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PUBLIC HEARING  
STATE OF NEW MEXICO  
OIL CONSERVATION COMMISSION

Pecos Hall, 1st Floor, Wendell Chino Building  
1220 S. Saint Francis Drive  
Santa Fe, New Mexico

TRANSCRIPT OF PROCEEDINGS  
February 26, 2025  
VOLUME IV

HEARD BEFORE:

HEARING OFFICER RIPLEY HARWOOD

COMMISSION MEMBERS:

GERASIMOS ROZATOS, Chair

BAYLEN LAMKIN, Member

DR. WILLIAM AMPOMAH, Member

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

2 TRANSCRIPT OF PROCEEDINGS

3 CHAIR ROZATOS: Good morning to everybody.  
4 Happy Wednesday. Today is Wednesday the 26th of  
5 February. This is the continuation of our case that  
6 we have been ongoing thus far. It is the hearing for  
7 the consolidated cases by Goodnight Midstream and  
8 Empire New Mexico. It's the various case numbers.  
9 I'll just read them again real quickly. Case  
10 Numbers 24123, 23614 through 17, 23775, 24018 through  
11 24020, and 24025.

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

17 MR. RUBIN: Thank you, Mr. Chair.

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

21 So, yeah, we came back at about  
22 5 o'clock. We had lost our video feed and our court  
23 reporter, so it was like a tree falling in the woods.  
24 So we are officially now back in open session.

25 Today, this morning, I suppose, if

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

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

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

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

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

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

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

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

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

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

9 So if I could have such a motion.

10 CHAIR ROZATOS: I move.

11 COMMISSIONER AMPOMAH: I second.

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

14 ALL MEMBERS: Aye.

15 MR. RUBIN: Okay. Any opposed?

16 (Motion approved.)

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

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



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

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

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

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

15 MR. RUBIN: It's okay.

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

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

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

23 MR. RUBIN: Yes.

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

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

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

10          MS. SHAHEEN: Okay. Thank you.

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

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

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

25          MR. RUBIN: Sure. Absolutely.

1 MS. SHAHEEN: Okay. Thank you.

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

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

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

11 MS. SHAHEEN: Thank you.

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

13 HEARING OFFICER HARWOOD: Absolutely.

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

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

16 CHAIR ROZATOS: Mr. Rubin, go ahead.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1 changes that at all.

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

4 MR. RUBIN: Okay.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

25 MR. MOANDER: Thank you, Mr. Rubin,



1 Commissioners.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

25 I think that everyone anticipated, just

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

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

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

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

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

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

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

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

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

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

16 MR. RUBIN: Let me ask this of Empire.

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

20 MS. SHAHEEN: Yes.

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

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

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

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

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

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

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

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

24 Is that a fair statement?

25 MR. RANKIN: Mr. Rubin, thank you for

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

7 MR. RUBIN: Okay.

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

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

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

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

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

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

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

14            MR. RUBIN:   Thank you, Mr. Rankin.  
15                         Before we got back to Empire,  
16    Mr. Moander, is that consistent?

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

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



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

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

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

12 MR. RUBIN: Excellent.

13 Ms. Shaheen.

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

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

22 MS. SHAHEEN: Thank you.

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

25 MR. SUAZO: Pilot can agree to the

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

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

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

14 MS. SHAHEEN: Not from Empire.

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

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

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

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

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

3 As said herein, the parties shall submit  
4 all evidence, testimony and legal argument on whether  
5 the granting of the applications by Goodnight would,  
6 1, impair correlative rights or cause waste in the  
7 EMSU, pursuant to Section 70-2-11; or 2, result in  
8 the disposition of produced water violation of the  
9 Federal Safe Drinking Water Act, or otherwise fail to  
10 protect public health, the environment and fresh  
11 water resources, pursuant to Section 70-2-12.B(15);  
12 and whether the granting of the applications by  
13 Empire would prevent the impairment of correlative  
14 rights or waste in the EMSU, pursuant to Section  
15 70-2-11; or 2, prevent the disposition of produced  
16 water in violation of the Federal Safe Drinking Water  
17 Act, or contrary to public health, the environment  
18 and fresh water resources, pursuant to Section  
19 70-2-12.B(15).

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

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

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

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

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

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

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

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

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

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

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

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

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

5 Okay?

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

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

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

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

25 I can say that yeah, Paragraph 2 and --

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

3 MR. RANKIN: Okay.

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

1 conclusion that they should mirror each other.

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

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

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

15 MR. RUBIN: Okay.

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

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

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

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

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

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

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

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

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

25           Now, they could demonstrate a violation

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

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

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

13 MR. RUBIN: Ms. Shaheen.

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

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

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

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

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

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

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

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

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

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

22 Yes, Mr. Chair.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

8                   MR. RUBIN: Thank you, Ms. Hardy.

9                   Mr. Rankin.

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

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

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

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

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

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

11 The evidence that we intend to elicit  
12 from Mr. Curtis is highly relevant to the issues in  
13 this case. They've been operating in this unit for  
14 60 years. And he has some documents that reflect  
15 what the early pressures are for the unit, which are  
16 important, I think, for the Commission to hear and  
17 see.

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

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

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

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

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

17          MR. RUBIN: Okay. Which came afterwards?

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

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

23          MR. RANKIN: After what?

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

1 intending to call a witness.

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

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

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

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

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

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

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

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

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

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

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

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

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

4           MR. RANKIN: Right.

5           MR. RUBIN: Okay. Fair enough.

6           CHAIR ROZATOS: I think that's the best.

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

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

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

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

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

1 the back of your minds with the questions and stuff.

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

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

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

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

14 STANLEY SCOTT BIRKHEAD,  
15 having first been previously duly sworn,  
16 testified as follows:

17 CROSS-EXAMINATION (Cont'd)

18 BY MR. RANKIN:

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

21 A. Is it still morning?

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

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

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

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

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

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



1 based on separate rock types within carbonates.

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

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

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

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

14 A. Okay.

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

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

21 A. As I said yesterday, 1.3.

22 Q. A 1.3?

23 A. Yes.

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

1 throughout all depths, correct?

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

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

7 A. Mm-hmm.

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

13 A. Not even.

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

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

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

25 Q. And is that applied within a certain range

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

4 A. It's a flag.

5 Q. Yeah.

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

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

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

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

15 A. Yes.

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

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

22 For the dolomite portion of the ternary  
23 diagram we used to calculate the mineralogy, I used a  
24 2.9 grain density there to account for up to 20  
25 percent anhydrite cement as, again, being generous.

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

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

7 Q. Okay. So it wasn't a uniform 2.9. It was  
8 2.9 and then 2.7 for the --

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

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

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

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

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

25 A. There is a distribution of core saturations

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

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

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

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

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

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

3 A. What do you mean?

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

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

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

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

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

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

5           Q. Well, yesterday we talked about the  
6 definition of residual oil being within a range of  
7 20 percent to 40 percent oil saturation.

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

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

16          A. Yes, correct.

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

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

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

25          A. I can.

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

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

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

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

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

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

25          Q. Have you undertaken a study to evaluate how



1 much conventional core needs to be corrected in a ROZ?

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

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

6 A. Yes, I have.

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

9 A. He did.

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

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

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

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

19 Q. Okay.

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

22 Q. Oh, just two days ago?

23 A. Yes.

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

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

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

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

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

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

19          Q. That would be a 10 saturation unit?

20          A. Yes.

21          Q. Okay.

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

1 saturation units.

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

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

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

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

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

16 A. That'd be probably from primary production.

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

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

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

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

1 1973 showing the correction is a possible correction  
2 that was shown by them. That's what happens when you  
3 bring it up to surface.

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

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

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

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

13 A. No. The paper from 1973.

14 Q. Yeah.

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

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

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

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

1 information that was given.

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

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

7 Q. Okay.

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

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

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

20 Q. I understand that, and so my --

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

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

1 saturation units; is that correct?

2 A. Yes.

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

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

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

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

11 Q. Okay.

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

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

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

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

1 I want to make sure I understand it.

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

3 Q. Okay. Okay.

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

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

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

17 Q. How about the n value?

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

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

1 conservative value as well.

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

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

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

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

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

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

18 A. Different, yes.

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

22 A. It would.

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



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

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

14 A. Yes.

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

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

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

25 A. Although he was somewhat vague within his

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

10 A. That is in that column there.

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

14 A. Yes.

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

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

23 A. I did want to presume that.

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

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

2 In this next section here, Paragraph 15,

3 I think you start getting in to your analysis here.

4 You state that, "We see in the interpretation of the

5 wireline, as well as shows in mudlogs and core with

6 available wells that the ROZ zone consistently appears

7 in the same intervals with oil saturations greater

8 than 20 percent. This suggests large amounts of

9 continuity across the interval."

10 Did I say that right?

11 A. Yes.

12 Q. Okay. I guess my question to you is, I

13 don't see -- I'm talking about your exhibits here. I

14 don't see where in your exhibits you've demonstrated

15 that the oil accumulations that you've identified are

16 correlated across the interval.

17 A. I was asked to read about Dr. Davidson's

18 testimony. I was not asked to present evidence for

19 that.

20 Q. Okay.

21 A. So what I can say, is that when you migrate

22 oil into a system, that's a great sign of continuity.

23 Having water everywhere is just status quo. When you

24 have oil in several wells across a large area, you can

25 assume that there is some level of continuity across

1 the migration pathway.

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

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

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

14 A. Yes.

15 Q. How many feet thick is the San Andres?

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

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

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

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

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

4 A. Above the Lovington Sand?

5 Q. Yes.

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

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

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

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

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

21 A. Yes, all of it.

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

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

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

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

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

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

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

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



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

5           Q. What exactly was as displayed?

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

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

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

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

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

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

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

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

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

5 A. Okay.

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

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

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

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

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

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

1 match this classic ROZ profile?

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

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

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

19 A. In the high case, they would be around that  
20 level. In the low case, they would average around the  
21 30 percent range.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

20 A. Absolutely not.

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

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

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

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

3 A. Absolutely not.

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

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

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

18 A. Yes.

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

1                   And I guess we're talking about the EMSU  
2       746 here, right?

3                   A. Yes, such as that.

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

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

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

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

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

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

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

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

7 HEARING OFFICER HARWOOD: Chairman Rozatos.

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

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

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

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

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

18 CHAIR ROZATOS: Ms. Shaheen.

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

22 CHAIR ROZATOS: How much longer?

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



1 think it would be a problem.

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

4 CHAIR ROZATOS: Mr. Moander?

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

8 CHAIR ROZATOS: Mr. Beck.

9 MR. BECK: No objection.

10 CHAIR ROZATOS: Thank you.

11 Mr. Suazo.

12 MR. SUAZO: No objections from Pilot.

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

20 MS. SHAHEEN: Thank you, Mr. Chair.

21 CHAIR ROZATOS: Thank you.

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

25 MS. HENRY: Yes, that's correct.

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

3 MS. HENRY: Yeah.

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

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

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

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

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

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

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

24 HEARING OFFICER HARWOOD: Okay.

25 MS. HENRY: And then after that, we would

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

3 THE HEARING OFFICER: You're being pretty  
4 optimistic.

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

7 THE HEARING OFFICER: All right.

8 MS. HENRY: Thank you.

9 HEARING OFFICER HARWOOD: Thank you.

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

12 BY MR. RANKIN:

13 Q. Good afternoon, Mr. Birkhead.

14 A. Good afternoon.

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

20 A. No. But Ryan Bailey does.

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

25 A. With Ryan's testimony, no.

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

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

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

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

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

21           A. Yes.

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

25           A. Yes.

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

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

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

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

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

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

1 similar because the saturations change slightly.

2 On the next track over, the porosity  
3 track, we see the total porosity and effective  
4 porosity, BVW, which is just the  $S_w$  times porosity.  
5 And then my baffle curve to indicate where there could  
6 be baffles.

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

10 And then the last track, what's called  
11 19, what we'll call 19, is the permeability that I  
12 calculated from .01 to 100, using the Lucia method.

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

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

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

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

22 A. Correct.

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

1           A. Yes.

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

8           A. Yes.

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

14          A. Right, at the Lovington Sand.

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

18          A. That or slightly above it.

19          Q. Yes.

20          A. And it's the -- sorry. It's not that huge  
21 shift. It's the minor shift between, say, 4200 and  
22 4000.

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

25          A. Yes.

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

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

10 A. Yes.

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

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

23 Q. There's a what?

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



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

5           A. Correct.

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

10                  And just for reference, again, I think  
11 we've covered this, but it's a new day, each of these  
12 tick marks is a 20 percent oil saturation or  
13 20 percent; is that right?

14           A. Yes.

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

17           A. Yes, correct.

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

20           A. Yes.

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

25           A. We see that porosity goes from a fairly high

1 value on each of those. Each of those incisions, each  
2 of those grid lines are 10 PU. So it's actually not  
3 20 in those, it's 10 PU.

4 So we go from about 15 percent porosity  
5 above, where we expect to see a fairly low oil  
6 saturation residual, to slightly -- to a place where  
7 the porosity drops down fairly low to around  
8 4 percent, a little bit greater than 4 percent, where  
9 the residual oil saturation goes high because it's low  
10 porosity.

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

15 A. It's density, neutron and PE.

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

21 A. Can you rephrase the question?

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

25 A. The dolomite matrix affects -- it gives

1 slightly higher porosities, given an already tight  
2 bulk density.

3 Q. Okay. Now, I understood that you were using  
4 2.9 as your factor for dolomite in your  
5 interpretation; is that right?

6 A. Yes.

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

9 A. About a 20 percent inclusion for anhydritic  
10 cements.

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

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

15 Q. Say that word again.

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

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

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

1 2.71 for the limestone element.

2 Q. Okay.

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

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

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

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

16 A. From the literature, understanding that  
17 there is going to be a certain amount of anhydritic  
18 cement throughout it, and that the porosity -- the  
19 Umaa-RH0maa cross-plot plotted a little bit higher  
20 than dolomite, indicating that there was something  
21 heavier in there.

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

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

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

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

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

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

25 A. Yes, that is higher to lower.

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

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

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

10          A. Yes.

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

15          A. That's the physics.

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

18          A. There could be an increase in cements.

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

23          A. The density increases.

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

1 curve is resistivity.

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

3 Q. Including the depth track and the formation  
4 track.

5 A. Yes.

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

8 A. Yes.

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

11 A. Yes.

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

16 A. Yes.

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

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

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

24 A. The shallow should be the blue one.

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

1 you're seeing in the resistivity curve as you go from  
2 4800 feet down through the higher oil saturation zone.

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

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

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

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

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

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



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

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

10                  A. That's fine.

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

14                  A. Yes.

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

17                  A. Correct.

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

20                  A. Well, it -- yes.

21                  Q. Yeah. In very simple terms, yeah.

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

24                  A. At all, yes.

25                  Q. But saline water does?

1           A. That's true. Correct.

2           Q. And does rock?

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

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

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

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

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

15          Q. Which is the clay?

16          A. That would be the one to the outside.

17          Q. That would be the what?

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

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

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

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

2       Yes.

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

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

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

9           A. Yes.

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

14          A. With the higher oil saturations?

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

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

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

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

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

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

12 Q. Right.

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

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

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

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

1           A. Mainly because it's low porosity.

2           Q. Now I'd like to talk about the permeability.

3       Okay? And I think that's the far curve. That's your  
4       Lucia curve, right?

5           A. Yes.

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

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

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

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

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

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

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

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

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

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

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

10 A. Can you rephrase the question?

11 Q. Yeah. Now that we know what these curves  
12 are, I'm just asking you to do the same thing we did  
13 for the other two curves and just walk us through from  
14 4800 feet down through the higher oil saturation  
15 zones. Explain to me what's happening with these  
16 curves.

17 A. With the permeability curves?

18 Q. Permeability.

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

20 Q. Yeah, yeah.

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

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

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

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

10 A. Correct.

11 Q. And low perm is to the left?

12 A. Yes.

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

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

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

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

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

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

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

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

25 A. Which is why I provided three curves.



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

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

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

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

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

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

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

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

22 A. Key factors?

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

1           A. In the upper part, where there's low  
2 resistivity, the main factor that would probably  
3 impact this would be  $R_w$ , the resistivity of the water.

4           Q. Okay. And explain how that relates to high  
5 or low oil saturations as we go through the curve from  
6 4800 feet down through the higher oil saturation.

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

8                     It's the main part of the Archie  
9 equation. So it's  $A$  over porosity to the  $n$  power  
10 times  $R_w$  over  $R_t$ . So  $R_w$  is a big component of that.

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

14          A. As you increase resistivity, the  $R_w$  matters  
15 less and the  $m$  and  $n$  values start to matter more.

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

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

1 data that we have.

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

8 A. Correct.

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

11 A. Mm-hmm.

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

15 A. Sorry?

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

18 A. No.

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

21 A. Yeah. I said as resistivity increases to  
22 infinite values,  $R_w$  matters less.

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

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

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

8 A. Yes.

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

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

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

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

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

24 A. No, I wouldn't say that.

25 Q. Okay.

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

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

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

9           A. Yes.

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

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

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

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

19          Q. Okay.

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

22          Q. Okay.

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

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

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

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

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

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

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

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

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

3 A. We sure don't.

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

7 A. Of course.

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

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

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

19 A. Yes. And 4 percent porosity rock.

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

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

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

1 above 40 percent?

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

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

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

7 If I'm looking at this correctly over  
8 the entire interval, the blue curve goes down to about  
9 25 percent oil saturation, possibly 30 percent oil  
10 saturation. The red curve starts at about 40. The  
11 red curve on the right goes a little bit over 80, as  
12 you suggested, and goes down to around 40 -- actually,  
13 to about 25, as well, in one part, giving an average  
14 of around 30 to 40 percent oil saturation.

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

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

22 Q. So if I draw a line right down the middle, I  
23 see a fair number of spikes on the high side, above  
24 50 percent, right?

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



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

3 Q. Okay.

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

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

8 A. I'm pretty certain. If we go back to the  
9 679 core data, we'll see at the very top of the log  
10 where there are very, very low porosities and the  
11 measured oil saturations in those are, like, 70, 80  
12 percent.

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

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

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

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

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

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

2 A. No.

3 Q. -- your understanding as well?

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

5 Q. Okay.

6 A. That that works in low porosity carbonates.

7 It's not that, yeah. Please, yeah.

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

13 A. Yes.

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

19 A. Yes.

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

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

3 See that it says "XTO EMSU 746" --

4 A. Yes.

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

8 A. Yes.

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

11 A. As far as I can tell.

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

14 A. Right.

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

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

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

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

8 Q. Yeah.

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

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

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

23 A. Yes.

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

1     that you're talking about?

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

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

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

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

19            A. Yeah.

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

22            A. I -- I --

23            Q. Hold on. Let me just finish.

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

1 your petrophysical analysis?

2 A. I interpreted 29 wells.

3 Q. Yeah.

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

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

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

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

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

1           A. Mm-hmm.

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

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

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

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

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

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

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

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

3 A. Okay.

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

6 A. I'll take your --

7 Q. Okay.

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

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

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

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

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

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

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

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



1 provided that to us in discovery.

2 MS. SHAHEEN: Thank you.

3 BY MR. RANKIN:

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

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

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

21 On the right-hand side, between the  
22 bracket here, which indicates the top and bottom perms  
23 that were tested, is the well tests from the well  
24 file. You see on September 19, 2005, XTO perfed from  
25 5130 to 5138, perfed 24 holes. And then from 5100 to

1 5110, I think that's 30 holes. And then from 5030 to  
2 5050, 60 holes, 4990 to 5000, 30 holes. And then they  
3 acidized the perfs with 3000 gallons 50 percent acid,  
4 and they flowed and swabbed 110 barrels of water in  
5 two days and had no gas reported. Then they went  
6 ahead and cemented -- set a cast iron bridge plug.

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

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

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

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

1 Q. Okay.

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

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

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

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

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

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

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

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

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

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

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

16 MR. RANKIN: Oh, yeah. Mr. Hearing Officer,  
17 before I forget, I'd like to move the admission of  
18 what will be Goodnight Midstream Cross Exhibit Number  
19 4, which is this 746 mud log. And I have a few --  
20 I'm a little backlogged and I have a few of these  
21 exhibits I need to circulate to all the parties, and  
22 I'll try to get to that this evening.

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

25 MR. RANKIN: Correct.

1           HEARING OFFICER HARWOOD: Any objection from  
2 the Empire?

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

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

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

15           MS. SHAHEEN: Empire would --

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

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

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

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

1 to introduce the rest of it.

2 MR. RANKIN: That's fine.

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

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

10 HEARING OFFICER HARWOOD: All right.  
11 Mr. Beck.

12 MR. BECK: No objection.

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

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

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

19 MR. SUAZO: Yes, it is.

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

22 MR. SUAZO: Yes, sir.

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

25

1 (Admitted: Goodnight Midstream  
2 Cross Exhibit Number 4.)

3 BY MR. RANKIN:

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

8 A. Yes.

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

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

25 A. Absolutely not. If you look at the

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

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

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

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

16 A. He's not following the data.

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

19 A. The resistivity and the porosity.

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

23 A. Looks like I did, yes.

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



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

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

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

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

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

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

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

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

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

6 A. Yes.

7 Q. I mean, the lack of fluorescence and no cut  
8 in the mud log, how does that fit into Mr. Melzer's  
9 ROZ cookbook?

10 A. It's a checklist. It's not an absolute  
11 thing. But it doesn't -- those things are indicators  
12 and is positive indicators in his checklist.

13 Q. So a lack of those things would be a  
14 potential negative indicator, right?

15 A. Not necessarily.

16 Q. I guess, trying to use the language, it's a  
17 potential negative indicator. Not necessarily  
18 doesn't mean it's not there.

19 A. It's a neutral indicator.

20 Q. A neutral indicator. Okay. I guess that's  
21 fair, because almost everything on Mr. Melzer's chart  
22 seems to suggest you find ROZ somewhere, right? So  
23 there's very few things that say negative, right?

24 MS. SHAHEEN: Objection to Mr. Rankin  
25 testifying.

1 THE HEARING OFFICER: It doesn't seem like a  
2 question.

3 MR. RANKIN: Yeah, that's fair.

4 HEARING OFFICER HARWOOD: It's more of a  
5 comment.

6 MR. RANKIN: That's fair. I'll have a  
7 chance to talk to Mr. Melzer about it in a little  
8 bit.

9 BY MR. RANKIN:

10 Q. Going back to your testimony, you suggest  
11 here that, and I'm going to talk to the first  
12 highlighting here, that, "The testimony from  
13 Dr. Davidson's deposition clearly states that they did  
14 not look into uncertainty."

15 Why do you say that? What's your basis  
16 for that position?

17 A. I would have to go back and look at the  
18 quote, but that is one of the things I looked at that  
19 he said he didn't look into. So I'd have to go back  
20 and look at the -- re-read that to find the quote.

21 Q. You didn't have a chance to really look at  
22 his rebuttal testimony, did you?

23 A. Not very long, no.

24 Q. Now, the next one here, on the same page,  
25 this is Page 9 of your testimony, "Regardless of the

1 San Andres, the agreement of oil saturation in the  
2 Grayburg clearly suggests successful migration through  
3 the San Andres at a minimum, and at other levels,  
4 reservoir storage, pre-(natures) waterflood."

5 Are you suggesting here that oil  
6 migrated from the basin through the San Andres into  
7 the Grayburg?

8 A. I'm saying it's very likely.

9 Q. Is it your understanding, based on the  
10 system here, that the -- so you think oil migrated  
11 through the San Andres into the Grayburg? That's your  
12 understanding of the migratory pathway?

13 A. That's not -- it's a complex path. So it  
14 migrated through the San Andres and also up fractures,  
15 faults and other fairways to get into the Grayburg.  
16 So there's multiple pathways, from the Wolfcamp oil  
17 into that system.

18 But yes, there's nothing in the way to  
19 keep the oil from migrating from the San Andres to the  
20 Grayburg.

21 Q. Very good. Yeah, I'm going to move on to  
22 the last bit of my examination of you. And I want to  
23 talk about the 520, the North Monument Unit 522 well.

24 Okay. I think it's Paragraph 26, you  
25 say that, "The NMGSAU Number 522 does show residual

1 (ROZ level) hydrocarbons in all different slopes  
2 presented in the plot. This means that whatever rock  
3 type exists, there can still be an oil saturation  
4 greater than twenty percent."

5 Did you review the well file for this  
6 well?

7 A. I have, since I wrote this.

8 Q. Okay. Yeah, that was my -- you anticipated  
9 the question.

10 So at the time you conducted your  
11 analysis and prepared this testimony, you had not  
12 reviewed the well file, correct?

13 A. I had not.

14 Q. Okay. And at the time you prepared your  
15 testimony and this analysis, had you reviewed the  
16 drilling records?

17 A. I looked for everything I could find on it  
18 at the time. I think since then I've looked at the  
19 OCD records and found some things that I hadn't seen  
20 before.

21 Q. Okay. Did you review to see if they  
22 production-tested the interval that you're referring  
23 to in your analysis --

24 A. Yes.

25 Q. -- subsequent to this testimony?

1           A. Yes.

2           Q. Okay. But at the time of the testimony, you  
3 had not?

4           A. No, I believe I had done, too, that part of  
5 it.

6           Q. Okay. And you're aware that the operator  
7 went back and they tested 100 percent water?

8           A. Yes.

9           Q. Okay. And where the core was showing as  
10 high as 60 to 70 percent oil saturation?

11          A. Yes.

12          Q. Yeah. And that's the core, right?

13          A. Yes.

14          Q. Yeah. Now, and that was conventional core,  
15 right?

16          A. Yes.

17          Q. Yeah. And now you're saying that the core  
18 is the lowest the saturation could be, so those  
19 numbers should be higher?

20          A. I would say that there are special  
21 circumstances where that's not true. I know where  
22 you're going with this. I mean, we know where each  
23 other are going with this.

24          Q. Yeah, okay. So yeah, you become aware that  
25 Apache has now tested that interval and immediately

1     abandoned it, right?

2             A. Yes.

3             Q. And they've set a bridge plug and they've  
4     moved back and they've not pursued that zone?

5             A. Yes.

6             Q. Okay. Now, before I let you go,  
7     Mr. Birkhead, we talked a little bit at the beginning  
8     and you told me you've only just done a cursory review  
9     of NuTech's analysis, but is it your opinion that what  
10    you did, your analysis, is different than what NuTech  
11    did?

12            A. My analysis, the purpose was to establish a  
13    range of oil saturations across the interval that were  
14    reasonable for what is equivalent to a P10 or P90  
15    evaluation.

16                    So the purpose of my evaluation was  
17    totally different from what NuTech's was. NuTech has  
18    their own petrophysics method. There's more than one  
19    way to skin a cat. Just because they use a different  
20    method does not necessarily make it wrong. Is it the  
21    way I would have done it? Maybe not.

22            Q. Okay. But, I mean, you told me that you  
23    weren't aware or didn't know, but I'm just going to  
24    represent to you that if they had calibrated their log  
25    analysis to water saturations in the 679 core, that's

1 not what you did, right?

2 A. That is not what I did.

3 Q. And you haven't evaluated the inputs or  
4 parameters that NuTech used in its analysis, right?

5 A. Not in detail.

6 Q. Okay. You know that they use varying m and  
7 n values?

8 A. I know that -- I believe over different  
9 zones, they use different m's and different n's.

10 Q. Do you know, are they the same m and n  
11 values in the same zones and the same variations that  
12 you used?

13 A. I don't think so.

14 Q. Yeah.

15 A. I think in some, they probably match.  
16 Because the 2.3, I believe they used in some of it,  
17 based on that four-county study. In other areas, they  
18 were probably going to vary a little bit.

19 Q. Yeah. I mean, they only use the four for  
20 different m and n values, right?

21 A. It could be. I don't remember that. I  
22 don't know the exact number they used.

23 Q. So you referenced that study and you recall  
24 that -- do you recall that there were only four  
25 different m and n values?



1           A. Well, you mentioned earlier -- I did read  
2     that, and you did mentioned before that that they used  
3     2.3 from that four-county study. When -- yes, I am  
4     somewhat familiar with it.

5           Q. And because of the different parameters and  
6     different inputs that NuTech used than what you used,  
7     that would lead to different interpretation methods?

8           A. The different methods lead to different  
9     methods, yes.

10          Q. Yeah. I guess this is one other thing I  
11     wanted to touch on before I do let you go. I  
12     apologize.

13                 Here in Paragraph 32, on Page 12, you  
14     say, "In this study" -- your study, right? When you  
15     say "In this study," it's your study, right?

16          A. Yes.

17          Q. Okay. -- "it is rare to find the San Andres  
18     capped by an anhydrite or anhydritic dolostone with no  
19     porosity that would significantly baffle the flow  
20     between the San Andres and Grayburg."

21                 Did I read that right?

22          A. Yes.

23          Q. Okay. And when you say the San Andres and  
24     Grayburg, you're talking about Ops Geologic San Andres  
25     top, right?

1           A. I would say either. But in this case, I was  
2 talking about Ops Geologic top.

3           Q. Okay. Have you identified any evidence  
4 confirming communication between Goodnight's disposal  
5 zone and the intervals above?

6           A. Looking at the petrophysical logs, the fact  
7 that there is a continuous -- an ROZ above and below  
8 the sequence boundary, I would say yes, there is quite  
9 a bit of evidence that there's some communication  
10 between them, from a log perspective.

11          Q. I'm confused, because I thought this was a  
12 different ROZ in the Lower San Andres. Are you saying  
13 that there --

14          A. We never -- we never talked about that.  
15 We've been talking about the ROZ in the San Andres.

16          Q. Hmm. Are you saying that this is one  
17 continuous ROZ?

18          A. I'm saying there are different elements,  
19 that one is -- as Dr. Melzer will talk about, the way  
20 that ROZs are positioned are different. But yes,  
21 there can be two stacked ROZs.

22          Q. In this case, is your interpretation that  
23 from the Grayburg down through to the base of the  
24 San Andres is a single ROZ?

25          A. I don't know enough to say that. They could

1 have undergone different parts of Nature's Waterflood.

2 Q. Okay. Were there different -- I mean, I'm  
3 confused, I guess. What do you mean by "different  
4 parts of Nature's Waterflood"?

5 A. I don't know. I'm not -- from a log  
6 perspective, there is a continuous saturation of  
7 hydrocarbons from the top of the San Andres, and then  
8 in the Grayburg, the saturations increase. That would  
9 lead me to believe that there's a continuous batch of  
10 hydrocarbons from the San Andres to the Grayburg.

11 There was nothing, however, to indicate  
12 that there was a boundary or a baffle or a testable  
13 barrier between the two that would seal the San Andres  
14 rock from the Grayburg.

15 Q. This is Mr. Bailey's Exhibit K-12, and I'm  
16 looking at it, it's a cross-section. And I'm trying  
17 to figure out how this shows that there -- with two of  
18 these logs that were included in this cross-section, I  
19 don't see any indication of continuous oil saturations  
20 in at least two of them. Do you agree?

21 A. Let me see. Well, there's at least one of  
22 them where the interpretation doesn't continue up into  
23 it. Let me get situated with the curves. Can you  
24 zoom in to the tracks, look and see what the track  
25 names are. So SOL is on the right.

1                   Okay. You can zoom back out now,  
2 please. You've included almost no part of the  
3 Grayburg above it. But yes, there's some area above  
4 the immediate Grayburg where there's not oil  
5 saturation in that point.

6                   Q. Just to be clear --

7                   A. We may be disputing the definition of  
8 "continuous."

9                   Q. Mr. Birkhead, this is your -- Ops Geologic's  
10 exhibit, not ours.

11                  A. It's Ryan's, so I have the ability to ask  
12 for you to zoom in, please.

13                  Q. No, no, I know. But I think you said -- I  
14 thought you were saying that we had cut off some  
15 part --

16                  A. No, no. I'm just saying that if you're  
17 trying to make a point with this, there's at least one  
18 well that doesn't have any Grayburg interpretation in  
19 it.

20                  Q. Okay. I guess I'm interested in what is  
21 potentially the disposal zone here, and I'm not seeing  
22 continuous oil saturations through the disposal zone.

23                  A. Can you please define the disposal zone?

24                  Q. Lower San Andres.

25                  A. Your question was about the San Andres

1 Grayburg. So this is a change in direction.

2 Q. Well, okay. I guess I'm wondering how  
3 you're seeing continuous oil saturations down through  
4 the San Andres.

5 A. In several of the logs, that's what we see.  
6 There are areas that are not -- there is no ROZ where  
7 the saturations are not as continuous, and others  
8 where they are.

9 I was not submitting that the Lower  
10 San Andres, the Upper San Andres and the Grayburg were  
11 all connected.

12 MR. RANKIN: Thank you. No further  
13 questions, Mr. Examiner.

14 THE HEARING OFFICER: Thank you, Mr. Rankin.

15 So, Mr. Moander, you're up if you have  
16 questions.

17 MR. MOANDER: I have no questions for this  
18 witness, Mr. Hearing Officer.

19 HEARING OFFICER HARWOOD: Mr. Beck.

20 MR. BECK: No questions.

21 HEARING OFFICER HARWOOD: Mr. Suazo?

22 MR. SUAZO: No questions.

23 HEARING OFFICER HARWOOD: All right.

24 Mr. Rozatos, or whoever wants to go  
25 first on the Commission.

1 CHAIR ROZATOS: I actually do have a few  
2 questions. Commissioners, if you don't mind if I  
3 start? Thank you.

4 EXAMINATION BY THE COMMISSION  
5 BY CHAIR ROZATOS:

6 Q. Thank you again, Mr. Birkhead. We  
7 appreciate it. And thank you for waiting patiently  
8 this morning.

9 A. I understand.

10 Q. We appreciate all that.

11 In a cross-examination with Mr. Rankin,  
12 remember you were talking about the resistivity  
13 between the rock and the oil and the water?

14 A. Okay.

15 Q. You made a statement that kind of piqued my  
16 curiosity. You were talking about how oil has  
17 infinite resistivity and how you can tell how much oil  
18 is in by the amount of resistivity that you see  
19 within -- through the porousness of the rock and what  
20 resistivity is coming through with oil, water, rock,  
21 et cetera.

22 You stated the equations are sensitive  
23 enough to distinguish oil and rock, high resistivity  
24 rock. And it was an Exhibit L-26.

25 CHAIR ROZATOS: Ms. Hardy or Ms. Shaheen,

1 can you bring up L-26, please.

2 BY CHAIR ROZATOS:

3 Q. Just to refresh your memory.

4 A. Absolutely.

5 Q. My question is just going to be, can you  
6 just please -- I am by no means a petrophysicist, nor  
7 a geologist, nor a hydrologist. So once they bring it  
8 up, if you wouldn't mind just kind of walking me  
9 through that.

10 A. Sure. Happy to.

11 CHAIR ROZATOS: And just as a reminder,  
12 Ms. Hardy, it was L-26. And thank you for bringing  
13 it up for me. No, please. I caught you off guard.

14 THE HEARING OFFICER: Mr. Rankin, maybe you  
15 could bring it up. The two of you could duel.

16 CHAIR ROZATOS: I think Ms. Hardy has it.

17 MR. RANKIN: Okay. I'm more than happy to  
18 help.

19 CHAIR ROZATOS: L-26. So we were focused --  
20 Ms. Hardy, if you wouldn't mind just zeroing in on  
21 about the 4800- to 5200-foot depth. That was where  
22 Mr. Rankin was at. A little more. There you go,  
23 right about in there.

24 BY CHAIR ROZATOS:

25 Q. Could you just explain this one for me, as

1 well, please.

2 A. I'll do my best. So if you take -- let's  
3 say you take a block of rock, just a cube of rock, and  
4 try and get the resistivity of that. The resistivity  
5 is going to be extremely high. It's solid rock, no  
6 empty volume inside of it.

7 You start adding a little bit of empty  
8 volume to it and you put oil into it, it's still going  
9 to read an infinite resistivity.

10 The only way you can start telling if  
11 there's -- the only way to add any conductivity to the  
12 rock is to start adding something that is conductive,  
13 such as saltwater.

14 So the resistivity tool is looking for a  
15 way to make it through the rock to the other side. So  
16 it's actually applying an electric current going  
17 through the rock and being measured on the other side.  
18 When you look at the resistivity compared to the  
19 resistivity of a water filled -- the resistivity of  
20 the water itself, you can start getting an idea of  
21 what the saturation of the water versus the other side  
22 of the component is, the other side of the pore space,  
23 which would be oil or gas or something like that.

24 So what you need is a conductive element  
25 to go through it. How you correct for the rock



1 effects is because the resistivity is going to -- the  
2 conductivity is going to go through the pore space,  
3 not just the rock. We're going to see the  
4 conductivity go through the most conductive areas.

5 We use things called saturation  
6 exponents and cementation exponents. This is the  $n$   
7 and the  $n$  we've been talking about this entire time.  
8 One of it -- what the  $n$  is related to, basically, how  
9 much the resistivity can vary between  $R_w$  and the true  
10 formation resistivity and what saturation you have.

11 The  $n$  is basically how connected up the  
12 pores are. So how much of a straight line they're in.  
13 So if you're in a straight line, your  $n$  can be very  
14 low. If you're in a very complex pore network, like  
15 this, it can be just crazy. And you can get up to  
16 really high values, like 4 up to 5, on the  $n$ . Where,  
17 typically, they're between like 1.6 and 2.1 or so.

18 Q. Okay. And I get that those are coefficients  
19 that you're using. In here, and on what we're looking  
20 at on the screen, you stated that the dash lines are  
21 clay, correct, the green dash on the far left?

22 A. Yes, sir.

23 Q. Okay. So you have some clay down there.  
24 And just help me -- let me just take one more step  
25 back. I apologize.

1                   This is a core that you've taken out of  
2                   and you're doing resistivity on it?

3                   A. I'm sorry. That's a great question. This  
4                   is actually a borehole that we dropped tools into to  
5                   measure the resistivity.

6                   Q. Got it.

7                   A. And do all of the measurements on.

8                   Q. Okay. So that's how you're seeing this  
9                   graph.

10                  A. Exactly.

11                  Q. Got it. Okay. I'm back with that one.  
12                  Okay. Thank you for explaining that one. I  
13                  appreciate it. And that was, I think, the part that I  
14                  was missing, that this is happening down a borehole at  
15                  some point.

16                  A. Yes.

17                  Q. And can you just explain to me as what you  
18                  just here at the very end of your cross-examination  
19                  with Mr. Rankin, you said that there's a continuous  
20                  oil saturation from the Grayburg down to the  
21                  San Andres. And I may have missed something somewhere  
22                  there. Could you explain that one for me?

23                  A. So, I wasn't sure quite where it came from  
24                  either, because I don't recall it coming up in  
25                  previous questions exactly, the continuity of the

1 Grayburg to the San Andres.

2 But if you look at the Grayburg section,  
3 where it is interpreted, where I've shown that  
4 Dr. Davidson's interpretation is similar to mine, it's  
5 showing an oil saturation.

6 Q. Okay. So that's what you're doing. You're  
7 looking at both of them, yours and the doctor's?

8 A. Yes.

9 Q. Awesome. No more questions for me. Thank  
10 you.

11 THE HEARING OFFICER: Commissioner Lamkin,  
12 you want to take the next questions?

13 COMMISSIONER LAMKIN: Sure.

14 EXAMINATION

15 BY COMMISSIONER LAMKIN:

16 Q. Good afternoon, Mr. Birkhead. Thank you for  
17 your testimony. I think I just have one question.

18 So, on all the wells that you had  
19 petrophysical data on, through logs or whatever, did  
20 you utilize that data from every single well to  
21 backstop your m and n values across your modeling?

22 A. So, the only -- so, no. What I had was the  
23 core data to calibrate to. So, core data and  
24 literature.

25 I'll put it this way. The  $R_w$ , the m and

1 the n are knobs. If you have data for one, you can  
2 vary the other two. If you have data for none, you're  
3 pretty much hung up in having to model things to  
4 calibrate to what the real data you have, which in  
5 this case is the core saturations.

6 So, we have indications of what the  $R_w$   
7 should be from the wireline logs, where we have the  
8 low resistivity and the porosity. We don't have exact  
9 cases of m and n except from literature.

10 From n, we have even less than that.  
11 So, the n was varied to fit the -- to calibrate to the  
12 core data low and high case.

13 COMMISSIONER LAMKIN: Thank you.

14 THE HEARING OFFICER: Dr. Ampomah.

15 COMMISSIONER ROZATOS: I just have one  
16 question to follow up with that.

17 EXAMINATION

18 BY CHAIR ROZATOS:

19 Q. I'm having difficulty now with the m and n  
20 being potential knobs. I know that that was just an  
21 illustration, but now try to help me understand how  
22 you're adjusting these numbers. Because it kind of  
23 now sounds like you're fitting these numbers.

24 A. Part of what this is, is realistically a fit  
25 to the core data. We're calibrating the core data,

1 calibrating to the core data. The core data is a fit.  
2 That's the data that we're including into it that  
3 we're integrating.

4 So what we're doing is we're using --  
5 what you would normally do is use a was -- let's see,  
6 resistivity versus -- or Sw versus porosity. Just  
7 trying to remember what the picket plot is at the  
8 moment. Whenever you change any of the values, m or  
9 n, all the other values change, too.

10 So we have one value we can absolutely  
11 tie to, and that was the Rw, and which does vary per  
12 well. For the m and n, if we changed Rw, then what  
13 we're going to need to use for m is going to change,  
14 too, what we're going to use for n is going to change  
15 a little bit, too.

16 So we do calibrations to the core data  
17 because that's what's considered to be a good  
18 petrophysical model. And we don't have -- and the  
19 important part is, we do not have measured SCAL data,  
20 special core analysis data, porous plate pressure, cap  
21 pressure data, to show us what the m and n actually  
22 should be.

23 If we -- when we get that data, if we  
24 have that data, we could easily tell you what the m  
25 and n would be and how it would vary across the

1 reservoir.

2 Q. Okay. So, in theory, there are wells out  
3 there that have that sort of data so you could get a  
4 more concrete m and n?

5 A. Yes. If we could find more data that had  
6 that SCAL information for the n, it would be more  
7 important. The n is wettability. Wettability is  
8 important, which is on a field-by-field basis, and  
9 that would change per field.

10 Q. Okay. So just so I get it straight, we did  
11 not have that sort of data with these wells that you  
12 wrote your paper on -- or your equations on, and so  
13 the m and the n are more variable?

14 A. They are variable based upon the literature  
15 and based upon the calibration of the core data.

16 Q. Okay. Thank you.

17 A. Yes.

18 THE HEARING OFFICER: Dr. Ampomah.

19 EXAMINATION

20 BY COMMISSIONER AMPOMAH:

21 Q. Thank you. I do have a couple of questions  
22 for you.

23 A. I thought you might.

24 Q. Probably have like four pages or something  
25 like that. Just kidding. Okay.

1                   You know, you have analyzed quite a  
2     number of logs within the area that we are focusing  
3     on.

4                   A. Yes, sir.

5                   Q. Let me ask you, do you know that the  
6     San Andres Formation that we're dealing with, mostly  
7     if I look at the logs, mostly the Lower San Andres,  
8     it's more or less classified as an aquifer? Have you  
9     heard about that?

10                  A. I do think the majority of the San Andres  
11     ROZ is closer to the top. But there are definite  
12     indications throughout the few logs we had going  
13     through the Lower San Andres that an ROZ is there.

14                  Q. Now, I'm just saying that, have you heard  
15     that the San Andres, the Lower San Andres, has been  
16     more or less assumed as an aquifer?

17                  A. Oh, that is my impression.

18                  Q. That is your impression?

19                  A. Yeah.

20                  Q. I keep on going back to this. Maybe this is  
21     the first wells that we are probably dealing with.  
22     But let me ask you.

23                         So, within this ROZ, let's say the  
24     San Andres that we're talking about here, do you  
25     believe that, let's say, these higher numbers that you

1 are interpreting, you know, based on your analysis,  
2 it's really more or less -- if these higher oil  
3 saturations are more or less realistic, would you  
4 believe or would you agree that XTO or any other  
5 companies would probably not drill water wells within  
6 these areas?

7 A. I would assume that they have done the  
8 research to know that it's residual oil and that it's  
9 okay to do that. But I can't look into -- I haven't  
10 looked into the past to see what the case was, so I  
11 can't speak to that.

12 Q. And we will come to the log that you have  
13 went back and forth with Mr. Rankin and then our Chair  
14 where you are predicting more like, let's say,  
15 significant amount of oil saturation, about  
16 80 percent, 60, 70 percent, you know.

17 You know, so if you use that as an  
18 example, I mean, with that amount of oil in there, who  
19 is going drill a water well through that?

20 A. That is in porosity. That is about  
21 4 percent. That is not going to flow under normal  
22 conditions.

23 Q. Okay. We'll come to that one.

24 COMMISSIONER AMPOMAH: Let's go to L-15, if  
25 you can bring it up. L-15. I do have some



1 questions. Just a quick one. L-15. Yeah, right  
2 there.

3 BY COMMISSIONER AMPOMAH:

4 Q. Okay. So you more or less utilize this to  
5 estimate your high and then the low. So with this,  
6 maybe I missed it, can you explain to the Commission  
7 how the corrections were applied, especially to the  
8 higher?

9 A. Absolutely. So it was a -- because we don't  
10 have a good depth shift on the core and an actual  
11 gamma ray to go along with it to do a fine-tuned depth  
12 shift, cross-plotting on this is going to be highly  
13 suspect. So a lot of this was visual.

14 Looking at the minimum -- what we know  
15 as the minimum possible oil saturation from the core,  
16 these are the results of that. So these are the log  
17 curves placed on a cross-plot. So this is not the  
18 core data.

19 But then so I matched the low case to  
20 what the minimum possible oil saturation was and it  
21 was more like the maximum of the minimum, is what I  
22 matched it to, understanding that it would be a  
23 further correction for the lost oil.

24 Q. So this one, it's not based on the core  
25 data?

1           A. No, that is not the core data that you're  
2 looking at. That is the wireline data.

3           Q. That's a wireline data?

4           A. Yes.

5           Q. Do you have any estimate to show us, you  
6 know, the data that you actually used to establish the  
7 correction factor or the correction equation?

8           A. If we can go back to my talk from this  
9 morning, I can show that plot, if that's -- I believe  
10 it was the third or fourth slide.

11           CHAIR ROZATOS: If you guys are going to  
12 have conversations, remember we need to have the  
13 microphones on, but the conversations should be  
14 coming through the hearing examiner.

15           MR. RANKIN: Mr. Examiner, Hearing Officer,  
16 the conversation I was having offline with  
17 Ms. Shaheen was simply, I think it's a plot that was  
18 presented in a summary presentation that we hadn't  
19 yet seen. So I just was asking Ms. Shaheen if she  
20 would, at her convenience, share the presentation so  
21 we had a copy of it.

22           THE WITNESS: I believe it's Slide 9.

23           MS. SHAHEEN: We're happy to share that with  
24 you.

25           A. So if we look at this, it's 679, and you'll

1 see from the green dots on the left-hand side that  
2 there's spots where the core saturation matches and  
3 doesn't match; that my lower case saturation is in  
4 red, the core uncorrected oil saturation is in green.

5 And yeah, there's definitely going to be  
6 parts where it doesn't match well, and others that  
7 matches very well, especially in the Ops Geologic area  
8 of the San Andres.

9 So what I did was, looking at the core  
10 oil saturation, matched it to the maximum and the  
11 minimum data to show what the -- to the top of the low  
12 case. Because this does require a variable n and  
13 variable m.

14 The correction that I applied is in the  
15 next track over, in Track 10. And that correction  
16 shows just about a maybe 10-unit, maybe in 5-unit, in  
17 cases, correction. So the correction I plot is  
18 actually very minor to this, only resulting in a  
19 change in average between the cases of about 30 to 40  
20 percent.

21 And that correction was done using the  
22 B sub o of 1.3 and the Egbogah calculation from, I  
23 believe, 1988 that's in my references. But it just  
24 uses a calculation for fluid loss and as based on the  
25 B sub o.

1           Q. Okay. Yeah, and I'll come to the m and n.  
2 But, essentially, so the output of the correction  
3 factors will be, is it the m and n from this? Like,  
4 let's say, from 9 to 10, what were the transformation  
5 factors?

6           A. So from 9 to 10 for the core data or --

7           Q. Yeah, from the core data.

8           A. From the core data, it was an equation. It  
9 was an equation based on the B sub o, and it was an  
10 equation by Egbogah from 1988 or so. I can show you  
11 that equation. It's a simple linear -- it's a simple  
12 rule-of-thumb equation, similar to the one  
13 Dr. Davidson used.

14          Q. Yeah, and that equation will give you --

15          A. It gives you about a 5 to 10 percent  
16 difference in oil saturation.

17          Q. Okay. And you --

18          A. And so n was varied in order to go from one  
19 case of saturation to the next case of saturation.  
20 That would be from a non-linear -- we're going from a  
21 linear to a non-linear model on n. But both were  
22 varied.

23          Q. Okay. Thank you for that. But I thought  
24 from the earlier testimony, probably -- I don't know  
25 if Dr. Lindsay touched on that or probably -- or Ryan

1 touched on that or not. But it sounded to us, I think  
2 probably Ryan talking about you use analogous data  
3 from somewhere where they applied the squeegee  
4 saturation measurement to help establish that when  
5 you --

6 A. Yeah. So I reviewed that. That was not --  
7 I did not make just a bulk calculation based upon that  
8 paper from Seminole Field. I actually used a  
9 calculation from the '80s that was specifically meant  
10 for residual oil.

11 Q. So not just necessarily the Seminole Field?

12 A. Right. So it was -- I'm not sure -- I mean,  
13 they used corrections from taking conventional core  
14 all the way to a sponge core, and that was their  
15 correction.

16 I don't know what their exact  
17 environment was like and what our environment was like  
18 at the time, so I had to go with more of a rule of  
19 thumb. But when I looked at both, they're fairly  
20 similar. I think ours is a little more conservative.

21 Q. Yeah, thanks for clarifying that, because I  
22 had a little bit of a concern on that one.

23 So based on the cross-examination from  
24 Mr. Rankin, it sounds like there's another company,  
25 NuTech, that did another petrophysical analysis. And

1 I'm sure probably we'll have the opportunity to get to  
2 that. But let me ask you, what are the main  
3 assumptions that you utilize in your analysis?

4 A. The main assumptions that go into this is  
5 how much above the minimum oil is actually the right  
6 amount.

7 Q. How much minimum oil?

8 A. How much above the minimum oil we see in the  
9 core is the actual amount. Because that is what is  
10 variable, is the high case, low case. So we know  
11 there can't be less than what we measured, but we know  
12 there can be more.

13 Q. So on that L-15, if you remember that, where  
14 you used the log data to plot, to establish your low  
15 and then the high, I presume there was mud log data  
16 that came with it.

17 A. Absolutely, yes. And Mr. Rankin covered  
18 that.

19 Q. Yes. Where there gas shows or fluorescence,  
20 you know, in most of the mud logs that you reviewed?

21 A. In the ROZ --

22 Q. Yes.

23 A. -- in the Upper San Andres, there certainly  
24 was. In the lower San Andres, there were minor gas  
25 shows that, admittedly, could have been recycled gas.

1           Q. Okay. So let me ask you this one one more  
2 time. You know, in your experience, you know, have  
3 you seen any play where the estimated oil saturation  
4 is about 50 percent, and even in some places about  
5 60 percent, and oil is still immobile?

6           A. We usually have pay cutoffs that are higher  
7 than that. But yes.

8           Q. So is your testimony that --

9           A. I'm sorry. Please go ahead.

10          Q. Okay. So is your testimony that there are  
11 wells where the saturation is about 60 percent, but  
12 they still do not -- it's still not mobile?

13          A. Yes.

14          Q. Do you have a reference to some of these?

15          A. If you look into some more of the  
16 unconventional plays, where there's a lot of tighter  
17 porosity around 4 percent, if you get into tight sands  
18 that have oil, a lot of times we have -- I've been --  
19 let's see. Peregrino, in Brazil, clastic sand,  
20 heavier oil, similar to what we would see here, needs  
21 a water -- is definitely immobile at 60 percent.

22          Q. Okay. So I asked the question wrongly. So  
23 I'm talking about a conventional play, not  
24 unconventional, where, let's say, saturation can go  
25 about 60 percent and still the oil has not reached the

1 critical oil saturation to move.

2 A. If we're looking at relative perm, we look  
3 at the core data that was given to us from the 679 or  
4 from the RR Bell, one of them shows that there are  
5 high saturations, about 60 percent, in the lower  
6 porosity rock. Do we usually see that in conventional  
7 zones? We're not usually looking for that, because  
8 the zones we're looking for are usually higher  
9 porosity than 4 percent.

10 So it does happen, but usually I'd say  
11 the migration pathway is going to go mostly into the  
12 porous rock.

13 Q. Do you know the type of -- in your previous  
14 answer, you talked about different types of oil that  
15 could probably result in that.

16 A. Yes.

17 Q. But do you know the type of oil we are  
18 dealing with here?

19 A. I know that it's residual and probably a low  
20 API oil. I do not know exactly what it is.

21 Q. Yeah. My next one was, do you know the API?

22 A. Nope. No, sir, I don't.

23 Q. So this is a carbonate, right?

24 A. Yes, sir.

25 Q. So would you agree that probably started



1 with, like, let's say, oil-wet reservoir?

2 A. I would say, assuming it's a water -- mixed  
3 wettability to an oil-wet reservoir is a very easy  
4 assumption to make.

5 Q. And then there's a high possibility that it  
6 can transition to, let's say, mixed wet, with all the  
7 flushing that is going on?

8 A. Oh, yes. Yeah. I'm just saying that  
9 there's a range towards mixed wet to oil wet. It's a  
10 range of data. So it's a range of -- it's a range of  
11 possibilities between the two.

12 Q. So is your testimony that the rock that we  
13 dealing with, the system that we dealing with, is  
14 probably mixed wet?

15 A. No, sir. I'm saying it's somewhere between  
16 mixed wet and oil wet.

17 Q. Okay. Certainly you have a lot of  
18 experience, so help me here.

19 COMMISSIONER AMPOMAH: Let's go to EMSU 679,  
20 so probably Exhibit L-25, if we can share that.  
21 L-25. Yeah, let's scroll down to the San Andres  
22 bottom. Okay. Right there.

23 BY COMMISSIONER AMPOMAH:

24 Q. So on Track 7, the core data points, will  
25 this be the transformed -- would they be the

1 corrected?

2 A. Those are the uncorrected.

3 Q. This is uncorrected?

4 A. I would have to see the header, but I  
5 believe those are the uncorrected.

6 Q. I thought all from there on was all the  
7 analysis, the final analysis that you did.

8 A. Well, I still often show the raw data and  
9 the not. So that is the -- that would be the  
10 uncorrected.

11 Q. Okay. So which one is the corrected one?  
12 Because I don't want to --

13 A. The corrected one is not on there.

14 Q. The corrected one is not here?

15 A. No. That is not on this plot.

16 Q. Yeah, so then can we go back to that one? I  
17 think, yeah, we showed that.

18 A. Yes, in the plot that I just showed a few  
19 minutes ago, that was the 679.

20 THE WITNESS: If we can go back to that.  
21 That's in the PowerPoint, please.

22 BY COMMISSIONER AMPOMAH:

23 Q. And we'll still come back to one more here.

24 A. Sure. This is it.

25 Q. Yeah, okay. And thanks for clarifying that,

1 because I was going to use the uncorrected one.

2 Yeah, so if you look at Track  
3 Number 10 -- so then let's start with 9. So what were  
4 the m and n values that got you to 9, if you can share  
5 with us?

6 A. They were variable. So, the m varied  
7 between 2.3 and I believe around 4 or so. The n would  
8 have varied from around 3 to upwards of 9, based upon  
9 the porosity.

10 Q. You said the m will vary from --

11 A. A 2.3.

12 Q. The m will be 2.3?

13 A. And it uses the Focke and Munn equation for  
14 it based on permeability range. So I think it goes up  
15 to around the high 3s, low 4s.

16 Q. Okay, 3, 4s. And then the n?

17 A. The n was an algorithm I developed based  
18 upon the core calibration, which is from a -- it goes  
19 from a little bit over 3, I believe, to around -- not  
20 between 9 and 10.

21 Q. Well, so you said you have a reference where  
22 the n value can go to 9 or even probably 20?

23 A. There's references that show that going over  
24 20. I'm not saying it does that here. I'm just  
25 saying that there's references in the world. There's

1 rocks in the world that do that.

2 Q. Well, in my formation evaluation class, I  
3 guess probably I thought that the  $n$  value should be  
4 probably 1.8 to 2.5, and commonly, probably 2.3 is  
5 what people have been using a lot.

6 A. Then we have to add a lot more oil to this,  
7 would be the result. If we used an  $n$  of about 2.3, we  
8 would end up with a booming reservoir that's  
9 90 percent oil saturated.

10 So we have to raise the  $n$ , as is  
11 suggested by literature, in mixed- to oil-wet systems  
12 in order to pull the saturation down to the residual  
13 levels.

14 Q. So that shows that without more or less  
15 measuring the  $m$  and  $n$  -- I mean, let's say if you use  
16 more like the common numbers that we are more or less  
17 accustomed to, then that makes it much easier.  
18 Because I do know that, okay, these are the typical  
19 values that are being used.

20 But going extremely high, it's just  
21 established the uncertainty associated with, let's  
22 say, these numbers without any proof, like you were  
23 talking to the Chair about, you know, any proof with  
24 regard to what is the actual  $m$  and  $n$  value.

25 A. The  $n$  value did use something from

1 literature, a variable, and did use the 2.3 from  
2 literature in the four-county study used in the  
3 San Andres.

4 So I actually decided to make it a  
5 little more conservative and vary the m, as in Mary,  
6 above 2.3.

7 Q. So let's look at the Track 10. Starting  
8 from the bottom of the Grayburg, at the bottom, so  
9 let's say where you have -- is it 39? No, probably  
10 just on top of the 4100.

11 A. Yes, sir.

12 Q. And then so probably 40, 50, where we have  
13 the core.

14 A. Yes.

15 Q. Yeah. Right there, I think on your 10, I  
16 can see that there's a lot of improvement in the  
17 match, but certainly it's not a hundred percent.

18 A. Absolutely.

19 Q. Yeah. But I can see that there's a lot of  
20 improvement there. Now, so right on the top there, we  
21 do have -- how would you classify that? Is it a water  
22 zone, right on the top, like let's say probably 40,  
23 50, all the way to, let's say 4100?

24 A. I would suggest that that is likely to be  
25 cores that have been -- had more fluid expelled from

1       them. I would also suggest that Goodnight agrees with  
2       me, because they're getting the same saturation that I  
3       am.

4               Q. So then probably the 40, 50, maybe would be  
5       a water zone.

6               A. The 40, 50 would be -- all of these would be  
7       mostly water, they would flow water. Would it be  
8       100 percent water? No. But not based on the  
9       resistivity and the porosity and the calculations from  
10      both companies.

11              Q. Okay. And once we go down, I'm just looking  
12      at the resistivity log and then also comparing to,  
13      let's say, the water saturations that we are seeing.

14              A. Yeah, totally copacetic. But yeah.

15              Q. Okay. So let's go to 4200 all the way to,  
16      let's say, 42- -- the distance between them is 20, 20,  
17      or -- I think it was 20, 20, right? Each box going  
18      down is 20. Okay.

19              A. Each one is 20, yes.

20              Q. Each one is 20, okay. So then let's look at  
21      4200 all the way to, let's say, 400 and -- 425- -- no  
22      4280. So 4200 to 4280.

23              A. Yes.

24              Q. On your Track Number 10, this one would  
25      be -- how would you describe this formation?

1           A. I would describe this as a residual zone as  
2 well as Goodnight does.

3           Q. And that is clearly shown also -- on the  
4 core --

5           A. Yes.

6           Q. -- that is clearly shown?

7                     Now, my tough question to you is, how  
8 much of this will be recoverable?

9           A. I am not -- given that we're going to do --  
10 that there's a plan for a CO2 flood, I am not -- that's  
11 a question for someone else that that is their  
12 specialty.

13           Q. So as part of this here, and are we going to  
14 hear from another testimony to tell us with all the  
15 numbers that have been estimated, how much of it is  
16 going to be movable?

17           A. Yes, sir. We've made note of your question  
18 over the past. We're very aware of the question. We  
19 will make sure it gets answered.

20           Q. And I'm also -- so I do see that there's a  
21 strong simulation that is coming up, right? So there  
22 are relative perms that we're utilized in that, and I  
23 hope that also will more or less match up to, let's  
24 say, whichever oil that could be moved. So the  
25 simulation --

1           A. So, Doctor, I would say that we have not had  
2 the opportunity to -- we don't have relative perm data  
3 from here.

4           Q. Yeah, but there was a history matching.

5           A. Yes. And that will be spoken to at length.

6           Q. Yeah. So definitely I want to see the  
7 relative perm that was used for the history matching.

8           A. Absolutely. I'm just clarifying it. I  
9 apologize.

10          Q. Okay. I appreciate that.

11                   It sounds like you included mineralogy  
12 in your porosity and in all the calculations.

13          A. Yes.

14          Q. Now, let me ask. So with the m and n values  
15 that you used here, especially I think the m value is  
16 more or less typical, the one that you used, but the  
17 n, you said, has a broader range.

18                   Did you check with, let's say, the other  
19 fields in that area, you know, did you check with  
20 other fields in that area to see if there could be any  
21 analogous numbers that might have been used and  
22 established in the area?

23          A. I do have colleagues that have worked the  
24 San Andres in other areas that have used variable n's  
25 that are similar that are -- that can get pretty high.



1 I'm not sure of the exact statement, but the fact that  
2 a variable m and n is needed is a well-known factor.

3 Q. Okay. Can we go to L-22. There you are  
4 showing the core. You are showing the Kv, so I want  
5 to know if this one is based on a core or is based on  
6 some type of calculation. L-22.

7 Yeah, so on the left, or it's on the  
8 right, would this be a core or is a --

9 A. That should be -- I'm sorry. I'm predicting  
10 your answer -- I'm predicting your question.

11 Q. No, I already asked it of you. So you can  
12 probably proceed. Thank you.

13 A. So it is a core -- it is a measured core.

14 Q. And the measured core measured the Kv?

15 A. Yes, sir. Those are individual measurements  
16 of, I believe, like, full diameter samples.

17 Q. You know, how is this -- and it's good that  
18 they mentioned the Kv.

19 A. Yeah, it's amazing.

20 Q. Yeah. So how would this compare to the  
21 typical one, where when we are doing simulations, we  
22 start with, like, let's say, .1 of the Kh?

23 A. So I know for reservoir modeling, they often  
24 use .1 in a lot of reservoirs, including clastics.  
25 And I always have a little bit of a hinky -- a little

1 bit of a weird feeling about it. So I think in this  
2 case, I would definitely make it something better than  
3 .1 with the Kv, especially.

4 Q. Okay.

5 A. With the Kv/Kh ratio.

6 Q. Okay. And let's just scroll to the L-25 one  
7 more time. And it would be great if you can make a  
8 note that this one is uncorrected, because when I saw  
9 it, I'm like, these are all different, different. But  
10 thanks for explaining that. So if you can take notice  
11 of that here.

12 But I just want to point to something  
13 quick. So the bottom of the Grayburg, I think there,  
14 we all agree that it's a water zone, just to confirm  
15 that. The bottom of the Grayburg where you have,  
16 let's say, GB-26, that zone down there, we all -- we  
17 agree that probably is a water-bearing zone.

18 A. All I can say, as far as agreeing or  
19 disagreeing, is that looking at the log properties and  
20 comparing the rest of the data to this, it does not  
21 calculate as being a 100 percent water-bearing zone.

22 Q. I didn't catch the last part.

23 A. Sorry?

24 Q. I didn't catch the last part of your  
25 response.

1           A. Oh, I'm sorry. I always speak too fast.

2                   Based on the log data we have and the  
3       limited core data we have, showing that there is some  
4       oil saturation, there is some residual oil there.

5                   What it would flow under conventional  
6       means would be water, 100 percent water with no trace  
7       of oil.

8           Q. Okay. Thank you. Now, so there is  
9       Seminole, there is Tall Cotton, Goldsmith in the area.

10          A. Yes, sir.

11          Q. Do you know if the San Andres that is the  
12       target zone there went through the same injection as  
13       we are seeing in the EMSU?

14          A. Went through the same history?

15          Q. Yeah, of saltwater injection.

16          A. I'm not certain of that. I'm not aware.

17          Q. Definitely Steve would probably know about  
18       that?

19          A. Yes.

20          Q. Now, so this well, EMSU 679, do you know the  
21       year it was drilled?

22          A. I don't recall. I did look at the dates  
23       before. I know several of them were in the '90s. I'm  
24       not exactly sure when this one was drilled.

25          Q. Yeah, so definitely, I do know that the core

1 was collected in 1990. So probably that was when it  
2 was drilled. And then also the analysis was performed  
3 in 1990.

4 A. Yes, sir.

5 Q. Yeah, that is what I have here.

6 Now, do you know when the EMSU RR Bell  
7 Number 4 was drilled and bored?

8 A. I believe that was longer ago. I believe  
9 that was an older well.

10 Q. Older well. Okay.

11 A. I could be misspeaking, but that's what I  
12 seem to recall hearing.

13 Q. Yeah. So you have a lot of experience, so  
14 help me here. Can you quantify the impact of the  
15 large volume of water that has already been injected  
16 into the San Andres on the present-day saturation  
17 numbers that probably we might have?

18 A. Depending on the affinity of the water, the  
19 chemical affinity, what's in it, the salinity, all  
20 that, it could have some changes on it. It could have  
21 some change on the saturation in the negative  
22 direction. Obviously not in the positive direction.

23 Q. Oh, definitely.

24 A. Yeah.

25 Q. Well, so what that means is that -- okay,

1 let me ask. So would you believe that, let's say,  
2 this well, 679, drilled in 1990, and with the higher  
3 levels of the saturation that are being estimated  
4 today, that had been being estimated based on the 1990  
5 well information, probably the present-day oil  
6 saturation is not the same as this?

7 A. Potentially.

8 Q. But you are using that to estimate how much  
9 oil is in place, and you're asking the Commission to  
10 make our decision based on that. So how do we  
11 quantify, you know? Help us. Based on your  
12 experience, how do we quantify the current -- how do  
13 we even say that the current oil-in-place calculation  
14 that has been put across here is correct without  
15 taking into consideration the maximum volume of oil --  
16 of water that has been injected?

17 A. Well, I would add to that, that that is  
18 going to be clearly addressed by Jim with his model.

19 Q. Okay. I will love that. Thank you. Okay.

20 Based on your analysis, I saw you've  
21 done a lot of wells here. So did you check the newer  
22 wells, let's say, any newer wells, to check the  
23 saturation changes compared to the older wells,  
24 whether consistent or probably not consistent?

25 A. That is a phenomenal idea. It wasn't part

1 of the scope at the time that I did it, but that is a  
2 great -- that would be a great thing to check, because  
3 the same petrophysical model should work either way  
4 and we should see variations from one to the other.  
5 So we would see a difference. So the newer wells  
6 would reflect current-day saturations.

7 Q. And now I really want to see an example of  
8 that, because then that one can tell us, you know,  
9 let's say the impact of the saltwater injection on the  
10 saturation.

11 I know models can do that, but real  
12 evidence -- I mean, if you have the log and it's  
13 showing these changes to establish that there's still  
14 a high level of ROZs in there, that at least helps us  
15 a lot to quantify the impact of the saltwater  
16 injection.

17 Do you know if any RST log has been  
18 logged on any of the older wells? RST, the saturation  
19 log.

20 A. Oh, as like a pulsed neutron, sort of?

21 Q. Yes, yes.

22 A. I believe there was an EPT run on the log in  
23 the north, but I'm not sure -- I'm not aware of one in  
24 the EMSU. I'd have to look back at my database to see  
25 if I have any.

1 Q. Okay.

2 A. I look at about 10 different projects a  
3 week, so...

4 Q. So let's go through this. Is it possible  
5 there are potential changes in the wettability system?  
6 And you clarified that. You're saying that it is  
7 between oil wet and mixed wet.

8 A. Yes. I'm hedging my bets and setting it  
9 somewhere in between.

10 Q. I thought probably you said, okay, it was  
11 oil wet, and then probably now we are mixed wet. So  
12 then, I could have posed that question, but anyway,  
13 let me still ask.

14 Is it possible that potential changes in  
15 the wettability system may impede the available oil  
16 saturation that has been calculated now?

17 A. Changes in the wettability would potentially  
18 change the saturations that we see.

19 Q. And can you explain to the Commission how  
20 the changes in the wettability might impact the oil  
21 saturation changes?

22 A. Changing its affinity to hold to the side of  
23 the pore, along with drops in pressure, can make  
24 things move. So if you're changing the geometry of  
25 the fluid within the pore, then you can make it move

1 out of the pore space into another.

2 Q. So does that mean that with a high volume of  
3 water that has been injected, you know, like the  
4 flushing, the flushing, and if there has been some  
5 changes in the wettability, it is possible that some  
6 of these oils is probably -- some of this residual oil  
7 became mobile, and therefore, probably might have been  
8 moved?

9 A. Within the larger porosities is where that  
10 is most likely.

11 Q. Okay. Now, due to the higher volume of the  
12 water injection that has gone into the San Andres, it  
13 is definitely possible that there has been elevation  
14 in the pressure. I mean, the reservoir pressure might  
15 have increased. So do you believe that this can  
16 reduce the capillary forces, thereby more or less  
17 reducing the residual oil in place?

18 A. Oh, that's going back a long way, the  
19 capillary forces. I would expect more that dropping  
20 the pressure in residual oil would be more likely to  
21 move the hydrocarbons.

22 Q. Yeah, and I'm sure probably you know where  
23 I'm going with this. So let me ask another one. Can  
24 you comment on the fact that these higher volumes of  
25 water that has already been injected into the



1 San Andres, probably increased the viscous forces,  
2 overcoming the capillary forces, thereby probably  
3 still reducing the residual oil saturation?

4 A. It is possible in the lower porosities. I  
5 would say that most of this was probably bypassed by  
6 the larger porosities where the water probably was  
7 more likely to go.

8 Q. So with all these phenomena that I've gone  
9 through with you, you know, based on your experience,  
10 would you say that there is quite a number of  
11 uncertainty associated with the oil-in-place  
12 calculations that have been presented to the  
13 Commission?

14 A. I would say there is very little uncertainty  
15 with the presence of oil. But there is uncertainty  
16 with the calculation of the oil in place. And that's  
17 why I wanted to provide a low and a high number, for  
18 possibilities.

19 Q. You know, so the processes that we just  
20 discussed and we went through this, you know, do you  
21 believe that -- and I think if you are able to provide  
22 to the Commission like, let's say, some analysis on  
23 the timeline with regard to other wells and then newer  
24 wells to see how the saturations are changing,  
25 probably that would clear all the doubts with regards

1 to that.

2 A. I would love that. Yeah, that would help,  
3 though. It would be excellent.

4 Q. You know, don't you believe there should  
5 have been a prompt response from the operator, whoever  
6 the operator was, probably when the 679 well was  
7 drilled? There should have been a prompt response to  
8 probably, more or less, try to cease any injection in  
9 the area.

10 Because right now, you have all this  
11 volume -- high volume of water, that probably due to  
12 other fossils that we talked about, probably might  
13 have reduced the residual oil saturation.

14 A. I liken this back to the shale gas  
15 revolution, where a lot of stuff back then, like if  
16 you look -- because you just -- source rock with  
17 something you drill through. You don't look at it.  
18 You see it, you see gas response, you're like, "Oh,  
19 I'm not going to produce that." Twenty years down the  
20 road, it's the thing of the day.

21 So I imagine, and this is pure  
22 supposition, that if someone was looking at it back  
23 then and seeing that versus something they had above  
24 them, then they probably would be not that interested  
25 at the time.

1 Q. So then that would be on the economics?

2 A. That would be on the economics at the time.

3 Q. Okay. And do you know we are going to  
4 listen to some economics here?

5 A. I cannot speak to that. I do not know.

6 Q. Let me check to make sure I do not have any  
7 additional questions for you.

8 But I'm also interested in knowing  
9 whether the Goldsmith, Tall Cotton, Seminole had any  
10 extensive water injection into, let's say, the  
11 San Andres prior to the commercialization of the ROZs.  
12 I really want to have some answers out of that.

13 A. I believe Steve will probably be able to  
14 cover that. And if not, I will get the answer.

15 Q. Okay. On the average, how would you say  
16 your interpretation is different from the one that  
17 NuTech -- I hope I got the name right.

18 A. NuTech, yes, that is correct. From what I  
19 can -- they have a proprietary software. I believe  
20 they use the Simandoux equation for their saturation  
21 equation, which I used for Archie. They used a  
22 variable m and n, where they used four different m's  
23 and n's, according to Mr. Rankin.

24 So mine was, I'd like to say, a bit more  
25 complex, looking for the ranges. But that doesn't

1 mean we both didn't arrive at -- that they didn't  
2 arrive at an answer that was close to the range of  
3 values that I provided.

4 Q. So my last question will be, you know, I  
5 went through most of the logs that you interpreted.  
6 There are some of them that are quite, like -- a  
7 number of them that you probably see that it is all  
8 water, water, water, water, especially within the  
9 Lower San Andres. Was that a trend that you saw?

10 A. There tended to be more water in the Lower  
11 San Andres than in the Upper San Andres. And that's  
12 where I placed -- that's usually where I discovered my  
13 Rw, was within the San Andres.

14 Q. Oh, within the Lower San Andres? Okay.

15 Thank you for your time and I do  
16 appreciate your knowledge. Thank you.

17 A. Thank you.

18 THE HEARING OFFICER: Thank you,  
19 Dr. Ampomah.

20 So this brings us full circle to you,  
21 Ms. Hardy, for redirect. Oh, Ms. Shaheen, sorry, for  
22 redirect.

23 Before we do that, I'm keeping track of  
24 time here, I guess it would be appropriate, given the  
25 audience, that I say that the Lovington Sands are

1 running out of our hourglass today.

2 Mr. Rozatos has a 4:00 p.m. hard stop.  
3 It's 3:30 right now. We need to get Mr. Birkhead  
4 done and out of here. So just bearing that in mind.  
5 Ms. Hardy, I'll turn it over to you for redirect.

6 And bear that in mind, Mr. Rankin, when  
7 the inevitable re-cross comes in.

8 I'm sorry, Ms. Shaheen. Sorry.

9 MS. SHAHEEN: That's okay. Thank you,  
10 Mr. Harwood.

11 REDIRECT EXAMINATION

12 BY MS. SHAHEEN:

13 Q. Mr. Birkhead, going back to your low case  
14 and a high case, I know you've described to me the  
15 range of possibilities between the low place and the  
16 high case -- I'm sorry, the low case and the high  
17 case. Can you provide a similar explanation to the  
18 Commission about how that works?

19 A. Sure. Certainly. What it's meant to  
20 represent, and I think we've already mostly covered  
21 this, is that it's the beginnings of uncertainty  
22 study.

23 So I'm looking for the lowest possible  
24 it can be and what is a reasonable value for what the  
25 highest it can be. So these can be considered likely

1 to be the P10, P90 cases. There's a 90 percent chance  
2 it's going to be at least this small -- or at least --  
3 and there's a 10 percent chance it's going to be at  
4 least this big at the end.

5 So we're looking for a range of values,  
6 looking at uncertainty. You're doing Monte Carlo  
7 analysis at the end in value, when we have more data,  
8 would be obviously the next step to go through to  
9 figure out the distributions, the possible  
10 distributions of OOIP.

11 Q. And you also talked about, with Mr. Rankin  
12 and I believe with Dr. Ampomah, at what water  
13 saturation you would expect oil to be mobile. Have  
14 you reviewed any fields that inform your opinion on  
15 this subject?

16 A. I have worked several, and I think we talked  
17 about this a little bit, where I've worked in fields  
18 where the residual -- where the oil wouldn't move  
19 until you got to a saturation of, like, 80 to 90  
20 percent -- or 60, 60 to 70 percent when you have  
21 heavier oils.

22 The point is that just all of these are  
23 very dependent on fluids and the lithology and the  
24 porosity. So there's a direct relationship between  
25 the porosity and the capillary forces and how easily

1     it'll move.

2                   So it's just, I guess, to restate, how  
3     difficult it is to answer in one answer with one value  
4     when it's going to move, because it definitely varies  
5     based upon the facies, the properties, the fluid type,  
6     and the pore space.

7           Q. There was some testimony earlier about  
8     why -- or excuse, some discussion earlier about why  
9     the saturations in the core do not add up to 1. Can  
10    you elaborate on that?

11          A. I can. I think that was basically just  
12    meant to tie up a question from before. I had to deal  
13    with this all the time. When I first started as a  
14    petrophysicist, I was really confused when I just saw  
15    oil, water, and if it didn't add up to 1.

16                It's just a -- it's because we lose  
17    water, we lose oil as we go up the hole. We lose it  
18    to gas, we lose it to -- and get up to the surface,  
19    gravity, water falls out, it dehydrates, all those  
20    things.

21                The summation with the porosity, it  
22    never equals up to 1. If it does, it's shocking, and  
23    it's probably a pressure core. And even then, it's  
24    going to be sloshing around within the tube.

25                So what they typically call it, in a lot

1 of reports, is saturation of gas. And forever I  
2 thought -- forever, when I first started, I thought  
3 that was, like, hydrocarbon gas. Turns out it just  
4 means saturation of air. It's just whatever's not  
5 fluid. So that is why it never equals up to 1.

6 Q. There was also some testimony earlier about  
7 the San Andres tops and the differences between our  
8 pick of the tops and Goodnight's pick of the tops.  
9 Are you aware of any literature that addresses the top  
10 of the San Andres as it relates to the Lovington Sand?

11 A. Yes. Yes, I have. This goes back to the  
12 reference from Ryan Bailey from yesterday at the Loco  
13 Hills Field. We did go back to who defined the top  
14 within that paper. Turns out it was a Mr. Roy Foster,  
15 senior petroleum geologist with the New Mexico Bureau  
16 of Mines and Mineral Resources, in 1976.

17 So it seems in this case, the  
18 description of the top of the San Andres being about  
19 130 to 150 feet above the Lovington Sand was made by  
20 New Mexico Mines and Mineral Resources.

21 Q. I'm going to make an effort to share at this  
22 point.

23 THE HEARING OFFICER: Again, it's the speed  
24 with which you speak.

25 THE WITNESS: Oh, I'm sorry.



1           HEARING OFFICER HARWOOD: You're definitely  
2 going to hold the record, at least so far. I'm sure  
3 the court reporter will confirm this, most words per  
4 hour.

5           THE WITNESS: The Micromachines commercial,  
6 I watched it way too many times growing up. So I'll  
7 repeat more slowly.

8           A. So the Loco Hills paper that Mr. Ryan Bailey  
9 discussed yesterday at length, discussing the top of  
10 the San Andres, the top was actually defined by -- or  
11 written about by Mr. Roy Foster, senior petroleum  
12 geologist, New Mexico Bureau of Mines and Mineral  
13 Resources, in 1976.

14          Q. And turning to Page 12 here.

15          A. It's the bottom of 12 and the top of 13.

16          Q. I'm sorry, bottom of 12, top of 13?

17          A. Yes, ma'am.

18          Q. Here we go.

19          A. So I'll just read this slowly. "The  
20 San Andres Formation, Leonardian and Guadalupian, is  
21 about 1500 feet thick in this area. The upper part is  
22 dolomite with an interval of sandstone and black  
23 shale, known as the Lovington Sand, about 150 feet  
24 below the top."

25          Q. And the top there refers to the top of the

1 San Andres; is that correct?

2 A. Yes, ma'am.

3 Q. Thank you.

4 MS. SHAHEEN: I would move for admission of  
5 this exhibit as K-57.

6 HEARING OFFICER HARWOOD: Mr. Rankin, any  
7 objection?

8 MS. SHAHEEN: Okay. I'm going to turn now  
9 to Figure 5 in the paper.

10 MR. RANKIN: No objection from Goodnight.

11 HEARING OFFICER HARWOOD: Any objection from  
12 OCD?

13 MR. MOANDER: No objection from OCD,  
14 Mr. Hearing Officer.

15 MR. BECK: No objection from Rice and  
16 Permian.

17 HEARING OFFICER HARWOOD: Pilot?

18 MR. SUAZO: No objection from Pilot.

19 HEARING OFFICER HARWOOD: It'll be admitted.  
20 Thank you.

21 MS. APODACA: Excuse me. We already have a  
22 K-57. I think she would be up to K-60.

23 MS. SHAHEEN: K-60. I will trust you on  
24 that. Thank you very much.

25 THE HEARING OFFICER: It'll be admitted as

1 Exhibit K-60.

2 (Admitted: Empire New Mexico  
3 Exhibit K-60.)

4 BY MR. SHAHEEN:

5 Q. And turning now to Figure 5 in Exhibit K-60,  
6 is --

7 A. This is simply an exhibit of what is  
8 described in words on Pages 12 and 13, the San Andres  
9 Formation below the Premier Sand, and about 150 feet  
10 above the Lovington Sand. And, again, defined by  
11 someone working for the state.

12 Q. Thank you. I'm going to stop sharing here  
13 and share with you a different document. This is, I  
14 believe, the mud log that Mr. Rankin used earlier,  
15 which is identified as Bates Number Empire 23614-17, I  
16 want to say, 3917, but I'm not sure here. It's the  
17 exhibit that was previously admitted with respect to  
18 the excerpt that Mr. Rankin showed earlier.

19 MS. SHAHEEN: And I brought it up here to  
20 show, it's the same document, a little farther up in  
21 the depths here. And I just wanted to have  
22 Mr. Birkhead take a look here, if we start -- I  
23 believe Mr. Rankin was focused on maybe 4200, 4300  
24 thereabouts.

25 But if you look above and below the

1 excerpt that Mr. Rankin used, you can see that there  
2 are other comments, observations about the cores that  
3 are different from what Mr. Rankin was focused on.  
4 And I thought it might be helpful to start here at  
5 about 4050.

6 MR. RANKIN: I'll object. It's way outside  
7 the scope of my cross-examination. I was focused on  
8 a very narrow area. This is almost 800 feet above  
9 where we're talking about.

10 THE HEARING OFFICER: Well, all right. But  
11 I think it's fair. You opened the door.

12 But I haven't heard a question yet. I'm  
13 hearing testimony from Ms. Shaheen.

14 MS. SHAHEEN: Thank you. I have a question  
15 now for Mr. Birkhead. If he could just take a look,  
16 and he can direct me to what he thinks are the  
17 pertinent depths here as well.

18 BY MS. SHAHEEN:

19 Q. But taking a look here at the depth of 4050,  
20 there are some observations of the core here that I  
21 think are helpful, Mr. Birkhead. Can you describe  
22 those to the Commission?

23 A. I absolutely can. So this is one of those  
24 places where, up and within the Upper San Andres,  
25 we're seeing consistent descriptions of yellow

1 fluorescence and streaming cut. And, again, some  
2 lower gas along with the streaming cut, and also some  
3 higher gas along with the streaming cut and  
4 fluorescence.

5 So we're actually seeing, as I mentioned  
6 from the very start of whenever I started, that we  
7 have direct indications of hydrocarbons showing up  
8 throughout the San Andres.

9 Q. Are there any other depths that you would  
10 like for us to look at here?

11 A. I would probably look in the next hundred  
12 feet up to make sure that we're covering the bottom of  
13 the Grayburg and the top of San Andres. And to also  
14 see that we still have very large gas shows as we're  
15 getting into what I believe is the Grayburg.

16 Q. Is this good, 3900?

17 A. That would be perfect.

18 Q. Would you please describe what you see here  
19 to the Commission.

20 A. With this, we are -- it's not a -- they ran  
21 out of words apparently on this. But this is a sandy  
22 dolomite, with a very large gas response, and  
23 moderately calcareous. There's no cut in these. You  
24 can see that they're not always cut when there are  
25 massive gas shows. So you can have one or the other

1 or none of all, but it all tells a story, all the logs  
2 together.

3 Q. Any other depths that would be helpful for  
4 the Commission to take a look at?

5 A. I think that would be plenty for now. I  
6 can't think of anything at the moment. That would be  
7 it.

8 MS. SHAHEEN: Thank you, Mr. Birkhead.

9 I have no further questions and pass the  
10 witness. And just would note for the record that we  
11 will be submitting the remainder of the mud log as an  
12 exhibit.

13 THE HEARING OFFICER: Okay. And I don't  
14 think there's anyone to pass the witness to. We're  
15 still going to hopefully hold to the rule against a  
16 recross-examination.

17 MR. RANKIN: Mr. Hearing Officer, there was  
18 one segment of Ms. Shaheen's redirect that addressed  
19 mobile oil saturation that I would like to just ask  
20 Mr. Birkhead about.

21 HEARING OFFICER HARWOOD: Okay.

22 RECROSS-EXAMINATION

23 BY MR. RANKIN:

24 Q. Mr. Birkhead, on the question of mobile oil  
25 saturation, if 380 million barrels of water were

1 withdrawn from the San Andres in the zone that we've  
2 been discussing here with these oil saturations you've  
3 identified, would you expect that would be a reservoir  
4 character change that would likely lead to the  
5 mobilization of those oil saturations that you've  
6 identified?

7 A. Without any residual oil, without  
8 significant chemistry change, it would be difficult to  
9 say how much would happen if you significantly changed  
10 the chemistry of the water which is being extracted.  
11 So it's the same.

12 I would expect that only minimal,  
13 considering it's residual. Anything above that would  
14 just be a tiny bit of the re-added oil that Bob  
15 Lindsay talked about the first day that came out after  
16 Nature's Waterflood.

17 Q. I'm not sure I quite followed that. You're  
18 saying what would be --

19 A. Essentially what I'm saying is that there  
20 may be a little bit of oil extracted that could result  
21 in a sheen of oil on something, that if someone looks  
22 for it. But that I do not expect a large amount of  
23 the oil to move.

24 Q. Thank you.

25 A. But I think Dr. Ampomah's question was

1 really good about checking them out versus time.

2 MR. RANKIN: Thank you, Mr. Hearing Officer.

3 THE HEARING OFFICER: Okay. May

4 Mr. Birkhead be excused?

5 MR. RANKIN: No further -- yes, he may.

6 MR. MOANDER: No objection from OCD.

7 MR. BECK: Yeah, he may be excused.

8 HEARING OFFICER HARWOOD: Pilot?

9 MR. SUAZO: No objection from Pilot.

10 HEARING OFFICER HARWOOD: Thank you,

11 Mr. Birkhead. You're free to go.

12 MR. SUAZO: And to the court reporter, I

13 apologize.

14 THE HEARING OFFICER: You kept her on her  
15 toes, Mr. Birkhead. If you ever get tired of your  
16 field, you have a great future as an auctioneer.

17 All right. Let's see. So it's 3:45. I  
18 mean, I don't know what we do with the spare 16  
19 minutes. I suppose we could at least get  
20 Dr. Buchwalter sworn in, but I'm not sure it's worth  
21 it.

22 Your thoughts, Mr. Rozatos?

23 CHAIR ROZATOS: I don't think it's worth it  
24 either, but I do see that Mr. Rankin is raising his  
25 hand really phrenetically now, with a lot of



1 tediousness, to catch our attention.

2 MR. RANKIN: I appreciate that. I  
3 appreciate the attention. Mr. Hearing Officer, I  
4 appreciate that we're on limited in time.

5 I wanted to just orally raise this  
6 motion with the Commission at this time based on the  
7 testimony that was provided by both Mr. Bailey and  
8 Mr. Birkhead.

9 As you all are aware, I have previously  
10 filed a motion to strike the rebuttal witnesses,  
11 Mr. Bailey and Mr. Birkhead, only as with respect to  
12 certain testimony and analyses that they provided  
13 that are clearly not rebuttal testimony, should have  
14 been presented as part of their case in chief.

15 And based on the testimony that they  
16 presented over the past two days, I think that's been  
17 established, that what they presented is very  
18 different from what was initially presented on direct  
19 from NuTech and Empire's own witness, Mr. McShane.

20 The petrophysical analyses, the  
21 oil-in-place analyses are vastly different than what  
22 was presented initially.

23 And based on that, two weeks before the  
24 hearing, we have been substantially prejudiced by our  
25 ability to try to review and analyze what has been

1 presented. We still don't have some of the  
2 information that we would need to do so.

3 So I would ask at this time to renew my  
4 motion to strike the portion of the testimony  
5 identified in my initial motion or, in the  
6 alternative, to provide us the opportunity for short  
7 surrebuttal so that we can adequately review and  
8 respond to the new testimony that should have been  
9 presented on their case in chief.

10 THE HEARING OFFICER: I have a couple of  
11 concerns. And I don't mean to step on anybody's toes  
12 here. I'm sure Mr. Rubin has thoughts on this as  
13 well.

14 First of all, I'm not sure how much of  
15 what you're objecting to was covered in direct  
16 examination, and if it was, why there was no  
17 objections raised at that time, and how much it was  
18 covered in your cross-examination of these witnesses.  
19 Because if it's covered in your cross-examination of  
20 these witnesses, you opened the door to this  
21 testimony.

22 When you cross-examine witnesses in a  
23 way that is like doing a deposition, you often end up  
24 with answers you don't like.

25 Mr. Rubin, I'll pass it on to you. But

1 those are just my initial thoughts.

2 MR. RUBIN: Thank you, Mr. Harwood.

3 And I do echo those sentiments. We  
4 should hear from the Empire in response to the  
5 motion, especially now that it's been renewed.

6 And it is hard to parse out some of the  
7 testimony that would be struck versus that which  
8 would not be struck as well. That's a difficult  
9 challenge.

10 But I suggest to the Commission that we  
11 hear from the remaining parties on this point first.

12 MS. SHAHEEN: First I'll note that I believe  
13 Mr. Rankin has waived his objection here by allowing  
14 both Mr. Bailey and Mr. Birkhead to testify today  
15 without objection.

16 Second, I would say, for all the reasons  
17 stated in our responses to the motion to strike and  
18 the motion to exclude, this testimony should be  
19 allowed.

20 It's very clear, when you review the  
21 written rebuttal testimony, that the testimony is  
22 directly responsive, in Mr. Bailey's case, to Preston  
23 McGuire, who has not yet testified, and to  
24 Dr. Davidson, who has not yet testified. It's very  
25 clear that this is in rebuttal to their testimony.

1           Second of all, here we are on the third  
2   day, the end of the third day, and we have, I think,  
3   offered three witnesses. And it's very clear that  
4   Goodnight is going to have even more time to respond  
5   to the testimony of Mr. Bailey and Mr. Birkhead  
6   between now and the time that they offer their  
7   witnesses.

8           And obviously, we don't believe there's  
9   a need for written surrebuttal. But they're welcome  
10  to surrebut the testimony that you've heard today and  
11  yesterday when they are back here with their  
12  witnesses.

13           Generally speaking, in an administrative  
14  proceeding, the Commission would act as if they were  
15  a Court in a bench trial, and they are -- their  
16  expertise and their experience allows them to weigh  
17  the evidence and determine what is credible, what is  
18  reliable, and what should be included in their  
19  decision, to support their decision. There's no need  
20  to exclude any evidence.

21           And in fact, I'll just refer to one  
22  case. And it is an unpublished opinion, but I  
23  believe that it's perfectly suitable -- or applicable  
24  here. It has to do with a proceeding before the  
25  Water Quality Control Commission. Let me see if I

1 can find it here relatively easily.

2 I'll describe it generally until I can  
3 find it. In that case, the Court of Appeals  
4 recognized that the Hearing Examiner did exactly what  
5 was appropriate in the instance. She allowed all of  
6 the expert testimony in, and then the Commission  
7 weighed that testimony and decided what it should be  
8 relying on. And that case is cited in our papers.

9 Finally, Goodnight is not prejudiced.  
10 They argue that they're prejudiced because they've  
11 had no opportunity to depose the rebuttal witnesses'  
12 supplement expert reports, or otherwise file a  
13 surrebuttal.

14 They cite a number of cases that are  
15 completely in opposite to what we're doing here  
16 today. One is a criminal case where the rebuttal  
17 witness was never disclosed. Another is a civil case  
18 where the rebuttal witness was never disclosed.

19 So they've cited nothing in support of  
20 their position here today. We believe the motion  
21 should, therefore, be denied.

22 THE HEARING OFFICER: Mr. Moander.

23 MR. MOANDER: So OCD is not picking a side  
24 on this issue, but to maybe flesh this out a bit  
25 more, I think it's an inaccurate statement to say

1 that Goodnight didn't actually preserve the  
2 objection. They filed a motion on this, so I think  
3 there's a level of complying with the ultimate order  
4 from the Commission in not creating or putting  
5 objections on the record at that point in time.

6 Again, OCD didn't pick a side, but a lot  
7 of this testimony certainly does seem to be post  
8 facto developments designed to rebut other witnesses,  
9 not necessarily OCD's, but I did want to clarify for  
10 the record, I think does have a thoroughly documented  
11 objection that listed specifically provisions that  
12 were at issue that was filed before the hearing, and  
13 the Commission did, in fact, rule on it.

14 So I just wanted to put that out there,  
15 that I didn't think that's totally correct under the  
16 circumstances.

17 THE HEARING OFFICER: Mr. Beck.

18 MR. BECK: I agree with Mr. Moander, that  
19 when you have a motion that's been submitted and that  
20 it's ruled on and you comply with that, you're not  
21 waiving your objection to renewing it afterwards.

22 I think that it's unfair to say that  
23 it's clear that both of these witnesses were rebuttal  
24 to Mr. McGuire. I think that Goodnight did a good  
25 job in its motion in fairly, and I would say

1 charitably, characterizing what was actual rebuttal  
2 testimony to Mr. McGuire versus what was substantive  
3 evidence.

4 I think one thing that was very clear  
5 was, understandably, Empire was put in a difficult  
6 position when it revised Mr. Dillewyn's testimony  
7 about the reservoir characterization, only to have  
8 Mr. Dillewyn at his deposition say that he did not  
9 adopt his revised testimony.

10 I think that that put Empire in a  
11 difficult position because now we've got three  
12 different reservoir characterizations from Empire.  
13 And I think that probably the way that they've  
14 revised their witness list says a lot about whether  
15 this is actually rebuttal testimony or whether they  
16 want to put it forth as their primary evidence, when  
17 you have your two rebuttal witnesses going  
18 essentially first out of your 11 witnesses, as  
19 opposed to in rebuttal.

20 So I think that Mr. Rankin makes a good  
21 point in renewing his objection, given the timeliness  
22 of that late disclosure and the inability to prepare  
23 for it and the inability to depose either of those  
24 witnesses and have them change or disclaim their  
25 testimony as he got with Mr. Dillewyn.

1                   So I certainly think that, at least in  
2                   this case, we can see prejudice. I think that at the  
3                   very least, given the timing of what we've seen  
4                   today, if the Commission's, you know, intent is to  
5                   stand by its order, and I would assume that it is, I  
6                   don't think it's unfair, given the timing of what  
7                   we're seeing over likely the next couple months in  
8                   this hearing, to allow surrebuttal, which would rebut  
9                   what has been classified, I think, by Empire's  
10                  rebuttal.

11                 THE HEARING OFFICER: Thank you, Mr. Beck.

12                   Mr. Suazo.

13                 MR. SUAZO: Yeah, Pilot concurs with  
14                 Mr. Beck's statements just now and supports  
15                 Goodnight's position on this issue.

16                 HEARING OFFICER HARWOOD: Thank you. I  
17                 guess my suggestion would be, since my 4 o'clock  
18                 alarm just went off, that we think about this  
19                 overnight and take it under advisement and rule on it  
20                 when the Commission thinks they've considered the  
21                 issue as thoroughly as they need to. That would be  
22                 my suggestion, and I'll turn it over to Mr. Rubin.

23                 MR. RUBIN: Yeah, that would be my  
24                 suggestion as well. It is confusing to have rebuttal  
25                 witnesses go first. That was a bit -- and it is



1 difficult to say when, if at all, Mr. Rankin should  
2 have objected at that point.

3 I do think that we should -- I'd like to  
4 consider the case law to see if Ms. Shaheen's  
5 characterizations of it are correct. I think we  
6 can -- there's no reason why we need to rule on this  
7 at 4 o'clock today. I will have a recommendation for  
8 the Commission tomorrow.

9 CHAIR ROZATOS: I do have some leniency. I  
10 said 4:00 to 4:15. So I'm trying not to -- please  
11 let's not make it 4:15, but if we have to, we have  
12 to.

13 My question, can you reiterate,  
14 Mr. Rankin, what you want from the Commission through  
15 the objection? Either sustain your objection or  
16 what?

17 MR. RANKIN: Thank you, Commissioner  
18 Rozatos. I've asked for the Commission to reconsider  
19 my motion to strike, to strike the portions of the  
20 rebuttal witness testimony that is not proper  
21 rebuttal.

22 And I've identified that in the motion  
23 and I've highlighted all the different exhibits and  
24 all the different testimony that is not truly  
25 rebuttal.

1           In the alternative, I would ask that we  
2 be provided an opportunity, either through written  
3 surrebuttal or orally, to respond to that additional  
4 testimony.

5           CHAIR ROZATOS: Okay. And that's what I  
6 wanted to clarify. So your surrebuttal, you would  
7 want the potential of either written or oral?

8           MR. RANKIN: Yeah. And I haven't actually  
9 conferred with the witnesses who would be doing that.  
10 I think they can do it orally. I just want to make  
11 sure that when I do so -- and I heard Ms. Shaheen say  
12 that no, there's no need to exclude any evidence in  
13 this case where you're acting as both the fact finder  
14 and the final arbiter. I have yet confer with either  
15 of them, but I believe that they can do it orally.

16           CHAIR ROZATOS: Okay. I must concur with  
17 counsel for the OCC that the Commission should think  
18 about this and do its homework as well and look into,  
19 as was brought up, an unpublished opinion, I believe  
20 you mentioned Ms. Shaheen?

21           MS. SHAHEEN: There are a number of cases  
22 that we cited in our papers. So one that I'm  
23 thinking of that's most similar to this situation is  
24 In Re: Louisiana Energy Services. And Ms. Orth was  
25 the hearing examiner in that case. And the Court

1 does an excellent job of explaining what is  
2 appropriate in an administrative proceeding.

3 CHAIR ROZATOS: One second before you add  
4 your comment, just to clarify. This was a WQCC  
5 hearing, correct?

6 MS. SHAHEEN: That's correct.

7 CHAIR ROZATOS: Okay. And I apologize for  
8 interrupting you. Please continue with your thought.

9 MS. SHAHEEN: I'll note for the record that  
10 Goodnight has had over -- almost a year to rebut the  
11 original testimony that we filed in the first four  
12 cases, back in September, October of 2023. Then they  
13 had ten months to rebut our arguments in that  
14 testimony.

15 Basically, they're getting yet a third  
16 bite at the apple if they are allowed to provide  
17 written surrebuttal here. And I, for one, personally  
18 don't believe that's fair.

19 CHAIR ROZATOS: Okay. I appreciate your  
20 sentiments. Thank you.

21 Go ahead, Mr. Rankin.

22 MR. RANKIN: Thank you. Just to respond, I  
23 do believe I preserved my objection, because I did  
24 state at each witness, Mr. Bailey and Mr. Birkhead,  
25 that I intended to question them to determine whether

1 or not their testimony varied from the underlying  
2 case in chief. I intended to question them to  
3 determine how and to what extent their testimony was  
4 different then and, therefore, not proper rebuttal  
5 testimony.

6 And, of course, the information and  
7 testimony they provided is, of course, responsive to  
8 the testimony and information that Goodnight provided  
9 because we each have the same burden to prove that  
10 there's no waste and no impairment of correlative  
11 rights. So, of course, it's responsive.

12 The point is that that information in  
13 the context that was provided should have been done  
14 in the direct case. Instead, it was saved until two  
15 weeks before the hearing. And that is what's unfair.

16 Empire had the same amount of time to  
17 assess whether between the time they submitted it in  
18 August 2023 and later in August 2024, whether their  
19 petrophysics and geologic analysis was the proper  
20 one, was the correct one. And they stuck with it all  
21 that time. And they could have changed it, but they  
22 waited until two weeks before the hearing to do so.

23 CHAIR ROZATOS: Okay. And both sides have  
24 been noted. I think you both have preserved your  
25 sentiments for the record.

1 I have to go back to what Mr. Rubin  
2 said. Let us do our homework on our end as the  
3 Commission. We'll get our information. Guess what  
4 we're starting with tomorrow morning. So brace  
5 yourselves for another little delay in the morning so  
6 we can go over this.

7 So I think we have a path for the time  
8 being where we're going to be going. And then  
9 Mr. Harwood, if you're okay with it, I think we can  
10 call it now and we could pick up again in the  
11 morning.

12 THE HEARING OFFICER: That sounds great.

13 CHAIR ROZATOS: Excellent. You all have a  
14 good afternoon and a good evening.

15 (Proceedings adjourned at 4:03 p.m.)  
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25

AFFIRMATION OF COMPLETION OF TRANSCRIPT

I, Kelli Gallegos, DO HEREBY AFFIRM that on February 26, 2025, a hearing of the New Mexico Oil Conservation Commission was taken before me via video conference.

I FURTHER AFFIRM that I did report in stenographic shorthand the proceedings as set forth herein, and the foregoing is a true and correct transcript of the proceedings to the best of my ability.

I FURTHER AFFIRM that I am neither employed by nor related to any of the parties in this matter and that I have no interest in the final disposition of this matter. March 11, 2025



Kelli Gallegos

VERITEXT LEGAL SOLUTIONS

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<b>0</b>	<b>100</b> 582:12	654:13	602:18
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[agree - anhydrite]

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[bailey - best]

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[clarify - commissioners]

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[considering - correction]

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[modification - nature's]

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[natures - object]

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[pull - rankin]

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