PUBLIC HEARING
STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

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1220 S. Saint Francis Drive
Santa Fe, New Mexico

TRANSCRIPT OF PROCEEDINGS
February 25, 2025
VOLUME III

HEARD BEFORE:
HEARING OFFICER RIPLEY HARWOOD

COMMISSION MEMBERS:
GERASIMOS ROZATOS, Chair
BAYLEN LAMKIN, Member
WILLIAM AMPOMAH, Member

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I N D E X

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

TRANSCRIPT OF PROCEEDINGS

CHAIR ROZATOS: Good morning to everyone. My name in Gerasimos Rozatos. I am the acting director of the Oil Conservation Division, and also the acting chair for the Oil Conservation Commission.

I would like to bring our meeting back in order. It's a continuation from -- actually, it started on Thursday and yesterday and back into today.

This is the consolidated cases by Goodnight Midstream and Empire New Mexico that we are listening to. These are Case Numbers 24123, 23614 through 17, Case Number 23775, and Case Numbers 24018 through 020 and 24025.

Before we start, I want to definitely take a roll call, so if I could have the commissioners please state their names and that they're here.

COMMISSIONER AMPOMAH: Dr. William Ampomah. I'm a professor and professional engineer at New Mexico Tech, designee of the Energy secretary. Thank you.

CHAIR ROZATOS: Thank you, Doctor.

COMMISSIONER LAMKIN: Baylen Lamkin. I'm a petroleum engineer, designee of the commissioner of Public Lands.

CHAIR ROZATOS: Thank you, Commissioner Lamkin.

And as I said, I'm Gerasimos Rozatos, and I'm the acting director for the Oil Conservation Division.

So as we said, this is a continuation of the evidentiary hearing, so we'll transfer it over to our hearing officer, Mr. Harwood.

HEARING OFFICER HARWOOD: Thank you, Mr. Rozatos.

Good morning, everybody. A couple of housekeeping matters. Just a reminder to self and others: Phones to vibrate or silent. People who are attending via Zoom, we had a couple inadvertent interruptions yesterday, I think resulting from people who did not observe the protocol of staying on mute while you're listening. So I'll remind people attending via Zoom to please do that.

Second order of business is, I'm advised that yesterday I asked if Dr. Lindsay could be excused, but we never got an answer because there were all sorts of questions and stuff, and then I forgot to get back around to it.

So may Dr. Lindsay be excused? And I hope he's not just here because I didn't get an answer.

MR. RANKIN: Yes.

CHAIR ROZATOS: All right. Pilot and Rice?

MR. SUAZO: Yes.

MR. BECK: That's fine with Pilot.

MR. MOANDER: And for OCD, yes.

HEARING OFFICER HARWOOD: Doctor, this doesn't mean you have to leave. It just means you may if you wish. If you're here just because we didn't get through that, my apologies.

All right. I see a new face on the witness stand, and my guess is that would be Ryan Bailey.

MS. HARDY: That is correct, Mr. Examiner. Empire's next witness is Mr. Ryan Bailey.

HEARING OFFICER HARWOOD: All right. Before we take it any further, let me make sure that we have a court reporter.

CHAIR ROZATOS: Mr. Hearing Examiner, before we start, just to make sure, everybody, that you bring the microphones close so that the audio can pick up. Yesterday we were having some sound-effect issues in this corner of the room. So it helps the witness as well to be able to hear better. So please bring the microphone closer so the witnesses can hear.

HEARING OFFICER HARWOOD: Is it Doctor or Mr. Bailey?

THE WITNESS: Mr. Bailey.

RYAN MICHAEL BAILEY,

having first been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MS. HARDY:

Q. Good morning, Mr. Bailey.

A. Morning.

Q. Can you please state your full name for the record.

A. Ryan Michael Bailey.

Q. Thank you. By whom are you employed and in what capacity?

A. I am the vice president and co-founder of Ops Geologic.

Q. Have you previously testified before the Commission?

A. I have not.

Q. Can you please provide some information regarding your area of expertise.

A. I am a geoscientist, focused mainly on reservoir characterization.

Q. Have you provided a summary of your education, training and experience with your testimony as Exhibit K-56?

A. I have.

MS. HARDY: Mr. Hearing Examiner, based on Mr. Bailey's qualifications as set out here today and in his testimony, I request that he be qualified as an expert in geoscience, please.

MR. RANKIN: No objection.

HEARING OFFICER HARWOOD: Any objection from Goodnight?

MR. RANKIN: No objection.

HEARING OFFICER HARWOOD: Pilot and Rice?

MR. BECK: No objection.

MR. SUAZO: No objection from Pilot.

HEARING OFFICER HARWOOD: All right. He will be so recognized, Ms. Hardy.

BY MS. HARDY:

Q. Have you provided rebuttal testimony and exhibits in this case?

A. Yes, I have.

Q. Whose testimony are you rebutting?

A. Preston McGuire.

Q. Is there a specific topic of Mr. McGuire's that you're addressing?

A. Mainly, his stratigraphic model, as well as various other things, including a barrier separating the San Andres and the Grayburg, as well as other things that I probably have in my rebuttal testimony.

Q. Are you addressing Mr. McGuire's opinions regarding the depths of the San Andres Formation?

A. Yes, most certainly.

Q. And what about the existence of a residual oil zone, or a ROZ, within the San Andres?

A. Most certainly.

Q. Do you affirm today under oath that your testimony is true and correct?

A. Yes, I do.

MS. HARDY: Commissioners, Mr. Examiner, I request that Mr. Bailey's rebuttal testimony and exhibits, which are Exhibit K and sub Exhibits K-1 through K-56, be admitted into the record.

HEARING OFFICER HARWOOD: Goodnight's position?

MR. RANKIN: At this time we will not object, Mr. Examiner. I will question Mr. Bailey on the nature of his testimony. But at this time, I do not object to their admission.

HEARING OFFICER HARWOOD: Okay. Rice?

MR. BECK: No objection.

CHAIR ROZATOS: Pilot?

MR. SUAZO: No objections from Pilot.

HEARING OFFICER HARWOOD: OCD?

MR. MOANDER: No objection.

HEARING OFFICER HARWOOD: And, OCD, I'm sorry. I keep omitting you. I didn't mean to. But you have no objection to Mr. Bailey being an expert witness?

MR. MOANDER: OCD does not.

HEARING OFFICER HARWOOD: All right. They'll be admitted, Ms. Hardy.

MS. HARDY: Thank you.

(Admitted: Empire New Mexico Exhibits K, K-1 through K-56.)

BY MS. HARDY:

Q. Mr. Bailey, let's briefly go through some of the highlights of your testimony. And I will pull up the slides we're discussing here on the screen.

Can you please explain what this slide shows. And it's been marked as Exhibit K-3.

A. Yes, I can. And I apologize. I'm trying to get this to where I can turn it into a laser pointer, if I can find your cursor. This may be a little bit harder than I thought. There we go.

These are the two cored wells within the field. They're the bookends for, basically, the physical rock that we have to calibrate our petrophysical model. Dr. Lindsay spoke at length of both of these and the core analysis, so I'm not going to belabor that point. But I do want to walk you through what you're seeing here.

So in the first track here, you will see a gamma ray log as well as a caliper log. And if you have any questions about what any of these mean, I'm more than happy to explain that.

And the second track is just a depth track. This is set in subsea values.

In the third track, we have a net low and a net-pay flag here. Those are based on our petrophysical model. We ran sensitivities to net pay on the low side as well as net pay on the high side, based on the saturations.

In addition, you'll see that I have a PE curve, that's a photoelectric factor, it is a mineralogy indicator; as well as the resistivity curve here that I've shaded over 200 ohms. And there's nothing really important about that other than the fact that when we get higher resistivities, we may tend to look at mineralogy factors as well there.

In the fourth track here, or the third track, if you really do exclude the depth track, we have a neutron porosity as well as a density porosity curve. The density porosity is based on a dolomite matrix.

In the fourth track here, we have sonic curve, as well as bulk density.

And then in the fifth track here we have what is called oil saturation. So we have both our low and high case. In the dark green is the low case of what the potential oil saturations would be, and in the lime green would be the high case of what the potential high side of the oil saturations could be.

So as you can see, on both of these logs, we see oil saturations -- and I apologize. I've gridded this so that you can see it very clearly. Each grid line here is 20 percent saturation.

So as you can see, we have well over 20 to 40 percent within the Grayburg, and the San Andres, 20 to 40 percent as well.

One of the things I want to point out, and I'm going to show this later, is the importance of setting the stratigraphic model. And where we place our top and where Goodnight places their top of the San Andres is very different.

Our tops are based on not only Dr. Lindsay's experience within the field, as he defined these by the core for the top of the San Andres, but also literature that I have provided in my testimony.

It's important when you enter a field to do literature studies to understand what the potential geology is. The studies that I have provided, the type logs that I have provided in my testimony, are along the trend of the Artesia Fairway. They define very clearly a marker that's not been discussed very much here, at least yesterday it was not, called the "Lovington Sand."

The Lovington Sand sits in the middle of the Upper San Andres. It is shown, it's been seen in outcrop, it's tied from outcrop to the subsurface. It basically subdivides the Upper San Andres.

And then below that, we have what's called the PI marker, which is the top of the Lower San Andres. So as you can see here, I have a top of San Andres in red. I have the Lovington Sand in brown, and then the Lower San Andres in black, and obviously the Glorieta at the bottom of the section, which is the unitized interval, the base of the unitized interval, for the San Andres.

Q. And, Mr. Bailey, just to make sure it's clear, these two logs that you're here showing on this slide are the RR Bell and the EMSU 679 that Dr. Lindsay discussed extensively yesterday?
A. Yeah, that's correct. The RR Bell is on the east side of the field. If you can see in the base maps I provided, just above the logs here, you see this green star. That's where the RR Bell sits in the EMSU. And then the 679 is on the west side, out towards the basin.
Q. And do these logs show oil saturations throughout the San Andres?
A. They do, where we have data. So the RR Bell actually goes much deeper than the 679, as you can tell by the depth tracks.
The 679 actually stops at the Lovington Sand. It goes a little bit below the Lovington Sand. The core interval certainly does. The logs -- the red box here that's in Track 1 shows you the actual cored interval, so you can see where it was cored. The logs actually don't cover the bottom section of the core, probably because they didn't have enough room for the tools.
And then you can see the same on the RR Bell here. You can see the cored interval there

goes well below the Lovington Sand as well.

So we were able to identify that marker very clearly. Dr. Lindsay has done that and has certainly set us up to be able to correlate the San Andres across the field.

In addition, I have also included the Grayburg zone tops in here as well. Those were defined in the Commission hearings with the parties that were designing the EMSU unit -- the unitization hearings, excuse me. Those Grayburg zones were defined by the RR Bell curve in that document.

Q. And, Mr. Bailey, just to be clear, do these logs show oil saturations above 20 percent throughout the San Andres?

A. They do both on the low case and the high case.

Q. And have you reviewed Mr. McGuire's Exhibit B-9, which is his cross-section?

A. I have.

Q. And is it your understanding that Goodnight is arguing that that cross-section shows a 200-foot impermeable barrier between the injection interval and the Upper San Andres?

A. That is correct. And that barrier that they are -- well, they place their top, in general -- and we'll talk about that in a later slide. But I'll give them -- in general, they place it at the Lovington Sand marker. Sometimes it's well above that, sometimes it's below it. But in general, they're suggesting that there's a 200-foot barrier there.

I remind you that the core permeability in that zone is .1 millidarcies. .1 millidarcies is not an effective seal.

Q. And this shows a ROZ, in your opinion, below the Lovington Sand?

A. It does.

Q. What's shown on your next slide, which is marked --

A. This is a base map, and I've got the San Andres structure here. And we'll go through some structure maps here shortly. I've got several cross-sections that I've provided in my testimony.

Today I'm going to show you the two dip sections, A to A prime, and B to B prime. And then I'm going to show you a top comparison section so you can understand how Goodnight is picking their top.

And then I'm going to show you also a perf comparison section. That perf comparison section is based on XTO's perfs within the field that were designated San Andres to the State.

Q. So is this map showing the wells that you used to determine the structure of --

A. That is correct, yes.

Q. What's shown on your next slide, which is K-10?

A. Yes. This is Dip Section A to A prime. As you can see, we've got the EMSU 679 in the second track here. We've got the top of Grayburg very clearly on here. We've got this top of San Andres in the 679.

You can very easily see how this correlates across the EMSU and how we come up on structure. It's very recognizable for the top of the San Andres. It tends to be a tight interval at the top of it, as you can see by the neutron and density here.

And then, obviously, we can see the Lovington Sand below it, which is a good indicator for basically -- essentially what you would see about 120 to 140 feet from the top of the Lovington to the top of San Andres. And thinning up on structure, obviously.

Q. And, Mr. Bailey, is the gist of this that downdip to updip, there are oil saturations all the way through the San Andres?

A. That is correct. And more importantly, there are oil saturations below what Goodnight considers their barrier.

CHAIR ROZATOS: Ms. Hardy, I apologize. That buzz that you heard is the microphone straining to pick up your voice. Can you bring your microphone just a little closer to you? I apologize.

MS. HARDY: Yes. Thank you.

BY MS. HARDY:

Q. Mr. Bailey, are the fuchsia markings -- well, what do the fuchsia markings --

A. Yeah, I should have pointed that out. So we tried to run what we would call a baffle where we potentially see baffles. So the fuchsia marking that you see on the right side of the EMSU 458, we ran a cutoff of 1.5 percent phiT, effective porosity, to try to determine where we might have potential baffles, to understand where Goodnight was coming up with their own baffles in Preston McGuire's testimony.

And what you see there is that we do not see any consistent baffles across any of these curves -- or any of these wells. Excuse me.

Q. And do those baffles constitute a barrier to fluid flow?

A. They would constitute a barrier, yes, to

vertical fluid flow, as well as horizontally.
Q. But is it true that they're not contiguous?
A. They are not consistent or contiguous. There is no regional baffle in the EMSU.
Q. So they wouldn't prevent fluid migration?
A. They would not.
Q. What's shown here on Exhibit K-11?
A. The K-11 is Dip Section B to B prime. Again, this was just to the south, so we're going from the Ryno SWD, which is Goodnight's SWD well.
Again, just illustrating how basically easy it is to correlate the top of the San Andres across the EMSU, as well as the Lovington Sand and the Lower San Andres.
And again, we show -- here you'll see that we do have more baffles across here, so there is some more connectivity, mainly towards the upper part of the San Andres, as well as the upper part of the Grayburg.
Q. And again, those baffles don't show -- or don't allow for fluid?
A. They're not consistent across the field. These examples are just wells selected to show, essentially, the structural component of the stratigraphy as well as the stratigraphic model.

The baffles that are shown here do not continue anywhere or are inconsistent across the field at all depth levels.

Q. What's shown on Exhibit K-13?

A. Yeah, so this is the most important point to make here. And I want the Commission to understand that I've kind of shown you that it's pretty simple to correlate. I don't want to call it simple, but you can correlate the top of the San Andres across here.

In Preston McGuire's testimony, he made the argument that you can't really do it, it's more of an engineering-based top. Okay? That's not geology, that's not fundamental geology, and that's not how you go across a field and correlate sections.

And so what we've done, obviously I've provided in my testimony several examples of type logs illustrating the Lovington Sand, splitting the Upper San Andres, as well as into the Lower San Andres.

And what I want to show here is how Goodnight is correlating their section. Their line on this cross-section is the blue line. Okay? Our line for the top of the San Andres is the red line. Mind you, the EMSU 679, we've determined that top of San Andres by core. Okay? So that's one of our base points for the model.

Goodnight and us both agree that the top of the San Andres and the Ryno well is exactly where we both got it, at around negative 698 subsea. But as we move across and go updip of the section, you can see how Goodnight starts to vary their top, and it's really all over the place.

And I don't know if it's out of convenience, if it's a lack of fundamental geologic understanding of how to correlate stratigraphy. But I can tell you that it's wrong.

And it's important, very important, because what they are doing is they're excluding the Upper San Andres as a ROZ zone. Okay? They say -- he says in his testimony that the top of the San Andres cannot be correct because the ROZ zone is in the Lower Grayburg. I will tell you today that that is incorrect.

The Upper San Andres contains a ROZ zone, as well as below the Lovington Sand contains a ROZ zone as well.

Q. And, Mr. Bailey, is it your understanding that Goodnight has selected the formation tops based on pressure data?

A. My understanding is it's pressure data or mud losses. It's not very clear. It just -- he just says engineering-based data, so...

Q. It's not based on geology?

A. It's not based on geology, no. It's very clearly not based on geology.

Q. Okay. And have Goodnight's formation top picks crossed lithographic and stratigraphic boundaries?

A. Yeah, that's really what's important as a geologist. I mean, you've got to maintain a stratigraphic, I guess, integrity, I will call it. You can't cross chronostratigraphic boundaries. These are time boundaries, just so you understand.

We understand where the composite sequence boundaries are. We understand where the stratigraphy should tie together. And once you start jumping across those boundaries, well, then you've jumped the shark on understanding what your stratigraphy is.

Q. And what's shown on Exhibit K-14?

A. So, Exhibit K-14, just in case I haven't convinced you on the top of the San Andres, this is actually XTO wells that were drilled.

So, in the first column here, in the gamma ray column, you'll see a pink box here. And the perfs that were reported to the State and approved by the State are in this pink box here. So, everywhere where they have these perfs below our San Andres top is exactly where they have the San Andres top. Those perfs were designated San Andres and they were approved by the State as San Andres.

In the second well, it's the same thing. They actually perfed down well into the San Andres here, as you can see. And their top is right there, where I've got it pointed at the red arrow, which is exactly where our top is.

They set a bridge plug in the 713. They do not define the actual top of the San Andres here, but their defined bridge plug, the base of the bridge plug, is in Zone 6 of the Grayburg, which is sitting just above the top of the San Andres.

I don't really need their top to actually correlate this. I think you can see with your own eyes, Commission, that it's very easily correlatable across here.

Q. And, Mr. Bailey, did you determine your picks for the tops of the formation independently of these top picks?

A. I did. I did, actually. This was post me correlating across the EMSU unit, as well as around the EMSU unit. I actually went back to look, to confirm that what we had picked was consistent with what had been reported to the State.

Q. And is it your understanding that XTO sold the unit to Empire based on these tops?

A. Yeah. I want to -- that's an excellent point, Dana. So, XTO sold this field to Goodnight --

Q. To Empire.

A. I'm sorry. -- to Empire based on a ROZ interval below this top, down to 700 feet. Empire bought this field under the premise that they had a ROZ interval within the San Andres that they would be able to exploit at some point in time when they are ready, as they are the operator of the EMSU unit.

Q. What's shown on Exhibits K-16 and 17?

A. Yeah, K-16 and K-17 are the Upper San Andres structure map and the Grayburg structure map.

I want to make this clear, that we are on an anticline. I know that Dr. Lindsay talked about a double-humped anticline yesterday. I wanted to illustrate that in a map view so that you can understand that we definitely have a structural closure here within the EMSU unit.

Q. And does this show whether there is consistent reservoir thickness?

A. That will be in the next slide.

Let me -- just before you go there, just so you understand, I used roughly about 130 wells across the EMSU to correlate the Grayburg structure. I believe I'm somewhere at about 90 for the Upper San Andres, and 79 for the Lower San Andres.

Q. And, Mr. Bailey, one other question on this slide. Does fracturing become more pervasive as you are higher on the structure?

A. Yeah. You would expect -- given the tectonics that have occurred here. So Dr. Lindsay spoke about Grayburg deposition, that there was some basement fault block moving as the Grayburg was being deposited. We'll talk about that in the isopach map next.

But you would expect that, given the fractures we're seeing downdip in the 679, we've had Laramide tectonics, compressional tectonics affect the Permian Basin, as well as basin and range extension in the tertiary as well, that would enhance fracturing. Okay?

As you move up on a structure, this is very consistent, we see this in many reservoirs, A great example for fracturing off a reef edge or a Sligo or Edwards Reef margin for the Austin Chalk, you typically see more enhanced fracturing up on top of the reef or as you come down off the slope margin.

Now, this is not a reef, I'm not suggesting that; it's a carbonate ramp. But you would expect that as you come off that structure, you've had flexure that's going to enhance fracturing, especially up on top of the structure.

Q. And what's shown on Exhibits K-19 and 20?

A. K-19 is an isopach map. So it's pretty well documented that the Grayburg is on a distally steepening ramp. I want to make that point because Mr. McGuire argues that the top of the San Andres cannot be correct because the Grayburg needs to be 400 feet thick across the whole EMSU. That is just patently false.

The Grayburg actually thins up on structure and it thickens out into the basin. So by that basis, I mean, that's documented everywhere in multiple literature papers.

The Upper San Andres, or the San Andres itself, is more on a homoclinal ramp. So you can see by this map, there's not a lot of variation in the Upper San Andres thickness as you go down into the basin; whereas, you move off structure for the Grayburg, it begins to expand very quickly.

Q. And what's shown on Exhibits K-26 and 27?

A. K-26 and K-27 is giving you an indication of the Lower San Andres oil saturation percentages.

Now, I want to be clear that we go through a process of generating net reservoir maps using cutoffs of a 4 percent phiT, 50 percent Vclay and an 80 percent water saturation. And that 80 percent water saturation cutoff is because we are under the impression that we need 20 percent oil saturation to be able to have net reservoir here. So these averages are based on the net pay. Okay?

And so the net-pay averages for the Lower San Andres would be somewhere between 30 to 40 percent in the Lower San Andres across the EMSU, generally, or right around 30 percent. That's on the low case.

When you look at the potential high case for oil saturation, we can get upwards of 45 to 50 percent on a single-well basis.

Q. And what is shown on Exhibits K-32 and 33?

A. This is the original oil in place on a million barrels per section in the Lower San Andres. So as you can see, in general, we're somewhere between 15 to 40 million barrels per section, in the low case. And in the high case, we could be anywhere from 25 to 60 million barrels per section. That's a significant

amount of volume within the Lower San Andres.
Q. What's shown on Exhibits K-39 and 40?
A. K-39 and K-40, I'm going to walk you through the same thing. This is for the Upper San Andres, as you can see. In general, we have oil saturations on average within the net pay that are somewhere in the 28 to 30 percent range for the low case, and on the high case, we're generally somewhere between 30 to 40 percent on oil saturations.
Q. What's shown on Exhibits K-45 and 46?
A. And this would be the original oil in place for the Upper San Andres. Again, we're showing you that we have somewhere between 10 to 20 million barrels per section within the Upper San Andres on the low case. And on the high case, we're generally somewhere between 20 to 30 million barrels per section. Again, substantial volumes in the Upper San Andres.
Q. In what is shown on Exhibits K-53 --
A. So this is combined, so now you see the total San Andres as a whole. And as you can see, on the low case, we've got generally somewhere between 25 to 60 million barrels per section on the low case, and on the high case, we've generally somewhere between 30 to 85 million barrels per section. Again, significant

volumes for the total San Andres.

Q. And, Mr. Bailey, yesterday Dr. Lindsay testified about the fact that he didn't have actual core available for part of the interval.

But have you made these determinations based on your analysis of the geology and the well logs?

A. Yeah. So the saturation curves are tied to the core as deep as we have core. And, granted, we have two core points that we're working with. So there is a range of possibilities in the Lower San Andres without physical rock data that we cannot tie to.

But we've stayed consistent with our model based on the core data we have in the Upper San Andres down into -- below the Lovington Sand, below what they consider their barrier. We have stayed consistent with our model through the Lower San Andres.

Q. And what's shown on this exhibit?

A. Yeah, so this is just kind of a sum-up, just to give you numbers in front of you here.

So on a low case OOIP, we're talking about 191 million barrels. And on an OOIP high case, we're talking about 331 million barrels. And mind you, this is just for the EMSU unit. So this is over -- a total over the whole blue box you see up there that's outlining the EMSU, that's giving you an indication of the in-place numbers that are within the Upper San Andres, the Lower San Andres and the total as a whole.

As you can see on the low case, when you look at the total as a whole, we're talking somewhere around 630 million barrels on a low case, and over a billion barrels on the high case. Those are substantial volumes, gentlemen.

Q. And these conclusions are based on your analysis of the --

A. They are.

Q. Mr Bailey, can you please summarize your conclusions for the Commission.

A. I think the point here is that there's a lack of fundamental geology done by Goodnight. I don't think they or at least they have not illustrated that they understand how the stratigraphy works. They essentially don't have a stratigraphic model, as best I can tell.

As best we can tell, they've done everything on an engineering basis. That's fundamentally incorrect. It's unnecessary, given the amount of literature, given the core data that exists here, given the amount of wells that are here.

Engineering-based data, I like it. Again, their model is very similar to something you would do offshore, where you have very limited well data and you need paleo data to tie compartmentalized sands over long distances. It's unnecessary here.

It's fascinating that they came up with this model. Again, I don't know if it's out of convenience. I really don't understand how they came up with it, but it's certainly not geology.

Q. And, Mr. Bailey, to sum up, in your opinion, are your conclusions and determinations here consistent with the science, XTO's picks, Dr. Lindsay's evaluation?

A. Yes. I am very confident in our model for the San Andres. I'm very confident that we have saturations within the Upper San Andres above and below what Goodnight would consider a barrier that is nonexistent.

MS. HARDY: Thank you. Those are all of my direct questions for Mr. Bailey.

HEARING OFFICER HARWOOD: Okay. Thank you, Ms. Hardy.

I suspect that, Mr. Rankin, you may have some questions for Mr. Bailey.

MR. RANKIN: I do, Mr. Hearing Officer. However, in the midst of the summary, I got kicked off the network, so I may just need a minute or two to get back on and get back onto Teams so I can share my screen. Sorry for the inconvenience.

That was my screen beeping when I got kicked off. So I'm not on right now. I need just to get logged back on. It may take me a moment. I apologize.

HEARING OFFICER HARWOOD: Okay. We'll just stay on the record.

CROSS-EXAMINATION

BY MR. RANKIN:

Q. Apologize for the delay. Good morning, Mr. Bailey. How are you today?

A. I'm doing good. How are you?

Q. Good. So you were present for yesterday's testimony with Dr. Lindsay, correct?

A. I was.

Q. Okay. Just want to make sure.

I want to just get a little background on you. I'm going to pull up your rebuttal testimony just want to understand a little bit more about what your experience has been.

A. Sure.

Q. Yeah, okay. Once I get kicked off the network, it doesn't like -- I can't get back into my Adobe. So I'm going to have to just take a moment to restart my Adobe. I apologize. Apologize for the delay.

I think, Mr. Bailey, I have here in front of you -- once I share my screen, you'll be able to see it. Do you see your CV on your screen here?

A. Yes, I do.

Q. And that's marked as Exhibit K-56, correct?

A. That is correct.

Q. And this basically outlines your experience and background as a geoscientist?

A. That is correct.

Q. Just starting from chronologically here, reverse chronology, you went to University of Alabama?

A. That is correct.

Q. And that's where you got your master's and undergraduate degrees?

A. That is correct.

Q. Okay. And now, just kind of cruising through your experience, you started out with Anadarko; is that right?

A. That is correct.

Q. And your experience with Anadarko was in unconventional shale drilling mostly; is that right?
A. Predominantly, yes.
Q. What else did you do for Anadarko?
A. Cotton Valley Sands in Carthage.
Q. Were those horizontal wells, as well?
A. Not originally, no. They were vertical wells through the Cotton Valley Sands and then horizontal in the lower Taylor.
Q. So at the time you worked on those projects, were they horizontal development?
A. No. It was vertical.
Q. Okay. Were those conventional?
A. That is correct.
Q. Okay. Just for the record and just to make things clear, I noticed you doing this with Ms. Hardy, as well, would you just make sure that my questions are completed before you start answering.
A. I'm sorry.
Q. Because I may shift directions with my question. Okay? All right. Thanks.
Okay. So you did a little bit of conventional sands for Anadarko. But predominantly, it looks like it was unconventional shale, horizontal drilling, correct?

A. That would be fair.
Q. Okay. Then you were with Anadarko through 2016, and then looks like -- actually, sorry, through 2019. And have you had any experience with Anadarko in the Delaware Basin?
A. Yes, I have.
Q. And how many years have you worked on the Delaware Basin?
A. Approximately three.
Q. Three years? Which years were those?
A. That would be 2016 to the end of 2019, when Oxy bought us out.
Q. Okay. And what were your responsibilities with Anadarko during that time?
A. I was the geoscience manager for the subsurface and technology team; ultimately ended up being the asset manager for our Block 1 Monroe area in Ward County in the Delaware Basin.
Q. Okay. In those three years, you were on the Texas side?
A. Yes, I was.
Q. Okay. After you left Anadarko, then you joined JBL Energy Partners. What did they do?
A. Yeah, so that was a small outfit back in Houston. I moved back from Midland to Houston and was

helping them with the Grant Sands up in the Fort Worth Basin.

Q. What kind of play was that?

A. That is a sand play, as well. The Bend Conglomerate, as well.

Q. As well as being what?

A. The Bend Conglomerate and the Grand Sands both.

Q. Are those horizontal?

A. Yes, it was horizontal sand.

Q. Okay. And then you founded Arkatex Energy Advisors in 2020?

A. That is correct.

Q. And tell me a little bit about that, that outfit? What did you do with Arkatex?

A. That was my own company. I went out as a consulting geologist on my own. I was working up a prospect for the West Haynesville, developed that prospect and sold it last year to Mitsui.

Q. Tell me, what is the West Haynesville prospect?

A. The Haynesville/Bossier is a shale play on the western side of the East Texas Basin.

Q. Okay. And, again, that's a horizontal plane?

A. Yes, it is.
Q. Okay. So you're continuing in that role, as a consultant geologist with Arkatex?
A. Mainly, I focus on the Ops Geologic side, yes.
Q. And then you co-founded Ops Geologic in 2021. Tell me a little bit about that.
A. Yeah, I joined up with a colleague of mine, actually, two colleagues of mine, ex-Anadarko guys, to essentially build a geoscience outfit consulting firm. I'll call it soup-to-nuts exploration to execution of operations.
Q. And since you formed that group, tell me a little bit about what kind of work you guys have done.
A. We do mainly reservoir characterization. We've worked generally every basin in U.S. onshore, both conventional and unconventional.
Q. Okay. Tell me a little bit about the conventional work you've done.
A. Birdbear/Duperow in the Bakken. We've done some vertical wells on the CBP. We've done some conventional Cotton Valley work in Carthage, again. We've done some conventional re-completes in the Fort Worth basin within the Grant Sands in the Bend Conglomerate. I'm trying to think what else. Mainly

a lot of it's been unconventional horizontal drilling.
Q. Okay. And when you mentioned the acronym CBP --
A. Central Basin -- sorry.
Q. That's all right. I know it's real fun to be -- I mean, I know you're eager and you've got the answers, but just let me get them out, the questions out.
So CBP, Central Basin Platform, correct?
A. Yes, Central Basin Platform.
Q. Okay. All right. And what part of the Central Basin Platform were you on there?
A. Mainly on the Midland side -- well, I guess the Texas side, but down towards the -- working down towards the Midland Basin.
Q. On the eastern side of the Central Basin Platform?
A. That's correct.
Q. Okay. On the northern part, northern margin of that, the Central Basin Platform, or down on the southern end of it?
A. More towards the southern end.
Q. Okay. What's the field out there?
A. Well, there's several fields. So you've got some shallow intervals. And then Woodford/Barnett has

been pretty hot on the Central Basin Platform lately, so we've done quite a bit of reservoir characterization on that, as well as the Mississippian Lime.

Q. Okay. And the vertical wells -- those are all vertical wells out there?

A. Most of them turned into horizontal wells yeah. Our analysis was on the vertical portion of that.

Q. Okay. Just to be clear, these are Pilot holes that you're analyzing?

A. Yeah.

Q. And then they end up coming back in and re-completing it as horizontal?

A. That is correct.

Q. Okay. So they were doing test projects to kind of evaluate the full stratigraphic interval?

A. Generally those wells have already been drilled. We're just analyzing up and down the column to understand what the potential for reservoirs are.

Q. Okay. So you told me that they were vertical wells, but it wasn't a vertical well play. It was just that you were analyzing in the vertical portion of those wells?

A. That is correct.

Q. Okay. Now, I'm not seeing a lot of background experience in EOR-type projects.
A. That would be fair.
Q. Okay. Have you done any work on EOR projects?
A. I have not.
Q. When I say "EOR," I mean enhanced oil recovery. You're familiar with that term, obviously.
A. It's tertiary recovery. Yes.
Q. What about secondary recovery?
A. I have not done any waterfloods, either.
Q. Okay. So you've got no experience doing any waterfloods or evaluating any waterfloods?
A. I have not.
Q. Okay. And you've done no work evaluating tertiary recovery post secondary recovery, correct?
A. I have not.
Q. Okay. How about in carbonate systems?
A. In carbonate systems in general?
Q. Yeah.
A. Yeah. Austin Chalk. Like I mentioned, the Birdbear/Duperow in the Bakken. Mississippian Lime. Chase Council Grove in the Hugington Embayment. Smackover.
We have a lot of various projects out of

my -- correlated a lot of wells, a lot of -- across a lot of different basins in the U.S. onshore.

Q. Well, that's fair. I appreciate that. I just want to understand what your background is on the carbonate side.

Now, all those fields that you've talked about just then that contain or include carbonate systems, those were all horizontal wells, correct, that you were looking at?

A. Smackover's vertical.

Q. Smackover. I love the name of that field. Where is that?

A. Well, you've got Smackover running the Mexia-Talco trend in east Texas, all the way up to southern Arkansas and then down in Alabama and Florida.

Q. Smackover trend, who named that one?

A. Well, it's named after Smackover, Arkansas, which is where it outcrops.

Q. Okay. That's a great name.

Because you identify -- so that's -- okay. So one thing I was interested in, at the time when you were with Anadarko, you did some work on a divestment of assets, right?

A. That's correct.

Q. And part of that job was providing potential upside targets to prospective buyers?
A. That is correct.
Q. How would you -- that's basically pitching a prospect, right, for sale?
A. That's illustrating that there's upside potential within the asset.
Q. Since this case has a fair bit of discussion about upside potential, as it was marketed to Empire from XTO, let me know a little bit about how you go about marketing upside potential. What are you looking at?
A. We evaluate the reservoir. We look at the reservoir properties. We determine whether it has any value for potential exploration or exploitation. And we generally provide that as a potential upside target to the main pay zone that the company would be looking to acquire.
Q. Okay. So I want to just kind of drill down on that a little bit. Forgive the analogy or metaphor. But I want to understand, when you say "upside potential," does that generally mean it's a zone or an interval or a development that hasn't yet been established in the field?
A. It could be infill drilling within -- let's

just take Eagle Ford for a hypothetical. You might say we have upside potential in the Upper Eagle Ford or the Lower Chalk, you know, and we prove that based on the reservoir characterization. We may have tests in the ground that illustrate that it has potential.

Q. Okay. So when you're marketing those potential upsides, you put together a package that kind of provides the potential buyer your understanding of what the prospect may be, what the benefits may be or how that may be developed, right?

A. That is correct.

Q. And then on the other side, the potential sellers then would evaluate and assess what you're telling them, right?

A. That would be their due diligence, I would hope.

Q. Okay. And on that end, on that point, you would expect a buyer, you know, not to take your word for it, right?

MS. HARDY: I'm going to object to this line of questioning. I don't think it's within the scope of Mr. Bailey's rebuttal. He's not involved in any evaluation or in due diligence on the part of the Empire. I don't think it's relevant.

HEARING OFFICER HARWOOD: You all did open the door on this issue. Although the question, I think, calls for speculation. How does he know what the buyer is going to do?

MR. RANKIN: Fair enough.

BY MR. RANKIN:

Q. Mr. Bailey, as part of your work at Anadarko, did you also work on the acquisition side?

A. In general, no.

Q. No? Just on the sell side.

A. Yes.

Q. Okay. But as a seller, you would expect a buyer to do some due diligence, right?

A. I would be speculating, but I would hope so.

Q. Okay. Very good. Very good. I think I'll leave my questioning there for now, and I may come back to this area.

The reason I'm asking, Mr. Bailey, is because you have experience promoting upside potential, and now you're evaluating that exact upside potential that was promoted to Empire in this case. And I think it's relevant to inquire what your experience is and what it means to promote upside potential on a prospect. Right? So that's why I'm asking those questions.

MR. RANKIN: And I'll get to this a little bit later, and you'll see why, but I'm laying a foundation here, Mr. Hearing Officer. Because what Mr. Bailey is promoting here, I think it's worthwhile comparing to what XTO promoted. So that's why I want to understand a little bit more about his background and understanding about promoting assets.

HEARING OFFICER HARWOOD: Well, just be careful to ask questions and not testify.

MR. RANKIN: Sure, sure.

BY MR. RANKIN:

Q. Okay. So I think we've covered your background there. Just before I leave that topic on background, you haven't done anything with residual oil zones?

A. That is correct.

Q. You've never, prior to this date, looked at or evaluated a zone that was identified as the potential for a residual oil zone, correct?

A. That is correct.

Q. Now, how about any work in the San Andres? Have you done any work in the San Andres anywhere in the Delaware Basin?

A. It's limited.

Q. Where is it limited?

A. On CBP.

Q. And that would be on the Midland side?
A. Mainly, yes.
Q. Have you done any work on the west side of the Central Basin Platform?
A. If you're meaning in the west side in the Delaware Basin, yes.
Q. On the west side of the Central Basin Platform, have you done work?
A. No, I have not, other than what I've done here.
Q. Okay. How about in the Grayburg?
A. I have not.
Q. Let me ask you this question. When were you retained by Empire?
A. I believe it was September that they approached us, mainly to do a petrophysical model initially.
Q. Okay. That was sometime in September 2024, right?
A. That's correct.
Q. Okay. And what did they ask you to do at that time?
A. We were evaluating a few wells for a petrophysical model.
Q. What wells did they ask you to evaluate?

A. Off the top of my head, I don't know that answer.

Q. Okay. Were they wells that had previously been evaluated for petrophysics?

A. Presumably some of them had, yes.

Q. But you're not sure?

A. I'm not 100 percent certain.

Q. Okay. Did they discuss with you the fact that they already had these wells evaluated by a company called NuTech?

A. We were aware that NuTech had evaluated some wells for them, yes.

Q. But you're not sure whether the same wells that you were looking at, they asked you to evaluate --

A. I don't want to say one way or the other. That's a question you can ask my petrophysicist. He's next up.

Q. Got it. So you don't know. Okay.

Now, when I was reviewing the materials that were provided to us by your colleague, Mr. Birkhead, I noted that he did include in his folders NuTech Energy's original and revised analyses.

But you didn't provide me a folder, so I presume, then, that you did not yourself look at

NuTech's original or revised analyses. Did you?
A. No. That's not my responsibility.
Q. Okay. Now, when I was deposing Dr. Lindsay back in January, we had some discussions, of course, around the Grayburg and the EMSU. And one of the things he told me was that he was working on a new cross-section for the unit and he was working to put that together.
Did you have discussions with Dr. Lindsay in preparation for your testimony in these exhibits?
A. I did, yes.
Q. Did Dr. Lindsay provide you with a cross-section of the EMSU that he prepared?
A. Yes.
Q. Did you alter or adopt or change in any way the tops that Mr. Lindsay selected for that cross-section?
A. No, I did not.
Q. So did you yourself actually go through and pick the tops for the San Andres, or did Dr. Lindsay do that for you?
A. No. I did it myself. It was an independent analysis.
Q. Okay. So you received a cross-section from

Dr. Lindsay with the San Andres tops, but you also went around and picked your own tops, correct?

A. I didn't get Dr. Lindsay's cross-section until maybe December, so I had already started that process well before speaking with Dr. Lindsay on this.

Q. Did you change your tops to match Dr. Lindsay's tops?

A. I did not.

Q. So you varied from the picks of Dr. Lindsay, who is the Ph.D. expert, who spent his life working on the field, correct?

A. I don't know that I varied any of his tops. But I think our tops are pretty consistent across the EMSU.

Q. Okay. Let me ask that again. Did you change -- are your tops the same as Dr. Lindsay's tops?

A. I think they're probably pretty consistent.

Q. Okay. Did you double-check to confirm there are no differences between your tops?

A. Actually, Dr. Lindsay and I have spoken on a well-by-well basis. And I think we may be a few feet off here and there, but in general, we're very consistent.

Q. Now, are you aware that Empire provided a structure map to Goodnight at the outset of this case?

A. I assumed so. I don't know. Can you reference what you're talking about?

Q. Are you aware whether or not Empire provided Goodnight a structure map for both the Grayburg and San Andres at the outset of this case?

A. I have seen Joe McShane's structure. I don't know if that's related to what you're talking about. But yes, I've seen previous structure maps to mine.

Q. Okay. So you've seen Mr. McShane's structure map. Have you seen the tops that Mr. McShane picked for both the Grayburg and San Andres?

A. I have not.

Q. Okay. So you don't know, as you see here today, whether your tops are different or how they might vary from Mr. McShane's tops for either the San Andres or the Grayburg, correct?

A. I don't, but I suspect they're probably pretty similar.

Q. So you haven't looked -- I mean, would it surprise you that more than half of your top picks are different than Mr. McShane's?

A. Maybe. I don't know.

Q. But you haven't looked, so you don't even know?
A. I don't know, no.
Q. Did Empire provide you their top picks for the San Andres in preparation for your work?
A. We had a database of top picks, yes. Correct.
Q. Did you evaluate your top picks relative to Empire's top picks?
A. I didn't evaluate my top picks compared to their top picks. But there were certainly some differences in the original, I think his name is Nick Cestari, which I didn't agree with, and made my own independent analysis.
Q. So it sounds like there's some disagreements over what the San Andres top may be, and you actually didn't do all the work to evaluate what other people had done.
MS. HARDY: Object to the question. I think Mr. Rankin is tending to testify.
HEARING OFFICER HARWOOD: It's an argumentative question, and he'll rephrase it.
MR. RANKIN: I'll drop it.
BY MR. RANKIN:
Q. All right. Let's get into your testimony.

I've highlighted a phrase here on Page -- this is your exhibit -- before I get started, Mr. Bailey, let me go ahead and just confirm that this is your exhibit.
This is your self-affirmed statement, marked as your rebuttal testimony. I believe it's marked as Exhibit K. I extracted it from all the other testimonies. So it's 78 pages. I'll just scroll down to the bottom so you can see your signature to confirm it's your signature and it's dated February 8th, 2025. Is this your testimony?
A. It is.
Q. All right. So, starting off here, I wanted to ask just a couple things, because I think I got this from your summary, but I just want to make sure. Okay?
Essentially, I've highlighted this first phrase here which says, "Goodnight has chosen to use this model," and I presume you're referring to this engineering top or their own top picks, right, their own stratigraphic model?
A. It's a great question. It's not a stratigraphic model. I don't know what it is.
Q. So, in any event, you've chosen to use whatever their approach is, "to argue that there are not any ROZ zones within the San Andres and thereby

support the case for water disposal in the San Andres," right? Did I read that correctly?

A. Yes, you are reading that correctly. Yes.

Q. Okay. But I think I understood you to say that -- and I think you understand this, right, that the dispute in this case is not over what's happening above -- I mean, the dispute in this case is not over whether there's a ROZ or oil saturations above Goodnight's disposal zone? Do you understand that?

A. You're suggesting that my rebuttal is not rebutting that Preston McGuire said there's no ROZ in the San Andres?

Q. No. I'm asking you, do you understand that the dispute in this case is over whether or not there's a ROZ in the disposal zone, where Goodnight's injecting?

A. I'm not sure I understand where you're coming from on that.

Q. Okay. Well, let me ask you again. I mean, I think you phrased it pretty well. Let's see if I can find it.

Several times during your summary, you were pointing out that you believe that there are ROZ saturations below Goodnight's barrier, correct?

A. That is my responsibility, was my

responsibility to establish a ROZ within the San Andres, yes.

Q. Okay. So, my point is that the issue, the contention right now, and in this hearing, in this case, is whether or not there's a ROZ below Goodnight's barrier. Do you agree?

A. I think there's a contention that the ROZ that you define as a ROZ is within the San Andres where you define it in the lower Grayburg, as well as below your barrier where there's additional ROZ.

Q. Why does what you call an "interval" matter here?

A. Why does the interval matter?

Q. Why does what you call it matter?

A. Well, because your geologist said that the ROZ zone is in the lower Grayburg, not the Upper San Andres, so you have to establish that.

Q. I guess my point, and I think you understand this, is that what's at dispute is whether or not there's producible economic hydrocarbons below Goodnight's barrier. You agree with that at least, right?

A. I don't. I think the argument here is that you're impairing Empire's ability to exploit their potential ROZ zones.

Q. Okay. So one of those arguments, one of those issues is whether or not there's hydrocarbons below Goodnight's barrier. Agree?
A. Yeah. They're --
MS. HARDY: Objection to the question. I think Mr. Rankin is argumentative and testifying.
HEARING OFFICER HARWOOD: It's overruled. Go ahead.
A. That's fine. There's very clearly oil saturations below what Goodnight considers a barrier. We've very clearly shown that with the core data.
Q. Now, you're not telling me, as you sit here, that Goodnight's experts didn't evaluate the oil saturations above Goodnight's barrier, are you?
A. I'm not 100 percent certain what Mr. McGuire has evaluated.
Q. Okay. Let's set aside Mr. McGuire. Have you evaluated or reviewed Netherland, Sewell's oil in place or petrophysics?
A. My testimony here today is a rebuttal to Preston McGuire.
Q. Okay. So you haven't even looked at Netherland, Sewell's analysis or petrophysics?
A. I've looked at Dr. Davidson's report, yes.
Q. Okay. So you looked at it. So you're

familiar with where he put oil saturations, correct?
A. I am.
Q. Okay. So are you telling me that Goodnight's experts did not put oil saturations above its barrier for its disposal zone?
A. I think they do have oil saturations above the barrier.
Q. Okay.
A. You keep referencing a barrier. There is no barrier, just to be clear.
Q. Fine. Just to not argue about it, then, let's call it what Goodnight has identified as a barrier.
A. Okay.
Q. Very good. I'll move on from there.
Okay. I'm going to go ahead and pull up I think it's your Exhibit K-14. I'm going to scroll down, because I think this may help. Pictures are worth a thousand words.
Okay. So in this cross-section, you've helpfully identified, because we've been trying to figure this out for some time, where Empire -- let me ask you this. Does Empire adopt your pick for the top of the San Andres?
A. I think it's generally accepted, yes.

Q. So whatever was presented previously through Mr. McShane is no longer the tops that Empire is adopting?

MS. HARDY: I object to that question as being outside the scope of Mr. Bailey's testimony. I don't think he's -- he's testifying about his opinions.

MR. RANKIN: I need to know what Empire has adopted, what their tops are. He is -- so important that I need to know, which one is it?

HEARING OFFICER HARWOOD: I mean, we're talking about where the top is. That's been the subject matter of the witness' testimony, so I'm going to allow it. It's overruled.

BY MR. RANKIN:

Q. I'm trying to figure out which testimony to go by here. Okay? Is it Mr. McShane's, that you've told me you haven't really carefully reviewed and you haven't confirmed exactly where your tops are relative to his, or is it yours? So I'm just asking you, have you confirmed with Empire, does Empire adopt your pick for the top of the San Andres?

A. I haven't talked to Empire about adopting anything.

Q. Okay. So you're just giving your own

independent assessment of what you think the tops are?
A. I think I've been very clear this is an independent analysis.
Q. Okay. Very good. Just wanted to make that clear. I think I'm owed that, and I wanted to know. Thank you for confirming.
Now in this model here that you've got, your stratigraphic model, you've helpfully identified what you've picked for the top of the San Andres, correct?
A. That is my top of the San Andres in red, yes.
Q. Okay. And then you've identified here where Goodnight has put its top of the San Andres, in the blue line, correct?
A. That is correct.
Q. And this is your Exhibit K-14, to be clear. So the difference between these two is what you're saying is of critical importance, right? This roughly 200-foot interval between the two picks is what you're saying is unfairly excluded by Goodnight because it eliminates from the San Andres potential ROZ, correct?
A. That is correct.
Q. And tell me if you agree with this, that while -- because you reviewed Dr. Davidson's

petrophysics, right, where you've seen oil saturations in this zone, correct?
A. Yes.
Q. Okay. So Goodnight is not excluding those oil saturations from the zone, it's just putting them in a different zone, correct?
A. That is correct.
Q. So that ROZ, those hydrocarbons don't just disappear, do they?
A. No. His model is actually pretty consistent down to your barrier zone, where it changes.
Q. We'll talk about that.
A. Good.
Q. Yeah, we will. Okay. So I just wanted to make clear for the record that you're not saying that ROZ is being excluded by Goodnight, it's simply being assigned to a different interval of rock. Agree?
A. I agree.
Q. Okay. Thank you. Go back up to your testimony. Okay. I guess this comment here, the second comment here, just along the same lines, you're saying that your model is of critical importance because it shows ROZ in the Upper San Andres as opposed to Goodnight's approach, which shows that there's a ROZ in the Grayburg. Right?

A. That would be fair.
Q. Okay. And that's kind of what I just talked through with you in K-14, right?
A. Mm-hmm. Sorry. Yes.
Q. As I go back to K-14, have you evaluated or looked at the perfs in Goodnight's disposal wells?
A. On a minimal basis. I haven't focused on the perfs in Goodnight's wells, no.
Q. Okay. But would you agree with me that this interval that we were just talking about, that's disputed on K-14 between Goodnight's San Andres top pick and your top pick, that Goodnight's injection is not occurring in that interval?
A. No, I don't agree with that at all.
Q. Okay. You don't. But you just told me that -- okay. So did you look at Goodnight's --
A. You're referencing perfs. You're not talking about fluid, vertical fluid, but it would be impairing.
Q. Fine, I'm distinguishing. So I'm asking you, are the perfs below Goodnight's injection, San Andres top pick?
A. They are below the San Andres top, your -- Goodnight's San Andres top, correct.
Q. Okay. That's the question I was asking.

A. Well, just if you'd phrase it that way, that would be good.

Q. I understand that you're saying that there's communication between the two. My question, though, was whether or not you agree that Goodnight's injection perfs are below its top of San Andres pick.

A. That is correct.

Q. Okay. Something we can agree on. You state here in your rebuttal that you agree that the Grayburg and San Andres are separate geologic intervals, right?

A. They are separate geologic intervals by time.

Q. Okay. Just explain to me a little bit what that means, when you say something is a "separate geologic interval."

A. We have an uncomformity at the top of the Upper San Andres that is a period of non-deposition, a period where we have an erosional unconformity, right? That's how we define it. That's a time-separation boundary. That's what a sequence boundary is. And so the Grayburg is separate from the San Andres.

Q. And, generally, when you have separate geologic intervals, they generally function as separate reservoirs?

A. Generally, they can, depending on the properties themselves, yes.

Q. Have you evaluated whether or not the San Andres and Grayburg here operate as separate reservoirs?

A. In what capacity, Mr. Rankin?

Q. I'm asking you, I guess, as a guy that characterizes reservoirs.

A. I see consistent saturations all the way through the Grayburg and the San Andres. I think the stratigraphy outside of anhydrite cements some varying lithology in general, these are dolomites. Predominantly, the San Andres is more dolomite; whereas, you might have some -- you have dolomitized sands, predominantly, in the Grayburg.

Q. How do you define consistent oil saturations?

A. Well, you can see it on the cross-section. If you'd like to go back to that exhibit, we can show that.

Q. I want to get just sort of a generalized definition of what a consistent oil saturation is.

A. I provided that with the ranges in my map. So you can see, I said, there's ranges between 20 to 30, 35 percent oil saturations throughout the whole column. I think that's fairly consistent.

Q. We'll get to your maps. Okay? Because your maps are basically -- your maps are interpolating oil saturations between your colleague's, Mr. Birkhead's, oil saturation calculations, correct?
A. Yeah, that's correct.
Q. Okay. So your maps are interpolating through computer software what those oil saturations may be between those points, correct?
A. No. My maps are based on what Scott works through his petrophysical modeling. He provides me with the output curves for that, and then I go and map it.
Q. Okay. Just so I understand, what are the output curves?
A. He will provide me with a porosity, water saturation, Vclay, bulk density, if he has to make some changes to the matrix. Those are the general output curves.
Q. Just so I have them right, I was trying to write quick. Porosity?
A. Yes. We correct the porosity back to a dolomite porosity matrix.
Q. Water?
A. Water saturation.
Q. Sw, yeah?

A. Yeah. Sw and SWT, phiT, which would be total porosity, phiE, which would be effective porosity, Vclay as a volume. In some cases where we have source rocks, I will get TOC by weight percent on a modified passage. There's a lot of different curves that I get output to me.

But yes, he has, in general, his own net-pay values as well. I run my own calculations, based on his curves, to make sure that we're consistent. It is an iterative process, as it should be with good petrophysics and geology, I think, yeah.

Q. And those are the bases for your -- I think you discussed this in your testimony, right, where you've identified cutoffs for these different values?

A. That's correct.

Q. Okay. I'll come back to that. But those are the curves you're talking about.

So he provides you those curves, and maybe I'll save this from when we get into your maps. But essentially, just so I understand as a general overview, he provides you those curves and then you incorporate them into your mapping. Yeah?

A. I go through and do a computation for net pay, using those curves. So I do a net pay. I do an average phiT above the cutoff. So the average porosity within that net-pay volume, as well as the average water saturation within that net volume based on the 80 percent cutoff.

Q. Okay. And then from there, you incorporate with your cutoffs into your mapping?

A. The cutoffs are in the mapping, so I map the net pay, and then map the average porosity, the average water saturation, and go from there.

Q. And the maps in the software then interpolate across the map, correct?

A. Yes.

Q. Okay. But otherwise -- I mean, my point is simply that you're taking discrete log readings, interpretations, and then interpolating between those based on your inputs, correct?

A. That's correct.

Q. So back to my question, which is, how do you define consistent oil saturations? You're finding consistent oil saturations based on your inputs and then the output from your mapping software?

A. I'm finding that based on the curves Scott has provided me. So 1 minus Sw is oil saturation, right? So I can look at the oil saturation all the way through the curves that have been provided to me by the petrophysical model, and I can see that there's

consistent oil saturations through the Grayburg, all the way down through the San Andres, through the end of the Lower San Andres.
Q. All right. I guess my question then is, are you defining consistent oil saturations based on Mr. Birkhead's log analyses, the curves and his log analyses --
A. I --
Q. Let me finish.
A. Okay.
Q. Sorry. Are you defining consistent oil saturations based on Mr. Birkhead's discrete interpretations on each log, or are you defining it based on your outputs from your mapping software?
A. I'm defining it based on the averages that I see on the outputs that I've generated in the maps, yes.
Q. The maps. Okay.
A. And the logs themselves. I mean, it's very visible. We can go back to the cross-sections. It's easy for anyone to see.
Q. We'll get to the cross-sections.
I mean, you understand my question. I mean, like, the maps are interpolated, and Mr. Birkhead's is interpreted, but they're discrete

points. And I want to understand, if you're saying that, "I'm interpreting oil saturation as being consistent based on a correlated output" from your mapping software versus Mr. Birkhead's discrete analyses of his log --
A. My mapping output represents the petrophysical model. So the curves that he outputs are what the map represents.
Q. Very good. I mean, I think we got to the bottom of it.
A. All right. I'm just making sure. It seems like we keep circling back around.
Q. Well, I like to get to the bottom of things. Okay? I want to make sure I understand. All right?
All right. Now, the next sentence here is one that kind of threw me. "However, based on fluid communication between the San Andres and Grayburg in wells within the EMSU, it is undisputed that these reservoirs are in communication with one another."
Mr. Bailey, I mean, the whole reason we're here is because there is a dispute over whether or not there's communication, right, between these zones? Are you telling me that there's no dispute?
A. I don't think there's a dispute. I think

Chevron made it very clear, which your geologist actually uses as a resource or a reference, that they made very clear that there was San Andres fluid migrating into the Grayburg pre-flood.
Q. And did you yourself do an independent evaluation or investigation on whether or not there's communication?
A. It's basically based on that literature.
Q. Which literature?
A. It's in my documentation. It's a Chevron paper. I believe it's 1991 EMSU flood.
Q. Was it the one that Dr. Lindsay referred to about -- I think it's a 1996 paper, actually.
A. I think it's 1991, but I'm not 100 percent sure. It's in my documentation. We can review that. Actually, it's in the references, if you'd like to go down to that.
Q. Let's see. I wouldn't mind making sure I know which one.
A. I'd like to, too. Yeah, there it is -- sorry. No, I guess I don't have it in there. It should be in there.
Q. Mr. Bailey, I've spent so much time on these papers, I'll represent to you I believe it's the 1996 paper.

A. Okay. Maybe you're right. Can you pull that paper up? I'd appreciate that. I believe it was Kearney. Strickland and Kearney, maybe. Strickland, et al.
Q. Let me see if I have it here. Is this it?
A. Yeah, Strickland, et al. There you go. You can go down to the exact comment he made.
Q. By the way, this is a Goodnight Exhibit B-5 that we're looking at, Mr. Bailey. I think you include this in your testimony, don't you?
A. I do.
Q. Well, I kind of want to -- we can talk about it now. Let me see if I can find where that is in your testimony. Actually, if you don't mind, I'm going to go ahead and just switch over to your testimony, because I think you do talk about it.
A. Can we scroll down to the comment that's actually made, regarding the test?
Q. I'm going to do that, a hundred percent, I promise. But I also want to kind of put it in context with your testimony.
A. Sure.
Q. Okay? So this is Page 5 of your testimony, right? And this is the section, I believe, where you cite to and quote from that paper, correct?

A. That's correct.
Q. Okay. And starting at this bullet here, you quote from it, "During the time of primary production prior to unitization and initiating the waterflood in the Eunice Monument Field," and it goes on, right?
A. Yes.
Q. And then you go down here and you include some other language from -- it's also within quotes, "Barium sulfate scale has also been detected in surface vessels that are used to process the produced fluids," right?
A. I do. I think the most important part of this is, "Thus leading to the conclusion that sulfate-rich water found its way into some producing wells before water flow was initiated."
Q. Right.
A. Would you agree that the San Andres and Grayburg are communicating at that point?
Q. I get to ask the questions.
Let's go back to Mr. Strickland's paper. Okay? So I've highlighted here the portion that you quote in your testimony, right?
A. Mm-hmm.
Q. And I've also highlighted in green a portion that you left out of that quote. You didn't include

it.

A. Okay.

Q. And the portion that you left out says, "A possible explanation is shown in the sketch in Figure 4."

A. Okay.

Q. But you didn't include that in your --

A. Okay. Well, I apologize. I didn't mean to exclude that.

Q. Well, it's interesting, because that's actually an important piece of this assessment.

A. Okay. Let's go through it.

Q. So let's go on down to see what -- so just, first of all, before I do that, I want to point out a couple of things. Okay?

Looking at this quote, a couple of things that I think are worth noting, because I'm a lawyer and words are important, okay, so the second sentence here, starting with, "Although" says, "Although the drilling was confined to the Penrose and Grayburg formations," and this is talking about pre-waterflood drilling --

A. Mm-hmm.

Q. -- "apparently, some San Andres water was finding its way into the wellbore of these wells and resulted in a barium sulfate scale, barite, deposition problem."

Did I read that correctly?

A. You do.

Q. Okay. And so the word I wanted to focus on was "apparently," right?

A. Okay.

Q. And now, having read this paper, did you see any documentation or data supporting any of the chemistry conclusions that were made?

A. I don't know that I reviewed any chemistry conclusions, no.

Q. Okay. I've looked for it and I didn't see any chemistry data or references to databases or actually any data included in this paper showing what they're saying here. Okay?

A. No, I actually used this reference because your geologist used it as a reference to make the point that there wasn't communication because of chemistry issues.

So he's making a point on chemistry issues, but not being a problem because of San Andres water being pumped into the Grayburg. But then this statement right here clearly shows that there was -- apparently Chevron felt like there was San Andres water migrating into the Grayburg pre-flood.

Q. Right. But you didn't see any documentation or data supporting that speculation about whether there was or wasn't, did you?

A. I didn't. It's purely a rebuttal to Mr. McGuire's testimony.

Q. So let's go to Figure 4, because I think it's useful as well.

Well, before I do that, after the part that you excluded, there's another sentence here. It says, "Production experience strongly suggests that mixing of the water occurs in the producing wellbores rather than in the formation."

Did I read that correctly?

A. Mm-hmm.

Q. Okay. So it's not actually saying that there's San Andres water getting into the formation, right?

A. I actually disagree with you on the statement that they made that there was San Andres water migrating into the Grayburg. I don't know how you determine that any other way.

Q. Well, I'm asking, what it says.

A. It says that they're -- the mixing of the water occurs in producing wellbore rather than the

formation. I understand what you wrote, but that's --
Q. I didn't write it.
A. Well, I understand what you're saying, but that's very contradicting to the statement of the waters being -- San Andres migrating into the Grayburg pre-flood.
Q. Oh, we didn't say that.
A. I understand. But I'm saying that there's a contradiction here that clearly they've stated that the waters are migrating from the San Andres into the Grayburg pre-flood. Do you agree?
Q. I don't agree.
A. You don't agree that that's written on there?
Q. No.
A. Okay. So let's read right here.
Q. Mr. Bailey, I get to ask the questions. Okay? And I'm asking you, and I'm just asking you, you know, to confirm what I read, and you did. And so I think we can move on.
So now, the point I'm making, Mr. Bailey, is that what this statement says and what the paper says is that, apparently, some San Andres water was making its way into wellbores, not the formation, based on what they said, correct?

A. Actually, what it says is -- it is providing -- sulfate-rich water is coming into the producing wellbores.
Q. Thank you.
A. Yes.
Q. So let's go down to Exhibit -- or rather, Figure 4 in the paper, because I think this also will help illustrate that point. Did you look at Figure 4 in this paper?
A. I probably did. I don't recall. I've read a lot of paper.
Q. So you're not sure what it looks like?
A. I'm not a hundred percent.
Q. So let's find out.
A. It'll be interesting. Let's do it.
Q. Okay. Here's Figure 4. Okay? And, you know, I'm just going to -- it says what it says and it looks like what it looks like. Okay?
Figure 4 is a sketch of how San Andres water resulted in the formation of barium sulfate scale before the water flow was initiated.
And you'll note that in this figure that they have an image with an arrow pointing up into a wellbore, a producing wellbore, with a notation to the right of it saying "Bottom Water," with four question

marks. Right?

A. Yeah.

Q. And so wouldn't you agree with me that this is not necessarily -- it doesn't seem to be the conclusion? It's more a speculation or a question about whether and how this may be happening? Correct?

A. Agree.

Q. Okay. On that point, in your testimony, this is on Page 11, I've highlighted here, you state that, "Chevron concluded that sulfate-rich water made its way into the producing wellbores before the waterflood."

So you agree with me that it was limited to the wellbores. Okay?

And you go on to say that, "San Andres water is sulfate rich and Grayburg water contains barium. If the two are mixing prior to the waterflood, it can only be concluded that San Andres water is migrating into the Grayburg?"

My point here, Mr. Bailey, is that you've made a conclusion, a conclusory leap from wellbore to formation.

A. How else do you propose barium sulfate scale is occurring when sulfate-rich water is in the San Andres and barium-rich waters are in the Grayburg?

Q. I'm just going off what the Chevron paper says.
A. Okay. Well, I don't know how to else conclude that. If we've got barium sulfate scale happening, sulfate-rich water has to be migrating into the Grayburg.
Q. I understand that's your conclusion. I'm just pointing out what the paper says.
A. Okay.
Q. Now, I think we got -- we went off this track to talk about this paper. And I'm going to see if I can make my way back to where we were.
I think we were talking about the fact that the -- whether and to what extent the Grayburg and San Andres are separate geologic intervals. And I think that was higher up in your testimony.
A. It's in the summary, yes.
Q. And my question to you is whether or not you've done an evaluation of whether the Grayburg and San Andres function as separate reservoirs.
A. In what capacity?
Q. And that was that was the same thing you asked me, and my response to you was, well, I guess I'm asking you as a person who characterizes reservoirs, do you have an opinion about whether or

not the Grayburg and San Andres function as different reservoirs?

A. I think they're different reservoirs from a geologic standpoint, and that's how I'll place it.

Q. That's fine. Okay. Let me come back to this fracture issue.

HEARING OFFICER HARWOOD: Mr. Rankin, would this be a good time for the morning break? It seems like we're changing --

MR. RANKIN: I'm more than happy to accommodate a break right now.

HEARING OFFICER HARWOOD: Okay. It's 10:27. It seems like a different subject matter. Why don't we take 15 minutes, come back at 10:45.

(Recess held from 10:27 to 10:45 a.m.)

HEARING OFFICER HARWOOD: We're back on the record.

CROSS-EXAMINATION (Cont'd)

BY MR. RANKIN:

Q. All right, Mr. Bailey. I think we're back on. So I think we've picked up at Page 6 of your rebuttal testimony here, and I've highlighted another section that I want to talk to you about.

Here I've highlighted a passage where you've said that, "We define the top of the San Andres

as the tight dolomite sequence approximately 130 to 150 feet above the Lovington Sand and thinning to the east onto the Eunice Monument anticline, where it is approximately 100 feet below the top of the San Andres and the RR Bell Number 4." Correct?
A. Correct.
Q. Okay. Normally, a tight dolomite is normally a good barrier to flow. Agree?
A. Can be, yes.
Q. Okay. Next, Page 7 here of your testimony, you say that "In the EMSU 628, the reported perforated intervals by XTO from," -- and I'm not going to bother to read the depths, "are designated as San Andres," correct?
A. Correct.
Q. Okay. Now, what's your basis for saying, in your opinion, that these perfs are designated as the San Andres?
A. I have exhibits that illustrate that they're reported to the State.
Q. Okay. Now, did you evaluate where Goodnight put the San Andres top in this well?
A. I don't know that I had a top for Goodnight in this well.
Q. Okay. Are you aware that Goodnight provided

all of its top picks to Empire as part of the discovery in these cases?

A. I am aware, but I don't know that they covered all the wells that I evaluated.

Q. Okay. Did Empire provide to you Goodnight's top picks?

A. They did.

Q. Okay. But for this particular well, you did not look to see if there was a Goodnight top pick for this well?

A. I don't recall if there was a top pick for this. I didn't get that.

Q. So you're not aware that Goodnight had picked the top for this well at 4,088 feet?

A. I'm not certain on what depth they picked the top, no.

Q. Okay. So I'm just going to throw up an XTO well log for this well, for the 628.

MR. RANKIN: This is from the Division's records, Mr. Hearing Officer. I'm going to mark it as Goodnight Cross Exhibit Number 3.

BY MR. RANKIN:

Q. So, Mr. Bailey, this is from the Division's well file for this well. You see that it's got the API number and identifies this as the Eunice Monument

South Unit Number 628 well. This is the well we're talking about right?
A. Yes.
Q. Okay. And if I scroll down -- first of all you'll see that the operator is XTO Energy, correct?
A. Correct.
Q. And then I scroll down and it does have the San Andres, and the pick here, identified as OCD's top, is 4,087 feet. Do you see that?
A. I see that the OCD has it at 4,087, yes.
Q. Okay. And would that put it within or outside of your intervals that you identified in your testimony?
A. That would be below the interval that XTO reported the top depth.
Q. Okay. But you agree with me that this is an XTO document, correct?
A. I don't know that that's specifically an XTO document. I don't know if the State put that in there or not.
Q. Okay. But it's a different top pick than what you had for this well, correct?
A. If you will go to my exhibits, you'll see the top picks that XTO placed.
Q. Which exhibit number is it, just so I know?

THE WITNESS: Dana, do you have that? Apologize.

MS. HARDY: In your rebuttal testimony?

THE WITNESS: Yeah, my rebuttal.

MS. HARDY: It'll just take me a minute to get to it.

BY MR. RANKIN:

Q. I guess, Mr. Bailey, you're going to tell me that you have a different document that shows a different top pick, correct?

A. I have the document reported to the State of the tops of the San Andres, yes.

MS. HARDY: I do have your rebuttal. I can share my screen if you would like.

MR. RANKIN: Is it in his rebuttal?

MS. HARDY: Is that what you're referring to, Mr. Bailey?

THE WITNESS: Yeah. There should be three State documents for those wells.

MR. RANKIN: Dana, if you have it, you can tell me the exhibits and I'll move to them.

MS. HARDY: Not sure which exhibit it is.

THE WITNESS: It's in the cross-section. I have the State exhibits as well. I can provide those.

BY MR. RANKIN:

Q. Okay. Maybe during a break. But, I guess, which cross-section has it?

A. The same cross-section that we were looking at with the XTO perfs?

Q. I don't remember which one that was.

A. Exhibit --

Q. The K-10?

A. Maybe -- K-14.

Q. Okay. So here's Exhibit K-14. And I think the EMSU 628 is on the left, correct?

A. That is correct.

Q. And your pick for the top of the San Andres is at about 39. You tell me what your--

A. It was probably pretty close 3918.

Q. 3918? Okay. And the document I was showing you was deeper. It was about 40 -- 4,000 -- just about where Goodnight's pick is, correct?

A. Yes.

Q. So there's a difference of opinion in the well file about what that top pick is. Would you agree?

A. I agree. Do you also have the document for 658 that was reported to the State, selectively? I understand where you're going with this, but 658 also has the OCD top as well.

Q. Okay. Well, do you have it in your exhibits?

A. I have it in the State documents. But the same document you showed for 628, which I agree is there in the well file, if you look at 658 well file, their top for the OCD top is exactly where we have the San Andres top. So we have a contradiction here.

Q. Yeah, okay.

A. But the difference is, is that the documents, if you read into them, supplied by XTO, show the wellbore with their perfs and the designation for those perfs. And that's the documents that I have that I'd like to provide to you.

MR. RANKIN: Mr. Hearing Officer, I would go ahead and move the admission of that exhibit as Goodnight Cross Number 3.

HEARING OFFICER HARWOOD: Ms. Hardy, any objection?

MS. HARDY: No objection.

HEARING OFFICER HARWOOD: Any objection from OCD?

MR. MOANDER: No objection, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Rice?

MR. BECK: No objection.
HEARING OFFICER HARWOOD: Pilot?
MR. SUAZO: No objection from Pilot.
HEARING OFFICER HARWOOD: It'll be in admitted.
(Admitted: Goodnight Midstream Cross Exhibit Number 3.)
BY MR. RANKIN:
Q. Mr. Bailey, you just mentioned the EMSU 658, and I didn't prepare, I didn't review the well file for that well, but you identify here reported perforated intervals by XTO from 3,995 feet to 4,004 feet, and then 4,018 feet to 4,030 feet, and then 4,074 feet to 4,084 feet.
And you say that those are all designated as San Andres, correct?
A. Correct.
Q. And you're saying that those are above Goodnight's top of 4,145 feet measured depth, correct?
A. Correct.
Q. And that's the same cross-section we were just looking at, right?
A. That is in the same cross-section, yes.
Q. So I'll just dupe down there real fast. 658. Okay. So the 658 is the middle well here,

right?

A. Yes.

Q. And including in your cross-section, as you reviewed in your summary testimony, you include in the far right track -- I'm sorry. Do you refer to your companies as Ops or O-P-S?

A. That's correct.

Q. Either one?

A. Ops Geologic.

Q. So Ops Geologic has put together the low and high case based on its petrophysical analysis on the far right track, right?

A. Correct.

Q. And the intervals, are you aware of that -- And I guess you also show the -- are these the perfs here on the left-hand side, in your gamma ray track?

A. That's correct.

Q. Okay. It's a little hard to tell from this, but not this entire section was perfed, right?

A. No. It actually illustrates it is one full column. That's why I designated the depths in there where the perfs were.

Q. Okay. And the perfs are these little markings here?

A. In general, yeah.

Q. Are you aware that that well, down in this section here below, what you've identified as the San Andres, tested 100 percent water?
MS. HARDY: Object to the form of the question. Mr. Rankin is testifying. It's assuming facts that haven't been established.
MR. RANKIN: I'm asking if he's aware of the well file that shows that it tested 100 percent water.
HEARING OFFICER HARWOOD: I think you need to lay a little more foundation.
BY MR. RANKIN:
Q. Mr. Bailey, as part of your effort to evaluate your reservoir characterization work, did you look at the Division well file for this well?
A. I did not look at the production profile of this well.
Q. You didn't look at the production profile of this well, but you have interpreted production throughout this interval?
A. I'm sorry, I've interpreted production? I don't see anywhere I've interpreted production.
Q. I'm sorry. I misstated. You've interpreted high levels of oil saturation, but you didn't look at whether or not the well has tested in that zone?

A. I did not look at what that well tested in that zone. It's well understood that the San Andres, as a ROZ interval, does not perform as a main pay zone.
Q. So it was perfed. You knew it was perfed, right?
A. Yeah.
Q. But it didn't cause you to go look to see if it actually had tested?
A. No, I didn't.
Q. Now, as I understand, these increments here on the far right in your saturation curve, those are 20 percent increments, right?
A. That is correct.
Q. So if I look at some of the higher levels here, so it's 20 percent, 40 percent, 50 percent, upwards, between 50 percent and 60 percent in some of these intervals, correct?
A. It's in general between 20 and 40 percent, yes.
Q. In general, but I'm saying there's some highs in here that are above 40 percent. Don't you agree?
A. There is, yes.
Q. Okay. Isn't 40 percent a cutoff for

conventional oil generally?

A. From where?

Q. Well --

A. It's dependent on the wettability, the oil properties. There's a lot of factors that determine whether oil is mobile or not, if that's where you're going with that.

Q. Okay. Let me ask you, do you have an understanding of what saturations of oil is going to be mobile here?

A. I don't, no.

Q. Have you evaluated that?

A. I have not.

Q. Are you aware of any systems where oil is not mobile at 40 percent?

A. I don't think I've ever evaluated mobile oil at 40 percent in a water wet reservoir, as this is.

Q. Have you ever seen a system where you have interpreted oil saturations at 40 percent or higher where oil is not mobile?

A. I don't know that I have.

Q. This next section here is Page 9 of your testimony that I've highlighted here. I think this gets into your cutoffs, right?

A. Yeah.

Q. So I think I want to kind of -- I put that aside because I wanted to -- I knew I was going to get to it?
A. Okay.
Q. And here we are. So here you state that net-pay calculations for both the Upper and Lower San Andres were determined using 4 percent PhiT --
A. That's total porosity.
Q. Total porosity. Okay. -- cutoff and 80 percent water saturation cutoff, which, because water saturation is the inverse of oil saturation, that gives you 20 percent oil saturation cutoff, right?
A. Water saturation isn't the inverse of oil saturation, Adam. 1 minus Sw is oil saturation.
Q. Okay. Thank you for clarifying, since I'm not a petrophysicist or a geologist.
Okay. And then you've got 60 percent volume of clay cutoff for VCL, right?
A. That's correct.
Q. Okay. So just kind of generally, maybe you can walk through, what's the basis for each of these cutoffs? How did you choose each of these cutoffs?
A. Generally, in carbonates we've analyzed across many different basins, we use the 4 percent

PhiT cutoff. And 80 percent water saturation cutoff was used because I guess it's been determined that 20 percent of oil saturation is required for a ROZ. And a 60 percent Vclay cutoff. There's very little clay within this system.

Q. Okay. I think you mentioned in your summary that you had resistivity of 200 ohms, right?

A. That's me just coloring where I have high resistivity. That has nothing to do with the cutoffs.

Q. Okay. Now, on the 4 percent, that was corrected to a dolomite matrix, right?

A. That is a phiT curve that is generated from Scott was run on a 2.90 matrix.

Q. Okay. And why do you use this 4 percent?

A. As I just explained, in general, in our experience with carbonates that we've dealt with, 4 percent cutoff is a reasonable cutoff for total porosity.

Q. Okay. And the carbonates that you've dealt with, again, were not in Delaware Basin, right?

A. No, we're not dealing with carbonates specifically in the Delaware Basin.

Q. Okay. Now, you mentioned the volume of clay, 60 percent cutoff. Then you said there's very little clay here. Are you measuring any clay?

A. Very little clay. And I think that's a better question for Scott.
Q. Okay. So you didn't yourself have any input into that determination, that cutoff?
A. Very minimal. Yeah.
Q. Okay. What input did you have?
A. Just, in general, looking at the cores to try and understand do we see very much clay within the system. And, you know, I defer to Scott for determining what the cutoff of the Vclay would be.
Q. Okay. But in your evaluation of the core, which cores were you looking at?
A. The 679 and the RR Bell.
Q. And based on your review of those two cores, you're telling me you didn't see much clay, right?
A. In my discussions with Scott and our looking at the cores, no.
Q. Okay. Did your identification of any clay affect your -- I guess you tell me. Did it affect or evaluate in anyway your analysis of oil in place or the reservoir here?
A. I'm sorry. Rephrase that question.
Q. Yeah. Your determination that there's very little clay or there is some clay in the system, did it affect the petrophysics analysis at all? Or is

that a question for Mr. Birkhead?

A. That's a question for Mr. Birkhead.

Q. Okay. Now, you told me that you had a -- I think you told me, right, I may be mistaken, but it was a total porosity of 4 percent, right?

A. Correct.

Q. Okay. Because there's some clay, do you also have an effective porosity?

A. We do have an effective porosity.

Q. What's your effective porosity?

A. My average effective porosity?

Q. Sure.

A. I don't know off the top of my head. It's going to be a little bit lower than the total.

Q. You don't know how much lower?

A. I would be speculating.

Q. Forgive me, because I -- was that part of the -- your effective porosity would have been a value that would have been provided to us in advance of the hearing?

A. Yeah. You were provided the petrophysical curves, is my understanding.

Q. Okay. So your understanding is that we should have gotten -- you expect us to have gotten petrophysical curves that Mr. Birkhead generated?

A. That would be my expectation, yes.
Q. Okay. Because you'd want to know what the effective porosity is, right? If you got some clay and it's a different total porosity, you'd want to know what the effective porosity is, right?
A. I mean, that's up to your petrophysicist.
Q. Okay. But, I mean, if I'm trying to evaluate what you guys did, we'd want to know what the difference is between total versus effective, right?
A. Sure.
Q. Okay. Now, I asked you and you told me that you didn't look at it, so I guess I'm going to have to direct this to Mr. Birkhead. But you didn't have any discussions with Mr. Birkhead about whether or not these cutoffs were different than what NuTech Energy used in its analysis?
A. I'm not aware of what cutoffs NuTech used, no.
Q. Okay. So you didn't look to see if they were the same or different or how your analysis was different from NuTech's, right?
A. I think that's a better question for Mr. Birkhead.
Q. Okay. But you didn't yourself?
A. I didn't do the petrophysical analysis, so

no.

Q. How about on the geology side, did you evaluate whether your geologic interpretation aligned or was conflicting with what NuTech presented?

A. I would presume that NuTech did not do any stratigraphy, did not do a correlation. That's not what they do.

Q. Did you look to see if they interpreted any clay or shale in their model?

A. I think they used the Simandoux model, so they did have some volume of clay within their model.

Q. Okay. So you know enough that they did use Simandoux, but you didn't evaluate to what extent or how they interpreted clay or shale in their model, right?

A. No, I didn't. That's Mr. Birkhead's responsibility.

Q. Okay. Lots of getting shifted over to Mr. Birkhead, I guess.

A. Well, he ran the petrophysical model and you're asking a petrophysical questions.

Q. Well, I guess I was asking -- you know, it seemed to be it would also inform your geology. Like, I wanted to understand whether you assessed NuTech's assessment of the system to understand whether you

were aligned or not. Right?
And it sounds like that hadn't happened, right? You didn't look to see if they interpreted clay or shale?
A. I did not.
Q. Okay. All right. Now, here on the bottom of Page 10 of your rebuttal, you identify, another passage here I've identified. And here, I'll read it out loud. "And while we have fewer wells available for evaluation in the Lower San Andres, there are clear zones of interest with oil saturations over 20 percent and potentially in the range of 40 to 60 percent."
Did I read that right?
A. Say that again?
Q. Did I read that correctly?
A. Read it again.
Q. "And while we have fewer wells available for evaluation in the Lower San Andres, there are clear zones of interest with oil saturations over 20 percent and potentially in the range of 40 to 60 percent," right?
A. That's correct.
Q. Now, we kind of talked about this already, right, and you told me that you have not evaluated

whether or what saturation level oil might be mobile in this system, right?
A. I don't know the answer to that. I'm not sure anyone does because it hasn't been tested.
Q. Okay. So you don't know at what saturation oil might be mobile, right?
A. Not in this field, no. Or any field around here, to be honest.
Q. Now, are you aware that -- have you looked -- how can I phrase this? You're aware that, obviously, the EMSU is a waterflood, correct?
A. In the Grayburg, yes.
Q. Okay. And are you aware that EMSU has six water-supply wells that supplied the water for the waterflood?
A. I'm not certain on how many wells, but I am aware that there are water-supply wells in the field, correct.
Q. Okay. And as part of your work to evaluate or characterize the reservoir, did you study or identify which of those wells were the water-supply wells?
A. They're marked with a "WSW" on my map, and then specifically -- I mean, they're within our evaluation if they had the logs to evaluate them.

Q. Okay. So I'm going to go to your K-10. And this cross-section here, which I think was designed for the purpose of showing us the tops of the formations, right?

A. Yeah.

Q. So I'm going to draw your attention to the two logs on the right, the 457 that I've highlighted here, and the 458. Okay? Those two wells are two of the water-supply wells that provided water for the waterflood? Were you aware of that?

A. I'm sure they are if you tell me they are. I'd have to go back and look.

Q. Okay. But you put them on here and you interpreted them, but you don't know whether they -- sitting here, you weren't sure that they were the water-supply wells.

A. I'm speculating.

Q. Okay. So yeah, I'll represent to you that those two wells are two of the six water-supply wells that were used to supply water for the purposes of the waterflood. Okay?

A. Okay.

Q. And here, in these two water-supply wells, and again, I think we talked about this, that each of these ticks is a 20 percent oil saturation, right?

A. Yes.
Q. And in each of these wells, you've interpreted 20, 40, 60, a high between as high as 60 to 80 percent oil in the 457, correct?
A. It is over 60 percent, yes.
Q. And then in the 458, down in the bottom here, minus 1300 subsea, I'm seeing 20, 30, 40, up to as high as 60 percent oil saturations in that water supply well, correct?
A. Yes.
Q. Those are fairly easy -- you stated very, very high water -- oil saturations, right?
A. Yeah.
Q. Now, I'm going to bring up a map here, just for ease of reference. Pictures are always worth a thousand words, usually, or more. This has been marked as Goodnight Exhibit B-8. This is an exhibit in Mr. McGuire's testimony. You reviewed Mr. McGuire's testimony?
A. I did.
Q. This is a map of some of the wells in the EMSU field that includes the location of the water-supply wells. As you did, they're marked with a WSW.
A. Okay.

Q. And the 457 is here in the middle. I'm highlighting it. And then the 458 is up here in the northeast corner. Do you see that?
A. Mm-hmm.
Q. And Mr. McGuire has taken the total volumes of water produced from the 457 and he's posted them on this well. 42.2 million barrels have been produced from the 457. Do you see that?
A. Yes.
Q. You hadn't looked at the production history for that well before you put that together, that cross-section, had you?
A. No.
Q. Okay. And then the 458 has produced 49.5 million barrels of water. Had you looked at that before you put together that cross-section?
A. Nope.
Q. Now, going back to that cross-section, you're telling me that, as you sit here, you don't think that 60 percent oil saturation would be mobile?
A. I think that it probably would, yes.
Q. So after producing that volume of water, are you aware that neither of those wells have reported any skim oil or oil production?
A. I am not.

MS. HARDY: That hasn't been established. Like a foundation.

MR. MOANDER: Mr. Harwood, I have a concern about this. If we're going to get through this, then I think Mr. Rankin has a good faith basis to ask questions based on what evidence will be put into evidence. And if he's asking those questions on a good faith basis, then it's fair for cross-examination.

Unless we want to make Mr. Bailey subject to recall whenever we have these hearings, I think it's entirely proper to ask questions with evidence that Mr. Rankin has a good faith basis to believe will come in.

HEARING OFFICER HARWOOD: Well, there's a fine line between having a good faith basis and having evidence in the record.

MR. MOANDER: I think the testimony in the record, I think that testimony is in direct testimony in the record from Goodnight's witnesses, from the evidence of what's been reported on these wells. So that evidence is in the record. He's just asking questions.

HEARING OFFICER HARWOOD: Well, as long as it's -- all right, as long as the evidence is forthcoming, it's fair game.

MS. HARDY: I think there's a lack of foundation. I think Mr. Rankin can ask if Mr. Bailey has reviewed the evidence. But the problem is that Mr. Rankin is testifying, and he's doing that continuously through his questions, instead of just asking the witness a question.

HEARING OFFICER HARWOOD: Well, I'm hearing that he's not testifying, that there will be evidence to support the hypothesis that he's built into the question.

What is the question again, Mr. Rankin.

MR. MOANDER: Mr. Hearing Officer, an offer of proof I think, would overcome this pretty quickly. Because of my recollection, there is evidence in the record of this. While OCD is not necessarily intervening in the dispute amongst the operators, I think an offer of proof is a shortcut way to resolve this quickly, and then we can move on.

MR. RANKIN: Well, Mr. Hearing Officer, I appreciate that, and I understand Ms. Hardy's concerns. I think we're in a little different circumstance here before the Commission.

These volumes are in the Division's records. I could ask that the Division or the

Commission take administrative record of them. However it wants to be done.

I don't think there's any dispute of what the records say or what the volumes are. These volumes were actually provided to us by Empire, so I find it a little bit funny that Empire would object to admission or acknowledgement of what Empire's own records show the volumes were produced from these well.

HEARING OFFICER HARWOOD: Okay. I'm going to overrule the objection. Remind us of the question.

MR. RANKIN: I was asking Mr. Bailey, if he was aware that the 457 had produced 42.2 million barrels of water, and whether the 458 will have produced 49.5 million barrels of water.

And he said that he wasn't because he didn't look at the -- well, he can say for himself.

A. I did not look at those volumes. Can you tell me where the perfs are for those wells, please?

Q. Yes, I can.

A. I'd love to see that.

Q. I guess your counsel can bring that up, but I'm not going to. You're not asking me questions. I get to ask you questions. But I do know where those perfs are.

So, Mr. Bailey, as part of your reservoir -- I mean, so you're not also aware of whether those wells have produced any skim oil or produced any oil, correct?

A. I can't imagine any -- no, I'm not, but I can't imagine anyone here was sitting on the tanks looking if there was skim oil.

Q. Okay. But you're not aware of any records reflecting that any oil or production had been recovered from those wells, correct?

A. I'm not.

Q. Okay. Here on the bottom of Page 12 of your testimony, I've highlighted another section here where you were talking about pointing out that there are other CO2 floods in the San Andres along the same trend, across the Northwest Shelf, the Central Basin Platform, and then you put in parentheses, Hobbs, Wasson, Seminole, Vacuum, Means, Hanford and Goldsmith-Landreth units, right?

A. Yes.

Q. Okay. Because I think not everybody knows where all these are, these are all fields with -- first of all, these are all fields with primary production, correct?

A. As far I know, yes.
Q. Okay. Primary production in the San Andres, correct?
A. I don't know that all of them have primary production in the San Andres, no.
Q. Okay. So you haven't -- you cite to these fields, but you don't have an understanding of the production history from these fields?
A. I don't know that all of them are primary producers from the San Andres.
Q. Are you saying you don't know because you didn't look or you don't know because --
A. I'm saying these are active CO2 floods in the San Andres, so they're tertiary recovery efforts.
Q. Okay. My question though is, have you evaluated or determined whether any of those fields -- all those fields have undergone primary production in the San Andres?
A. I have not evaluated all those fields, no.
Q. Okay. I think I understood you to say that they're on the same trend. What do you mean by the "same trend"?
A. They're on the Artesia Fairway trend.
Q. Okay.
A. So they are in line, they have the same

stratigraphy. The Hobbs Unit is actually just north of the EMSU. Oxy is currently doing a CO_2 flood there. There are several others as well. I think there may be 52 active CO_2 floods in the San Andres at this point. I have to check those numbers, but I think it's pretty close. So it's a pretty hot topic in the, the CCUS community.

Q. I mean, I think it's helpful to find a map, so I'm going to see if I can find a map real quick.

Mr. Bailey, I'm showing here Dr. Lindsay's Exhibit B-2. Do you see it on your screen?

A. I do.

Q. Okay. And, unfortunately, we don't have a marker for exactly where the EMSU is located, but I'm going to do my best, and you can tell me if you agree or not. But I believe the Hobbs Field is up here and I believe the EMSU is just to the southwest, roughly in this location where my cursor is. Is that correct?

A. Fairly close.

Q. And then I think you also referenced the fields across the Northwest Shelf, which I believe -- is fair to say this sort of arc is the Northwest Shelf up here?

A. Yeah, the whole arc, all the way across,

down into Hobbs and the EMSU.
Q. Okay. So this is the Northwest Shelf, right?
A. Uh-huh.
Q. You're including the EMSU in the Northwest Shelf?
A. No. I'm saying that it's on the same Artesia trend. It's got the same trend-tigraphy.
Q. But nevertheless, the Northwest Shelf is this sort of arc just above where the EMSU is located, correct?
A. That's correct.
Q. And then these other fields that you referenced, the Hobbs, the Wasson, Seminole, Vacuum, Means -- I guess Vacuum is up here on the Northwest Shelf, correct?
A. Correct.
Q. And the Wasson, I don't think it shows up over here.
A. It does. It's right there.
Q. Okay. Seminole is over here, just on the eastern side of the Central Basin Platform, correct?
A. Yes.
Q. Means, I think it's not showing up down here, but I think it's also on the eastern side of the

Central Basin Platform, correct?
A. Central to central east.
Q. Hanford is also on the eastern side of the Central Basin Platform, correct?
A. Sure.
Q. And then the Goldsmith-Landreth units, they're not showing up here, but I think they're roughly in this area here, kind of the central --
A. It's pretty close.
Q. Pretty close. Okay. All right. So you're telling me that those fields that we just walked through are all on the same trend as the EMSU, which is to the southwest of Hobbs?
A. No. What I implied was that they're all CO_2 floods in the San Andres.
Q. You said they're on the same trend.
A. I said that some of them are on the same trend along the Northwest Shelf and Central Basin Platform.
Q. Okay. I guess your words speak for themselves, but the way I read it is there are currently several active CO_2 floods in the San Andres along the same trend.
A. Mm-hmm. The Hobbs is along the same trend. The Vacuum is on the same trend. The Wasson, Means,

Hanford and Goldsmith-Landreth, they're all on the CBP. So they're all CO2 floods within the San Andres, was my point I was trying to make.

Q. All on the San Andres. Okay. What do you mean by "trend"? I mean, generally, I think -- I guess I don't know. What does "trend" mean to you?

A. I find trends in stratigraphy itself, so I find that the Northwest Shelf running around to the EMSU, the Hobbs, in general, conform to the same stratigraphic nomenclature as well as the same stratigraphy and lithology. Very similar anyway.

I also provide those type logs from multiple fields along the Northwest Fairway, confirming the Lovington Sand, as well as this top of the San Andres. So it's very consistent with ours.

Q. On Page 14 of your testimony, I've highlighted a statement here, I think one of the other areas where we agree. Stated that, "Below Goodnight's top is a dolomite/anhydrite unit, but this interval contains porosities well over 4 percent as well."

You agree that that's an anhydrite?

A. I think it has anhydrite cement, yeah. Yeah, and we can see that on the photoelectric factor curve.

Q. How do you calculate porosity for anhydrite?

A. How do I calculate it? The calculations for porosity are done by Scott. They're also -- you can pull them off the raw logs for the beefy dolomite. So we have raw bulk density that's converted to porosity, and we can get an indication of what the porosity is.
Now, we're not saying this is anhydrite bedding. This is actually anhydrite cements, so that needs to be clarified. There is no anhydrite bedding in the Upper San Andres, or in your barrier.
Your actual barrier, as you call it, is the Lovington Sand. It's actually sand and mudstone. It's not a dolomite or anhydrite at all.
Q. You're finding sand in the San Andres?
A. That's the Lovington Sand. That's why it's called the Lovington Sand.
Q. Is it a siliclastic sand?
A. It's a dolomitized sand.
Q. Okay.
A. So it's not anhydrite. It's properly -- your stratigraphy done by your geologist is incorrect.
Q. Okay. But just to be clear, when you refer to it as a "sand," it's not a siliclastic sand, it's a dolomitized sand?
A. It's a dolomitized sand.
Q. You're talking about the size of the grain

when you refer to it as a sand?

A. Yeah. I mean, it's got quartz grains in it. It's been dolomitized.

Q. Okay.

A. It's had fluids move through it. It's been dolomitized.

Q. This PDF, Page 15 here, I recognize that you're highly critical of Goodnight's approach, and so I'm inviting some more criticism, I suppose. But you state here that, "Mr. McGuire has chosen to ignore the work of many technical experts in the field and their subsurface analyses. Goodnight is using an engineering approach to define the top of the San Andres based on a purported pressure boundary as opposed to utilizing lithostratigraphic or chronostratigraphic correlations."

Did I read that correctly?

A. You did.

Q. Okay. Just for the benefit of the record and folks, including myself to some extent, would you please explain to us what you mean by a lithostratigraphic correlation.

A. That is an actual lithology correlation, so the actual lithology of the formation.

Q. When you talk about lithology, you're

talking about rock types?
A. Rock types, correct.
Q. And then you're talking about chronostratigraphic. I took a little bit of -- I didn't take Greek, but I know that it means time. Just explain to us what you mean by chronostratigraphic.
A. Yeah, those are time surface boundaries, so Goodnight consistently jumps up and down across chronostratigraphic boundaries, as well as lithostratigraphic boundaries. And I think I've shown that in my cross-section.
Q. I'm going to pull up an exhibit here. This is Goodnight Exhibit B-17 that was part of Mr. McGuire's direct testimony. Did you review this exhibit when you reviewed Mr. McGuire's testimony?
A. I don't think I specifically reviewed this documentation.
Q. This Exhibit B-17 shows, on the far left of the table, the API numbers for wells in the EMSU. The next column shows the well name and well number. And then following, in the blue, are the Goodnight San Andres picks in that well, and in the well file pick, what was in the well file that the operator had picked of that well.

The next columns in red are the difference between those picks; the ISO interval, in other words, sort of the depth of the -- as a result of that pick, what the depth of the Grayburg would be at that location.

And then also the final column there is Goodnight's Grayburg ISO interval for that column.

So the one before that, the well file, Grayburg ISO, is what would be the resulting interval for the Grayburg based on the well file on that San Andres pick, and the one to the right is Goodnight's Grayburg ISO interval based on its pick. Do you understand that?

A. I see it.

Q. So I've highlighted two of the wells here, just to point out that, you know, what Goodnight picked, for example, the EMSU 459 for San Andres was at 4,050 feet and that's the same depth as the well file. You see that?

A. I do.

Q. And then the biggest difference here between what Goodnight picked in the well file was in the single well, the 461, at least on this table, where there's about almost a 200-foot difference between what Goodnight picked and what the operator of that well picked. Do you see that?

A. Yeah. That's common with the OCD picks and operator picks in the field.

Q. Now, I mean, the 458 -- I think in your cross-sections, you had the 458, right?

A. Yes, I have it at the end of one of my cross-sections.

Q. And I think you were showing, as you were walking through, that that 458 is higher on structure in the EMSU, right?

A. That's correct.

Q. Wouldn't you expect that, being higher on structure, it would have a shallower top pick?

A. I'm sorry, for the San Andres?

Q. Yeah.

A. It does have a shallower top pick than what you're showing here.

Q. Okay. But this was an operator pick that at the time was Chevron.

A. Okay.

Q. Okay. And so Chevron was the operator and they picked the same top that Goodnight picked.

A. I would argue they picked it wrong.

Q. Okay. Over here on Page 17, the statement you make, "The pick can be made very clearly," as you stated previously in your summary, and the pick here I think you're referring to is the San Andres pick, right?

A. That is correct.

Q. "The pick can be made very clearly across EMSU both lithologically and chronostratographically, as illustrated in Exhibits K-10 through K-14." So those are the cross-section maps that we talked about already, right?

A. Correct.

Q. And you mentioned this before, but that there's an erosional boundary between the San Andres and Grayburg, right?

A. Correct.

Q. Okay. And I understand that -- well, let me just pull this up. Let me just talk about it.

This is Goodnight Exhibit B-15 that was part of Preston McGuire's direct testimony. I don't know if you reviewed this as part of the documentation that was submitted to the Commission back when the EMSU was created as a statutory waterflood.

Did you review this document as part of your assessment of this field?

A. I believe I reviewed it, but I've got to get familiar with it. I've slept a lot.

Q. Sure. I'm glad you did. At least one of us has.

So I guess the point that I want to draw your attention to is this highlighting here, where at the time of the formation of the unit, Gulf -- or actually, this is from the technical committee report, I believe, states that, "The contact between the Grayburg and the San Andres is gradational and there's no clear marker for the top of the San Andres which can be traced across the field."

And I know that you're going to tell me you disagree, right?

A. Yes.

Q. Okay. So my question to you then is, as I understand both Dr. Lindsay's testimony and your testimony, is that you've got two cores that you're using to help identify the top of the San Andres, correct?

A. That is correct.

Q. So the RR Bell 4 and the EMSU 679, right?

A. That is correct.

Q. What specifically are you looking for in the core to identify the top of the San Andres versus any other erosional boundary or composite sequence boundary that might exist within that core?

A. The premier sandstone is a pretty good marker in the core. It's the base of the Grayburg.
Q. How is it a good marker? What distinguishes it?
A. It's a dolomitic sand that you can see in core.
Q. And what's the difference between the premier sandstone and the Lovington sandstone?
A. Depth.
Q. Okay. Otherwise, they're relatively similar?
A. They're both dolomitized sandstones, yes.
Q. So once you've identified the premier sandstone based on depth, what are you looking for in the logs? Because you only have two cores, right? How are you correlating the cores to your logs to extend your interpretation of the San Andres top across the field?
A. So we could take the depth of the premier sandstone in the core, take it back to the log interval, so we know the depth of it, we know the base of it, that is the top of the San Andres. That can then be correlated across the field.
Q. Okay. So you're just going off depth, measured depths, for each well; is that right?

A. I mean, that's what you would identify what the depth of an interval is, yeah.

Q. Okay. But I thought I understood you to say that you were looking at signals in the logs to identify --

A. There's some very clear signals in the log as well.

Q. Okay. What are the signals?

A. There's a very tight neutron signature at the top of the San Andres.

Q. And you see that tight neutron signature across the field?

A. I do. It's got some porosity within it in certain areas, which is likely where we've got some communication between the Grayburg and San Andres, likely fractures associated with it. I don't know that 100 percent because we don't have core through it, but speculating that we will.

Q. I guess what I'm wondering is, Mr. Bailey, because we've gone through a couple instances and pointed out where there are different top picks in the well files, between different operators, and you're telling me that it's really easy to pick, but I'm just -- I'm asking you, you know, in your opinion though, you're telling me that it's really easy to correlate, right?

A. I don't know that it's easy, but I think that it's not hard. I think you can commonsense correlate your way across here if you understand how to correlate well logs and use all the well logs available.

Q. Okay. It's not easy, but it's not hard, that's your --

A. I mean, there's certain areas when you're coming up onto the structure itself where you might get some collapse features, you get some expansion of section, maybe there's a bathymetric low. There's some variability across it, but in general, yes, it's -- especially up on structure, it's very easy to correlate.

Q. In your cross-section, K-13 here, I just kind of was wondering how this came to be. You've got, from left to right, Goodnight's active injection wells within the EMSU, right?

A. Yes.

Q. And then you've got over here in this -- yeah, that's the 679, right?

A. Yeah, 679, EMSU 001, EMSU 628, EMSU 660.

Q. Okay. Now, the EMSU 1, do you understand that that is Empire's saltwater disposal well?

A. Yes. That's Meyer B-423 originally, or what it was named before.
Q. Now, in each of the wells you've interpreted or Ops Geologic has interpreted oil saturations, but not for that well. Is there a reason?
A. Yeah. There's no density porosity curves.
Q. Okay.
A. This image is just to show how inconsistent Goodnight's tops are across the EMSU, which is very clear to anybody it looks at.
Q. But there's a porosity log, right?
A. I'm sorry, there's a porosity --
Q. I'm sorry. There's not a porosity log. That was your point, right?
A. That's correct. That's why we can't do the evaluation. There's no bulk density or neutron.
Q. But there's a -- what's the far right?
A. That's a sonic log.
Q. And can you calculate porosity from the sonic log?
A. You could, yeah.
Q. But you guys didn't do that?
A. No, we did not. We don't model porosity based on sonic logs. There's a lot of inconsistencies with that methodology.

Q. But it could have been possible and you could have actually evaluated whether there was oil saturation in that well, too, right?
A. We would have still needed a neutron log. We don't have a neutron log.
Q. Okay. But you had a resistivity log, right?
A. We do have a resistivity log, yeah.
Q. Okay. And if you had a resistivity log -- but you're telling me you don't model sonic logs to arrive at a --
A. We need a neutron log also for porosity. That's what's used in the porosity calculation as well.
Q. Okay. In terms of evaluating this field, have you been able to assess what the recovery factors might be in the event a ROZ development were put in place, or evaluated, you know, how to assess what the recovery might be in the ROZ?
A. That's an engineering question. That's not for me.
Q. Okay. So you haven't?
A. Yeah. That's an engineering question. That's not for me.
Q. Okay. You were here during Dr. Lindsay's testimony yesterday, right?

A. Yes.

Q. Did you hear him talk about his experience, across the street from the Goldsmith units?

A. I'm sorry, across the street from the --

Q. Well, did you hear him talk about his experience with CO2 across the way from the Goldsmith area units?

A. I listened to a lot of testimony, but you've got to be more specific.

Q. Did you hear Dr. Lindsay testify about how in the unit he was working on for CO2 flood, where he experienced moldic porosity, that the CO2 was essentially lost and being sequestered and not creating an oil -- I forget the term he used, like an oil wave, it was not contacting or pushing oil through the system?

A. I don't recall hearing that. I mean, it could have been in his testimony, but I also could have been at the bathroom. I don't know.

Q. Okay. So I'm going to scroll down here. We'll go into these questions here a little bit, but I wanted to understand, like, so you -- part of what you did was you took the petrophysical analysis, the oil saturations that Mr. Birkhead prepared, and then you use those to calculate oil in place, right?

A. That is correct.
Q. Okay. And to do an oil-in-place calculation, do you need to understand what the oil formation volume is?
A. We were given an oil formation volume factor.
Q. From whom?
A. From Goodnight -- I mean, from Empire. Sorry.
Q. Okay. And that was an oil formation factor that you used for both the San Andres and the Grayburg?
A. Yes, it would have been. I actually did not do the Grayburg evaluation. It was not my responsibility. My focus was on the San Andres.
Q. Were you instructed not to assess the Grayburg?
A. No. For time purposes, my time, they wanted to focus on the San Andres, which is the reason we're here.
Q. So that oil formation volume factor was given to you by Empire. Did you assess whether that was for the San Andres?
A. We asked specifically for a oil formation volume factor for the San Andres, yes.

Q. Okay. But you weren't part of how that bulk oil formation volume factor was prepared?

A. No. That came directly from them.

Q. So it was the same factor that was used for the Upper San Andres as the Lower San Andres?

A. That is correct.

Q. When you calculated these -- and this is your structure map. But when you calculated your oil-in-place maps, you would have used the effective porosity, correct?

A. No. I used the total porosity as a cutoff.

Q. Okay. Well, just because I'm ignorant of it, would you tell me why you chose the total versus the effective.

A. That's the determination Scott and I came up with, to use of the 4 percent total porosity. In general, as I mentioned, that's what we do with carbonates that we've analyzed before.

Q. Even though you identified some shale content?

A. I would say the shale content was very minimal.

Q. Okay. All right.

A. The clay content. Let's be specific. Not shale, clay content.

Q. Very fine. Well, okay.
A. And we only had two cores to verify that, just so you understand that, of which we used both. And Goodnight only used one, is my understanding.
Q. I want to ask you a little bit about that as well. And you can tell me if this is more appropriate for Mr. Birkhead.
I wasn't entirely clear, but I want to make sure I understand. When you did this work with Mr. Birkhead, did you calibrate your analysis to -- as I understood it, it sounds like you've calibrated it to two cores, right?
A. That's correct.
Q. And that was the RR Bell and the EMSU 679, right?
A. Correct.
Q. Now, because you didn't evaluate what NuTech had done, you don't know how or whether they calibrated their petrophysical analysis, right?
A. No. I did not speak with NuTech on their petrophysical analysis.
Q. So, let me start with the structure map here. This, marked as Exhibit K-15, is your structure map for the Lower San Andres, right?
A. Mm-hmm.

Q. Okay. And reading the structure map, the highest structure is the hotter color, right, red?

A. That is correct.

Q. And the lower structure is the cooler color, the blue, indicating -- so as you go to the southwest, you go downdip this direction, right?

A. That's correct. Into the basin.

Q. So looking at this, the -- actually, let me go to the Upper San Andres. This is the one I was more interested in.

Okay. So, this is K-16. This is the Upper San Andres, right?

A. It is.

Q. Okay. And so the red areas are the areas that are above minus 350. And this is a subsea interval, correct?

A. That is correct.

Q. Okay. And what you're showing here is the portion of the Upper San Andres that are above minus 350 subsea all in this red, correct?

A. Correct, 350 -- at 350 or above, yeah.

Q. Okay. So, just looking at this, approximately, what do you think, how many sections are above minus 350 within the EMSU?

A. How many sections?

Q. Yeah.
A. I don't know, maybe two and a half, three. Three, maybe, if I do average. You asked me to pick on the orange outside the red. I mean, I can partial that off, but that would be a guesstimate.
Q. Yeah, I guess I'm asking you, everything that's red, right?
A. I thought you were asking everything that was outside of that.
Q. Everything above 350, minus 350?
A. Okay. Well, we've got basically a section and a half of red, essentially.
Q. Okay. Now, you heard Dr. Lindsay's testimony yesterday, right? And he placed the producing oil-water contact at -- above which only oil is produced at minus 350 subsea, correct?
A. I believe so, yes.
Q. So on this map here, where you've got your contouring arrows above -- at -- cutoff at minus 350, everything in the red would have been producing above that contact, right?
A. If it was perfed in that interval.
Q. It was perfed in that interval?
A. And, again, we still have a lot of water to deal with here.

Q. But that's when we're talking about depths that were above that, right? Minus 350 is above that water, right?

A. Those intervals were not perfed. Were they perfed in there? I haven't reviewed every single well, but I would have to look at the perfs in the San Andres to understand whether they were perfed there or not. If they weren't, then no, they didn't produce out of the San Andres.

Q. Okay. So yeah, I guess you're anticipating my next question, okay, is whether or not you have looked at whether not any of these wells or any wells in that area have produced oil that you've indicated here, right?

A. I have not looked at any production of oil in the San Andres in the EMSU.

Q. So if any wells were drilled and completed, okay, and perfed between minus 350 subsea and above, they would have produced that oil, right?

A. If there is oil in place there and they perfed that interval and there wasn't a bunch of water associated with it, then maybe it would be.

Q. But you're showing me --

A. That contact changes, Adam.

Q. Okay. But you're showing me that there is oil in place here, right?

A. No. I'm showing you a structure map not even showing you oil.

Q. Okay. I'm sorry, you're right. I apologize. So if there's oil in place there and there are wells perfed at those depths, they could have produced oil, right?

A. That's if there is oil in place there, they would have produced, and they were perfed in the Upper San Andres, they would have produced oil likely, yes.

Q. And we'll get to your oil-in-place calculations, but if that's the case, then that would have been included in your calculations for the ROZ?

A. My calculation for the OOIP section is for the total Upper San Andres. So it goes from the top of the Upper San Andres to the lower. So that's all the net pay within that interval. That's a pretty big interval. So could be -- net pay may be at minus 400, may be at minus 450. Doesn't mean it's at negative 350.

Q. Okay. All right. So this is, I think, your Upper San Andres, your average oil saturation high case, right?

A. That is correct.

Q. Okay. And this is Exhibit K-40, right?

A. Yes.

Q. Okay. All right. So this is me just making sure I understand. Okay? So, as I understand this, this is showing the average oil saturations, right? So if I look at, say, this area here in red -- which is the highest oil saturations that you calculated in the Upper San Andres, right?

A. Within the net-pay interval.

Q. Okay. So, everything within that red area would have an average oil saturation of above 40 percent, right?

A. Generally around those specific wells, yes.

Q. Okay. So, that's the case with each of those areas that are colored in red, right?

A. Yes, that is the evaluation over those areas for the average oil saturation in the net-pay interval.

Q. Okay. So, that's all above -- I mean, that's above what conventional oil is considered, right? Conventional oil is generally considered to be at 40 percent oil saturations.

A. I don't know that that's factual everywhere. I really don't. I don't know the answer to that. Can you find documentation or cite something that specifically says that?

Q. What do you use when you're doing your assessments for clients on what is considered to be, you know, conventional oil saturation?
A. We look at what the potential of a reservoir will produce. I don't know that I specifically say that a set oil saturation is going to be producible. I think it varies from field to field, and it takes a little petrophysical work to understand all the factors that might influence that.
Q. But in your testimony, you told us that the residuals on saturation that you're working off of, okay, the assumption you're working off of, is 20 percent to 40 percent oil saturation, right?
A. I think in general we show that it's in that range within the net-pay interval, yeah.
Q. So, the next interval up from 40 percent would be considered conventional.
A. I don't know any specific documentation that says that. Do you have that?
Q. Well, I mean, if you're saying between 20 and 40 percent is residual oil, what would be conventional? It would be something above 40 percent?
A. What I'm telling you is, we calculate oil saturations within the average range of 20 to 40 percent in the interval. I'm not determining

whether it's mobile or not.
Q. Okay. I understand. I guess my point, though, is that on this map here for the Upper San Andres, you're calculating saturations that are above what you've defined as residual oil between 20 and 40 percent. Agreed?
A. These are the average saturations across the Upper San Andres.
Q. Okay. It is what it is, according to your analysis, right?
A. It's pretty clear it's Upper San Andres average: S-o percent high case.
Q. This is your Exhibit K-45, and I believe it shows the Upper San Andres oil in place by millions of barrels per section, right?
A. Yes.
Q. And that's your low case?
A. Correct.
Q. So looking at the contour intervals here, this is millions of barrels, right? So the cooler numbers, the blue numbers, it looks like you've got parts of the southwest corner of the EMSU are at about -- is this between two and four million barrels, is that right, per section?
A. Yes.

Q. And then the more aqua color is between four and six million barrels per section?
A. That is correct.
Q. So just looking at this, it looks like much of the EMSU in the Upper San Andres has fairly low calculated or estimated oil-in-place volumes, especially in the northwest, west, southwest and southern part of the unit. Do you agree?
A. Yeah. We have very little well data out there; it could vary. We don't have any well data, to speak of, so it's extrapolating out beyond the points up to the north on the Rice EM SWD 20, as well as the OC Fed Com and the Rice EM SWD O33M. So it's extrapolating those values based on those wells. We do not have any wells in the northwest corner.
I'd also like to point out that Goodnight tends to agree with our rock evaluation, because they put all their -- well, their disposal wells that they're seeking to get permitted up on the structure where the best rock quality is. And those are in the blue diamonds there. You can see those very clearly.
Q. Based on this map, so the highest estimated oil-in-place values are this relatively discrete area around the EMSU. Which well is that, the 658?

A. That would be the 658, that's correct.
Q. And then around the RR Bell Number 4 and the 746, it looks like those two are driving the correlation here on the east side of the unit?
A. Yes, they are.
Q. And then in this other portion, it's really the 658 and maybe the 628?
A. Yes.
Q. Okay. So those are the highest oil in place in this zone, right?
A. Yes.
Q. So in this area, would you expect any recovery of oil by conventional means?
A. I do not.
Q. Okay. And I asked you this, but I think you're going to tell me the same thing, that you don't know how to -- you wouldn't be able to calculate a recovery factor for this?
A. That's an engineering question, yeah.
Q. Okay. Let me just take a moment. I know we're getting close to lunch. I'm going to see if I can wrap up before the lunch hour.
Mr. Bailey, did you, as part of your reservoir characterization, review Goodnight's drilling reports?

A. I have not, no.
Q. You mentioned, Mr. Bailey, in your summary, something that caught my ear, and I wanted to ask you about it. You said that XTO sold the EMSU based on the concept that there's a residual oil zone in the field. Do you recall that?
A. I do. It's down at 700 subsea.
Q. And I'm wondering, if you're saying, is it your understanding, that Empire is relying on XTO's representations regarding a potential ROZ?
A. I think that they evaluated that as a potential reservoir that they could eventually exploit with tertiary recovery methods, yes.
Q. I guess my question, though, is, is it your understanding that Empire was relying on those representations?
MS. HARDY: Object to the foundation. Lack of foundation.
HEARING OFFICER HARWOOD: I'll allow it. It's overruled.
BY MR. RANKIN:
Q. So, my question is, have you had any discussions with Empire, is it your understanding that they were relying on XTO's representations about whether or not there's a potential ROZ?

A. I don't know what Goodnight relied on. I would be speculating, and I'm not going to speculate on something that happened well before I -- several years before I was contacted to do my evaluation.

Q. Okay. Just to be clear, you're talking about Empire, right, not Goodnight?

A. I'm sorry. Empire, yeah. I apologize.

Q. Okay. But you made a point to make that a point in your summary, that XTO was marketing this for ROZ. I'm wondering why you made that point in your summary, because it's not in your testimony. I'm wondering why you decided to make that a point.

A. Yeah, so I found that sales package recently, and I was looking at it to -- I found a cross-section within that sales package. And that cross-section -- this is twofold. That cross-section confirms the tops, our structure, our stratigraphic model that we're using, it's very consistent with our stratigraphic model.

And number two, they are actually selling on the fact that there is a ROZ zone down to negative 700 subsea, which is well below Goodnight's top, and almost down into -- really down into the Lower San Andres for us.

So, I think it's very interesting that

Exxon sees a ROZ zone down to 700 subsea, they actually marketed their material, people evaluated it, and Empire likely took that into account as they were evaluating that.

I don't know if there was a bidding process for this asset. I would be speculating. Maybe they paid for that value, maybe they didn't. I don't know.

Q. So, XTO didn't put a ROZ below minus 700 feet subsea, did it?

A. Not, in their sales package, no.

Q. Okay. So Empire wouldn't be or couldn't be relying on anything XTO marketed below minus 700 subsea, correct?

A. I don't know. They could have relied on their own evaluation.

Q. I mean, we talked about this a little bit when I first engaged with you, given your experience on promoting upside potential with Anadarko. I mean, your expectation is that a buyer would want to do their own evaluation, correct?

A. I would, yeah.

MR. RANKIN: Mr. Hearing Officer, I think, if it's appropriate, I just want to make sure I'm done with the witness. Can I double check with my client before we break for lunch, or however the Commission prefers to proceed?

HEARING OFFICER HARWOOD: How much more do you --

MR. RANKIN: I expect none, but before I give up the opportunity to ask Mr. Bailey another question, I want to make sure that I don't forgo something that my client wants me desperately to ask.

HEARING OFFICER HARWOOD: How much time do you need?

MR. RANKIN: Two minutes, one minute.

HEARING OFFICER HARWOOD: All right. We'll just stay on the record. Take your time.

(Pause in the proceedings.)

MR. RANKIN: Thank you, Mr. Hearing Officer. I appreciate the opportunity. I think I have one kind of category of questions, a small -- this may just only be one question.

BY MR. RANKIN:

Q. Mr. Bailey, looking at this oil-in-place map here for the Upper San Andres, you and I talked about the structure map previously that you had prepared and we discussed a bit about how the high structure is generally in this area I'm circling with my cursor around the EMSU 658. Do you agree that's where the high structure is?

A. Yeah, that's the general trend.

Q. Okay. And so based on that, where the location of the high structure is, these hot spots with the high oil-in-place calculations, that's the only place where you've calculated a high oil-in-place, which it matches up with your high structure, correct?

A. It does.

Q. Okay. So if there were wells completed in these high oil-in-place intervals in that high structure location, you would have expected them to produce oil, correct?

A. I don't know that for 100 percent. Depends on where the net pay is. It could be below that at minus 350. It could be at minus 400 where the net pay is.

Q. But you didn't go through and evaluate any of the wells that are completed, perfed or tested in that area, did you?

A. I don't recall any wells that were perfed down into the San Andres specifically at 658 or the EMSU 4746 or the RR Bell or the 628.

Q. Anything that was perfed above minus 350 subsea, which is --

A. I am not 100 percent sure. I'd be speculating. So I'm not going to do that.

MR. RANKIN: No further questions, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Thank you, Mr. Rankin.

What's the Commission's thoughts on lunch? It's 12:05, what time do you want to reconvene, Mr. Rozatos?

CHAIR ROZATOS: I think we should do it like last time, yesterday, about an hour and 15 minutes.

HEARING OFFICER HARWOOD: Okay. All right. So we'll come back, if my arithmetic is correct, at 1:20 p.m. And we'll pick up with OCD's cross-examination at that time.

Thank you all. We'll be off the record for lunch.

(Lunch recess was held from 12:05
to 1:20 p.m.)

HEARING OFFICER HARWOOD: So let's see, it's Mr. Moander versus Mr. Bailey.

MR. MOANDER: Thank you, Mr. Hearing Officer. The OCD doesn't have any questions for this individual, so I'll pass the witness, Mr. Hearing Officer. Thank you, though.

HEARING OFFICER HARWOOD: Okay. Thank you.
We'll pick it up, then with Mr. Beck for Rice Operating.

MR. BECK: No questions.

HEARING OFFICER HARWOOD: And either Mr. Suazo or Mr. Parrot for Pilot, or anyone for Pilot. Going once, going twice. Pilot, are you out there?
All right. Well, nobody for Pilot, so then who wishes to start for the Comission?
Dr. Ampomah.

COMMISSIONER AMPOMAH: Thank you.

EXAMINATION BY THE COMMISSION

BY COMMISSIONER AMPOMAH:

Q. Thank you, Mr. Bailey. Can we bring up one of your slides? And I'll check that. I think that is going to be K-3, if we can bring it up.
I want to know the sensitivity analysis. You talked about you did the sensitivity analysis on the net pay. So I want to know -- I want you to explain more about the processes that went into that sensitivity analysis.

A. Yeah, so when Mr. Birkhead was running his petrophysical model, we had sensitivities for a low and high case on the water saturation. Okay? So we had two separate things that we're doing here with the cementation and saturation exponents that are part of Archie's equation.

And so -- I'm sorry. Were you going to --

Q. No. Go ahead. I'm listening.

A. Okay. And so we varied the m throughout the section. The cementation exponent is varied through the San Andres, the Upper and Lower San Andres. But on both cases, that variation stays the same. The only thing that changes is the actual saturation exponent n. And so that is varied through the San Andres.

So that's what gives us a varying oil saturation that you see on Track 5. Okay? So that's why we have a high case and a base case, is what I'll call it, or a low case.

Q. Okay. Let's look at this on the Archie's equation. You said what was changing was n.

A. Yes, n is varied -- is different in the high case versus the low case.

Q. So then can you give me the values for the high and then the low?

A. Well, I think the variation of n on the high case is actually an algorithm that Mr. Birkhead used.

So that's probably a better question for Mr. Birkhead, who'll be up next.

Q. Okay. I appreciate that. So essentially it was the changes in the saturation that was mostly utilized in terms of the sensitivity analysis, and that automatically impacted the net pay, too?

A. Yeah. So that impacts the net pay because of the water saturation cutoff itself. Right? So the water saturation cutoff that was used to determine the net pay determines the amount of net pay, which is why we provide a low and a high case on every map within the exhibits.

Q. Okay. Let's look at this log once again. You know, I'm a little bit not sure why you picked the Lovington right at where you pick it. Why is that not the base of the San Andres or -- yeah, the top of the San Andres?

Just look at the gamma ray log and then explain to the Commission why you believe that the top has to be where it is compared to, let's say, where you picked the top of the Lovington.

A. Yeah, so the Lovington Sand has been identified an outcrop and tied to subsurface across multiple fields. And so Dr. Lindsay identified the Lovington Sand within the 679 core as well as the

RR Bell core. Okay?

So we understand that the Lovington Sand sits within the middle of the Upper San Andres; it splits the Upper San Andres. Okay? And so the upper part that you see, the next sequence up that you see, where we have a tight neutron density signature, and I don't have a pointer here, but you can see in Track 3, I'll call it Track 3, we leave the depth track out, but you can see how tight that gets at the top. That's a diagnostic signature across the field for the top of the San Andres and how it is correlated.

Q. But there's no changes in the PE.

A. No -- well, there are some subtle changes in the PE. You just can't see them. The lines are through them.

But in general, you're looking at similar stratigraphy, yes. You see the similar PE all the way down through the Lower San Andres as well. It's because we're dealing with dolomites, in general, or dolomitized sands, that give a similar PE representation. Okay?

Q. So on this particular log, are you saying that you use the core to help you identify the Lovington, or it was strictly based on the gamma ray log?

A. No. The core was used to identify the Lovington and the top of the San Andres.

Q. Now, on this particular log would you more or less deny or more or less confirm or disagree that if anybody doesn't have a core, probably they're going to put the base of the San Andres right at the top of the San Andres where you picked the Lovington Sand?

A. No, I am not.

Q. Okay. Thank you. And what is the calibration for this particular well?

A. I'm sorry, say that again.

Q. The calibration depth, because you are showing me subsea, and I mean --

A. Oh, the measured depth?

Q. Yeah.

A. I would have to go back to my database. I show everything in subsea. I apologize.

Q. Okay. And I presume you are not able to tell me what the Rw is for, let's say, this estimation, right?

A. What the Rw is?

Q. Mm-hmm.

A. Oh, you mean the actual Rw we used?

Q. Yes.

A. I believe that -- I'm not going to speculate on that. Scott will answer that directly, yes.

Q. Okay. Can we go to K-2, Exhibit K-2? So the yellow location is showing Empire's SWD. Can you tell the Commission where it's completed?

A. The SWD?

Q. Yes.

A. I believe that there are perfs within the San Andres possibly deeper as well.

Q. Okay. The San Andres. Is Empire going to shut that well down, do you know, or no?

A. I wouldn't be able to say what Empire is going to do with that well.

Q. Okay. So would it be fair to say that -- or let me put it this way. Has there been any analysis on this particular well whether it has impacted production in the Greenburg, that you know of?

A. I'm not aware of that, no, sir.

Q. And Empire definitely owns that well. And do you know when that well was drilled?

A. I don't know the exact date of when that well was drilled, but it was previous to Empire's acquisition of this asset.

Q. Okay. So based on your geological analysis, you say that that well, I mean the Empire SWD well, is completed in the same formation as Goodnight's SWD wells?

A. I would say it's probably in similar zones, yes.

Q. Okay. Thank you. Do you have access to Goodnight's well information as part of your analysis that you did?

A. Do I have a sense of what information? I'm sorry.

Q. Okay. So I'm asking that you showed all the wells that you have in this area, but I'm asking if you had data from Goodnight's wells, the existing SWDs, as part -- or did you include that as part of your analysis?

A. Yes, several of the wells. So all the wells that you see with a green star on them were used in the analysis. Some of these we don't have logs for, but most of them we do. So quite a few of them.

Q. So, you know, we started with K-3 and then we pointed out some of the discrepancies there could be in terms of picking the tops.

I mean, if you pick out three geologists in the room, probably everybody's going to give you a different top. So I'm asking you, who has the final authority, you know, in terms of deciding which top is the best top?

Let me rephrase my question. So I'm asking that there are a lot of uncertainties associated with the tops that have been picked, and we went through one of them. Well, let's say if I don't have a core, I'm just going to pick where you picked the top of the Lovington as the top of the San Andres. But you have a core, so clearly you were able to more or less descend through that.

So with all these uncertainties associated with the tops here and there, my question is, do you know who has the final authority in terms of the final tops that can be adopted by the Commission?

A. I would expect that you would adopt our tops as the top of the San Andres.

Q. So you have authority. Okay.

A. Well, I mean, I'm not saying I have the authority. But, I mean, we have literature to back it up, we have core data to back it up, and we've correlated it across the field.

I don't know how -- the Lovington Sand sits in the middle of the San Andres. It's not the top of the San Andres. But I'm kind of confused on why you're determining to put the top at the top of the Lovington Sand.

Q. Okay. Are you aware of the New Mexico Bureau of Geology?

A. Yes sir.

Q. So was there any discussion, as part of your work, any discussion with the New Mexico Bureau of Geology with regards to discussions on the tops picks?

A. We did not have a discussion with them, but they have reported tops. And several wells that we can actually -- we'll show you as well.

Q. So how do your top picks compare to that of the Bureau of Geology's picks?

A. Well, it's funny enough. Sometimes they're deeper, sometimes they're right on, sometimes they're shallower. So it's very inconsistent within the OCD as well.

Q. Well, so are you saying that OCD picks and then the Bureau of Geology picks are sometimes different?

A. Oh, yes, 100 percent. And I'll show you that.

Q. Okay. So that establishes the uncertainty associated with the picks of the tops.

Now, as a commissioner and as I'm looking through all these uncertainties associated with this, are you saying that your tops that you've

picked more or less supercedes all the other tops?
A. I'm telling you that our top is consistent with the geology and the literature and the experts that have studied the field for 40-plus years. We have core data to support it.
I would suggest that our tops are consistent, much more consistent than either the OCD's or Goodnight's.
Q. Thank you. Okay. There was another well that was showed as well that had the same issue with regard to the tops. So yeah, it's a little confusing, you know. You know, we're trying to figure out what is the best solution here, so it's more challenging. But let me move on here.
Now, you showed in your saturation -- so if we can go to K-3, and it's the same for -- yeah, let's use K-3, for instance. You're saying that each -- that is more like 20 percent?
A. Each grid line is 20 percent.
Q. Yeah. Okay. Now, I mean, I'm still trying to figure out, based on the -- the cross-examination by Mr. Rankin showed the one well, that is a water producing well that goes through the San Andres.
You have a lot of experience in the oil business. Tell the Commission how, let's say, a

saturation of about 40 percent, 50 percent, there will never be an oil production, you know, through that well.
A. Are you asking why the oil wouldn't be mobile?
Q. Yes. At least why would there not be even a single amount of oil produced through that water well that was completed in San Andres, assuming -- you know, he went through that with you. You showed more, like, he picked -- you have percentage that's more, like, 50, 60.
So how is it possible that no single -- each of these were tested oil production?
A. I'm uncertain on where the exact perfs would be in those wells, number one.
Number two, this is all residual oil. I don't know that the water-supply wells themselves don't have skim in the tanks. I don't think any of us were there to see that, whether it's reported or not, whether there's a sheen or was some possibility of some oil that was sitting on the tanks. I don't know that answer.
Q. And probably the petrophysicist will help me here on this one, but let me put it on record anyway.
We do know -- and you talked about you

do not know the mobile oil here?

A. That's correct.

Q. So do you know if the petrophysicist will know about that?

A. I think he might give some better indication of what might be the mobile oil, but I can't speak for him.

Q. Okay. There are cores you showed, you know, as we went through a series of the logs. It sounds like they were cored from EMSU 329, 457, 458, 461. Why were these cores not analyzed, especially for fractures?

A. You mean the wells that were cored in the Grayburg?

Q. I think some of them were in the Grayburg, and these two was in the San Andres and all over the place.

A. The only wells we had access to were the RR Bell and the 679. So any core that was specifically in the Grayburg, we did not analyze. Our focus was on the San Andres.

Q. So is it your testimony that none of these other wells that I mentioned go through the San Andres?

A. The wells that you just mentioned? I'd have to go back and look at the cross-section. But I assume that all those go through the San Andres, yes. We do not have core other than the RR Bell and the 679.

Q. So you know there are cores, but you did not have access to them?

A. That's correct, yes.

Q. Okay. Now, XTO sold the EMSU, the interest in that, to Empire. Now, my question to you is that, you know, you talked about how some of the SWDs could impact, you know, the injection could impact, let's say, the upper layer, which is the upper formation, which is the Grayburg. You talked about that.

A. It could.

Q. It could. Okay. So why did XTO not oppose to any of the existing saltwater injection in this area, and even Empire went ahead and still drilled, or more or less, when it was XTO, they still have SWDs that goes into the San Andres?

A. That would be a question for XTO. I don't know the answer to what their thinking was on that.

Q. Do you really believe in all these high saturations that you are picking in nonconventional reservoir?

A. All our saturations, specifically on the

RR Bell and the 679, are tied to the core. So we have core saturations, those saturations are tied to the core. So the model is built off of that for every other well. So all the saturations that we have here, especially on the low side, that is the base case. That is tied to the core properties, the core oil saturations that were measured.

Q. Well, now, so are you -- is it your testimony that, let's say, K-3, Exhibits K-3, K-4 100 percent matches the core saturations that were shown to us yesterday?

A. Down through the cored interval, yes, sir. It's very consistent, yes. I'm not going to say every single dot on the core matches, but it's very consistent. And Mr. Birkhead is going to go through that.

Q. But you told me -- then why do we have high and lows here in the saturation estimation?

A. Because this is the conventional core. We know the conventional core is probably the likely lowest oil saturation we would see. If we had done pressure or sponge core, we may have higher values, as Mr. Lindsay testified to yesterday.

Q. Is there a well-documented reference that substantiates the potential changes in the different types of the saturation measurements?

A. I think he used an example out of Seminole Field. I don't believe any of these wells in the EMSU have been sponge or pressure cored.

Q. But there is no reference -- is there any documented, I mean, any published material on this subject to establish that?

A. Yes. I think Mr. Birkhead is going to go through that.

Q. I appreciate that.

A. Yes sir.

Q. Thank you. And then you're saying that there's going to be testimony where we do have -- where the actual core measurements are correlated to your log measurements?

A. Yes, sir. He's going to show the petrophysical plots and all his interpretations. So you'll be able to see the core values as porosity and permeability and oil saturations or water saturations.

Q. So in your estimation of the oil in place, what parameter was the most uncertain?

A. I mean, all of it kind of is, if you're being honest. I mean, there's a range of possibilities when you're dealing with reservoirs like this. I think that, you know, that's why we provided a range of probabilities, or possibilities, if you will. We wanted to show what we thought that the low side could be and the high side could be.

We don't see everything in black and white. And so that's why you have the low cases and the high cases, because we're showing you a range of possibilities of what could be there.

Q. Yeah, and you showed us, you know, these higher numbers that you have in your testimony, which would be K-55. Yeah, you showed us that. And my question to you is, why is this not conventional play?

A. Well, it's because he's got significant water and it's below the oil-water contact. So when this field was being drilled, they were staying above the oil-water contact, in conventional wisdom, as you would.

You know, when you're drilling conventional wells, you're not trying to drill below the oil-water contact. What's left is a residual zone, and that's what's being targeted all around these fields that I have shown.

The EOR efforts that are being done to date within the San Andres is because they're all residual oil zones. They weren't targeted as a conventional primary pay.

Q. Okay. Then what is the wettability here in the San Andres in the EMSU?
A. I think that that's a question that Scott will be able to answer for you.
Q. So there's been a mention of the Seminole Field, Tall Cotton, Goldsmith sites. Can you tell the Commission what kind of numbers, in terms of the oil in place, that we have in these analogous wells -- no, fields that we are talking about here today?
A. The oil-in-place numbers for the other fields?
Q. Yeah, if you can.
A. I didn't evaluate the other fields personally, so I don't have the numbers for those. I haven't done the study on those fields.
Q. And they are not in the literature?
A. They may be, but I didn't look for specific numbers. All I was trying to illustrate is if there are several EOR projects going on in these fields.
Q. So then these numbers that has been calculated as oil in place, was it compared to any other play within the Permian?
A. My evaluation was strictly for the EMSU.
Q. Now, based on your limited experience, you know, as you went back and forth in the ROZs

prospecting, you know, so how did you do the quality checks, you know, on your results? How did you do that?

A. The petrophysical modeling and the log analysis itself is consistent no matter what reservoir you're looking at.

Q. You don't believe that the ROZ is more complex and cannot necessarily be treated as a conventional reservoir?

A. I think when you have core data to calibrate your petrophysical models to, that you've got a pretty good process to be able to model the rest of the wells in the field.

Q. Now, there was a discussion about, you know, the paper that was published in 1996 by Strickland, et al. I hope I've got the name right. And the discussion, you know, as we all read, is more like the production or the let's say the migration of the water from the San Andres was not through the formation. At least that is what I read. And they are saying that it's through the wellbore.

I mean, how do you explain this, do you have any knowledge, as a geologist?

A. I don't know how to explain sulfate barium waters getting into the Grayburg when the Grayburg doesn't have sulfate barium water.

So my presumption is, if you ask me on a commonsense basis, that as the Grayburg main pay zone was being produced, you're reducing pressure within the Grayburg, which naturally fluids are going to find their way to the lowest pressure zone. So given the amount of fractures that we saw in core, the likelihood of fracturing up on the structure themselves, that we have some migration of the fluids into the Grayburg. I really don't see how any other way it could have gotten there. That's my point, I guess.

Q. Okay. We've talked about this one.

I still want to talk a little bit about that EMSU 457 and then 458 well.

COMMISSIONER AMPOMAH: So I don't know if you can bring it up, 457 and then 458.

THE WITNESS: 810, 11, somewhere in there.

COMMISSIONER AMPOMAH: I should have put the K number. I don't have it.

THE WITNESS: It's in the cross-section.

COMMISSIONER AMPOMAH: Yeah, it should be multiple logs, I think, that are being compared.

THE WITNESS: It was used for the stratigraphic correlations. It's in the cross-sections.

COMMISSIONER AMPOMAH: So probably let's do 14. Yeah, let's do K-14.

BY COMMISSIONER AMPOMAH:

Q. So in K-14, we do have EMSU 628 well. I'm actually on the same record, though. You have the Lovington Sand where you picked it, where you picked the Lovington Sand.

I mean, if you look at the gamma ray log on the Track 1, water should not be where the San Andres is, just looking at -- I mean, this one, there's no core. So just looking at the gamma ray log signature, I'm still trying to figure that one out.

A. Doctor, you could correlate the tops across the field, and that's where the top sits, and it's always above the Lovington Sand.

You need to always remember, the Lovington Sand sits in the middle of the Upper San Andres; it splits it. And so you can't have the top of San Andres at the Lovington Sand. Okay? We know that. We know it from literature. We know it from the core data. I mean, the top of San Andres sits above the Lovington Sand.

That is why the top is where it is, and it's correlated back to the core wells 679 and the RR

Bell.

Q. I guess I'm going to ask OCD about that.

So the water wells, the water wells, and I think 457 and the 458 water wells, so if we can get that one. I think that one should be --

A. K-12.

Q. No. That should be K-10.

A. K-10. Sorry.

Q. Yeah. So K-10, again, so let's just pick one of them. These are water wells, so let's pick, let's say, 457. And in there, let's say, the petrophysics is showing saturations in excess of, like, 50 percent, 40 percent, 50 percent.

As part of the analysis that you did, did you review the well records for these wells?

A. I didn't review any well records for those wells, no, sir.

Q. So as part of the petrophysics that was done, was there a review of the well records?

A. No. The petrophysics was modeled off the core wells.

Q. The petrophysics was modeled --

A. The petrophysics was modeled off the two core wells we have. Those are the only core data, physical rock data we have to calibrate to. That is extrapolated into the well logs for all the other wells that don't have core.

Q. But here you've done a petrophysical analysis right here.

A. What do you mean? Yes, we have a petrophysical analysis that's extrapolated to the other wells based on the core wells.

Q. So are you telling the Commission that, let's say, you did not utilize the software to interpret these logs to get, let's say, the saturations, the net pay, the net gross and all of that, that you're showing here, there was no analysis then?

A. No, we had the raw logs. We didn't create these logs. We had the logs when they were logged. Okay? All I'm telling you is, is that our petrophysics, so the saturations you're seeing -- the porosity you see is not -- is not changed. That's the dolomite porosity. Okay? The resistivity is what it is. The PE curve is what it is.

The only thing that's changed here is the low and high saturations that you're seeing in there.

Q. Do you know if there is any relative perm that has been done on any of these cores?

A. I know that there are permeability measurements, yes.

Q. No, I mean, relative perm.

A. That's a question for Scott. I believe there has, but those are -- those are -- there's definitely perm measurements.

Q. Yeah, okay. Because I want to know the critical oil saturation for the San Andres, at least in the EMSU. And then even I want to know what the residual oil saturation to water injection in the Grayburg, how much is it, you know?

So that is to -- that is going to help us a lot, you know, in terms of being able to ascertain these saturations.

And, you know, you talked about these saturations are based on the core, but, you know, if you were here yesterday, based on Dr. Lindsay's testimony, you do have a core where the saturation of the water and the saturation of the oil doesn't sum up to 1. And I asked about where that difference is --

A. That's probably air. You're expulsing water, you're expulsing gas, you're expulsing oil out of the core. You're never -- you're likely never going to get to 1 on any core you take.

Q. Yeah. I'm getting to that more, because when you say that, let's say, the remaining saturation can be, let's say, air, I don't think that was factored when you try to do the correlation of the well log information to that of the core. But I know want you mean, so I'm not going to really go that far.

So is it your testimony that the core data was the one that was, more or less, utilized for the quality checks on the estimations that were made, especially for the saturations?

A. Yeah. So all the wells are -- the two core wells we have are core calibrated, and all the wells are quality checked based off that core calibration. That is the n points for the petrophysical model.

Q. There was a discussion about the Bo and since you presented and you worked on it, I mean, you used it in estimating your oil-in-place calculation, do you know the source of that?

A. That source is from Empire's engineer.

Q. Were there any variations in the uncertainty that was calculated, let's say, for the high and then the low for the Bo?

A. No, I used the same Bo for both.

Q. So then let me repeat my question earlier on and ask you, if you look at the 7758 Ah phiT 1 minus Swu over the Bo, which of these parameters is more uncertain?

A. Well, I think that, like I said, through the cored interval, I think we're confident with the -- based on the core measurements.

Now, where we get into wells where -- or in the lower San Andres where we don't have core, obviously there's going to be some uncertainty with that because we don't have physical rock to tie it to.

So our model is just carried on down based on the core data all the way through the San Andres. We did not alter it in any way.

Q. You know, in your Exhibit K-3, you talked about the DT, that is the sonic log. I heard you say there is some inconsistency with the sonic log, so you did not use that in calculating your porosities.

A. I said that we don't typically use sonic logs based on themselves to generate sonic porosities because there can be inconsistencies with them. We would have to model that porosity based on the sonic log. It's not that we can't do it. It's just not as good as the density log.

And in that case of that well, we didn't have a neutron log anyway, so we would not have done the petrophysical analysis on that well.

Q. Okay. Let's talk about the oil-in-place calculation for a moment. So if you look at those values that was in your testimony, and now the K-55, so did you perform any, like -- let me just put it this way. What is the uncertainty associated with these calculations?

A. I mean, I can't quantify what the uncertainty would be. All I'm telling you is we put a low case and a high case, based on our model. And that's our range of possibilities.

Q. So when I asked you about it, I said what is the standard deviation from -- assuming you have -- you have 190, you have -- I mean, you have 331. In the Lower San Andres, you have 438.76 low and then 718, so I'm asking you, what is the -- I mean, what is the uncertainty associated with this? You should be able to quantify that.

A. I would suggest that our range of possibilities is quantifying the possibility or uncertainty, as you call it.

Q. So, more or less, the average between them would be more like your mean?

A. I think that our total is a low side case for our model, and the high case, as you can see on the right. I mean, that's why we're providing the sensitivities, to give you a low case based on the model.

Q. No, this is not a sensitivity. I mean, you said that there is a way that you calculated the low and then there's a way that you calculated the high.

If you're talking about uncertainty, then I want to see expectation curve that shows all the statistical analysis to show us even where the p50 is. Because this has a lot of uncertainty in terms of your standard deviation.

A. Okay. I do not have any curves to show you on uncertainty analysis. But I would argue that our base case is consistent with the core data, so -- our base case, our low case, is the core data saturations. The high case is corrected based on using a sponge core or a pressure core, what would the percentage be of increase.

And so when you say that there's no sensitivities done, I guess I would argue that us providing a low and high case instead of a black and white case of what could be there, we're at least providing a range of possibilities of what we think there. So you can look at it as a range of possibilities or you could look at it as potential uncertainty of could it be this high or could it be this low.

Q. Yeah, you made a great point. So you're saying that, let's say -- and I know that Scott will get into this more -- that your lower case is based on the core?
A. That's correct. That's the base case.
Q. Now, are you saying that your high case is based on, let's say -- assuming you are using a sponge or, let's say, some other way of calculating the saturation, how are you able to quantify that?
A. Well, that's what I'm saying. Out of the Seminole Field, there's the published data of the increase with a sponge core from 18 percent to 24 percent, to a pressure core of 32 percent.
And so you can take that range there and you can use that to say, okay, our potential oil saturations could be higher in this core, we believe, we've expulsed the oil out of it. So if we provide that range, if we have done a sponge core or a pressure core, then our possibility of our volumes could be much higher than what we're seeing based on those oil saturations.
Q. So you mean that --
A. That it's providing you with the sensitivity of potential oil volumes within the reservoir.
Q. I mean, when you talk about, let's say,

sensitivity, we all do know that in petroleum, we do have a way to report our oil in place, and that is the one I'm talking about. I mean, and I've forgotten that paper, I know we have the same -- we're trying to do the same for CO_2.

COMMISSIONER AMPOMAH: Steve, I don't know if you remember that one, I mean, that document that talks about how we more or less assign uncertainty with regard to our --

CHAIR ROZATOS: We'll have the doctor reiterate his question.

Doctor, I apologize for that.

COMMISSIONER AMPOMAH: No problem. Thank you.

BY COMMISSIONER AMPOMAH:

Q. So you've done some, let's say, analysis here using more of the low, based on the saturation. So I get that, and that more or less has become of your mean.

But when I say that this probably is not sensitivity analysis, even though you are showing us high and low, based on some assumptions, you know, based on some assumptions, as petroleum, you know, in our petroleum business, we do have a way of actually representing our volumes. And that is based on uncertainty analysis, and that is the one that I'm talking about. And when we get on the break, I can check and see that document and then probably reference that.

Now with these volumes that has been presented to us, do you know how much of this is recoverable?

A. I do not. That would be an engineering question.

Q. So is that something that probably Scott is going to speak to?

A. Scott is not an engineer. He's a petrophysicist. I suspect that you'll get that from one of the engineers that are testifying.

Q. So there is a possibility that the recovery factor here could be zero, right?

A. It's not my expertise to speak on that.

COMMISSIONER AMPOMAH: Okay. Let me check to see if I have any other questions. I think I'll probably reserve my other questions for the petrophysicist. So thank you so much.

THE WITNESS: Thank you.

EXAMINATION

BY COMMISSIONER LAMKIN:

Q. Good afternoon, Mr. Bailey.

A. Good afternoon.

Q. Thank you for testifying this afternoon. I think I just have one question that wasn't covered already.

Can you speak a little bit more to what you see as the underlying flaws to the methodology for determining tops that Goodnight uses as far as pressure differential between zones?

A. Yeah. I think that it's -- I've tried to make it clear, and I think we'll go through some more of this. But I've tried to make it clear that they did do the research, right?

So we have outcrop tied to subsurface, along -- as I mentioned, along the Northwest Shelf, the stratigraphy. San Andres Lovington Sand still present. It's consistent, and obviously we have the core data that clearly Goodnight -- I don't know whether they used it. I don't know if they understand what the stratigraphy is.

What I will say is that moving your top up and down on pressure boundaries, or where you may have taken losses in mud, is not geology. And it neglects the literature, the experts that have come in here and done all the outcrop work and tied this to subsurface, and it neglects the stratigraphic model.

We have not created anything new here. We've just done the homework. That's all it took, is I came in, I do the research, I contact the experts that have worked in this field for decades, I get their opinions and what they've worked on and try to understand it and then put a model together. And that's all I've done.

And having the two cores make it very, very clear. And then as I use the logs across there, which I think are fairly simple to correlate across in most cases, you know, I think it's a simple model that is consistent with what's been done in the past.

I don't think what they've done -- and I think they admit that. It's not geology, it's engineering.

Q. Thank you for that response. I think the only other question I have is, in your opinion, do you think that any disposal into the San Andres in commercial quantities is inadvisable.

A. I do. I think you're causing harm to Empire. I don't think it's -- you know, I know Bob said this, but they're the operator of the EMSU. Okay? They're the operator. They run the EMSU unit. They pay for it, they bought it.

Whether you think they're going to go do

EOR, I do, I know they have some tests, they plan. And I think that they should have the opportunity to go in and actually test this without having continued water injection influencing what could happen in the San Andres, or furthermore, overpressuring the San Andres and having breakthrough into the Grayburg where it causes damage to their existing Grayburg producers. I think it's a very fine line and very dangerous.

COMMISSIONER LAMKIN: Thank you. No more questions.

CHAIR ROZATOS: Thank you for your testimony today. I don't have any questions.

MR. RUBIN: No, no questions.

HEARING OFFICER HARWOOD: All right, then. Ms. Hardy, redirect.

MS. HARDY: Yes. Thank you. I don't think this will take too long.

REDIRECT EXAMINATION

BY MS. HARDY:

Q. Mr. Bailey, when Mr. Rankin was questioning you earlier, he asked several questions about your experience in evaluating different formations. Do you recall those questions?

A. I do, yes, ma'am.

Q. And do you follow the same general geological principles of reservoir characterization when you are evaluating different formations?

A. Yes, we do. That is the standard workflow we use, and it's been tried and true. We typically have repeat clients for it, as we do a lot of A&D evaluations?

Q. Mr. Rankin asked you several questions about whether the San Andres and Grayburg function as separate reservoirs. Do you remember those questions?

A. I do.

Q. Okay. And I think you stated that they are different from a geological standpoint?

A. That is correct.

Q. But can fluid migrate between them?

A. I believe it can, yes.

Q. Mr. Rankin also asked you questions about XTO's sales documents. Do you recall those questions?

A. I do.

Q. And do you have experience with XTO's reservoir evaluations?

A. I have some experience with them, yes.

Q. And in your experience, are they generally reliable?

A. They're generally very thorough. Certainly on the geology side. I mean, they're generally recognized as the fathers of sequence stratigraphy, so they know what they're doing.

Q. Mr. Rankin asked you a number of questions about the State geologist formation top picks for the EMSU 628 included in the NMOCD well file. Do you recall those questions?

A. I do, yes.

Q. And he showed you a document from the well file?

A. Yes, he did.

Q. Okay. I'm going to pull up that document here, as well as some others, and ask you about them.

Actually, so this -- is another document from that same well file? I'm not sure if it's --

A. We can show the same one that Mr. Rankin showed. We can also show what the operator provided as the tops, and then we could go well by well so that the counsel here can see that even the OCD varies their tops from well to well, depending on, I guess, where the State geologists wanted to put them.

Q. Okay. Have you looked -- can you identify this document that I've pulled up here on the screen?

A. Yes, I can.

Q. And what is it?

A. That is the EMSU 628 wellbore with the perfs that XTO had within the well.
Q. And is it the same well that Mr. Rankin showed you that --
A. It is, yes. This is 628. So you can see at the bottom, and I think this is important for everyone to see, the San Andres perfs, as I documented in my testimony, as they have labeled, they have the Grayburg perfs labeled Zone 1, 2, Zone 2A, Zone 3, 4, 5, 6. And then SA is San Andres. San Andres perfs at 3918 to 24.
If we go back to the cross-section, and I believe that was K-14.
Q. You said it's the K-14?
A. I believe it's K-14, yeah. It's the cross-section. I want to get this across, because only half the story is there when you show just what the State geologist picked. And so that's the importance of this.
So in 628, you can see perfs starting designated at 3918 measured depth by XTO as reported to the State. And we just showed you that document.
At 3918, that's exactly where our top of San Andres is. Those are San Andres perfs provided by the operator.

Now, if you go back to what the State geologist decided, I believe Mr. Rankin pointed out that he had a top of 4075, which is where Goodnight put their top. So that's already inconsistent with what the operator reported.

Now let's go to the 658. Can you go to the 658? Do you have it up? Yeah, okay. Good. Can you scroll down a little bit.

You can see the San Andres perf is at 3995 to 4004. Everybody agree with that? We can all see that? Zoom in there. We've got it at 3995 to 4004 is the top of San Andres as reported by XTO to the State.

Now can we go to the State geologist where he reported the top?

Q. Let me just pull that one up. For the 658?

A. That is correct, yes.

Q. Sorry, I'm having to switch back and forth to what I'm showing here.

A. That's okay. That's great. So they reported the top for the 658, and the State geologist reported it at 3949.

Now if you'll go back to the cross-section, please.

If you'll recognize, we're the top of

our -- on 658, where we have the top of the San Andres, the top of the San Andres is about 3950. It sits right in the middle. Would you all agree? And you can see that correlation from the 628 to the 658.

So the State geologist reported in this well the exact top that the operator reported. But yet, in the 628, they didn't.

So let's do one more. Let's do 713.

Q. There it is, right?

A. Okay. So 713, we don't have the top of San Andres here as reported by XTO, but what we do have is the cast iron bridge plug set at 4052.

Now would you please go back to the State geologist top for this well. Even though the operator didn't report a top of San Andres, the State geologist has the top at 3942.

Can we go back to the cross-section? So let's look at this. So the cast iron bridge plug that the operator reported is right there, you can see it in the pink bar in the depth track, in the measured depth track. About 4052 is the bottom of it. But yet the State geologist reported the top 3942.

THE WITNESS: Now, Doctor, you asked me, "Maybe I need to talk to the OCD." I think you can look at this cross-section and you can certainly see the top of the Grayburg. I think you can certainly see correlating our top with the San Andres, can you?

Where we have the top of the San Andres, do you agree across those sections that that looks the same?

Okay. I apologize. I'm just saying -- I don't mean to -- I don't mean -- I apologize for putting you on the spot.

A. But I think that most people in the room could look at this and see that the tops correlated across here are very consistent. And the inconsistent thing is what's being reported by the operator and what's being put down as the OCD top.

So if Goodnight went by what was done by the OCD, then their top would have to be up in the Grayburg, which would be inconsistent with what thicknesses they're predicting for the Grayburg. It would certainly be significantly less than the 400 feet that they're expecting.

Q. Mr. Bailey, is there anything else that you wanted to add about these?

A. I don't. I think that there's a diagnostic signature for the top of San Andres. We know we have the Lovington Sand that's sitting in the middle.

You've got to be above it. I think that the neutron density curves, the bulk density curves, give you a great indication of where the top of that is.

I think that there is some areas where you have some porosity, like you see in 628, at the top of it. But you can see the gamma ray signature is very consistent through here.

I think in my case, as I keep saying, I think it's fairly easy to correlate. I think this section -- and I've looked at a lot of logs and it's probably not fair to everyone else, but to me it seems very easy to correlate.

MS. HARDY: Mr. Hearing Examiner and Commissioners, I would like to move the three XTO documents as exhibits. Since Mr. Rankin had identified part of the well file for one of those, I think they need to be admitted in the interest of completeness.

HEARING OFFICER HARWOOD: Do you have numbers for them?

MS. HARDY: They can -- in terms of the exhibit numbers?

HEARING OFFICER HARWOOD: Sure, for the record.

MS. HARDY: Yes, for the record. Let me

just get to -- I think they would be K-57, 58 and 59.

HEARING OFFICER HARWOOD: Mr. Rankin.

MR. RANKIN: No objections.

HEARING OFFICER HARWOOD: Objections from OCD.

MR. MOANDER: No objection, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Mr. Beck?

MR. BECK: No objection.

HEARING OFFICER HARWOOD: Any objection from Pilot?

MR. SUAZO: No objection, Mr. Hearing Examiner.

HEARING OFFICER HARWOOD: Okay. That will be admitted.

MR. RUBIN: Mr. Hearing Examiner, if I may. If we can just ensure that those are e-mailed to all parties, as well as to Ms. Apodaca?

MS. HARDY: I will do that. And I also wanted to include the State geologist picks that we referenced, along with each matching well.

HEARING OFFICER HARWOOD: As part of these numbered exhibits?

MS. HARDY: Yes, correct.

HEARING OFFICER HARWOOD: Do I need to go through the objection thing again? If I hear silence, I'll assume those are part of those exhibits. And I hear silence. They'll be made part of those.

MS. HARDY: Thank you.

(Admitted: Empire New Mexico Exhibits K-57, K-58 and K-59.)

BY MS. HARDY:

Q. Mr. Bailey, I just have a couple of other questions for you.

If we can look at your Exhibit K-14 there, can you go through -- and maybe you already did this with respect to the State geologist's pics, but let me know, and just summarize the tops of the formations and what you're showing on that exhibit?

A. Yeah, I'm showing the top of the Grayburg, the top of the San Andres, the Lovington Sand, the San Andres Goodnight picks for the 628 and 658 that I had, as well as the Lower San Andres.

Q. And if we look at your cross-section, Exhibit K-6, this is the one I meant to look for, does this show the top of the Lovington Sand?

A. It does. It shows it below the Premier Sand, below the top of the San Andres Formation.

MS. HARDY: Let me just make sure that those are all of my questions. And that's it. I don't have any other questions. Thank you.

HEARING OFFICER HARWOOD: Okay, great. May this witness be excused?

MR. RANKIN: Mr. Hearing Officer, I know that you're not eager to open doors for recross, however, there were a couple comments that Mr. Bailey made on his response to redirect that I believe I need to address or ask a couple questions about.

And if you'd like, I can explain what they are and why.

HEARING OFFICER HARWOOD: Go ahead. It's an informal hearing. I may regret this.

RECROSS-EXAMINATION

BY MR. RANKIN:

Q. Mr. Bailey, in your comment, you made the comment about Goodnight's -- what Goodnight did or didn't do with the core as part of its effort to identify the top of the San Andres.

You don't know, as you sit there, whether Goodnight Midstream had available to it the RR Bell Number 4 core or the EMSU 679 core at the time it made its picks, do you?

A. I do know that they had access to the RR Bell core and they did not use the RR Bell core.

Q. Let me ask you again. As you sit here, you don't know whether Goodnight Midstream had access to those cores at the time it made those picks, do you?

A. I don't, no.

Q. Thank you. Mr. Bailey, you were asked about whether or not the injection into the San Andres is causing harm to the San Andres and to Empire. And you said in response that the Empire has some tests, and I don't know what those tests are. And I'm wondering what tests you're talking about.

A. I'm suggesting that they have the game plan to go and test the potential for the San Andres ROZ.

Q. Okay. So you're telling me that you misspoke, because they don't have any tests at this point?

A. I'm not saying they have current tests. I'm saying that they're expected to go figure out whether they can make this work as a potential ROZ zone.

Q. I misheard you then, because I thought you said that they have tests. I wanted to make sure I understood that.

When Ms. Hardy was asking you questions about XTO and your experience with XTO, you told her that your experience with XTO is that they're reliable, their evaluations are reliable, right?

A. In general, I believe so, yes. Anything that comes from Exxon has pretty strong oversight.
Q. Now, in your Exhibit K-55, you identified your analysis for the oil in place, right?
A. Mm-hmm.
Q. And as I understand, your testimony is the low case and the high case, this is all limited to the exterior boundaries of this EMSU, correct?
A. It is. Just the blue box, that is correct.
Q. So, for example, the Upper San Andres, your low case is 190 million barrels for that blue box.
A. That's correct.
Q. And for the Lower San Andres, your low case is 438 million barrels for that blue box, right?
A. That's correct.
Q. Okay. But, you know, you told me also previously that you had looked at XTO's brochure promoting the potential upsides in the EMSU and the three units, correct?
A. Yes.
Q. And in that brochure, which is part of Mr. Wheeler's exhibit packet, I believe it's Exhibit A-5, it identifies all three exhibits -- rather, all three units, and it shows a type log for the three units with a 900 million barrel oil-in-place

assessment for all three units. Do you see that?
A. Mm-hmm.
Q. But your analysis is that the EMSU alone on the low case is 629 million barrels.
A. Okay.
Q. That's a substantial difference than XTO.
A. I haven't done the analysis on AGU or EMSU-B, so I don't know what the ranges are for either of those. If you have those, I'd certainly love to see them.
Q. But even on the high side, you're estimating one billion barrels, which is just for the EMSU.
A. I would like you to keep in mind that we evaluated the total San Andres. They cut it off at 700 subsea TVD, so we have additional footage that we're including in that value.
Q. Say that again.
A. They cut it off at the base of the ROZ, which they have at 700 subsea. We continue to use all our wells all the way down to the Glorieta, so we have additional footage we're including in our values.
Q. So more apples-to-apples would be to compare your Lower San Andres to --
A. No. I think that if we cut ours off at 700 subsea for the actual calculation, that our numbers

would come down to whatever their numbers, probably likely closer to what they have.

Q. Okay.

A. The Upper San Andres would not change. The Lower San Andres would.

Q. But wouldn't they both have to change?

A. No, because the base of the ROZ is below the Upper San Andres.

Q. When Dr. Ampomah was asking you about trying to pick the San Andres top, I had a question there, because you were relying heavily on the Lovington Sand, okay, identifying the Lovington Sand, knowing then that the top is going to be above that, right?

A. That's an important marker, yes.

Q. Because above the Lovington Sand, then you've got the Premier Sand, right?

A. The Premier Sand would be at the base of the Grayburg.

Q. Okay. But as we understand from Dr. Lindsay's testimony and his, you know, substantial work on the EMSU and the Grayburg, that the EMSU and the Grayburg was subaerial exposed numerous times, right?

A. Yes, with within sequences, high-frequency sequences. Yeah.

Q. Okay. And it's possible and it's likely -- is it -- let me ask you this. Is the top of the San Andres, actually is it an unconformity?
A. It is. It's a composite unconformity.
Q. Okay. And so --
A. Sequence boundary. Excuse me.
Q. So over time, when the sea surface receded, isn't it impossible that there could be erosion that would have cut through unconformities?
A. There could be collapse over time for sure, yeah. And so what you might see is collapse breccias, which may indicate where you're seeing some of that tighter neutron that doesn't have the porosity associated with the gamma ray signature.
Q. Well, I'm not actually talking about collapse breccias. I'm talking about actually erosion through time, cutting through time, resulting in loss of features, right?
A. What you would see is actually karstic. You would not see a significant amount of erosion on the dolomites themselves. You might see karstic collapse.
I don't know, if you're arguing that we have 150 feet of erosion occurring over the period between the San Andres and Grayburg, I would tell you that that's not occurring.

Q. So you haven't seen that?
A. No.
HEARING OFFICER HARWOOD: Mr. Rankin, you're beyond two questions --
MR. RANKIN: I'm done.
HEARING OFFICER HARWOOD: -- and what was asked on redirect. Are you done?
MR. RANKIN: I am done, yeah.
HEARING OFFICER HARWOOD: All right. So may this witness be excused?
MR. MOANDER: No objection from OCD.
MR. BECK: No objection from Pilot.
HEARING OFFICER HARWOOD: Rice and Pilot?
MR. SUAZO: Yeah, the witness may be excused.
HEARING OFFICER HARWOOD: Okay. All right, Mr. Bailey, thank you.
We'll take a break at 3 o'clock. So we've got 30 more minutes. Why don't we start with -- is it going to be Scott Birkhead?
MS. HARDY: Correct. Scott Birkhead is our next witness.
HEARING OFFICER HARWOOD: Okay. Is that okay with the Commission?
Ms. Hardy.

MS. HARDY: Ms. Shaheen is actually presenting Mr. Birkhead.

HEARING OFFICER HARWOOD: Okay.

MS. SHAHEEN: I'm sharing now.

STANLEY SCOTT BIRKHEAD,

having first been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MS. SHAHEEN:

Q. Mr. Birkhead, could you please state your name and spell it for the record.

A. Stanley Scott Birkhead. The last name is B-I-R-K-H-E-A-D.

Q. By whom are you employed and in what capacity?

A. I own my own petrophysical consulting company. I was brought on by Ops Geologic to help out Empire with this endeavor.

Q. What is your area of expertise?

A. Petrophysics.

Q. And how does your testimony today compare to Mr. Bailey's testimony?

A. It's additive.

Q. Would it be fair to say that Mr. Bailey testified about the geology, and you're going to be testifying primarily about saturation?

A. Yes, ma'am. I'll be testifying about the petrophysics characteristics.

Q. Have you testified before the Commission or the Division before?

A. No, ma'am.

Q. And you've attached your credentials to your written testimony in this manner, which is Exhibit L, and your credentials are attached as Exhibit L-53. Is that right?

A. Yes.

MS. SHAHEEN: I would ask that Mr. Birkhead be qualified as an expert witness in petrophysics in this field.

HEARING OFFICER HARWOOD: Any objection from Goodnight?

MR. RANKIN: No objection.

HEARING OFFICER HARWOOD: OCD?

MR. MOANDER: No objection.

HEARING OFFICER HARWOOD: Rice?

MR. BECK: No objection.

HEARING OFFICER HARWOOD: Pilot?

MR. SUAZO: No objection.

HEARING OFFICER HARWOOD: He will be so recognized.

MS. SHAHEEN: Thank you.

BY MS. SHAHEEN:

Q. And your rebuttal testimony, your written rebuttal testimony was submitted in this matter as Empire's Exhibit L; is that right?

A. Correct.

Q. Do you have any changes to that testimony?

A. No, ma'am.

Q. Do you affirm that the statements therein are correct and adopt Exhibit L as your sworn testimony here today?

A. I do.

MS. SHAHEEN: Commissioners, I'd move admission of Exhibit L including the data on Pages 16, 17, Appendix A, and Exhibits L-1 through L-53.

HEARING OFFICER HARWOOD: Any objections, Mr. Rankin?

MR. RANKIN: Mr. Hearing Officer, I don't have any objections at this time. I'm going to ask Mr. Birkhead some questions about the work he did relative to the pre-existing petrophysical work that was done on direct -- in direct testimony framework.

HEARING OFFICER HARWOOD: I would expect no less.

Mr. Moander.

MR. MOANDER: I'm sorry, Mr. Hearing Officer. I was conferring with some of my staff. Could I hear that question again?

HEARING OFFICER HARWOOD: Any objection to Exhibit L and all the attachments Ms. Shaheen rattled off?

MR. MOANDER: No, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Mr. Beck?

MR. BECK: No objection.

HEARING OFFICER HARWOOD: And Pilot?

MR. SUAZO: No objection.

HEARING OFFICER HARWOOD: All right. They will be admitted, Ms. Shaheen.

MS. SHAHEEN: Thank you.

(Admitted: Empire New Mexico
Exhibit L, Appendix A,
Exhibits L-1 through L-53.)

BY MS. SHAHEEN:

Q. Mr. Birkhead, let's start with a summary of your testimony. What are some of the deficiencies that you saw in Dr. Davidson's analysis?

A. Sure. I'm happy to go over that. Is there a way we can put this in the slideshow mode so that I can read it a little easier? I think I have the mouse, so I might be able to do it.

Q. Is it not in slideshow mode? I think I'm going to have to stop sharing and try it again.

CHAIR ROZATOS: Actually, just at the very bottom there, Ms. Shaheen, there's a little drop bar that says -- right next to it, it says 59 percent. To the left of it, it's way at the bottom of your screen, right next to it, there is that little box with a line that comes underneath it. To the left.

MS. SHAHEEN: To the left.

CHAIR ROZATOS: Go to the left. Right, that one. Click on that, and that should make it go into slideshow mode.

MS. SHAHEEN: Interesting. Let me stop sharing, because I'm not sure what's going on here on mine.

CHAIR ROZATOS: Someone on the platform, please mute yourself. Thank you.

MS. SHAHEEN: I should do that. I don't know why it's not doing it.

CHAIR ROZATOS: Ms. Hardy, do you have it? Maybe you could try.

MS. SHAHEEN: Or maybe you can come show me. Thank you.

THE WITNESS: I'm sure I can continue on if this continues.

MR. RUBIN: Let's see what we can get. We'll give it a minute more.

MS. HARDY: Ms. Shaheen e-mailed it to me so I can pull it up. I'm just waiting for the e-mail to come through. Takes a minute with attachments.

A. Okay. So my remit was to rebut Dr. Davidson's testimony, which required looking at the petrophysics, looking at all his files and reading his testimony in detail. So within that, I've been able to find a few deficiencies that are definitely worthy of note.

One of the big ones is that Goodnight only used a small fraction of the available core data to build a model for the San Andres. Dr. Davidson neglected obvious first-order data, such as visible and quantifiable oil volumes, fluorescence, oil odor in pits, streaming cut, floating oil in the cuttings box, and gas increases across the San Andres interval.

What this means, he explained this away in some pieces as organic matter. I can show you directly in further slides that there's direct evidence.

With inconsistent and improperly picked tops, Goodnight's petrophysical model was calibrated on an incomplete section of the San Andres, only the bottom part of the 679.

When the correct San Andres tops are used, Goodnight's interpretation would also include a San Andres in the ROZ. I know that was talked about a lot during the last session.

What I would also say is that while reading the testimony of Dr. Davidson, he goes into extreme length about what you would do if you had all the data possible to interpret a carbonate reservoir.

The fact of the matter is, we don't have all the data necessary to interpret a carbonate reservoir to the level that he suggests. We don't have sonic data in most of the wells. We can't calculate secondary porosity. We can't do detailed rock typing in this.

So I'm going to basically talk about how we need to take care of our assumptions as we're doing this.

Q. And what would an appropriate petrophysical approach look like here?

A. So, using the correct petrophysical approach, along with the correct stratigraphic model, it illustrates a range of volumes, not just one single possibility. When we do this, in this case, it ends up with a continuous volume of hydrocarbons that actually meet the definition of a ROZ.

But we don't just give one answer. That automatically defeats the entire system. It's just not realistic. And part of the reason for this is that Goodnight falsely assumed that the San Andres is non-reservoir from the very start, which basically led it into a saturation model that just assumes it's wet.

Q. And does your petrophysical model integrate all of the available data?

A. Yes, ma'am. There's some data that I'm learning about now that I didn't see, but all of the data that was available to me at the time that showed indications, and didn't, I used.

Q. And you've used that model to come up with a range of outcomes; is that right?

A. Absolutely.

Q. Next slide. What does this cross-section show?

A. So this is a little bit of a rehash of what Ryan went over, but it's just to illustrate the point of looking at a cross-section of more or less random wells through the EMSU, and including the Ryno, of how a level set, baseline set, top of the Lovington Sand, in black, across the log, along with Ops Geologic's tops, which are a certain distance, depending on the well, above the Lovington Sand, and Goodnight's tops, which are at some times above and below the Lovington Sand.

I don't care how much erosion you get from the top of the San Andres down to the Lovington Sand. You can't still have the Lovington Sand there and the top of the San Andres below it. So it has to be -- the San Andres has to be on the top.

MS. SHAHEEN: And for the record, I'll note that this is Exhibit L-3.

BY MS. SHAHEEN:

Q. Turning to the next slide, Exhibit L-9, what does this slide show, and why is it important?

A. So it took me a while to figure out exactly, from the testimony, what exactly Dr. Davidson had been doing to get such high water saturations within the San Andres.

It finally came to me when he actually showed his workflow, looking at facies first. If facies are first, you're basically defining everything else based upon the rock type that you decide the reservoir is.

In this case, you look at this plot of resistivity index versus water saturation. Apparently -- this is my intention, or my assumption of what Dr. Davidson used, that he used in his testimony.

If you choose, he mentioned several times that there is deep water facies all throughout the San Andres and a large percentage of it. With that, he chooses that these are either basically wackestone or packstone.

If you look at these saturation curves that are circled in red, this ends up being the lowest water saturation that you can get based on that resistivity ratio. So if you happen to call the entire San Andres deep water facies and happen to call it all wackestone, then your saturation can never be less than 92 percent; meaning that there is absolutely no chance, he's not giving it a chance to even show a ROZ, regardless of the resistivity, porosity, those things.

Packstone, it's a little bit better. You can have an Sw less than around 64 percent at really high resistivity index ratios, but even then, it's already forcing the facies to not show a ROZ. And this is not fair to -- this is not petrophysics, not without data to support it.

Q. Turning to the next slide.

A. This is just an example of my total water saturation versus depth, what this shows. And I will say that the darker points are the North Monument, Grayburg, San Andres Unit 522, which I'm sure we're going to talk about later.

But the lighter points behind it are all the EMSU saturations. I always use total water saturation to find things, because in this situation, effective porosity is pretty much meaningless because it's a carbonate system with very little clay.

So if we go into that case, then we shouldn't be looking at phiE. It's phiT is what is really important. PhiT and SWT are the important parts.

You can see the low case and the high case. As Ryan had mentioned, my low case is based upon the core data that we have that's uncorrected. The high case is based upon a correction that I applied to it, based upon a Egbogah paper from the 1980s, which I have the reference for in my documentation. And it uses B sub o and another factor for basically stripping out, bleeding out to the surface. We can look at that equation later if needed.

Q. What is the significance of the red vertical line?

A. The red vertical line just shows where, like, basically, a critical average. So the red line is at 60 percent water saturation. The blue line is at 80 percent saturation, oil saturation being 1 minus SWT.

What we see is that the average for SWT across most of us is in the low case -- in the low case is exceeds 30 percent and certainly exceeds, in most cases, 20 percent.

Q. Turning to the next slide, what do these mud logs show?

A. So the important part to these documents, again, comes back to petrophysical integration. These are mud logs that cover the San Andres when it was being drilled. So this includes gas curves, gas chromatograph, showing what levels of carbon molecules we have. It shows where there are shows. And it also gives cutting descriptions as to what seen when they put lighter fluid onto the samples to see what would -- if they had streaming cut, traces, fluorescence, things like that.

I know in this case, it's a little bit hard to read, so I put on the side what I'm seeing at those depths. Throughout this section, we see cut fluorescence on the EMSU 628. The top of the

San Andres is noted on the log.

In the 660, we see cut fluorescence and even oil odor on the pits. So if you want to talk about movable oil, yes, drilling the well, we are seeing movable oil at the surface. So I know that's not what we're talking about, but we're seeing definite indications of hydrocarbons.

Q. Why are these two mud logs important?

A. So -- they should be the -- one more.

Q. Oh, one more.

A. There we go. I added this slide just as a way to reinforce this and also because I really, really enjoyed the description from the EMSU 673, where, from one of the samples, they show "Heavily oil saturated" as one of the descriptions.

If we look at the 746, we also see oil smell at the pits, small amounts of oil floating in a box, trace microfracs, yellow fluorescence, and fresh cut. So, definite indications, first-order indications of hydrocarbons.

Q. Next slide. We saw these photos in Dr. Lindsay's testimony. Why are they important for your work?

A. This is a pass-through slide just to show that what petrophysics actually is an integration of all data. So we use core, we use the core volumes, we use mud logs, we use cuttings descriptions, and we use the water line. And from this, there is no doubt that we have oil within this reservoir.

Q. Turning to the next slide.

A. So this is the EMSU 679. This is the start of some comparisons I'm going to show between Goodnight's interpretation and Empire/Ops Geologic interpretation. The main thing I want to show is, aside from -- I'll just go from -- I'll start from left to right.

So we have the gamma ray resistivity and density neutron. To the right of that, we have the interpreted curves, meaning the SWT high and low case. SWT low would be in the red in this case. And then the core data would be in -- the uncorrected core data is in Track 9, and Track 10 is the correction of the core data. You'll see that it's not a huge amount of correction that's been applied to it. It's something that's quite reasonable.

And what I'd like to point out in this case is that Dr. Davidson and I agree in a lot of places. And in Track 11, where his saturation in fuchsia and my saturation in red matched quite well through the section. We clearly both agree, in large part, about things that are happening within the Grayburg. And with the new tops given, we also agree with what's happening at the very top of the San Andres, which is there's hydrocarbon there.

What we don't see -- are in agreement with is that the saturations Dr. Davidson shows drop off as soon as you get into their top of the San Andres.

The point of the image on the left is a 51-year-old plot from a Core Labs training manual of a depleted oil reservoir zone, showing what happens when you have 30 percent oil saturation in a reservoir and you take a core.

And what this shows is that when you have a depleted reservoir, the closest thing I can think of to what we would have here, aside from the Egbogah paper that I saw, we can go from 30 percent oil saturation all the way down to 12 percent.

So 12 percent saturation is not a deal killer. In fact, it's quite reasonable to explain what a ROZ would be.

Q. Am I correct in understanding that the low case is based on the conventional core saturation?

A. Yes, ma'am.

Q. And the high case is based on the corrected

core saturation?
A. That is correct.
Q. Next slide.
A. Okay. So this is just another comparison slide of Dr. Davidson's interpretation versus mine. I'm bad about keeping the same colors consistent, so I'll just describe to you what the colors are in each slide.
So Dr. Davidson's Sw is in green, mine is in blue. In this case for the low case saturation, again, what you'll see is that in the little bit of Grayburg above and in the San Andres below, until you get to the Goodnight top of San Andres, we match really, really well.
All of a sudden, as soon as you get into what is the Lovington's Sand, they've decided to change what facies they have and the saturations have gone down to around 90-ish percent, which is -- 90-ish percent Sw, which is -- just makes a big assumption.
Q. And why do you believe Dr. Davidson's analysis differs here?
A. Because he's defining this as all deep-water facies. Our porosities match below the San Andres. What do you call it? I'll call it "our San Andres" or "their San Andres." Everything is the same.

Resistivities are the same level above and below the San Andres top. The only change that there is, is a change in the choice of facies being used.

Q. And that relates to your previous discussion of the wackestone, packstone; is that right?

A. Yes.

Q. Next slide.

A. This is the last comparison slide. I think this has the largest section of comparison. This is the EMSU 673 showing that, again, Dr. Davidson and I largely agree in saturations. His is the green curve, mine in this case is the blue curve. That in some cases, he actually has a lower water saturation than I do.

And as soon as you get to the Lovington Sand, just like clockwork, the saturations go down to about 90 percent. Whereas, in mine, I am keeping the same model going, using the same interpretation style, not making a blanket change. And I'm still showing ROZ across that.

Q. In your opinion, does this illustrate that Goodnight recognizes a ROZ in the San Andres?

A. Absolutely. With the information that the San Andres top was picked incorrectly, then they are definitely putting a ROZ into what is known as the

San Andres.
Q. And does this slide also show porosity?
A. It does. So that is the other really important point, as you'll see through most of my rebuttal testimony and most of the logs that I put into my testimony, that you see a continuous porosity all throughout the Lovington Sand, all the way up into the Grayburg.
This does not scream seal to me. What I like, the technical definition of the seal, I believe, is 10 to the minus 6 darcy. This is not what we're seeing. That is not the kind of rock we're seeing in the Lovington Sand or anywhere within this range.
Q. So if I understand correctly, the porosity here does not reflect a seal or other type of barrier that would impede fluid flow; is that right?
A. Yes, ma'am.
Q. Next slide.
A. This is just to speak to the average oil saturations that I am calculating over this. Again, the way that we really need to look at -- and this speaks to the doctor's questions earlier, that we really need to look at this in an uncertain way. We cannot look at this as one single value, as Dr. Davidson is doing. Dr. Davidson is giving one

single value for oil in place and one single value for oil saturation across this.

What we're doing is giving you a case that's based upon uncorrected data and a case that's based on corrected data. This is the start to providing uncertainty analysis for this in a Gaussian distribution, which we will go into with more Monte Carlo analysis.

So in this case, the averages, just putting a rough line to it, are about 30 percent oil saturation in the low case and about 40 percent oil saturation in the high case. What is the answer for real? It's probably somewhere in between. We can't just use the high case or the low case, unless we understand it within the context of probability.

Q. Next slide.

A. This is a composite slide to go with the previous one. Dr. Davidson commonly asserts within his testimony that there is a large -- that there isn't a high enough level of saturation or a tall enough level of porous interval to describe a ROZ zone.

The Empire/Ops Geologic interpretation clearly shows that it is highly possible and more likely and definitely within the range of the low and the high case to have a very continuous level of ROZ throughout the entire San Andres or much of the San Andres.

Q. And can you tell the commissioners what you mean by "net pay"?

A. Net pay is a really esoteric term that has a lot of different meanings. In this case, net pay means that with the CO_2 flood, we would be able to move some of this ROZ. So it would not be conventionally producible, but in this case, we believe that it would be something that CO_2 would be able to flood into and help to move.

Q. Turning to the final slide.

A. This is a roll-up of the OOIP on the low case and the high case. Again, you can look at either, the answer is somewhere in between.

The important part that I wanted to point out is that if you look at the tracks of the columns on the far right, the one to the left is Goodnight's OOIP, using their tops as reported in their testimony. And then I went through and calculated -- basically calculated that again, using our tops to show what the difference would be.

In this case, because our tops were the same in the Ryno, the OOIP doesn't change. From that point on, it starts to change a little bit. So in EMSU 746, we go from 13.3 to 14.78. EMSU 713 had barely any San Andres, so it's hard to -- it's not a striking difference.

But then the EMSU 673, we go from 3.1 million barrels to 8.94, and this is using their analysis of what's there.

EMSU 660, we go from 2.7 to 5.84. EMSU 628, 6.8 to 8.4. And then 658, from zero to 5.31. This is a striking difference and an admission that since the tops of the San Andres are actually shallower than originally picked, that there is a ROZ in the San Andres.

Q. And just to be clear, when you refer to OOIP?

A. It's original oil in place.

Q. And MMBO is millions of barrels of oil.

MS. SHAHEEN: I have no further questions at this time. I pass the witness.

HEARING OFFICER HARWOOD: Perfect timing, Ms. Shaheen. Let's see. We're right at 3 o'clock. I'm sure you planned it this way. So let's take a 15 minute break. We'll be back at 3:15.

(Recess held from 3:00 to 3:15 p.m.)

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

MR. RANKIN: Yes, Mr. Hearing Officer.

CROSS-EXAMINATION

BY MR. RANKIN:

Q. Good afternoon, Mr. Birkhead. How are you today?

A. Good.

Q. Good. Let's see. So I think I'm probably going to start with just identifying your rebuttal statement here. I've got here on the screen, as soon as I share it, your rebuttal statement, which is marked as Exhibit L. And as with your colleagues, I excerpted it from the packet overall.

And I'll just confirm with you that this is your signature and it's February 10th, 2025, and this goes on for another numerous pages with your exhibits to a total of 78. Does this represent your Exhibit L that you submitted?

A. It appears to, yes.

Q. Okay. I just want to kind of get a sense for your background, as well. I don't know what URTEC is. What was your URTEC?

A. URTEC is the Unconventional Resources Technical Conference. So it's a conference that's been happening for the last ten years or so that talks about everything unconventional. So from petrophysics to completions to geochemistry. And I've helped with the petrophysical section of that for the past -- this will be my third year helping with that.

Q. So it's focused on unconventional petrophysics?

A. Unconventional resources in general.

Q. Okay. Resources. Got it. Okay.

And then just these are overviews of the other regions that you've worked. And that's for the U.S. range, across different basins. It looks like. Yeah?

A. Yes.

Q. And I guess, if you would just summarize for me. It looks like you also came out of Anadarko, correct?

A. Correct.

Q. And at Anadarko, you did petrophysics as well?

A. Yes.

Q. Okay. And it looks like you did work in a wide variety of areas overseas as well as domestic; is that right?

A. Correct. They had me working everything.

Q. In terms of the U.S., while you were at

Anadarko, did you work in the Permian?
A. Yes, a little bit. Not excessively was my main area, but over the 15 to 16 years I was there, it was a significant -- it was a fair amount.
Q. It was a fair amount to work in the Permian?
A. Yes.
Q. Okay. And in the Delaware Basin?
A. Yes.
Q. Okay. On the Texas side, New Mexico side?
A. It was on the Texas side.
Q. Up on the Central Basin Platform?
A. A little bit. It was mostly scoping sort of things. It wasn't an asset that I was maintaining.
Q. Okay. So the work you did on the Central Basin Platform was, as you put it, scoping potential assets or scoping assets?
A. That's what I recall. It would have been quite a while ago. It would have been, like, pre-2012.
Q. Okay. And when you were doing that with the prospects, in what formations; do you recall?
A. I know I had looked at the San Andres, Yates. I've looked at the Wolfcamp. I've done a significant amount of study in the Wolfcamp. So just kind of the general formations. Brushy Canyon. That

sort of...

Q. Again, that was all on the tech side, right?

A. Tech.

Q. How about in the Grayburg?

A. I'm sorry?

Q. How about the Grayburg?

A. I did not look at the Grayburg while at Anadarko, but I have done significant looks at it since then.

Q. Okay. Let me scooch up here. I'm mostly, as you can tell, trying to figure out your experience relative to what we're doing here.

A. Yes.

Q. So after your Anadarko, you went to a firm or group called, I'm going to butcher the name, DeGolyer and MacNaughton?

A. Yes.

Q. Okay. And it was an independent consultancy?

A. It is. It's equivalent to Netherland, Sewell.

Q. It's what?

A. It's equivalent to Netherland, Sewell.

Q. Got it. Understood. So in that role, you were doing a lot of reserve estimates?

A. Yes, reserve petrophysics.
Q. Okay. In collaboration with geologists?
A. Correct.
Q. Okay. And it looks like you were there for approximately two years. What regions or fields did you work on while you were there?
A. It was largely the -- the lion's share of it was Russia and residual hydrocarbons and trying to do waterfloods. We had saturations of, say, like, 10 to 15 percent oil saturation we were trying to get out of the ground.
Q. What kind of reservoirs were they?
A. They were mixed, but they were clastic and there were some carbonates, if I remember correctly. It was over a very large area.
Q. And these were waterfloods, you said?
A. Yes.
Q. Okay. So they were looking to waterflood --
A. They wanted the last drop.
Q. They wanted the last drop. Clastics and carbonates, right?
A. Yes.
Q. Okay.
A. That's what I recall.
Q. Okay. And then are these all separate

employments, or are these different projects you did within the --

A. So as I mentioned, I own a consulting company. These are all different clients that I've had while owning that consultancy.

Q. Okay. So that's Petrobrane.

A. That is Petrobrane.

Q. Okay. And just, without going through each and every one, it looks like there's a fair number of CCUS or carbon capture, utilization and sequestration projects; is that what --

A. Yes. I've been working a number of CO2 projects.

Q. Those are mostly in the U.S., or are they abroad as well?

A. So far those have all been in the U.S.

Q. Okay. Are you seeing more CCUS projects than you are ROZ projects?

A. Yes.

Q. Yeah. Is that because of the tax incentives for CCUS?

A. I would hate to guess on their motivations, but...

Q. Just looking at your projects here, it looks like I'm seeing CCUS, but I'm not seeing ROZ, right?

A. Yes.
Q. Yeah?
A. Yes.
Q. Okay. So the carbonate systems that you have worked on, that would be at least the one field or fields in Russia where you're working on waterflood development?
A. Yes.
Q. Where else have you worked on carbonate?
A. Brazil. I've worked in a few -- let's see, Mississippi Lime. Just a lot of the typical limestone -- lime fields. Oklahoma. I'm bad with formation names. I can always look those up.
Q. What kind of developments were those that you were working in? Were they horizontal drilling? Or what kind of --
A. Both. Horizontal and they were vertical. So there was -- the ones in Brazil were heavy oil, large porosity -- oh, actually, no. I'm sorry. I misspoke.
The ones in Brazil that were carbonates were subsalt. Medium porosity.
Q. Okay. But that was a horizontal play?
A. No. That was vertical.
Q. Vertical play. Sorry.

A. Right.
Q. And on the CO_2 injection that you identify here in your summary, that CO_2 injection, has it been limited to the CCUS side of CO_2?
A. It has. There's CO_2 projects that have not been green-lit yet by the EPA or by states that have been given primacy.
Q. Okay. So there's projects that are in the development stage for carbon capture, utilization and sequestration?
A. Correct.
Q. Okay. So Class 6.
A. Yes, Class 6.
Q. Okay. On the UIC program. Sorry.
So, yeah, all in all, basically, you've got 20-some-odd years of doing petrophysics work in a variety of backgrounds and fields, correct?
A. Correct.
Q. Okay. But more limited on the carbonate side; is that fair?
A. A little more limited on the carbonate side, but it's all petrophysics.
Q. Okay. And none so far on ROZ, correct?
A. Aside from this one, no.
Q. Okay. And --

A. But I would say I have seen residual oil before, but I've not been on an ROZ project.
Q. So when you say you've seen ROZ before, was it part of a -- I mean, obviously, the Russia one you mentioned, where you're looking to target oil saturations in the 10 to 15 percent range, I guess those are from conventional core saturations? Or how are you characterizing those oil saturations?
A. These are core saturations, and there's been lots and lots of production. So it's more about stating, like, what the saturation likely is to be now with whatever new wells we have.
Q. Okay. So besides that Russian experience, where else have you looked at or explored or looked for or evaluated residual oil?
A. Well, no, I said I have seen residual oil. One of the cases was a well in Ghana where we drilled a well, and it was just basically a ROZ.
Q. And in that case, did the operator pursue that ROZ interval?
A. No. Because right next door there was a play that had several billion barrels of oil that had 30 percent porosity and was 90 percent oil saturated.
Q. So right next door, there were wells with 90 percent oil saturation, which you would

characterize as conventional saturation?
A. Yes. Yeah, it's a conventional play.
Q. Okay. And so nothing -- have you worked on any tertiary recovery projects, just to be clear, whether it's ROZ or post-secondary recovery?
A. No.
Q. Okay. And we talked a little bit about your experience in carbonate systems. Have you worked in a carbonate ramp system, like the EMSU?
A. I couldn't say with certainty, but I've done a lot of research into them over the years. So I can't say exactly what the environment was.
Q. So nothing comes -- nothing, as you're sitting here, comes to mind that --
A. Nothing that I could put my finger on and say I know for sure that it was a carbonate ramp, under oath.
Q. Got it. I appreciate that. Very good. Okay. I think I got a handle on all that.
Jumping up to your testimony, the bottom of Page 2 of your testimony, I've highlighted a statement here where, under Paragraph 8, you say, "There are significant indications shown in the following document that validate the likelihood of an ROZ in the San Andres of Eunice Monument South."

I just want to ask a couple questions about this. What stuck out to me when I read this sentence was what I term qualifiers.

The first one is indications, and it's not exactly a strong statement, but what do you mean when you say "indications"? And, you know, I understand you're going to point me to the direct evidence and the interpretations you've done. But I guess I would just like to know when you say "indications," what you're talking about.

A. Yeah, I'd say if you're talking -- you may not have spoken to a petrophysicist before, but this is the way that we talk.

Q. Yeah, yeah.

A. There's always a caveat. The answer to a lot of our questions about what do you do in this case, is: It depends.

Q. Yeah.

A. But in this case, what you do, in this case, is you look at the indications for oil, which the undeniable indications are oil in the core, oil that's seen in the pits and within the cuttings, fluorescence, cut, those things and increased gas that's red across the zone.

So that, along with the logs, which do

require a complex understanding of what's going on to breach the saturations that are shown by the core and that we see in the ROZ, you've got to look at all the pieces of data that you can.

Q. That would include, as well, well tests or any production tests that may have --

A. So I would stop right there a little bit. The whole point of a ROZ is you don't see oil during a test.

Q. Okay. Well, I understand that, I guess. And that's the case if the oil is truly at a residual saturation, right?

A. Well, we're parsing definitions. I'm saying, if it's a ROZ, it's not going to have oil flowing. You're saying, "What if it's not a ROZ?" So I'm not sure how to answer that.

Q. Well, I'm sure we'll get down to brass tacks on that. We'll get down to it. But I guess my point is that -- let me ask you a question. I understand you're working under the assumption that the definition of a residual oil zone is oil saturations from 20 to 40 percent; is that fair?

A. I'm working under the assumption that 20 percent is kind of what is written in the literature. But I'm not working with the assumption that it's the lowest it can go.

Q. Okay. Are you aware of any ROZ plays anywhere in the Permian Basin that have targeted oil saturations below 20 percent?

A. No, I am not.

Q. Okay. Very good. And now, on the upper end, I mean, what would you describe, define a residual interval?

A. I appreciate the question. That it depends. It depends upon the wettability. It depends upon the rock properties. You can have residual oil up to 50 percent. A standard range could be anywhere from 30 to 50, dependent upon the wettability and the oil type.

So we're looking at a mixed oil wet system. You can have pretty high residual oil values that aren't going to flow unless you put some external means on it to move it.

Q. All right. There's a lot to unpack in there and I'm going to work on you.

A. Okay.

Q. Not work on you, I'm going to work with you. We'll unpack it. Okay?

A. That sounds better.

Q. So I know wettability has been an issue, and it is an issue, okay, in these complex carbonate systems. And it's an issue because the wettability will dictate a lot about how the oil behaves, right --

A. Yes.

Q. -- in the rock, in the pores?

And in here, I understood you to say that it's your understanding that in this EMSU carbonate system, we're dealing with a mixed oil-wet system, right?

A. No. I said mixed wet to oil wet.

Q. Mixed wet to oil wet. Okay.

A. There have not been -- to my knowledge, there have not been any exact -- any tests done in the San Andres for wettability within the EMSU. And that's an important point, that it has to be within the EMSU because the oil is specific to here and the pore types are -- and the geology is specific to here.

We can say, by the way, that the resistivity behaves -- it certainly behaves in a mixed-wet to oil-wet fashion.

Q. I'm sure we may come back to that, but mostly I just wanted to get your understanding of what the wettability was in the system. Okay?

A. Yeah.

Q. Now, basically, depending on -- I'm a lawyer so we use the word "depends," and, you know, people joke about lawyers answers, right? It's always, "It depends." So I'm not foreign to that.

But you're telling me that you're working under the assumption that the low end is 20 percent and the high is going to be around 50, but it depends on the wettability?

A. It depends on what wettability, it depends upon -- yeah, it depends on several factors.

Q. So now on the wettability question, okay, how does wettability affect the high end of your definition of a ROZ?

A. Say the more oil wet and the lower API you have of oil, the higher saturation you have to have before it will start to move.

Q. Slow down a little bit for me. Say it again. Sorry.

A. Sure. The more oil wet it is, the more it sticks to the sides of the pores. And the lower the API of the oil, the less gas -- the less gassy it is, the harder you're going to have -- the harder time you're going to have getting it to move.

Q. All right. Okay.

A. Sorry. I've always spoken fast. Feel free to tell me to slow down.

Q. Understood. Yeah, no, I appreciate it.
So basically, the reason -- as I understand, in these Mother Nature waterflood systems, where you have a potentially saturated formation that at some point in geologic time had been or may have been saturated with oil, 60, 70, 80 percent, whatever the saturations may have been, and then during the uplift that was experienced causing the hydraulic head to flow water through the Grayburg and San Andres, we had multiple pore volumes sweeping -- stripping some of the lighter ends off your oil and basically converting your system from -- to a more oil-wet system. Is that right? Is that your understanding of how the Mother Nature's Waterflood --
A. That is my understanding, is that -- yes.
Q. So in a system that had been heavily swept by multiple pore volumes, you're likely to see a more oil-wet system, right?
A. I can't say that as a universal thing.
Q. Okay. But in a system like the San Andres, where it's been swept by dozens of pore volumes, I mean, isn't that generally what you would expect to see in the San Andres, in the EMSU, with multiple pore volumes that Dr. Trentham and Mr. Melzer have discussed in their written testimony?

A. From what I understand in the San Andres, the multiple pore volumes of fluid have assisted in making the system oil wet. Everything that starts out not as a source rock, will start off as water wet, but it will have an affinity to oil wetness in certain carbonates.

Q. Okay. Understood. No, I appreciate that.

I mean, I don't know if that's helping anybody else, but I just wanted to make sure I understood, you know, where you're coming from and where your concept was of the current status of the EMSU system and the wettability of it. Okay?

Shifting back to where we were. So in the next sentence here, in the second half of the sentence that I've highlighted, you say that, "Petrophysical interpretation of the wells reveals oil saturations that fall within the range of a ROZ," right? And that's what we were just discussing, right?

A. Yes.

Q. And I guess that was why I was asking these questions, because I wanted to understand what your understanding of the range of a ROZ is. And so as I take it, you know, it's a little bit -- you know, 20 percent up to 50 percent, depending on what

wettability.
A. Yeah. And the reason why I'm a little cagey about the 20 percent is because we don't know what the technical limit is. It could be lower than that.
Q. I'll come back -- I may come back to that to ask you what you mean by that, because -- I may come back to that. I don't think you addressed that in your testimony, so I'll see if I have time to come back to that.
Okay. Now, in your testimony that you've submitted and your analysis that you've done, is it your opinion that the ROZ you've identified that is an indication -- no, let me back up.
In this first sentence I was discussing with you, I talked about I saw some qualifiers. The first one was the indications. Okay? We talked about that one.
The next qualifier that I see is this word "likelihood." So when I read that, you say there's significant indications of a likelihood of a ROZ, so it sounds like, you know, that there's -- that this -- and I guess you mean by "this document," you mean your testimony, right?
A. Yes. Yeah.
Q. "This document," your testimony.

So what I understand you to say is that your testimony, you believe your testimony validates the likelihood that there's a ROZ in the San Andres; is that right?

A. Yes. Absolutely.

Q. So, I mean, just trying to frame it so, you know -- what you're comfortable saying is that you're validating the likelihood of a ROZ in the San Andres?

A. So what I am -- maybe, perhaps, some background is important. In the oil industry, we deal with probabilities. We don't deal with certainties. The more data we have, the more likely we are to have a certainty. So until we have the absolute certainty, we keep using words like this. And we deal with ranges, which is why I had a low case and a high case. So that is the primary reason for those kinds of adjectives.

Q. Got it. And I appreciate it. And you understand why I'm having that discussion with you?

A. Absolutely.

Q. Yeah. So in your oil saturations, in your analysis that you've conducted, have you interpreted oil saturations that go above your 50 percent "depending" range for a ROZ.

A. I'm sure there are.

Q. Yeah. But you still call those -- you're still calling it a ROZ with those higher oil saturation?

A. I am not calling them anything. I am saying that that is the overall log interpretation. I'm looking at the averages.

Q. Okay. Okay, yeah. Just meaning you don't want to be defined by labels, right? I mean, you're just looking for what you think the oil saturations are and where they are?

A. Yes.

Q. Okay. And you're not going to ascribe a label to it, you're just going to tell us where they are and how much you think there is?

A. Mm-hmm.

Q. Okay. Now, you likely heard some of my discussions with your colleague about some of the questions about mobility. And, of course, you can understand why we're all wondering about it.

Do you have an opinion on what oil saturation oil would become mobile?

A. It is an incredibly dependent answer. I think what I mentioned before was that around 30 to 50 percent oil saturation is probably when it would start to move a little bit, but based on relative perm, it'd be just a tiny, tiny fraction of the fluid movement. You'd have to have a significant higher saturation to move larger volumes of hydrocarbons.

Q. What was that last part you said?

A. If you look at relative permeability, albeit very small fraction of the fluid would move once it reaches that point -- a very small fraction of the hydrocarbon would move once it reaches that point. With the fraction increasing, the higher the saturation is.

Q. Okay. So you used the term called "relative permeability," and I have a layman's understanding of that term. And one of my questions is, did you prepare a permeability curve?

A. I prepared three.

Q. Three?

A. Yeah.

Q. So three different relative perm curves?

A. No. That's -- relative permeability and permeability are not the same thing.

Q. Okay. I'm with you. So you prepared three different perm curves. Did you prepare a relative perm curve as well?

A. No, no.

Q. Okay.

A. That requires some detailed core testing, detailed core analysis.
Q. So, tell me about the perm curves then that you prepared?
A. They are stock equations based upon the Lucia classification of rock types. There's a Type 1, Type 2 and Type 3, based upon varying qualities.
So, as I mentioned before, Dr. Davidson made a generalization as to the rock type throughout the entire San Andres, with very little -- I think it was 95 percent of it being deep water facies.
I can't make that call. That is all -- it's irresponsible to actually call the entire reservoir one type, without having enough data for it. So I gave options for three different permeabilities.
Q. So those were just stock equations, so you didn't actually generate or produce your own permeability curve, then?
A. No.
Q. Okay. Got it.
A. It wasn't part of the remit.
Q. Again, these are coming from me, from a lay- -- but the permeability curves, are those vertical perms or horizontal?
A. Those are typically known to be horizontal

perms.

Q. Horizontal perms. All three of those types are horizontal perms?

A. Yes.

Q. Okay. So did you not use, then, any vertical perm in your assessment of the rocks?

A. There was no requirement to calculate a vertical perm. What we can see is the continuity of the porosity, which the porosity is going to be a direct relationship to permeability.

So if you want to say that there's a relationship, continuous porosity infers a decent vertical perm.

Q. I don't mean to take us down a sidetrack here, but this kind of raised a question I had. Because I think in your well logs, you included baffles.

A. I put potential baffles.

Q. And those baffles, I mean, wouldn't those have to be based on a vertical perm?

A. The baffles, if you have zero -- so vertical perm is the composite of all the horizontal perms. So it's a geometric average of all the horizontal perms. So you can infer that by saying that there is a bit of horizontal permeability or porosity that is below a certain percent. You can say maybe this can be a baffle.

Q. Okay. So you inferred your baffle flags based on your determination of the horizontal perms in those locations?

A. Based upon the lithology, based upon the porosity and based upon the look at the logs.

Q. Okay. A little sidetrack. When I get down sidetracks, it takes me a moment to get back. Sorry, one moment.

Okay. While we're on logs and cores, I want to back up to ask you a couple more overview questions before I forget about them.

I think I understood from your colleague, Mr. Bailey, that O-P-S was retained in September; is that right?

A. Ops Geologic?

Q. Yeah, Ops Geologic. Sorry.

A. I believe so.

Q. Okay. So what was your understanding about why you were retained by Empire? What did they ask you to do?

A. I was brought into Empire by Ops Geologic to look at the testimony and look at the -- and do a petrophysical evaluation of the San Andres, which in order to rebut the testimony, you have to do your own interpretation.

Q. You were provided the petrophysical analysis that were conducted by NuTech; is that correct?

A. Yes.

Q. And as I understand, you were provided both the original analysis that NuTech prepared as part of its August 2024 testimony, as well as its revised petrophysical analysis that was submitted in December, correct?

A. Yes. I received that a few weeks -- I believe a few weeks ago.

Q. Okay. And have you reviewed and analyzed NuTech's analysis in both its original and revised?

A. It wasn't part of my remit, but I did browse that, look at it to see where it fit into mine.

Q. Okay. And what was your determination about how it fit into yours?

A. My determination is that it fit well within the range, from what I could tell, of what I was calculating as a high and a low case.

Q. Do you understand what inputs and parameters NuTech employed to conduct its petrophysical analysis?

A. I have read a lot of the documentation, so I can refresh myself on some of it. But yes, I did read through it.

Q. Do you understand that NuTech, when it prepared its revised analysis, calibrated its petrophysical analysis to the water saturations in the EMSU 679 well?

A. I do not understand that.

Q. Okay. What's your understanding about how --

A. I don't know if they did it to the oil saturation or the water saturation.

Q. Okay.

A. I don't recall whether they -- which one they said they calibrated to.

Q. If they had calibrated it to the water saturation, what would your response be to that?

A. That would definitely be a high case estimate.

Q. Why is that?

A. Because the core loses fluid as it goes up. As we said, it loses oil and it loses water. So you could use the -- since both of them lose fluids, you could use the core oil saturation as the ultimate low case, and you could, in theory, use the core water saturation as the ultimate high case.

Q. And the reason -- just explain for us laypeople how the water saturation is related to the oil saturation.

A. Well, because of the way that they clean the cores and --

Q. I'm sorry. I'm asking just more simply than that. Because oil saturation is 1 minus water saturation, right?

A. Yes.

Q. So, basically. So, like, I use the word "inverse," but --

A. Yeah, inverse is not -- that would make it percentage.

Q. Mr. Bailey didn't like that. But, essentially, you can derive your oil saturation if you know your water saturation, correct?

A. Depending if you have a two-fluid system.

Q. Okay. And that's the assumption, right, that we're operating under in petrophysics, right?

A. When you bring up a core, you're no longer in a two-fluid system.

Q. Okay.

A. But it starts out as that.

Q. Okay. So you just perused NuTech's analysis, but you didn't study it?

A. Yeah, I didn't revise on it for a weekend.

Q. So, yeah, you didn't get into it well enough to even understand how they calibrated or what inputs of parameters they used?
A. Not to be able to state with assurance today what they did, as in what curves they calibrated to.
Q. And Empire didn't tell you what they had done either?
A. I read Galen's documentation. I just can't speak to it at the moment without looking at it.
Q. Understood. And so because of that, you can't tell me how your analysis is different than theirs?
A. I can say that looking at his Sw curve, it seems to follow from the range, in general, of what my low and high case are.
Q. And when you're talking about his analysis, can you tell me which one? Because I mentioned there's two; there's an original one and then there's --
A. I see. It'd be the most recent analysis.
Q. Okay. And you're saying that falls within the range of your -- which one, your high or low?
A. It's a range.
Q. It's a range. Falls within the range of the high and low. Got it. I'm with you. Okay.

Now, on to what you've done. Did you calibrate your petrophysical analysis to -- as I understand it, you calibrated the two cores that are available, right?

A. Yes.

Q. And those would be the EMSU 679 and the North Monument San Andres 522 well, right?

A. No. It's the RR Bell and the 679.

Q. I'm sorry.

A. I did recently look at the North Monument.

Q. Now, just for my benefit, explain to me, at a high level, how you calibrate those two cores to your petrophysical analysis.

A. Analysis. So varying m and n, as we all -- as Davidson and I both completely agree, that to use a model unlike -- although Davidson used a model that didn't require n directly. You need to vary both because it's a complex carbonate system.

So what I did was looked at the cores and I tied the core oil saturation to the maximum of the core oil saturations that I saw on the log and then did a correction to that based on the Egbogah correction that was placed in the -- published in the '80s, to get to a corrected oil saturation and then use that as my high case.

So, effectively, what I did was I used the Archie phiT equation because we were in a clay-free system, and Archie should work just fine with a variable m and a variable n.

And that is actually upheld by Dr. Davidson's plots that he shows, that you can still use Archie in those cases, you just have to vary those properties.

So the n was varied and the linear relationship into a non-linear relationship for one of the cases to make it match the core-corrected case to give us the high case possibility.

Q. Explain if you would, the correction that you applied. And I think -- was that the image I saw on the summary that you presented? There was an image discussing core corrections.

A. That is from 1968, I believe, and that's how long ago they actually -- and it was published in the 1973 Core Lab Manual.

Q. But the guidance you were following for the core correction was from 1980?

A. That is from the 1980s. The reference is from Egbogah. It's on my testimony.

Q. Okay. So just if you would, just so I understand it, explain, what was the correction that you did?

A. It uses a correction for fluid loss and a correction for oil expulsion -- and a correction for gas expulsion based on the B sub o that we're given based.

Q. Based on what?

A. Based on the B sub o.

Q. Okay. And the B sub o was provided to you by Empire, correct?

A. Yes.

Q. And that's the oil volume factor --

A. Formation factor.

Q. Understanding that you were provided a value from Empire, what's the normal process for determining the B sub o?

A. That is outside -- that is an engineering thing. I don't typically calculate B sub o's myself.

Q. Do you know how it's done?

A. Aside from in the lab, I couldn't tell you the exact process.

Q. Okay. Is it generally formation specific, location specific?

A. It's typically fluid specific.

Q. Fluid specific. So you'd need to know, like, the API, the gravity, the gas content, that kind

of thing of the oil? Is that basically what you're talking about?
A. Mm-hmm.
Q. Okay. And that wasn't nor has it been available for the San Andres, correct?
A. Not that I've seen.
Q. So do you know, with the value that Empire gave you, what it was based on, where it came from?
A. No. No, I do not.
Q. Okay. You don't know if it's -- where it's from or anything.
A. It came from Darrell, the engineer.
Q. You didn't ask him where it came from or what the basis was for it?
A. I think I did. And it was, "This is what we're using."
Q. Okay.
A. As a best case -- or not even as a best -- sorry. Not as a best case, but just, "This is what we're using."
Q. Obviously, I mean, you use B sub o in your work, right?
A. Only when calculating the oil in place, which is not part of the typical everyday petrophysical process. We're worried about what's

down there at the time.

Q. Okay. So because it's not typical or normal for you to do that, you're mostly doing interpretations. Do you have a sense for the reasonableness of the B sub o that he gave you?

A. I think we -- I think it's a very good relative B sub o to use. If we use one that's lower, then the amount of oil we have, it goes way up.

So in order to keep the OOIP from just exploding -- and so if we put in a B sub o that's lower, the oil saturation -- the oil in place just goes higher.

Q. So just based on the output, you feel like it was a reasonable --

A. I think it's a reasonable mid-case scenario.

HEARING OFFICER HARWOOD: Mr. Rankin, is this a good place to -- it looks like you were about to change subjects. We just need to take a five- or ten-minute break.

MR. RUBIN: Mr. Harwood, let's say ten.

HEARING OFFICER HARWOOD: Okay. Let's say ten.

MR. RANKIN: That's fine. Thanks.

HEARING OFFICER HARWOOD: So we'll come back at 4:05.

(Recess held from 4:05 to 4:14 p.m.)

HEARING OFFICER HARWOOD: Mr. Rubin.

MR. RUBIN: Thank you, Mr. Hearing Officer.

Chair, Members of the Commission, it occurs to me I think there was a necessity that we go into closed session for the remainder of today for the purposes of discussing this pending adjudicatory matter.

It is of some concern to me that we change horses perhaps in midstream, but I would like to discuss that in a confidential manner with the parties. And, of course, I regret any inconvenience to the parties right now.

But what I would like to do is, if a motion is granted, to go into closed session and have the room cleared for the day, and we would see you all back at 9:00.

So if I could have a motion to go into closed session pursuant a Section 10-15-1.H(1) and (3) for the purposes of deliberating on pending adjudicatory matters. Do I have a so moved?

COMMISSIONER AMPOMAH: I move.

CHAIR ROZATOS: I second.

MR. RUBIN: And can I have a roll call vote.

CHAIR ROZATOS: Aye.

COMMISSIONER LAMKIN: Aye.
COMMISSIONER AMPOMAH: Approved.
(Motion approved.)
MR. RUBIN: So we are now in closed session. You all get to leave early for the day. Special treat. And we will see you all here at 9:00.
(Proceedings adjourned 4:16 p.m.)

AFFIRMATION OF COMPLETION OF TRANSCRIPT

I, Kelli Gallegos, DO HEREBY AFFIRM that on February 25, 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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