, and at other levels, reservoir storage, pre-(natures) waterflood."

Are you suggesting here that oil migrated from the basin through the San Andres into the Grayburg?

A. I'm saying it's very likely.

Q. Is it your understanding, based on the system here, that the -- so you think oil migrated through the San Andres into the Grayburg? That's your understanding of the migratory pathway?

A. That's not -- it's a complex path. So it migrated through the San Andres and also up fractures, faults and other fairways to get into the Grayburg. So there's multiple pathways, from the Wolfcamp oil into that system.

But yes, there's nothing in the way to keep the oil from migrating from the San Andres to the Grayburg.

Q. Very good. Yeah, I'm going to move on to the last bit of my examination of you. And I want to talk about the 520, the North Monument Unit 522 well.

Okay. I think it's Paragraph 26, you say that, "The NMGSAU Number 522 does show residual

(ROZ level) hydrocarbons in all different slopes presented in the plot. This means that whatever rock type exists, there can still be an oil saturation greater than twenty percent."

Did you review the well file for this well?

A. I have, since I wrote this.

Q. Okay. Yeah, that was my -- you anticipated the question.

So at the time you conducted your analysis and prepared this testimony, you had not reviewed the well file, correct?

A. I had not.

Q. Okay. And at the time you prepared your testimony and this analysis, had you reviewed the drilling records?

A. I looked for everything I could find on it at the time. I think since then I've looked at the OCD records and found some things that I hadn't seen before.

Q. Okay. Did you review to see if they production-tested the interval that you're referring to in your analysis --

A. Yes.

Q. -- subsequent to this testimony?

A. Yes.

Q. Okay. But at the time of the testimony, you had not?

A. No, I believe I had done, too, that part of it.

Q. Okay. And you're aware that the operator went back and they tested 100 percent water?

A. Yes.

Q. Okay. And where the core was showing as high as 60 to 70 percent oil saturation?

A. Yes.

Q. Yeah. And that's the core, right?

A. Yes.

Q. Yeah. Now, and that was conventional core, right?

A. Yes.

Q. Yeah. And now you're saying that the core is the lowest the saturation could be, so those numbers should be higher?

A. I would say that there are special circumstances where that's not true. I know where you're going with this. I mean, we know where each other are going with this.

Q. Yeah, okay. So yeah, you become aware that Apache has now tested that interval and immediately

abandoned it, right?

A. Yes.

Q. And they've set a bridge plug and they've moved back and they've not pursued that zone?

A. Yes.

Q. Okay. Now, before I let you go, Mr. Birkhead, we talked a little bit at the beginning and you told me you've only just done a cursory review of NuTech's analysis, but is it your opinion that what you did, your analysis, is different than what NuTech did?

A. My analysis, the purpose was to establish a range of oil saturations across the interval that were reasonable for what is equivalent to a P10 or P90 evaluation.

So the purpose of my evaluation was totally different from what NuTech's was. NuTech has their own petrophysics method. There's more than one way to skin a cat. Just because they use a different method does not necessarily make it wrong. Is it the way I would have done it? Maybe not.

Q. Okay. But, I mean, you told me that you weren't aware or didn't know, but I'm just going to represent to you that if they had calibrated their log analysis to water saturations in the 679 core, that's

not what you did, right?

A. That is not what I did.

Q. And you haven't evaluated the inputs or parameters that NuTech used in its analysis, right?

A. Not in detail.

Q. Okay. You know that they use varying m and n values?

A. I know that -- I believe over different zones, they use different m's and different n's.

Q. Do you know, are they the same m and n values in the same zones and the same variations that you used?

A. I don't think so.

Q. Yeah.

A. I think in some, they probably match. Because the 2.3, I believe they used in some of it, based on that four-county study. In other areas, they were probably going to vary a little bit.

Q. Yeah. I mean, they only use the four for different m and n values, right?

A. It could be. I don't remember that. I don't know the exact number they used.

Q. So you referenced that study and you recall that -- do you recall that there were only four different m and n values?

A. Well, you mentioned earlier -- I did read that, and you did mentioned before that that they used 2.3 from that four-county study. When -- yes, I am somewhat familiar with it.

Q. And because of the different parameters and different inputs that NuTech used than what you used, that would lead to different interpretation methods?

A. The different methods lead to different methods, yes.

Q. Yeah. I guess this is one other thing I wanted to touch on before I do let you go. I apologize.

Here in Paragraph 32, on Page 12, you say, "In this study" -- your study, right? When you say "In this study," it's your study, right?

A. Yes.

Q. Okay. -- "it is rare to find the San Andres capped by an anhydrite or anhydritic dolostone with no porosity that would significantly baffle the flow between the San Andres and Grayburg."

Did I read that right?

A. Yes.

Q. Okay. And when you say the San Andres and Grayburg, you're talking about Ops Geologic San Andres top, right?

A. I would say either. But in this case, I was talking about Ops Geologic top.

Q. Okay. Have you identified any evidence confirming communication between Goodnight's disposal zone and the intervals above?

A. Looking at the petrophysical logs, the fact that there is a continuous -- an ROZ above and below the sequence boundary, I would say yes, there is quite a bit of evidence that there's some communication between them, from a log perspective.

Q. I'm confused, because I thought this was a different ROZ in the Lower San Andres. Are you saying that there --

A. We never -- we never talked about that. We've been talking about the ROZ in the San Andres.

Q. Hmm. Are you saying that this is one continuous ROZ?

A. I'm saying there are different elements, that one is -- as Dr. Melzer will talk about, the way that ROZs are positioned are different. But yes, there can be two stacked ROZs.

Q. In this case, is your interpretation that from the Grayburg down through to the base of the San Andres is a single ROZ?

A. I don't know enough to say that. They could

have undergone different parts of Nature's Waterflood.

Q. Okay. Were there different -- I mean, I'm confused, I guess. What do you mean by "different parts of Nature's Waterflood"?

A. I don't know. I'm not -- from a log perspective, there is a continuous saturation of hydrocarbons from the top of the San Andres, and then in the Grayburg, the saturations increase. That would lead me to believe that there's a continuous batch of hydrocarbons from the San Andres to the Grayburg.

There was nothing, however, to indicate that there was a boundary or a baffle or a testable barrier between the two that would seal the San Andres rock from the Grayburg.

Q. This is Mr. Bailey's Exhibit K-12, and I'm looking at it, it's a cross-section. And I'm trying to figure out how this shows that there -- with two of these logs that were included in this cross-section, I don't see any indication of continuous oil saturations in at least two of them. Do you agree?

A. Let me see. Well, there's at least one of them where the interpretation doesn't continue up into it. Let me get situated with the curves. Can you zoom in to the tracks, look and see what the track names are. So SOL is on the right.

Okay. You can zoom back out now, please. You've included almost no part of the Grayburg above it. But yes, there's some area above the immediate Grayburg where there's not oil saturation in that point.

Q. Just to be clear --

A. We may be disputing the definition of "continuous."

Q. Mr. Birkhead, this is your -- Ops Geologic's exhibit, not ours.

A. It's Ryan's, so I have the ability to ask for you to zoom in, please.

Q. No, no, I know. But I think you said -- I thought you were saying that we had cut off some part --

A. No, no. I'm just saying that if you're trying to make a point with this, there's at least one well that doesn't have any Grayburg interpretation in it.

Q. Okay. I guess I'm interested in what is potentially the disposal zone here, and I'm not seeing continuous oil saturations through the disposal zone.

A. Can you please define the disposal zone?

Q. Lower San Andres.

A. Your question was about the San Andres

Grayburg. So this is a change in direction.

Q. Well, okay. I guess I'm wondering how you're seeing continuous oil saturations down through the San Andres.

A. In several of the logs, that's what we see. There are areas that are not -- there is no ROZ where the saturations are not as continuous, and others where they are.

I was not submitting that the Lower San Andres, the Upper San Andres and the Grayburg were all connected.

MR. RANKIN: Thank you. No further questions, Mr. Examiner.

THE HEARING OFFICER: Thank you, Mr. Rankin.

So, Mr. Moander, you're up if you have questions.

MR. MOANDER: I have no questions for this witness, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Mr. Beck.

MR. BECK: No questions.

HEARING OFFICER HARWOOD: Mr. Suazo?

MR. SUAZO: No questions.

HEARING OFFICER HARWOOD: All right.

Mr. Rozatos, or whoever wants to go first on the Commission.

CHAIR ROZATOS: I actually do have a few questions. Commissioners, if you don't mind if I start? Thank you.

EXAMINATION BY THE COMMISSION

BY CHAIR ROZATOS:

Q. Thank you again, Mr. Birkhead. We appreciate it. And thank you for waiting patiently this morning.

A. I understand.

Q. We appreciate all that.

In a cross-examination with Mr. Rankin, remember you were talking about the resistivity between the rock and the oil and the water?

A. Okay.

Q. You made a statement that kind of piqued my curiosity. You were talking about how oil has infinite resistivity and how you can tell how much oil is in by the amount of resistivity that you see within -- through the porousness of the rock and what resistivity is coming through with oil, water, rock, et cetera.

You stated the equations are sensitive enough to distinguish oil and rock, high resistivity rock. And it was an Exhibit L-26.

CHAIR ROZATOS: Ms. Hardy or Ms. Shaheen,

can you bring up L-26, please.
BY CHAIR ROZATOS:
Q. Just to refresh your memory.
A. Absolutely.
Q. My question is just going to be, can you just please -- I am by no means a petrophysicist, nor a geologist, nor a hydrologist. So once they bring it up, if you wouldn't mind just kind of walking me through that.
A. Sure. Happy to.
CHAIR ROZATOS: And just as a reminder, Ms. Hardy, it was L-26. And thank you for bringing it up for me. No, please. I caught you off guard.
THE HEARING OFFICER: Mr. Rankin, maybe you could bring it up. The two of you could duel.
CHAIR ROZATOS: I think Ms. Hardy has it.
MR. RANKIN: Okay. I'm more than happy to help.
CHAIR ROZATOS: L-26. So we were focused -- Ms. Hardy, if you wouldn't mind just zeroing in on about the 4800- to 5200-foot depth. That was where Mr. Rankin was at. A little more. There you go, right about in there.
BY CHAIR ROZATOS:
Q. Could you just explain this one for me, as

well, please.

A. I'll do my best. So if you take -- let's say you take a block of rock, just a cube of rock, and try and get the resistivity of that. The resistivity is going to be extremely high. It's solid rock, no empty volume inside of it.

You start adding a little bit of empty volume to it and you put oil into it, it's still going to read an infinite resistivity.

The only way you can start telling if there's -- the only way to add any conductivity to the rock is to start adding something that is conductive, such as saltwater.

So the resistivity tool is looking for a way to make it through the rock to the other side. So it's actually applying an electric current going through the rock and being measured on the other side. When you look at the resistivity compared to the resistivity of a water filled -- the resistivity of the water itself, you can start getting an idea of what the saturation of the water versus the other side of the component is, the other side of the pore space, which would be oil or gas or something like that.

So what you need is a conductive element to go through it. How you correct for the rock

effects is because the resistivity is going to -- the conductivity is going to go through the pore space, not just the rock. We're going to see the conductivity go through the most conductive areas.

We use things called saturation exponents and cementation exponents. This is the n and the n we've been talking about this entire time. One of it -- what the n is related to, basically, how much the resistivity can vary between Rw and the true formation resistivity and what saturation you have.

The n is basically how connected up the pores are. So how much of a straight line they're in. So if you're in a straight line, your n can be very low. If you're in a very complex pore network, like this, it can be just crazy. And you can get up to really high values, like 4 up to 5, on the n. Where, typically, they're between like 1.6 and 2.1 or so.

Q. Okay. And I get that those are coefficients that you're using. In here, and on what we're looking at on the screen, you stated that the dash lines are clay, correct, the green dash on the far left?

A. Yes, sir.

Q. Okay. So you have some clay down there. And just help me -- let me just take one more step back. I apologize.

This is a core that you've taken out of and you're doing resistivity on it?

A. I'm sorry. That's a great question. This is actually a borehole that we dropped tools into to measure the resistivity.

Q. Got it.

A. And do all of the measurements on.

Q. Okay. So that's how you're seeing this graph.

A. Exactly.

Q. Got it. Okay. I'm back with that one. Okay. Thank you for explaining that one. I appreciate it. And that was, I think, the part that I was missing, that this is happening down a borehole at some point.

A. Yes.

Q. And can you just explain to me as what you just here at the very end of your cross-examination with Mr. Rankin, you said that there's a continuous oil saturation from the Grayburg down to the San Andres. And I may have missed something somewhere there. Could you explain that one for me?

A. So, I wasn't sure quite where it came from either, because I don't recall it coming up in previous questions exactly, the continuity of the

Grayburg to the San Andres.

But if you look at the Grayburg section, where it is interpreted, where I've shown that Dr. Davidson's interpretation is similar to mine, it's showing an oil saturation.

Q. Okay. So that's what you're doing. You're looking at both of them, yours and the doctor's?

A. Yes.

Q. Awesome. No more questions for me. Thank you.

THE HEARING OFFICER: Commissioner Lamkin, you want to take the next questions?

COMMISSIONER LAMKIN: Sure.

EXAMINATION

BY COMMISSIONER LAMKIN:

Q. Good afternoon, Mr. Birkhead. Thank you for your testimony. I think I just have one question.

So, on all the wells that you had petrophysical data on, through logs or whatever, did you utilize that data from every single well to backstop your m and n values across your modeling?

A. So, the only -- so, no. What I had was the core data to calibrate to. So, core data and literature.

I'll put it this way. The Rw, the m and

the n are knobs. If you have data for one, you can vary the other two. If you have data for none, you're pretty much hung up in having to model things to calibrate to what the real data you have, which in this case is the core saturations.

So, we have indications of what the Rw should be from the wireline logs, where we have the low resistivity and the porosity. We don't have exact cases of m and n except from literature.

From n, we have even less than that. So, the n was varied to fit the -- to calibrate to the core data low and high case.

COMMISSIONER LAMKIN: Thank you.

THE HEARING OFFICER: Dr. Ampomah.

COMMISSIONER ROZATOS: I just have one question to follow up with that.

EXAMINATION

BY CHAIR ROZATOS:

Q. I'm having difficulty now with the m and n being potential knobs. I know that that was just an illustration, but now try to help me understand how you're adjusting these numbers. Because it kind of now sounds like you're fitting these numbers.

A. Part of what this is, is realistically a fit to the core data. We're calibrating the core data,

calibrating to the core data. The core data is a fit. That's the data that we're including into it that we're integrating.

So what we're doing is we're using -- what you would normally do is use a was -- let's see, resistivity versus -- or Sw versus porosity. Just trying to remember what the picket plot is at the moment. Whenever you change any of the values, m or n, all the other values change, too.

So we have one value we can absolutely tie to, and that was the Rw, and which does vary per well. For the m and n, if we changed Rw, then what we're going to need to use for m is going to change, too, what we're going to use for n is going to change a little bit, too.

So we do calibrations to the core data because that's what's considered to be a good petrophysical model. And we don't have -- and the important part is, we do not have measured SCAL data, special core analysis data, porous plate pressure, cap pressure data, to show us what the m and n actually should be.

If we -- when we get that data, if we have that data, we could easily tell you what the m and n would be and how it would vary across the

reservoir.

Q. Okay. So, in theory, there are wells out there that have that sort of data so you could get a more concrete m and n?

A. Yes. If we could find more data that had that SCAL information for the n, it would be more important. The n is wettability. Wettability is important, which is on a field-by-field basis, and that would change per field.

Q. Okay. So just so I get it straight, we did not have that sort of data with these wells that you wrote your paper on -- or your equations on, and so the m and the n are more variable?

A. They are variable based upon the literature and based upon the calibration of the core data.

Q. Okay. Thank you.

A. Yes.

THE HEARING OFFICER: Dr. Ampomah.

EXAMINATION

BY COMMISSIONER AMPOMAH:

Q. Thank you. I do have a couple of questions for you.

A. I thought you might.

Q. Probably have like four pages or something like that. Just kidding. Okay.

You know, you have analyzed quite a number of logs within the area that we are focusing on.

A. Yes, sir.

Q. Let me ask you, do you know that the San Andres Formation that we're dealing with, mostly if I look at the logs, mostly the Lower San Andres, it's more or less classified as an aquifer? Have you heard about that?

A. I do think the majority of the San Andres ROZ is closer to the top. But there are definite indications throughout the few logs we had going through the Lower San Andres that an ROZ is there.

Q. Now, I'm just saying that, have you heard that the San Andres, the Lower San Andres, has been more or less assumed as an aquifer?

A. Oh, that is my impression.

Q. That is your impression?

A. Yeah.

Q. I keep on going back to this. Maybe this is the first wells that we are probably dealing with. But let me ask you.

So, within this ROZ, let's say the San Andres that we're talking about here, do you believe that, let's say, these higher numbers that you

are interpreting, you know, based on your analysis, it's really more or less -- if these higher oil saturations are more or less realistic, would you believe or would you agree that XTO or any other companies would probably not drill water wells within these areas?

A. I would assume that they have done the research to know that it's residual oil and that it's okay to do that. But I can't look into -- I haven't looked into the past to see what the case was, so I can't speak to that.

Q. And we will come to the log that you have went back and forth with Mr. Rankin and then our Chair where you are predicting more like, let's say, significant amount of oil saturation, about 80 percent, 60, 70 percent, you know.

You know, so if you use that as an example, I mean, with that amount of oil in there, who is going drill a water well through that?

A. That is in porosity. That is about 4 percent. That is not going to flow under normal conditions.

Q. Okay. We'll come to that one.

COMMISSIONER AMPOMAH: Let's go to L-15, if you can bring it up. L-15. I do have some

questions. Just a quick one. L-15. Yeah, right there.

BY COMMISSIONER AMPOMAH:

Q. Okay. So you more or less utilize this to estimate your high and then the low. So with this, maybe I missed it, can you explain to the Commission how the corrections were applied, especially to the higher?

A. Absolutely. So it was a -- because we don't have a good depth shift on the core and an actual gamma ray to go along with it to do a fine-tuned depth shift, cross-plotting on this is going to be highly suspect. So a lot of this was visual.

Looking at the minimum -- what we know as the minimum possible oil saturation from the core, these are the results of that. So these are the log curves placed on a cross-plot. So this is not the core data.

But then so I matched the low case to what the minimum possible oil saturation was and it was more like the maximum of the minimum, is what I matched it to, understanding that it would be a further correction for the lost oil.

Q. So this one, it's not based on the core data?

A. No, that is not the core data that you're looking at. That is the wireline data.

Q. That's a wireline data?

A. Yes.

Q. Do you have any estimate to show us, you know, the data that you actually used to establish the correction factor or the correction equation?

A. If we can go back to my talk from this morning, I can show that plot, if that's -- I believe it was the third or fourth slide.

CHAIR ROZATOS: If you guys are going to have conversations, remember we need to have the microphones on, but the conversations should be coming through the hearing examiner.

MR. RANKIN: Mr. Examiner, Hearing Officer, the conversation I was having offline with Ms. Shaheen was simply, I think it's a plot that was presented in a summary presentation that we hadn't yet seen. So I just was asking Ms. Shaheen if she would, at her convenience, share the presentation so we had a copy of it.

THE WITNESS: I believe it's Slide 9.

MS. SHAHEEN: We're happy to share that with you.

A. So if we look at this, it's 679, and you'll

see from the green dots on the left-hand side that there's spots where the core saturation matches and doesn't match; that my lower case saturation is in red, the core uncorrected oil saturation is in green.

And yeah, there's definitely going to be parts where it doesn't match well, and others that matches very well, especially in the Ops Geologic area of the San Andres.

So what I did was, looking at the core oil saturation, matched it to the maximum and the minimum data to show what the -- to the top of the low case. Because this does require a variable n and variable m.

The correction that I applied is in the next track over, in Track 10. And that correction shows just about a maybe 10-unit, maybe in 5-unit, in cases, correction. So the correction I plot is actually very minor to this, only resulting in a change in average between the cases of about 30 to 40 percent.

And that correction was done using the B sub o of 1.3 and the Egbogah calculation from, I believe, 1988 that's in my references. But it just uses a calculation for fluid loss and as based on the B sub o.

Q. Okay. Yeah, and I'll come to the m and n. But, essentially, so the output of the correction factors will be, is it the m and n from this? Like, let's say, from 9 to 10, what were the transformation factors?

A. So from 9 to 10 for the core data or --

Q. Yeah, from the core data.

A. From the core data, it was an equation. It was an equation based on the B sub o, and it was an equation by Egbogah from 1988 or so. I can show you that equation. It's a simple linear -- it's a simple rule-of-thumb equation, similar to the one Dr. Davidson used.

Q. Yeah, and that equation will give you --

A. It gives you about a 5 to 10 percent difference in oil saturation.

Q. Okay. And you --

A. And so n was varied in order to go from one case of saturation to the next case of saturation. That would be from a non-linear -- we're going from a linear to a non-linear model on n. But both were varied.

Q. Okay. Thank you for that. But I thought from the earlier testimony, probably -- I don't know if Dr. Lindsay touched on that or probably -- or Ryan

touched on that or not. But it sounded to us, I think probably Ryan talking about you use analogous data from somewhere where they applied the squeegee saturation measurement to help establish that when you --

A. Yeah. So I reviewed that. That was not -- I did not make just a bulk calculation based upon that paper from Seminole Field. I actually used a calculation from the '80s that was specifically meant for residual oil.

Q. So not just necessarily the Seminole Field?

A. Right. So it was -- I'm not sure -- I mean, they used corrections from taking conventional core all the way to a sponge core, and that was their correction.

I don't know what their exact environment was like and what our environment was like at the time, so I had to go with more of a rule of thumb. But when I looked at both, they're fairly similar. I think ours is a little more conservative.

Q. Yeah, thanks for clarifying that, because I had a little bit of a concern on that one.

So based on the cross-examination from Mr. Rankin, it sounds like there's another company, NuTech, that did another petrophysical analysis. And

I'm sure probably we'll have the opportunity to get to that. But let me ask you, what are the main assumptions that you utilize in your analysis?

A. The main assumptions that go into this is how much above the minimum oil is actually the right amount.

Q. How much minimum oil?

A. How much above the minimum oil we see in the core is the actual amount. Because that is what is variable, is the high case, low case. So we know there can't be less than what we measured, but we know there can be more.

Q. So on that L-15, if you remember that, where you used the log data to plot, to establish your low and then the high, I presume there was mud log data that came with it.

A. Absolutely, yes. And Mr. Rankin covered that.

Q. Yes. Where there gas shows or fluorescence, you know, in most of the mud logs that you reviewed?

A. In the ROZ --

Q. Yes.

A. -- in the Upper San Andres, there certainly was. In the lower San Andres, there were minor gas shows that, admittedly, could have been recycled gas.

Q. Okay. So let me ask you this one one more time. You know, in your experience, you know, have you seen any play where the estimated oil saturation is about 50 percent, and even in some places about 60 percent, and oil is still immobile?

A. We usually have pay cutoffs that are higher than that. But yes.

Q. So is your testimony that --

A. I'm sorry. Please go ahead.

Q. Okay. So is your testimony that there are wells where the saturation is about 60 percent, but they still do not -- it's still not mobile?

A. Yes.

Q. Do you have a reference to some of these?

A. If you look into some more of the unconventional plays, where there's a lot of tighter porosity around 4 percent, if you get into tight sands that have oil, a lot of times we have -- I've been -- let's see. Peregrino, in Brazil, clastic sand, heavier oil, similar to what we would see here, needs a water -- is definitely immobile at 60 percent.

Q. Okay. So I asked the question wrongly. So I'm talking about a conventional play, not unconventional, where, let's say, saturation can go about 60 percent and still the oil has not reached the

critical oil saturation to move.

A. If we're looking at relative perm, we look at the core data that was given to us from the 679 or from the RR Bell, one of them shows that there are high saturations, about 60 percent, in the lower porosity rock. Do we usually see that in conventional zones? We're not usually looking for that, because the zones we're looking for are usually higher porosity than 4 percent.

So it does happen, but usually I'd say the migration pathway is going to go mostly into the porous rock.

Q. Do you know the type of -- in your previous answer, you talked about different types of oil that could probably result in that.

A. Yes.

Q. But do you know the type of oil we are dealing with here?

A. I know that it's residual and probably a low API oil. I do not know exactly what it is.

Q. Yeah. My next one was, do you know the API?

A. Nope. No, sir, I don't.

Q. So this is a carbonate, right?

A. Yes, sir.

Q. So would you agree that probably started

with, like, let's say, oil-wet reservoir?

A. I would say, assuming it's a water -- mixed wettability to an oil-wet reservoir is a very easy assumption to make.

Q. And then there's a high possibility that it can transition to, let's say, mixed wet, with all the flushing that is going on?

A. Oh, yes. Yeah. I'm just saying that there's a range towards mixed wet to oil wet. It's a range of data. So it's a range of -- it's a range of possibilities between the two.

Q. So is your testimony that the rock that we dealing with, the system that we dealing with, is probably mixed wet?

A. No, sir. I'm saying it's somewhere between mixed wet and oil wet.

Q. Okay. Certainly you have a lot of experience, so help me here.

COMMISSIONER AMPOMAH: Let's go to EMSU 679, so probably Exhibit L-25, if we can share that. L-25. Yeah, let's scroll down to the San Andres bottom. Okay. Right there.

BY COMMISSIONER AMPOMAH:

Q. So on Track 7, the core data points, will this be the transformed -- would they be the

corrected?

A. Those are the uncorrected.

Q. This is uncorrected?

A. I would have to see the header, but I believe those are the uncorrected.

Q. I thought all from there on was all the analysis, the final analysis that you did.

A. Well, I still often show the raw data and the not. So that is the -- that would be the uncorrected.

Q. Okay. So which one is the corrected one? Because I don't want to --

A. The corrected one is not on there.

Q. The corrected one is not here?

A. No. That is not on this plot.

Q. Yeah, so then can we go back to that one? I think, yeah, we showed that.

A. Yes, in the plot that I just showed a few minutes ago, that was the 679.

THE WITNESS: If we can go back to that. That's in the PowerPoint, please.

BY COMMISSIONER AMPOMAH:

Q. And we'll still come back to one more here.

A. Sure. This is it.

Q. Yeah, okay. And thanks for clarifying that,

because I was going to use the uncorrected one.

Yeah, so if you look at Track Number 10 -- so then let's start with 9. So what were the m and n values that got you to 9, if you can share with us?

A. They were variable. So, the m varied between 2.3 and I believe around 4 or so. The n would have varied from around 3 to upwards of 9, based upon the porosity.

Q. You said the m will vary from --

A. A 2.3.

Q. The m will be 2.3?

A. And it uses the Focke and Munn equation for it based on permeability range. So I think it goes up to around the high 3s, low 4s.

Q. Okay, 3, 4s. And then the n?

A. The n was an algorithm I developed based upon the core calibration, which is from a -- it goes from a little bit over 3, I believe, to around -- not between 9 and 10.

Q. Well, so you said you have a reference where the n value can go to 9 or even probably 20?

A. There's references that show that going over 20. I'm not saying it does that here. I'm just saying that there's references in the world. There's

rocks in the world that do that.

Q. Well, in my formation evaluation class, I guess probably I thought that the n value should be probably 1.8 to 2.5, and commonly, probably 2.3 is what people have been using a lot.

A. Then we have to add a lot more oil to this, would be the result. If we used an n of about 2.3, we would end up with a booming reservoir that's 90 percent oil saturated.

So we have to raise the n, as is suggested by literature, in mixed- to oil-wet systems in order to pull the saturation down to the residual levels.

Q. So that shows that without more or less measuring the m and n -- I mean, let's say if you use more like the common numbers that we are more or less accustomed to, then that makes it much easier. Because I do know that, okay, these are the typical values that are being used.

But going extremely high, it's just established the uncertainty associated with, let's say, these numbers without any proof, like you were talking to the Chair about, you know, any proof with regard to what is the actual m and n value.

A. The n value did use something from

literature, a variable, and did use the 2.3 from literature in the four-county study used in the San Andres.

So I actually decided to make it a little more conservative and vary the m, as in Mary, above 2.3.

Q. So let's look at the Track 10. Starting from the bottom of the Grayburg, at the bottom, so let's say where you have -- is it 39? No, probably just on top of the 4100.

A. Yes, sir.

Q. And then so probably 40, 50, where we have the core.

A. Yes.

Q. Yeah. Right there, I think on your 10, I can see that there's a lot of improvement in the match, but certainly it's not a hundred percent.

A. Absolutely.

Q. Yeah. But I can see that there's a lot of improvement there. Now, so right on the top there, we do have -- how would you classify that? Is it a water zone, right on the top, like let's say probably 40, 50, all the way to, let's say 4100?

A. I would suggest that that is likely to be cores that have been -- had more fluid expulsed from

them. I would also suggest that Goodnight agrees with me, because they're getting the same saturation that I am.

Q. So then probably the 40, 50, maybe would be a water zone.

A. The 40, 50 would be -- all of these would be mostly water, they would flow water. Would it be 100 percent water? No. But not based on the resistivity and the porosity and the calculations from both companies.

Q. Okay. And once we go down, I'm just looking at the resistivity log and then also comparing to, let's say, the water saturations that we are seeing.

A. Yeah, totally copacetic. But yeah.

Q. Okay. So let's go to 4200 all the way to, let's say, 42- -- the distance between them is 20, 20, or -- I think it was 20, 20, right? Each box going down is 20. Okay.

A. Each one is 20, yes.

Q. Each one is 20, okay. So then let's look at 4200 all the way to, let's say, 400 and -- 425- -- no 4280. So 4200 to 4280.

A. Yes.

Q. On your Track Number 10, this one would be -- how would you describe this formation?

A. I would describe this as a residual zone as well as Goodnight does.

Q. And that is clearly shown also -- on the core --

A. Yes.

Q. -- that is clearly shown?

Now, my tough question to you is, how much of this will be recoverable?

A. I am not -- given that we're going to do -- that there's a plan for a CO2 flood, I am not -- that's a question for someone else that that is their specialty.

Q. So as part of this here, and are we going to hear from another testimony to tell us with all the numbers that have been estimated, how much of it is going to be movable?

A. Yes, sir. We've made note of your question over the past. We're very aware of the question. We will make sure it gets answered.

Q. And I'm also -- so I do see that there's a strong simulation that is coming up, right? So there are relative perms that we're utilized in that, and I hope that also will more or less match up to, let's say, whichever oil that could be moved. So the simulation --

A. So, Doctor, I would say that we have not had the opportunity to -- we don't have relative perm data from here.

Q. Yeah, but there was a history matching.

A. Yes. And that will be spoken to at length.

Q. Yeah. So definitely I want to see the relative perm that was used for the history matching.

A. Absolutely. I'm just clarifying it. I apologize.

Q. Okay. I appreciate that.

It sounds like you included mineralogy in your porosity and in all the calculations.

A. Yes.

Q. Now, let me ask. So with the m and n values that you used here, especially I think the m value is more or less typical, the one that you used, but the n, you said, has a broader range.

Did you check with, let's say, the other fields in that area, you know, did you check with other fields in that area to see if there could be any analogous numbers that might have been used and established in the area?

A. I do have colleagues that have worked the San Andres in other areas that have used variable n's that are similar that are -- that can get pretty high.

I'm not sure of the exact statement, but the fact that a variable m and n is needed is a well-known factor.

Q. Okay. Can we go to L-22. There you are showing the core. You are showing the Kv, so I want to know if this one is based on a core or is based on some type of calculation. L-22.

Yeah, so on the left, or it's on the right, would this be a core or is a --

A. That should be -- I'm sorry. I'm predicting your answer -- I'm predicting your question.

Q. No, I already asked it of you. So you can probably proceed. Thank you.

A. So it is a core -- it is a measured core.

Q. And the measured core measured the Kv?

A. Yes, sir. Those are individual measurements of, I believe, like, full diameter samples.

Q. You know, how is this -- and it's good that they mentioned the Kv.

A. Yeah, it's amazing.

Q. Yeah. So how would this compare to the typical one, where when we are doing simulations, we start with, like, let's say, .1 of the Kh?

A. So I know for reservoir modeling, they often use .1 in a lot of reservoirs, including clastics. And I always have a little bit of a hinky -- a little

bit of a weird feeling about it. So I think in this case, I would definitely make it something better than .1 with the Kv, especially.

Q. Okay.

A. With the Kv/Kh ratio.

Q. Okay. And let's just scroll to the L-25 one more time. And it would be great if you can make a note that this one is uncorrected, because when I saw it, I'm like, these are all different, different. But thanks for explaining that. So if you can take notice of that here.

But I just want to point to something quick. So the bottom of the Grayburg, I think there, we all agree that it's a water zone, just to confirm that. The bottom of the Grayburg where you have, let's say, GB-26, that zone down there, we all -- we agree that probably is a water-bearing zone.

A. All I can say, as far as agreeing or disagreeing, is that looking at the log properties and comparing the rest of the data to this, it does not calculate as being a 100 percent water-bearing zone.

Q. I didn't catch the last part.

A. Sorry?

Q. I didn't catch the last part of your response.

A. Oh, I'm sorry. I always speak too fast.

Based on the log data we have and the limited core data we have, showing that there is some oil saturation, there is some residual oil there.

What it would flow under conventional means would be water, 100 percent water with no trace of oil.

Q. Okay. Thank you. Now, so there is Seminole, there is Tall Cotton, Goldsmith in the area.

A. Yes, sir.

Q. Do you know if the San Andres that is the target zone there went through the same injection as we are seeing in the EMSU?

A. Went through the same history?

Q. Yeah, of saltwater injection.

A. I'm not certain of that. I'm not aware.

Q. Definitely Steve would probably know about that?

A. Yes.

Q. Now, so this well, EMSU 679, do you know the year it was drilled?

A. I don't recall. I did look at the dates before. I know several of them were in the '90s. I'm not exactly sure when this one was drilled.

Q. Yeah, so definitely, I do know that the core

was collected in 1990. So probably that was when it was drilled. And then also the analysis was performed in 1990.

A. Yes, sir.

Q. Yeah, that is what I have here.

Now, do you know when the EMSU RR Bell Number 4 was drilled and bored?

A. I believe that was longer ago. I believe that was an older well.

Q. Older well. Okay.

A. I could be misspeaking, but that's what I seem to recall hearing.

Q. Yeah. So you have a lot of experience, so help me here. Can you quantify the impact of the large volume of water that has already been injected into the San Andres on the present-day saturation numbers that probably we might have?

A. Depending on the affinity of the water, the chemical affinity, what's in it, the salinity, all that, it could have some changes on it. It could have some change on the saturation in the negative direction. Obviously not in the positive direction.

Q. Oh, definitely.

A. Yeah.

Q. Well, so what that means is that -- okay,

let me ask. So would you believe that, let's say, this well, 679, drilled in 1990, and with the higher levels of the saturation that are being estimated today, that had been being estimated based on the 1990 well information, probably the present-day oil saturation is not the same as this?

A. Potentially.

Q. But you are using that to estimate how much oil is in place, and you're asking the Commission to make our decision based on that. So how do we quantify, you know? Help us. Based on your experience, how do we quantify the current -- how do we even say that the current oil-in-place calculation that has been put across here is correct without taking into consideration the maximum volume of oil -- of water that has been injected?

A. Well, I would add to that, that that is going to be clearly addressed by Jim with his model.

Q. Okay. I will love that. Thank you. Okay.

Based on your analysis, I saw you've done a lot of wells here. So did you check the newer wells, let's say, any newer wells, to check the saturation changes compared to the older wells, whether consistent or probably not consistent?

A. That is a phenomenal idea. It wasn't part

of the scope at the time that I did it, but that is a great -- that would be a great thing to check, because the same petrophysical model should work either way and we should see variations from one to the other. So we would see a difference. So the newer wells would reflect current-day saturations.

Q. And now I really want to see an example of that, because then that one can tell us, you know, let's say the impact of the saltwater injection on the saturation.

I know models can do that, but real evidence -- I mean, if you have the log and it's showing these changes to establish that there's still a high level of ROZs in there, that at least helps us a lot to quantify the impact of the saltwater injection.

Do you know if any RST log has been logged on any of the older wells? RST, the saturation log.

A. Oh, as like a pulsed neutron, sort of?

Q. Yes, yes.

A. I believe there was an EPT run on the log in the north, but I'm not sure -- I'm not aware of one in the EMSU. I'd have to look back at my database to see if I have any.

Q. Okay.

A. I look at about 10 different projects a week, so...

Q. So let's go through this. Is it possible there are potential changes in the wettability system? And you clarified that. You're saying that it is between oil wet and mixed wet.

A. Yes. I'm hedging my bets and setting it somewhere in between.

Q. I thought probably you said, okay, it was oil wet, and then probably now we are mixed wet. So then, I could have posed that question, but anyway, let me still ask.

Is it possible that potential changes in the wettability system may impede the available oil saturation that has been calculated now?

A. Changes in the wettability would potentially change the saturations that we see.

Q. And can you explain to the Commission how the changes in the wettability might impact the oil saturation changes?

A. Changing its affinity to hold to the side of the pore, along with drops in pressure, can make things move. So if you're changing the geometry of the fluid within the pore, then you can make it move

out of the pore space into another.

Q. So does that mean that with a high volume of water that has been injected, you know, like the flushing, the flushing, and if there has been some changes in the wettability, it is possible that some of these oils is probably -- some of this residual oil became mobile, and therefore, probably might have been moved?

A. Within the larger porosities is where that is most likely.

Q. Okay. Now, due to the higher volume of the water injection that has gone into the San Andres, it is definitely possible that there has been elevation in the pressure. I mean, the reservoir pressure might have increased. So do you believe that this can reduce the capillary forces, thereby more or less reducing the residual oil in place?

A. Oh, that's going back a long way, the capillary forces. I would expect more that dropping the pressure in residual oil would be more likely to move the hydrocarbons.

Q. Yeah, and I'm sure probably you know where I'm going with this. So let me ask another one. Can you comment on the fact that these higher volumes of water that has already been injected into the

San Andres, probably increased the viscous forces, overcoming the capillary forces, thereby probably still reducing the residual oil saturation?

A. It is possible in the lower porosities. I would say that most of this was probably bypassed by the larger porosities where the water probably was more likely to go.

Q. So with all these phenomena that I've gone through with you, you know, based on your experience, would you say that there is quite a number of uncertainty associated with the oil-in-place calculations that have been presented to the Commission?

A. I would say there is very little uncertainty with the presence of oil. But there is uncertainty with the calculation of the oil in place. And that's why I wanted to provide a low and a high number, for possibilities.

Q. You know, so the processes that we just discussed and we went through this, you know, do you believe that -- and I think if you are able to provide to the Commission like, let's say, some analysis on the timeline with regard to other wells and then newer wells to see how the saturations are changing, probably that would clear all the doubts with regards

to that.

A. I would love that. Yeah, that would help, though. It would be excellent.

Q. You know, don't you believe there should have been a prompt response from the operator, whoever the operator was, probably when the 679 well was drilled? There should have been a prompt response to probably, more or less, try to cease any injection in the area.

Because right now, you have all this volume -- high volume of water, that probably due to other fossils that we talked about, probably might have reduced the residual oil saturation.

A. I liken this back to the shale gas revolution, where a lot of stuff back then, like if you look -- because you just -- source rock with something you drill through. You don't look at it. You see it, you see gas response, you're like, "Oh, I'm not going to produce that." Twenty years down the road, it's the thing of the day.

So I imagine, and this is pure supposition, that if someone was looking at it back then and seeing that versus something they had above them, then they probably would be not that interested at the time.

Q. So then that would be on the economics?

A. That would be on the economics at the time.

Q. Okay. And do you know we are going to listen to some economics here?

A. I cannot speak to that. I do not know.

Q. Let me check to make sure I do not have any additional questions for you.

But I'm also interested in knowing whether the Goldsmith, Tall Cotton, Seminole had any extensive water injection into, let's say, the San Andres prior to the commercialization of the ROZs. I really want to have some answers out of that.

A. I believe Steve will probably be able to cover that. And if not, I will get the answer.

Q. Okay. On the average, how would you say your interpretation is different from the one that NuTech -- I hope I got the name right.

A. NuTech, yes, that is correct. From what I can -- they have a proprietary software. I believe they use the Simandoux equation for their saturation equation, which I used for Archie. They used a variable m and n, where they used four different m's and n's, according to Mr. Rankin.

So mine was, I'd like to say, a bit more complex, looking for the ranges. But that doesn't

mean we both didn't arrive at -- that they didn't arrive at an answer that was close to the range of values that I provided.

Q. So my last question will be, you know, I went through most of the logs that you interpreted. There are some of them that are quite, like -- a number of them that you probably see that it is all water, water, water, water, especially within the Lower San Andres. Was that a trend that you saw?

A. There tended to be more water in the Lower San Andres than in the Upper San Andres. And that's where I placed -- that's usually where I discovered my Rw, was within the San Andres.

Q. Oh, within the Lower San Andres? Okay.

Thank you for your time and I do appreciate your knowledge. Thank you.

A. Thank you.

THE HEARING OFFICER: Thank you, Dr. Ampomah.

So this brings us full circle to you, Ms. Hardy, for redirect. Oh, Ms. Shaheen, sorry, for redirect.

Before we do that, I'm keeping track of time here, I guess it would be appropriate, given the audience, that I say that the Lovington Sands are

running out of our hourglass today.

Mr. Rozatos has a 4:00 p.m. hard stop. It's 3:30 right now. We need to get Mr. Birkhead done and out of here. So just bearing that in mind. Ms. Hardy, I'll turn it over to you for redirect.

And bear that in mind, Mr. Rankin, when the inevitable re-cross comes in.

I'm sorry, Ms. Shaheen. Sorry.

MS. SHAHEEN: That's okay. Thank you, Mr. Harwood.

REDIRECT EXAMINATION

BY MS. SHAHEEN:

Q. Mr. Birkhead, going back to your low case and a high case, I know you've described to me the range of possibilities between the low place and the high case -- I'm sorry, the low case and the high case. Can you provide a similar explanation to the Commission about how that works?

A. Sure. Certainly. What it's meant to represent, and I think we've already mostly covered this, is that it's the beginnings of uncertainty study.

So I'm looking for the lowest possible it can be and what is a reasonable value for what the highest it can be. So these can be considered likely

to be the P10, P90 cases. There's a 90 percent chance it's going to be at least this small -- or at least -- and there's a 10 percent chance it's going to be at least this big at the end.

So we're looking for a range of values, looking at uncertainty. You're doing Monte Carlo analysis at the end in value, when we have more data, would be obviously the next step to go through to figure out the distributions, the possible distributions of OOIP.

Q. And you also talked about, with Mr. Rankin and I believe with Dr. Ampomah, at what water saturation you would expect oil to be mobile. Have you reviewed any fields that inform your opinion on this subject?

A. I have worked several, and I think we talked about this a little bit, where I've worked in fields where the residual -- where the oil wouldn't move until you got to a saturation of, like, 80 to 90 percent -- or 60, 60 to 70 percent when you have heavier oils.

The point is that just all of these are very dependent on fluids and the lithology and the porosity. So there's a direct relationship between the porosity and the capillary forces and how easily

it'll move.

So it's just, I guess, to restate, how difficult it is to answer in one answer with one value when it's going to move, because it definitely varies based upon the facies, the properties, the fluid type, and the pore space.

Q. There was some testimony earlier about why -- or excuse, some discussion earlier about why the saturations in the core do not add up to 1. Can you elaborate on that?

A. I can. I think that was basically just meant to tie up a question from before. I had to deal with this all the time. When I first started as a petrophysicist, I was really confused when I just saw oil, water, and if it didn't add up to 1.

It's just a -- it's because we lose water, we lose oil as we go up the hole. We lose it to gas, we lose it to -- and get up to the surface, gravity, water falls out, it dehydrates, all those things.

The summation with the porosity, it never equals up to 1. If it does, it's shocking, and it's probably a pressure core. And even then, it's going to be sloshing around within the tube.

So what they typically call it, in a lot

of reports, is saturation of gas. And forever I thought -- forever, when I first started, I thought that was, like, hydrocarbon gas. Turns out it just means saturation of air. It's just whatever's not fluid. So that is why it never equals up to 1.

Q. There was also some testimony earlier about the San Andres tops and the differences between our pick of the tops and Goodnight's pick of the tops. Are you aware of any literature that addresses the top of the San Andres as it relates to the Lovington Sand?

A. Yes. Yes, I have. This goes back to the reference from Ryan Bailey from yesterday at the Loco Hills Field. We did go back to who defined the top within that paper. Turns out it was a Mr. Roy Foster, senior petroleum geologist with the New Mexico Bureau of Mines and Mineral Resources, in 1976.

So it seems in this case, the description of the top of the San Andres being about 130 to 150 feet above the Lovington Sand was made by New Mexico Mines and Mineral Resources.

Q. I'm going to make an effort to share at this point.

THE HEARING OFFICER: Again, it's the speed with which you speak.

THE WITNESS: Oh, I'm sorry.

HEARING OFFICER HARWOOD: You're definitely going to hold the record, at least so far. I'm sure the court reporter will confirm this, most words per hour.

THE WITNESS: The Micromachines commercial, I watched it way too many times growing up. So I'll repeat more slowly.

A. So the Loco Hills paper that Mr. Ryan Bailey discussed yesterday at length, discussing the top of the San Andres, the top was actually defined by -- or written about by Mr. Roy Foster, senior petroleum geologist, New Mexico Bureau of Mines and Mineral Resources, in 1976.

Q. And turning to Page 12 here.

A. It's the bottom of 12 and the top of 13.

Q. I'm sorry, bottom of 12, top of 13?

A. Yes, ma'am.

Q. Here we go.

A. So I'll just read this slowly. "The San Andres Formation, Leonardian and Guadalupian, is about 1500 feet thick in this area. The upper part is dolomite with an interval of sandstone and black shale, known as the Lovington Sand, about 150 feet below the top."

Q. And the top there refers to the top of the

San Andres; is that correct?

A. Yes, ma'am.

Q. Thank you.

MS. SHAHEEN: I would move for admission of this exhibit as K-57.

HEARING OFFICER HARWOOD: Mr. Rankin, any objection?

MS. SHAHEEN: Okay. I'm going to turn now to Figure 5 in the paper.

MR. RANKIN: No objection from Goodnight.

HEARING OFFICER HARWOOD: Any objection from OCD?

MR. MOANDER: No objection from OCD, Mr. Hearing Officer.

MR. BECK: No objection from Rice and Permian.

HEARING OFFICER HARWOOD: Pilot?

MR. SUAZO: No objection from Pilot.

HEARING OFFICER HARWOOD: It'll be admitted. Thank you.

MS. APODACA: Excuse me. We already have a K-57. I think she would be up to K-60.

MS. SHAHEEN: K-60. I will trust you on that. Thank you very much.

THE HEARING OFFICER: It'll be admitted as

Exhibit K-60.

(Admitted: Empire New Mexico Exhibit K-60.)

BY MR. SHAHEEN:

Q. And turning now to Figure 5 in Exhibit K-60, is --

A. This is simply an exhibit of what is described in words on Pages 12 and 13, the San Andres Formation below the Premier Sand, and about 150 feet above the Lovington Sand. And, again, defined by someone working for the state.

Q. Thank you. I'm going to stop sharing here and share with you a different document. This is, I believe, the mud log that Mr. Rankin used earlier, which is identified as Bates Number Empire 23614-17, I want to say, 3917, but I'm not sure here. It's the exhibit that was previously admitted with respect to the excerpt that Mr. Rankin showed earlier.

MS. SHAHEEN: And I brought it up here to show, it's the same document, a little farther up in the depths here. And I just wanted to have Mr. Birkhead take a look here, if we start -- I believe Mr. Rankin was focused on maybe 4200, 4300 thereabouts.

But if you look above and below the

excerpt that Mr. Rankin used, you can see that there are other comments, observations about the cores that are different from what Mr. Rankin was focused on. And I thought it might be helpful to start here at about 4050.

MR. RANKIN: I'll object. It's way outside the scope of my cross-examination. I was focused on a very narrow area. This is almost 800 feet above where we're talking about.

THE HEARING OFFICER: Well, all right. But I think it's fair. You opened the door.

But I haven't heard a question yet. I'm hearing testimony from Ms. Shaheen.

MS. SHAHEEN: Thank you. I have a question now for Mr. Birkhead. If he could just take a look, and he can direct me to what he thinks are the pertinent depths here as well.

BY MS. SHAHEEN:

Q. But taking a look here at the depth of 4050, there are some observations of the core here that I think are helpful, Mr. Birkhead. Can you describe those to the Commission?

A. I absolutely can. So this is one of those places where, up and within the Upper San Andres, we're seeing consistent descriptions of yellow

fluorescence and streaming cut. And, again, some lower gas along with the streaming cut, and also some higher gas along with the streaming cut and fluorescence.

So we're actually seeing, as I mentioned from the very start of whenever I started, that we have direct indications of hydrocarbons showing up throughout the San Andres.

Q. Are there any other depths that you would like for us to look at here?

A. I would probably look in the next hundred feet up to make sure that we're covering the bottom of the Grayburg and the top of San Andres. And to also see that we still have very large gas shows as we're getting into what I believe is the Grayburg.

Q. Is this good, 3900?

A. That would be perfect.

Q. Would you please describe what you see here to the Commission.

A. With this, we are -- it's not a -- they ran out of words apparently on this. But this is a sandy dolomite, with a very large gas response, and moderately calcareous. There's no cut in these. You can see that they're not always cut when there are massive gas shows. So you can have one or the other

or none of all, but it all tells a story, all the logs together.

Q. Any other depths that would be helpful for the Commission to take a look at?

A. I think that would be plenty for now. I can't think of anything at the moment. That would be it.

MS. SHAHEEN: Thank you, Mr. Birkhead.

I have no further questions and pass the witness. And just would note for the record that we will be submitting the remainder of the mud log as an exhibit.

THE HEARING OFFICER: Okay. And I don't think there's anyone to pass the witness to. We're still going to hopefully hold to the rule against a recross-examination.

MR. RANKIN: Mr. Hearing Officer, there was one segment of Ms. Shaheen's redirect that addressed mobile oil saturation that I would like to just ask Mr. Birkhead about.

HEARING OFFICER HARWOOD: Okay.

RECROSS-EXAMINATION

BY MR. RANKIN:

Q. Mr. Birkhead, on the question of mobile oil saturation, if 380 million barrels of water were

withdrawn from the San Andres in the zone that we've been discussing here with these oil saturations you've identified, would you expect that would be a reservoir character change that would likely lead to the mobilization of those oil saturations that you've identified?

A. Without any residual oil, without significant chemistry change, it would be difficult to say how much would happen if you significantly changed the chemistry of the water which is being extracted. So it's the same.

I would expect that only minimal, considering it's residual. Anything above that would just be a tiny bit of the re-added oil that Bob Lindsay talked about the first day that came out after Nature's Waterflood.

Q. I'm not sure I quite followed that. You're saying what would be --

A. Essentially what I'm saying is that there may be a little bit of oil extracted that could result in a sheen of oil on something, that if someone looks for it. But that I do not expect a large amount of the oil to move.

Q. Thank you.

A. But I think Dr. Ampomah's question was

really good about checking them out versus time.

MR. RANKIN: Thank you, Mr. Hearing Officer.

THE HEARING OFFICER: Okay. May Mr. Birkhead be excused?

MR. RANKIN: No further -- yes, he may.

MR. MOANDER: No objection from OCD.

MR. BECK: Yeah, he may be excused.

HEARING OFFICER HARWOOD: Pilot?

MR. SUAZO: No objection from Pilot.

HEARING OFFICER HARWOOD: Thank you, Mr. Birkhead. You're free to go.

MR. SUAZO: And to the court reporter, I apologize.

THE HEARING OFFICER: You kept her on her toes, Mr. Birkhead. If you ever get tired of your field, you have a great future as an auctioneer.

All right. Let's see. So it's 3:45. I mean, I don't know what we do with the spare 16 minutes. I suppose we could at least get Dr. Buchwalter sworn in, but I'm not sure it's worth it.

Your thoughts, Mr. Rozatos?

CHAIR ROZATOS: I don't think it's worth it either, but I do see that Mr. Rankin is raising his hand really phrenetically now, with a lot of

tediousness, to catch our attention.

MR. RANKIN: I appreciate that. I appreciate the attention. Mr. Hearing Officer, I appreciate that we're on limited in time.

I wanted to just orally raise this motion with the Commission at this time based on the testimony that was provided by both Mr. Bailey and Mr. Birkhead.

As you all are aware, I have previously filed a motion to strike the rebuttal witnesses, Mr. Bailey and Mr. Birkhead, only as with respect to certain testimony and analyses that they provided that are clearly not rebuttal testimony, should have been presented as part of their case in chief.

And based on the testimony that they presented over the past two days, I think that's been established, that what they presented is very different from what was initially presented on direct from NuTech and Empire's own witness, Mr. McShane.

The petrophysical analyses, the oil-in-place analyses are vastly different than what was presented initially.

And based on that, two weeks before the hearing, we have been substantially prejudiced by our ability to try to review and analyze what has been

presented. We still don't have some of the information that we would need to do so.

So I would ask at this time to renew my motion to strike the portion of the testimony identified in my initial motion or, in the alternative, to provide us the opportunity for short surrebuttal so that we can adequately review and respond to the new testimony that should have been presented on their case in chief.

THE HEARING OFFICER: I have a couple of concerns. And I don't mean to step on anybody's toes here. I'm sure Mr. Rubin has thoughts on this as well.

First of all, I'm not sure how much of what you're objecting to was covered in direct examination, and if it was, why there was no objections raised at that time, and how much it was covered in your cross-examination of these witnesses. Because if it's covered in your cross-examination of these witnesses, you opened the door to this testimony.

When you cross-examine witnesses in a way that is like doing a deposition, you often end up with answers you don't like.

Mr. Rubin, I'll pass it on to you. But

those are just my initial thoughts.

MR. RUBIN: Thank you, Mr. Harwood.

And I do echo those sentiments. We should hear from the Empire in response to the motion, especially now that it's been renewed.

And it is hard to parse out some of the testimony that would be struck versus that which would not be struck as well. That's a difficult challenge.

But I suggest to the Commission that we hear from the remaining parties on this point first.

MS. SHAHEEN: First I'll note that I believe Mr. Rankin has waived his objection here by allowing both Mr. Bailey and Mr. Birkhead to testify today without objection.

Second, I would say, for all the reasons stated in our responses to the motion to strike and the motion to exclude, this testimony should be allowed.

It's very clear, when you review the written rebuttal testimony, that the testimony is directly responsive, in Mr. Bailey's case, to Preston McGuire, who has not yet testified, and to Dr. Davidson, who has not yet testified. It's very clear that this is in rebuttal to their testimony.

Second of all, here we are on the third day, the end of the third day, and we have, I think, offered three witnesses. And it's very clear that Goodnight is going to have even more time to respond to the testimony of Mr. Bailey and Mr. Birkhead between now and the time that they offer their witnesses.

And obviously, we don't believe there's a need for written surrebuttal. But they're welcome to surrebut the testimony that you've heard today and yesterday when they are back here with their witnesses.

Generally speaking, in an administrative proceeding, the Commission would act as if they were a Court in a bench trial, and they are -- their expertise and their experience allows them to weigh the evidence and determine what is credible, what is reliable, and what should be included in their decision, to support their decision. There's no need to exclude any evidence.

And in fact, I'll just refer to one case. And it is an unpublished opinion, but I believe that it's perfectly suitable -- or applicable here. It has to do with a proceeding before the Water Quality Control Commission. Let me see if I

can find it here relatively easily.

I'll describe it generally until I can find it. In that case, the Court of Appeals recognized that the Hearing Examiner did exactly what was appropriate in the instance. She allowed all of the expert testimony in, and then the Commission weighed that testimony and decided what it should be relying on. And that case is cited in our papers.

Finally, Goodnight is not prejudiced. They argue that they're prejudiced because they've had no opportunity to depose the rebuttal witnesses' supplement expert reports, or otherwise file a surrebuttal.

They cite a number of cases that are completely in opposite to what we're doing here today. One is a criminal case where the rebuttal witness was never disclosed. Another is a civil case where the rebuttal witness was never disclosed.

So they've cited nothing in support of their position here today. We believe the motion should, therefore, be denied.

THE HEARING OFFICER: Mr. Moander.

MR. MOANDER: So OCD is not picking a side on this issue, but to maybe flesh this out a bit more, I think it's an inaccurate statement to say

that Goodnight didn't actually preserve the objection. They filed a motion on this, so I think there's a level of complying with the ultimate order from the Commission in not creating or putting objections on the record at that point in time.

Again, OCD didn't pick a side, but a lot of this testimony certainly does seem to be post facto developments designed to rebut other witnesses, not necessarily OCD's, but I did want to clarify for the record, I think does have a thoroughly documented objection that listed specifically provisions that were at issue that was filed before the hearing, and the Commission did, in fact, rule on it.

So I just wanted to put that out there, that I didn't think that's totally correct under the circumstances.

THE HEARING OFFICER: Mr. Beck.

MR. BECK: I agree with Mr. Moander, that when you have a motion that's been submitted and that it's ruled on and you comply with that, you're not waiving your objection to renewing it afterwards.

I think that it's unfair to say that it's clear that both of these witnesses were rebuttal to Mr. McGuire. I think that Goodnight did a good job in its motion in fairly, and I would say

charitably, characterizing what was actual rebuttal testimony to Mr. McGuire versus what was substantive evidence.

I think one thing that was very clear was, understandably, Empire was put in a difficult position when it revised Mr. Dillewyn's testimony about the reservoir characterization, only to have Mr. Dillewyn at his deposition say that he did not adopt his revised testimony.

I think that that put Empire in a difficult position because now we've got three different reservoir characterizations from Empire. And I think that probably the way that they've revised their witness list says a lot about whether this is actually rebuttal testimony or whether they want to put it forth as their primary evidence, when you have your two rebuttal witnesses going essentially first out of your 11 witnesses, as opposed to in rebuttal.

So I think that Mr. Rankin makes a good point in renewing his objection, given the timeliness of that late disclosure and the inability to prepare for it and the inability to depose either of those witnesses and have them change or disclaim their testimony as he got with Mr. Dillewyn.

So I certainly think that, at least in this case, we can see prejudice. I think that at the very least, given the timing of what we've seen today, if the Commission's, you know, intent is to stand by its order, and I would assume that it is, I don't think it's unfair, given the timing of what we're seeing over likely the next couple months in this hearing, to allow surrebuttal, which would rebut what has been classified, I think, by Empire's rebuttal.

THE HEARING OFFICER: Thank you, Mr. Beck.

Mr. Suazo.

MR. SUAZO: Yeah, Pilot concurs with Mr. Beck's statements just now and supports Goodnight's position on this issue.

HEARING OFFICER HARWOOD: Thank you. I guess my suggestion would be, since my 4 o'clock alarm just went off, that we think about this overnight and take it under advisement and rule on it when the Commission thinks they've considered the issue as thoroughly as they need to. That would be my suggestion, and I'll turn it over to Mr. Rubin.

MR. RUBIN: Yeah, that would be my suggestion as well. It is confusing to have rebuttal witnesses go first. That was a bit -- and it is

difficult to say when, if at all, Mr. Rankin should have objected at that point.

I do think that we should -- I'd like to consider the case law to see if Ms. Shaheen's characterizations of it are correct. I think we can -- there's no reason why we need to rule on this at 4 o'clock today. I will have a recommendation for the Commission tomorrow.

CHAIR ROZATOS: I do have some leniency. I said 4:00 to 4:15. So I'm trying not to -- please let's not make it 4:15, but if we have to, we have to.

My question, can you reiterate, Mr. Rankin, what you want from the Commission through the objection? Either sustain your objection or what?

MR. RANKIN: Thank you, Commissioner Rozatos. I've asked for the Commission to reconsider my motion to strike, to strike the portions of the rebuttal witness testimony that is not proper rebuttal.

And I've identified that in the motion and I've highlighted all the different exhibits and all the different testimony that is not truly rebuttal.

In the alternative, I would ask that we be provided an opportunity, either through written surrebuttal or orally, to respond to that additional testimony.

CHAIR ROZATOS: Okay. And that's what I wanted to clarify. So your surrebuttal, you would want the potential of either written or oral?

MR. RANKIN: Yeah. And I haven't actually conferred with the witnesses who would be doing that. I think they can do it orally. I just want to make sure that when I do so -- and I heard Ms. Shaheen say that no, there's no need to exclude any evidence in this case where you're acting as both the fact finder and the final arbiter. I have yet confer with either of them, but I believe that they can do it orally.

CHAIR ROZATOS: Okay. I must concur with counsel for the OCC that the Commission should think about this and do its homework as well and look into, as was brought up, an unpublished opinion, I believe you mentioned Ms. Shaheen?

MS. SHAHEEN: There are a number of cases that we cited in our papers. So one that I'm thinking of that's most similar to this situation is In Re: Louisiana Energy Services. And Ms. Orth was the hearing examiner in that case. And the Court

does an excellent job of explaining what is appropriate in an administrative proceeding.

CHAIR ROZATOS: One second before you add your comment, just to clarify. This was a WQCC hearing, correct?

MS. SHAHEEN: That's correct.

CHAIR ROZATOS: Okay. And I apologize for interrupting you. Please continue with your thought.

MS. SHAHEEN: I'll note for the record that Goodnight has had over -- almost a year to rebut the original testimony that we filed in the first four cases, back in September, October of 2023. Then they had ten months to rebut our arguments in that testimony.

Basically, they're getting yet a third bite at the apple if they are allowed to provide written surrebuttal here. And I, for one, personally don't believe that's fair.

CHAIR ROZATOS: Okay. I appreciate your sentiments. Thank you.

Go ahead, Mr. Rankin.

MR. RANKIN: Thank you. Just to respond, I do believe I preserved my objection, because I did state at each witness, Mr. Bailey and Mr. Birkhead, that I intended to question them to determine whether

or not their testimony varied from the underlying case in chief. I intended to question them to determine how and to what extent their testimony was different then and, therefore, not proper rebuttal testimony.

And, of course, the information and testimony they provided is, of course, responsive to the testimony and information that Goodnight provided because we each have the same burden to prove that there's no waste and no impairment of correlative rights. So, of course, it's responsive.

The point is that that information in the context that was provided should have been done in the direct case. Instead, it was saved until two weeks before the hearing. And that is what's unfair.

Empire had the same amount of time to assess whether between the time they submitted it in August 2023 and later in August 2024, whether their petrophysics and geologic analysis was the proper one, was the correct one. And they stuck with it all that time. And they could have changed it, but they waited until two weeks before the hearing to do so.

CHAIR ROZATOS: Okay. And both sides have been noted. I think you both have preserved your sentiments for the record.

I have to go back to what Mr. Rubin said. Let us do our homework on our end as the Commission. We'll get our information. Guess what we're starting with tomorrow morning. So brace yourselves for another little delay in the morning so we can go over this.

So I think we have a path for the time being where we're going to be going. And then Mr. Harwood, if you're okay with it, I think we can call it now and we could pick up again in the morning.

THE HEARING OFFICER: That sounds great.

CHAIR ROZATOS: Excellent. You all have a good afternoon and a good evening.

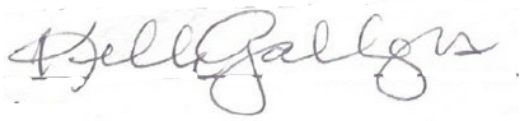
(Proceedings adjourned at 4:03 p.m.)

AFFIRMATION OF COMPLETION OF TRANSCRIPT

I, Kelli Gallegos, DO HEREBY AFFIRM that on February 26, 2025, a hearing of the New Mexico Oil Conservation Commission was taken before me via video conference.

I FURTHER AFFIRM that I did report in stenographic shorthand the proceedings as set forth herein, and the foregoing is a true and correct transcript of the proceedings to the best of my ability.

I FURTHER AFFIRM that I am neither employed by nor related to any of the parties in this matter and that I have no interest in the final disposition of this matter. March 11, 2025



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