PUBLIC HEARING

STATE OF NEW MEXICO

OIL CONSERVATION COMMISSION

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1220 S. Saint Francis Drive

Santa Fe, New Mexico

TRANSCRIPT OF PROCEEDINGS

April 23, 2025

VOLUME XIV

HEARD BEFORE:

HEARING OFFICER RIPLEY HARWOOD

COMMISSION MEMBERS:

GERASIMOS ROZATOS, Chair

BAYLEN LAMKIN, Member

DR. WILLIAM AMPOMAH, Member

COUNSEL TO THE COMMISSION:

MR. ZACHARY SHANDLER, ESQ.

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I N D E X

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

TRANSCRIPT OF PROCEEDINGS

CHAIR ROZATOS: Good morning to everybody. My name is Gerasimos Rozatos. I am the acting director of the Oil Conservation Division. I'm also the acting chair for the Oil Conservation Commission. We are continuing our evidentiary hearing today, on April the 23rd, 2025, for the consolidated cases by Goodnight Midstream and Empire New Mexico.

Again, as always, I start with the case numbers. The case numbers for this particular hearing are Case Numbers 24123, 23614 through 17, 23775, 24018 through 24020, and 24025.

One thing I wanted to mention before we started with our actual evidentiary hearing, Commissioner Ampomah has a scheduling conflict tomorrow with his classes that he is teaching, so we do need to start tomorrow at 10:30 to accommodate the commissioner's schedule. So please just arrange tomorrow, Thursday the 24th, that we start at 10:30.

Other than that, Mr. Hearing Officer, I transfer this hearing back over to you.

HEARING OFFICER HARWOOD: All right. Good morning, everybody. Before we start, are there any preliminary matters?

MR. WEHMEYER: Not from Empire.

MR. RANKIN: None from Goodnight this morning. Thank you.

MR. MOANDER: Nothing from OCD, Mr. Hearing Officer.

MR. BECK: Nothing from Rice. Thank you.

MR. SUAZO: Nothing from Pilot.

HEARING OFFICER HARWOOD: Okay. Great. If memory serves me correctly, it's redirect of Mr. Knights.

Mr. Knights, I just remind you you're under oath from yesterday.

MR. RANKIN: Thank you, Mr. Hearing Officer.

Good morning, Commission Chair, Commissioners.

WILLIAM J. KNIGHTS,

having first been previously duly sworn,

testified as follows:

REDIRECT EXAMINATION

BY MR. RANKIN:

Q. Good morning, Mr. Knights. How are you this morning?

A. Tired.

Q. It's good to be honest, especially when you're on the stand.

Mr. Knights I'm going to ask you a couple questions that were raised during your cross-examination yesterday.

Do you recall yesterday during cross-examination by Mr. Wehmeyer, Empire's counsel, where you were asked questions about your revisions to direct testimony that was submitted with the Commission?

A. Correct. Yes.

Q. And you made two corrections to your original direct testimony, correct?

A. Correct.

Q. And the first was to correct the oil-in-place calculation, because, as I understand, you understood it calculated based on 1-foot increments when they were really half-foot increments; is that correct?

A. Correct.

Q. And that resulted in you cutting the oil-in-place calculations in half, correct?

A. Correcting them to that value.

Q. Based on those half-foot intervals, right?

A. Yes.

Q. Now, you were deposed in December of 2024 before you identified the mistake, correct?

A. Correct.

Q. And Empire's experts could have reviewed your written testimony, exhibits, interpretive logs and your analysis in advance of your deposition, correct?

A. Correct.

Q. And they could have pointed out that error that resulted in 100 percent overestimate of the oil in place, correct?

A. Correct.

Q. But that didn't happen; that wasn't brought up during your deposition, correct?

A. No. Yes, correct.

Q. So no one else had identified to you that you had made that 100 percent overestimation of the oil in place, correct?

A. Correct.

Q. But you, yourself, identified that error after your deposition and made the correction yourself to your testimony after you brought that to my attention, correct?

A. Correct.

Q. We filed your revised testimony in January 2025, correct?

A. Correct.

Q. Then you also made another change, changing the oil-saturation cutoff in your interpretation or in your analysis from 30 percent to 20 percent, correct?

A. Correct.

Q. And, as I understand, you did so because it was easier -- your rationale was, it was easier to compare based on Empire's experts' own definition of what a commercial ROZ is, correct?

A. Correct.

Q. And you're not the only one who used the 20 percent oil-saturation cutoff in your oil-in-place analysis, correct?

A. That is correct.

Q. In fact, Empire's witness -- experts, Ops Geologic, did the same, correct?

A. Correct.

Q. And, in fact, when they used the 20 percent oil-saturation cutoff in their oil-in-place calculations, they effectively wiped off all the oil saturations that are below the 20 percent oil saturation in their oil-in-place calculations, correct?

A. Correct.

Q. So they did the same thing that Mr. Wehmeyer was accusing you of doing by wiping off 20 percent of

all oil saturation up to 20 percent from their oil-in-place calculations, correct?

A. Correct.

Q. Now, you were also -- Mr. Knights, you were also questioned about Dr. Lindsay's fracture study yesterday by Mr. Wehmeyer; do you recall that?

A. Yes, I do.

Q. And, in fact, you did review Dr. Lindsay's fracture study, which was presented as part of his evidence and testimony on the EMSU 679 core, correct?

MR. WEHMEYER: We have an objection. Every single question has been leading, and I've let 30 of them go. But at some point, we need to hear from the witness. Objection. Leading.

HEARING OFFICER HARWOOD: Well, it's a fine line. I tend to allow it if it will move things along. But bear it in mind, Mr. Rankin --

MR. RANKIN: I'll adjust.

BY MR. RANKIN:

Q. Mr. Knights, did you review Dr. Lindsay's fracture study on EMSU 679?

A. Yes, I did.

Q. What did you conclude about the fractures that he identified in that oriented core fracture study?

A. That they were -- basically same conclusions he had, is they were 1 to 2 to 3 inches, and a few of them were up to a foot or 2.

And I disagree with his interpretation that somehow that indicated that there were fractures and faults that go all the way down to the San Andres, 300 feet below it. Especially since those fractures in the cores need to be restricted to individual stratigraphic units.

Q. Now, you just used the words "San Andres," and I know having worked with you for as long as I have, that you're almost allergic to formation tops, so let's talk about it in different way.

So you mentioned the words "San Andres," how did do you relate that to Goodnight's permeability barriers?

A. As we've discussed the San Andres, I look at there's three different intervals in the San Andres. There's an Upper San Andres, a permeability barrier, and the Lower San Andres that Goodnight injects is in the Lower San Andres that is separated from the Upper San Andres and the Grayburg. And it is very confusing when somebody mentions San Andres of which three intervals are you talking about.

Q. So just to be clear, those fractures in

Dr. Lindsay's analysis of 1 to 3 inches, just explain whether it's your opinion those fractures could extend down to the depths where Goodnight disposal is occurring.

A. Yeah, I didn't see any indications that they would be extensive and, you know, more than the couple of feet that he actually identified in the wells.

Q. Okay. Now, kind of continuing down this path on fractures and communication, yesterday, Mr. Wehmeyer and Dr. Ampomah both asked you questions about what evidence of the permeability barriers you testified exist from approximately minus 500 subsea to about minus 700 subsea. Do you recall those lines of questions?

A. Yes.

Q. In preparation for your written testimony, did you actually review the core report for the EMSU 679 as part of our overall analysis?

A. Yes, I did.

Q. I'm going to go ahead and share my screen.

Mr. Knights, is this a document that you prepared that identifies excerpts from the core report that was provided to Goodnight by Empire?

A. Yes. This is Lindsay's fracture study data.

Q. And it's approximately six pages that you've

excerpted portions from that fracture study; is that right?

A. Correct.

Q. And if you would just review what this core report and the information from Dr. Lindsay's fracture study shows with respect to your opinions about permeability barriers that you were asked about yesterday.

A. So most of the permeability that's in the testimony so far has been horizontal permeability, and this core report actually has vertical permeability. So what I've highlight in blue is those permeabilities that have less than 1 millidarcy, in blue. So each one of those blue boxes that vary are variations in feet, I would consider a permeability barrier.

And as you go through, I've also put on the measured depth and TVD subsea. And so as we go through these pages, you can see that there are multiple perm barriers. As we go through the 179 feet, I think there will be 29 sections of individual perm barriers that individually could be perm barriers, but in aggregate, are significant perm barriers to vertical flow.

I think you'll see some other things I can describe.

Q. Before we move on, I'm going to ask you to just sort of orient us for the purposes of the record.

So this is a table of the core information, and I'm going from left to right here. You've got column headings, and I think it's the fourth column heading has the vertical permeability; is that right?

A. Correct.

Q. Just so the record is clear, you're talking about these blue boxes. The number to the immediate right of that blue box is the vertical permeability that was measured in the core that you're referring to, correct?

A. Correct.

Q. And then on the left-hand side, you've got the measured depths, which is from the core report itself, correct?

A. Correct.

Q. And then you've corrected that to a subsea depth based off the Kv for the well, right?

A. Correct.

Q. So let's start with the blue boxes. I'll scroll through. Just point out any points that you want to make.

A. Yeah, we can start at the very first one,

just to get oriented.

So the first, 4170, these are 1-foot increments. The permeability is 13 millidarcies. The next point down is .52 millidarcies, so a significantly lower perm. And even if they're not mathematically, the ratio of those is actually a perm barrier to fluid. So when you have distinct drastic changes in permeability, that's a restriction to vertical flow.

Then as you go down, there's a 1 millidarcy. Then you get back into 2 feet that are below a millidarcy. So I went through that entire core. And this is basically from 590, so down closer to the interval that I think is that main perm barrier across the field.

Q. Now, in addition, on the far right there's a description that whoever was analyzing the core -- is that who -- explain to me what this shows on the far right in the columns, the description.

A. That is the lithology description that a geologist that was interpreting the cores did. So I've marked two things on there. I've marked anhydrite where that is present in the core. And then I've also, in a few places, marked SHR, the solid hydrocarbon residue, as just important features that I

thought were important in the core.

Q. So just so the records is clear, what is the significance of the presence of anhydrite here? How does it relate to the testimony that Dr. Davidson gave?

A. Well, anhydrite is relatively difficult to identify, especially in these intervals. But when you do have anhydrite, and the interval, it does indicate that there is anhydrite there -- I think Dr. Davidson, from his log analysis, identified areas that from the log characteristic could represent anhydrite.

Q. So I'll scroll through the next page here. As I do, just let us know what's significant on each of these pages?

A. Again, in this 25-foot interval, there's four separate intervals that I would consider perm barriers. So I think those are individual layers, beds that, you know -- again, geology is deposited laterally and horizontally, so they could extend over significant areas.

Q. Okay. Next page.

A. Next 25 feet, there's five perm barriers. The other thing I'd like to present, these boxes in the red, those are extraordinarily high perm barriers. And one of the things that that does is it allows for,

say, loss circulation. But those are also barriers to vertical perm.

If you have fluid going up through the system and you're going through very, very low perm and you hit a 4 darcy perm interval, that fluid is not going to go up, it's going to go laterally. So it's like, bad analogy, but a reverse bucket with holes in it. You're trying to get the water to go up and you hit this hole, the pressure is dropping, the water fluid is going laterally instead of vertically.

So it's not just the low perm intervals that are barriers to vertical flow, it's also these high perm intervals. So as you go through, you'll see a number of those.

The other thing, on the right-hand side, you see an increasing number of indications of anhydrite.

Q. And on that point that you just made about the vertical perm and the red boxes, it appears to tend to -- explain if that correlates also with the horizontal perm in this case.

A. Correct. And sometimes you'll see a difference where the horizontal perm is much lower than the vertical perm, and that's an indication of fractures. But if you look at the perms here, those

high perm streaks, when you do have that fracture, it's very localized in 1 or 2 feet of the section and not completely in the entire interval.

Q. And just to be clear, the column to the left of your vertical perm column is the horizontal perm measurements; is that correct?

A. Yes. When they do the cores, they measure a maximum perm direction, and then 90 degrees to that to try to get a heterogeneity in the permeability, because there's some directional permeability.

Q. And then you mentioned something when you were talking about this vertical perm value. You mentioned the term "loss circulation." It was discussed yesterday. If you would, just spend a moment explaining what that means and why you refer to that term here when you were talking about that value.

A. As you're drilling a well and you have a fluid column and a pressure, if you hit a high permeability zone or a lower pressure zone, you start losing that fluid from the drilling mud and it goes out into the formation. And it's an indication of a significant change in pressure gradient, or pressure.

And that is basically in some areas where the logs might say there's porosity, but a loss circulation zone is a direct physical evidence of

change in pressure and permeability.

Q. And in this particular instance, this is just the 1-foot increment, so you wouldn't expect to see significant results in your drilling, correct?

A. Yeah, depending on -- but 1 foot would probably -- you would definitely -- probably see something. But it may not be significant.

Q. Next page here, just, again, touch on what we're seeing here and how it relates to your --

A. So we're down to 4250 in a measured depth and negative 665 TVD subsea. And we see now a little more concentrated permeability barriers. So there's 12 feet out of 13 feet that I would consider permeability barriers. And then as you can see, an aggregate on this 25 foot that goes with the significant barriers.

Again, I did mention yesterday about having a single perm barrier across the entire EMSU would be difficult to map. But in aggregate, these things are incredibly strong permeability barriers to vertical flow.

Q. And you put on here -- you indicated here the top of the San Andres, and you put in parentheses "GNM." What does that mean?

A. Well, that was my initials for Goodnight.

Since most people are discussing San Andres and the Grayburg, again I live in the TVD subsea world so I don't have to deal with that. But some people need -- so that is the Goodnight top, and it's right along some of this high permeability barriers.

Q. And you didn't pick that depth, correct?

A. No. I did not. I took that from Preston McGuire, Goodnight's geologist.

Q. And you're not opining on that depth, you're just putting that there for reference so we understand where Goodnight has picked its San Andres top and permeability barrier, correct?

A. Correct. You know, you can -- there's an infinite way of picking a top. And I think if you were just presented this data, you know, if you were thinking perm, you might go up to the top of that perm barrier and pick a top there. But the log data may pick it differently. It's just opinion. Nomenclature is a quagmire.

Q. Next page here, what does it show?

A. This shows two more perm barriers. Probably about 20 -- 90 percent of that interval is a perm barrier to vertical flow. You can will see some anhydrite on the right side.

Another thing that you see on the right

side is SHR. That's the one below, if you're following these curves. There it is. So SHR is solid hydrocarbon residual. And as I mentioned before, that is an indication that you're below the ROZ or very close to the base of the ROZ.

Q. And then I think this is your last page of this exhibit. What does that show here?

A. This shows more permeability barriers. Again, probably 90 percent of those are permeability barriers. But you're also seeing a little more of the high perm. So you have a couple feet here. And maybe that's 4 or 5 feet within that 10-foot zone. That would probably start losing mud weight and having a little more loss circulation.

Q. And you've also indicated here some additional SHR?

A. Yes, solid hydrocarbon residual.

And so in aggregate, I know I mentioned yesterday that between 500 and 700 feet, I see in my interpretation a significant number of permeability barriers, but I really hadn't presented a map or a cross-section or anything else. So I thought it would be important to again go back to the direct physical evidence, the actual core data, and kind of demonstrate what my interpretation is.

Q. Now, on that point, you didn't yourself map anything, but you reviewed Mr. McGuire's exhibits?

A. Correct.

Q. This is Mr. McGuire's Exhibit B-9, which is a cross-section that starts on the left from Empire New Mexico's EMSU 460, and it includes Goodnight's disposal wells that are existing in the EMSU and goes over to the EMS 462, which is another water supply well.

If you would, Mr. Knights, I'm going to ask you -- I'm going to direct your attention to the EMSU 460 and if you would, let us know what the approximate distance is of the EMSU 460 from the EMSU 679 well, which is the cored well that we were just discussing?

A. And its approximately 300 feet from the cored well. And so I think using the measured depth and the calculations from the core data and placing those on this cross-section would be in that 4200 to 4300.

Q. I'm going to zoom in to that depth so we can have a better look at it. I'd like for you to just tell us a little bit about what you're seeing at that depth and how that relates to the core data that we just reviewed.

A. If you could go back so I get the depths right on the measured depth, to the core, top and base. So the base was 43 and the top measured depth was 4175. So basically 42 to 4350.

So if we look at 42 to 4350 on this interval, it would be that interval there. So in that interval, I have a significant perm barrier between -- within that interval, that 29 separate perm barriers in 175 feet of rock.

And, again, I didn't do any correlations or mapping across the field. But if I did, and let's just assume these are correct, without my QC, but I would have extended that perm barrier across the stratigraphic interval across the EMSU and interpret that had as a perm barrier.

Q. Just to be clear, what is the 460 well here?

A. The 460 well is a water supply well. And so you can see where the plug-back and perfs are. So that was one of the wells -- I'm not quite sure, was it 65 million barrels of water that were withdrawn from that interval?

Q. And that was a well that previous EMSU operator Chevron drilled, correct?

A. Correct.

Q. And you reviewed the well file for that

well?

A. Yes, I did.

Q. Is that the top that Chevron picked; do you know?

A. I believe that's the top that Chevron picked. It's my understanding that Goodnight started with the Chevron San Andres pick as this pick that goes across there. And I think they've adjusted it. But that was the starting point for...

Q. Now, yesterday, Mr. Knights, you discussed generally, as part of your response to your cross-examination, your interpretation or understanding of what this influence or how the water supply wells and the volumes that were produced from the water supply wells and the volumes that were injected in the water injection wells that Goodnight operates that were depicted here influenced underscored or informed your interpretation of the perm barriers.

If you would, just explain, referencing this exhibit, how that is and how that supports your interpretation of these extensive permeability barriers across the EMSU.

A. So I always like to start out with the hard physical evidence, which is core data. And looking at

and reviewing that, I think that's a strong perm barrier to vertical flow.

And then the next data that I think is most important, again, is the material balance, both volumes and pressures.

And this, the water supply wells, making 69, so 130 million barrels out of this area indicated a long, extensive reservoir.

The four wells in the middle are the water injection wells. And those are injecting into -- the simple answer is, they're at the same depth as the water supply wells, I'd interpret that as an entire separate reservoir, a single reservoir across the entire EMSU.

And because the flows and the pressures have very little indications from the withdrawal or the injections, very limited pressure changes in the interval, that that is a tremendously large aquifer that has a huge capacity for both permeability and fluid volumes to be delivered in it. It also indicates that it is pressure separated there the intervals above.

MR. WEHMEYER: And I have an objection. I would move to strike. This is not in any of filed written testimony.

Additionally, yesterday I asked what is the method for determining your barriers so that we can have an intelligent and sworn conversation about it. And it was 7 percent porosity, was the answer.

All of the work that he's done overnight with counsel has not been disclosed as a matter of basic due process. This was due in writing months ago. And the explanation of I had overnight to come up with a new analysis is not sufficient.

We object to move that it be stricken on the basis that it was not disclosed.

MR. RANKIN: Mr. Hearing Officer, may I respond?

Mr. Hearing Officer, actually, Mr. Knights did discuss this analysis yesterday, and he explained that his interpretation is that because of the volumes withdrawn and the volumes injected and the fact that there is no response in the pressures, that informed his interpretation of the permeability barriers to being extensive and lateral in length.

I simply wanted to be table to clarify the basis for that, because he was challenged on that point. And I wanted to be able to show to the Commission what his basis for that testimony was.

MR. WEHMEYER: May I reply briefly?

THE HEARING OFFICER: Well, my understanding is that he was going to defer pressure issues to somebody else.

MR. RANKIN: That's true. And this is not addressing the pressure. This is addressing his interpretation of the geology and how that informed his opinion.

MR. WEHMEYER: May I reply briefly.

THE HEARING OFFICER: Okay.

MR. WEHMEYER: Again, none of this was disclosed. In fact, the geologist said he didn't do any geology. And when I gave him all the wells and said where are the mud losses, no idea; how does this pressure play into anything, no idea; how do mud losses have to do with anything, no idea.

The explanation of I took overnight to work with the lawyer is not sufficient. This is absolutely ambush. We've not had a due process opportunity to prepare or examine among this. This was do months ago if he wanted to do the work.

Additionally, with respect to the mapping, there's been no foundation for the -- somebody put colored markers across a poster board and called it a perm barrier. This is not science.

MR. RANKIN: Mr. Hearing Examiner, what

Mr. Wehmeyer is saying is just not true.
Mr. Knights, and I'm showing my screen here, is his direct testimony addressed mud loses in his direct testimony. Okay? He did address this issue, and it's important for him to be able to explain the basis of his opinion.

He was challenged on it. Mr. Wehmeyer was focusing on the porosity and other items. Mr. Knights did testify about his interpretation of the importance of understanding the effect of the large volumes of water withdrawn and the large volumes of water injected as a basis of his understanding and interpretation that there are extensive laterally permeability barriers.

So, Mr. Wehmeyer, it is not the case that this is ambush. He testified about it yesterday. And I'm simply trying to redirect to clarify the basis for his opinion. And that's exactly what he's giving us today.

HEARING OFFICER HARWOOD: It looks like your microphones are not working. Only mine is working. That's pretty insignificant. I can pass this around, I guess.

All right. Well, you can come up here and speak into this microphone. You can use this one

so we can continue so you can answer the question.

MR. RANKIN: Mr. Hearing Officer, previously counsel for Empire argued strenuously that in their opinion, because of the obligations of the commission to confirm that there is no waste and to protect correlative rights, it's important for the Commission the hear all relevant evidence.

This is not and ambush. This is all evidence that was discussed in Mr. Knights' testimony. He stated that he relied on the -- he reviewed the testimony of Mr. McGuire and relied on the exhibits by Mr. McGuire. He testified in his direct testimony that he was pointing out loss circulation.

And yesterday during cross-examination he testified that the extensive volumes, massive volumes of water that were withdrawn from the disposal zones and injected into the disposal zone informed his opinion about the lateral extent of these permeability barriers.

I understand that Mr. Wehmeyer doesn't want the Commission to hear what Mr. Knights has to say, but I think it is absolutely within the scope of the cross and the redirect. And I can ask that the Commission allow me to proceed.

HEARING OFFICER HARWOOD: Okay. I guess what I'm inclined to -- so what I'm inclined to do is give Mr. Davidson, like, 15 minutes of recross, limited to these exhibits, okay, these two exhibits that we've seen so far. And if there are any other new ones, you'd be able to do that.

I hate to open that door, and I don't mean that would be limited to Empire and not OCD, Rice or Pilot. You'd have to carry the ball for everybody. Would that be satisfactory?

With that said, you know, there's only limited merit to your objection. I think we've heard a lot of this before.

And I just would caution you, we don't need to hear this stuff again. I have in my notes from yesterday, as well as just now, the Lower San Andres. I know that wasn't Mr. Knights words, but that area, he said is an entire separate EMSU-side vast water reservoir. That is not the first time we've heard that.

Go ahead, Mr. Rankin.

I guess let's take a 10-minute break and figure out the what the technical issue is. Let's come back at 9:45.

(Recess held from 9:36 to 9:46 a.m.)

HEARING OFFICER HARWOOD: And your mic is working, Mr. Rankin?

MR. RANKIN: It is, Mr. Hearing Officer.

THE HEARING OFFICER: It looks like we're down to one dysfunctional monitor. Everything else seems to be working. So while it is, let's proceed.

Over the break, I did confer with Commission members, so I'm inclined to sustain Mr. Wehmeyer's objection there. There is new material beyond my technical ability to understand, but not the Commission's.

So to the extent that there's new material presented this morning -- and that's not to disadvantage you, Mr. Rankin. You know, if there's new material, I'm going to give Mr. Wehmeyer, an opportunity for recross on that new material and the Commission may have additional questions. Okay?

So to the extent that you opened the door to this new stuff, and in fairness to you, some of the questions from the Commission have opened the door to some of this new stuff, but it's going to be fully explored. Okay?

MR. RANKIN: Mr. Hearing Officer, I have no objection to additional recross of Mr. Knights.

HEARING OFFICER HARWOOD: It's already clear

at this point that we're going to probably be going into May. That's almost a foregone conclusion. So that being the case, you know, time this week is not necessarily a finite constraint.

MR. RANKIN: Mr. Hearing Officer, just so I'm clear on the ruling, your ruling is that you're sustaining Mr. Wehmeyer's objections to this additional redirect testimony; is that correct?

HEARING OFFICER HARWOOD: What I'm saying is there's merit to it, and we're going to solve it by not prohibiting you from continuing. But the stuff that you opened the door to will be fodder for cross-examination and further examination by the Commission, as well as OCD, Pilot and Rice. Although, you know, hopefully everybody else's cross and questions will cover your interests.

MR. RANKIN: And just to be clear, you're not striking Mr. Knights' testimony?

HEARING OFFICER HARWOOD: No, not striking it.

Your microphone is off again. It looks like everybody's microphone except mine is also off again. Nothing we can do about technical gremlins. Let's go off the record for five minutes and see what we can do.

(Pause in the proceedings.)

HEARING OFFICER HARWOOD: It looks like our microphones are working again. I can't remember the name of the witness, Empire's witness that spoke so fast, but I encourage the rest of you to emulate him while the microphones are working.

Go ahead, Mr. Rankin.

MR. RANKIN: Thank you, Mr. Hearing Officer. I appreciate it.

Before I move off this topic, I would like to move the admission of what I'll mark as Goodnight Exhibit 1, which is Mr. -- I'm going to mark this as Exhibit E-2, which is would be attached to Mr. Knights' direct testimony. And based on his testimony, in support of it, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Subject to my ruling, Empire, any objection?

MR. WEHMEYER: Is what he's saying is E-2 -- what is it, I guess, if I could inquire?

MR. RANKIN: If I may respond, Mr. Hearing Officer. It would be this six-page document that is excerpts from Dr. Lindsay's core report. It's got Bates labels from discovery provided to us by Empire.

HEARING OFFICER HARWOOD: Is this what we're seeing on the screen, EMSU 679 vertical perm barrier?

MR. RANKIN: Correct. Thank you, Mr. Hearing Officer. Yes.

MR. WEHMEYER: There's been no modifications to what was provided previously.

THE HEARING OFFICER: My understanding is the witness added the blue columns.

MR. WEHMEYER: Was that last night?

HEARING OFFICER HARWOOD: I'm guessing it was.

MR. RANKIN: It was last night.

MR. WEHMEYER: Then I absolutely have and -- we do not have brand-new -- with this whole case about perm barriers, we don't have new perm barriers that come in at 11:30 at night working with counsel. This is brand-new science work. We haven't had an opportunity to rebut it. We object strenuously.

HEARING OFFICER HARWOOD: I'm not going to admit it at this time. We'll see what happens after cross-examination. You can renew your request at that time.

MR. WEHMEYER: Very well.

BY MR. RANKIN:

Q. Now, Mr. Knights, I'm going to move on to another demonstrative that was helpfully presented to the Commission yesterday by Empire. I'm going to put

it on my screen so you can see it better that you could see it yesterday on the chart that they put up by your seat. And you just tell me if you need me to zoom out of zoom in.

But this is a demonstrative that was presented by Empire yesterday as part of your cross-examination. Do you recall?

A. Yes, I do.

Q. You hadn't seen this demonstrative exhibit before yesterday, correct?

A. Correct.

Q. And were you able to read it from where you were sitting yesterday?

A. No, I couldn't.

Q. Could you identify what the wells were?

A. Not really, no.

Q. Were you able to identify what the different lines were on the exhibit when you were being asked about them?

A. Well, they were described, but not labeled well enough that I felt confident about them.

Q. Since yesterday, did you have a chance to review the exhibit that was presented by Empire yesterday in your cross-examination?

A. Yes, I was.

Q. So at the time you didn't know -- you still don't know who created this, do you?

A. No.

Q. Or exactly what data they used to create it?

A. No, I do not.

Q. And you didn't have an opportunity at the time to determine whether it was accurate or not, correct?

A. Correct.

Q. I'm just going to ask you what your understanding is, as you sit here today, of what these different lines are.

So first of all, Mr. Knights, as you understand it, at the top here is map. What does that map show?

A. It shows the cross-section that goes across the EMSU from the northwest to the east and south, Southeast.

Q. Okay. And then how does that -- what's your understanding of what that cross-section map -- how does that relate to what's below on this exhibit?

A. I would say that that's the cross-section line, so it shows that those wells are a cross-section going across the entire EMSU.

Q. It's hard to see them. But if you'll zoom

in on this digital version, you can make out the well names and the API numbers, correct?

A. Correct.

Q. So a number of these are EMSU wells and then some of them are saltwater disposal wells, correct?

A. Correct.

Q. And many of these are actually Goodnight's wells, as I go across the cross-section, correct?

A. Correct.

Q. Mr. Knights, based on cross-examination from Mr. Wehmeyer, if you could, just tell us what you understand this blue line to be that goes across the cross-section here from left to right.

A. My understanding is that that's Goodnight's top of their San Andres.

Q. And since yesterday you haven't gone through to confirm yourself whether those are accurate or not, correct?

A. No, I have not.

Q. But your assumption is that those accurately reflect the picks that Goodnight has presented to Empire in the course of discovery in this case, correct?

A. I would assume so.

Q. Now, what's your understanding of what this

fuchsia or purple line is that I'm indicating with my cursor here?

A. I believe that indicates a loss circulation zone.

Q. And what's your understanding of where the information would have -- may have come from that Empire -- or whoever created this chart used to indicate those depths?

A. I'm not sure of the source, but when I reviewed it, I used the daily drilling reports.

Q. And you had reviewed the daily drilling reports that were provided by Goodnight in discovery; is that correct?

A. Correct.

Q. Now, I want to ask you, how do you relate this cross-section that Empire, as I mentioned, helpfully created showing a map across the entire EMSU showing a loss circulation interval, while operators drilled down into the San Andres that they encountered across the entire EMSU field, how do you relate that to the core data that we just reviewed?

A. Well, again, I think the core data shows that there's some very high permeability intervals that would be indicative of loss circulation. Some of those zones were very thin, so there might be minor

losses in fluids. But if they were thicker, they could have significant lose of fluid.

Q. Just looking at this, one thing, what's your main takeaway, just looking at this cross-section and looking at each of these wells across the entire field? What's your main take away about the loss circulation that we're seeing here?

A. The main takeaway is that the loss circulation is below the Goodnight structure top. And I believe the red is -- is that Empire's top of San Andres?

Q. Is that your understanding, that the red is Empire's pick for the top of the San Andres?

A. I think, but I really can't read it.

Q. Now, you have reviewed the drilling reports for many of these wells, correct?

A. Yes. Well, all the Goodnight ones. There's some on there I haven't reviewed.

Q. And yesterday during our testimony, you specifically called out the Andre Dawson, that you had recollected the drilling report from the Andre Dawson; do you recall that testimony?

A. Correct.

Q. Now, you just stated that the loss circulation was below the pick for Goodnight's pick

for the top of the San Andres, right?

A. Can you repeat that question.

Q. You stated that the loss circulation identified on this cross-section was below Goodnight's pick for the top of the San Andres, correct?

A. In most of the wells, but not in the Dawson on this.

Q. Now, you mentioned yesterday that you familiar with the Dawson drilling report; do you recall that?

A. Yes.

Q. And you stated, as I recall, and you can clarify, that there was some minor loss circulation high, and then deeper in the zone, there was more substantial loss circulation deeper down; do you recall that?

A. Yes.

Q. In particular location where Empire, whoever created this, we don't know, puts a loss circulation at approximately what depth would you say that is?

A. About 4050, maybe 4010.

Q. So now, Mr. McGuire did include in his testimony, this Exhibit B-20, the drilling report -- part of the drilling report for the Andre Dawson. Is this the Andre Dawson or part of the Andre Dawson

drilling report that you reviewed previously?

A. Correct.

Q. This is Exhibit B-20, Goodnight's Exhibit B-20?

Now, if you look at the first page on this exhibit, Mr. Knights, just explain to us what we're seeing here as we go down -- what is the drilling report saying beginning with this portion here that I'm highlighting in yellow?

A. That's a drilling report that says there's minor seepage noticed at 4,000 in the beginning, added magma fiber to control.

Q. If you would, relate that statement on the drilling report to what you testified about when you were reviewing the core report.

A. Well, the minor seepage would be maybe be one of those high perm streaks that's very thin, maybe 1 foot or so.

Q. That 4,000 feet, if I go back to the demonstrative from Empire, 4,000 feet is about the depth that I'm highlighting -- I'm marking here with my cursor, right?

A. Correct.

Q. And that's well above what the loss circulation zone is indicated on this cross-section,

right?

A. Yes. Significantly above it.

Q. So now let's go back to the drilling report on B-20. What is the next entry here that addresses any loss circulation?

A. That is 4295, and that is 22 barrels per hour. A decent -- decent or bad loss, but not tremendously significant. I don't think that would impede drilling.

Q. Let me go back to the demonstrative here and I'm going to look again at the Andre Dawson well. I'm going to go back down. Where would you place 4295 on this interval?

A. It would be right on top of the red and the blue. So I think that would be Empire's top of the San Andres and Goodnight's top of the San Andres.

Q. Do you see any indication or have you identified any indication in the drilling reports of any loss circulation that would correspond to what's marked on Empire's demonstrative here?

A. No, I do not.

Q. Just so I'm clear and the Commission is clear and not mislead, is there anything that you -- did you go back and look at the mud logs to determine whether there's any loss circulation reflected in the

mud log that corresponds with the depths identified by Empire in this cross --

A. Yes, I did. And I didn't see anything at that depth.

Q. Now, you talked about the fact that there are additional zones where there are more substantial loss circulation yesterday in your testimony.

If I go to the next page of this, how does that jibe with what you testified yesterday? And how does that relate to your understanding?

A. This statement at 4562, they were drilling dry, so they lost total returns. And my interpretation of that is, it's a large perm barrier or loss circulation zone with high permeability that's much thicker than those 1- or 2-foot zones.

And that is -- since that is relatively consistent deeper in this Lower San Andres, that I think that's another big data point for the potential of karsting, large karsting, in the Lower San Andres.

Q. Now, last page here, Mr. McGuire's Exhibit B-20, again, what do we see here and how does that relate to your interpretation?

A. Let's see. Drilled 12 -- vertical hole, 740 to 5760 and weight on bit and drilling dry.

So as they were drilling to 5760, they

couldn't keep fluid in the hole. The entire mud column just went out into the reservoir.

Q. Are there any other wells that you recall that also exhibited substantial loss circulations that you'd like to comment on?

A. I guess back on the Dawson, could you put your cursor at that 445, where that first loss circulation is.

Q. 4295; is that right?

A. That was the first one, but the second one was I believe at 45 -- right about there. Because the other thing I noticed on the cross-section is that most of these major loss circulation zones were similar depth below the perm barrier. And that's another indication that across the EMSU, you have a similar reservoir quality at that -- below the top of Goodnight's San Andres pick.

I think the other well that was familiar with was the Ryno.

Q. Okay.

A. And I remembered that I had multiple loss circulation zones. The first one I think being approximately where they have it marked. And then I think at 4560, I believe, they lost total returns. And I think it's right about where their black line

is, which I -- if I can believe correctly, that was Ops' top of Lower San Andres. But there were a number of multiple -- again, identifying that kind of quality of reservoir below the Goodnight top and actually Ops' top of the San Andres, as well. .

I think that's unique situation, where we have with two people picking the same top for San Andres.

Q. Now, I want to come back to another concept that you were crossed on yesterday by Mr. Wehmeyer. And if you recall in your cross-examination by Mr. Wehmeyer, do you recall him asking you or he referred to baffles and sometimes to barriers when he was examining? Do you recall that?

A. Yes, I do.

Q. What's your understanding, according to Mr. Wehmeyer's definitions, of the difference between those two terms?

A. Well, it's my understanding that Mr. Wehmeyer defines baffles as limited aerial extent perm barriers.

And my perm barriers are, I think, an aggregate of perm barriers or baffles I would consider perm barriers to vertical flow. So any one of those little low permeability intervals on a core thing

would be maybe considered a baffle or a perm barrier, depending on your definition. But in aggregate, I think those are a strong vertical permeability barrier, especially when you have an interval of 100 feet and 50 percent of the rock is low perm.

Q. So if you would, Mr. Knights, just explain, just for clarity for the record, is it still your opinion that there are effective barriers, lateral extensive barriers, in the aggregate, across the interval in the EMSU from minus 500 subsea to minus 700 subsea?

A. Yes. That's my testimony.

Q. And now just going back again to Empire's demonstrative exhibit, just please explain how loss circulation that is depicted here and on this demonstrative exhibit supports your conclusion.

A. Well, the loss circulation, especially when you consider the multiple loss circulations and the full column loss circulations at approximately a similar depth below Ops San Andres top and the Goodnight San Andres top would indicate that is another indication of a somewhat uniform reservoir and continuity across the entire EMSU.

Q. Now, I'm going to pull up your direct testimony, and is this exhibit -- it's Figure 13 from

your revised direct testimony. Does this exhibit here support, corroborate what we just reviewed as to the loss circulation and Empire's demonstrative exhibit?

A. The perm barrier there is approximately the same depth as the perm barriers that were in the cored interval, and if you extrapolate Preston's tops across the EMSU.

Q. And you undertook some of this mapping previously in your direct testimony and represented in Figure 14, correct?

A. Well, mapping -- they're basically points on a map and a cross-section. I didn't create contoured maps, but depending on how you define a map.

Q. Does this network of barriers that you're discussing also match up with the -- one moment.

Looking at Dr. Davidson's slides from his summary testimony, Slide Number 17, titled "Cross Section Showing Interval of Bedded Anhydrites," does this network of barriers that we were just discussing also match up with the bedded anhydrites that Dr. Davidson identified in his log interpretation analysis in his Slide 17 that go from the northwest to the southeast across the EMSU?

A. Yes. Those are approximately the same depth intervals across the EMSU.

MR. RANKIN: Mr. Hearing Officer, at this time, I would move the admission of Goodnight E-2, this Slide 17 from Dr. Davidson's summary testimony.

HEARING OFFICER HARWOOD: That's not -- I thought all these slides were already in the record.

MR. RANKIN: They were demonstratives. We didn't move them into admission. I just want to make sure that this slide, in particular, is moved into admission. I'll be happy to have the whole thing moved into admission or have it be part of the record.

HEARING OFFICER HARWOOD: Any objection from Empire.

MR. WEHMEYER: If this was not appended to the sworn testimony when we received the direct testimony with exhibits and evidence, absolutely I object. There's been no fountain laid for its accuracy. This witness didn't create it. We oppose admission.

HEARING OFFICER HARWOOD: Was it?

MR. RANKIN: It was not part of Mr. Davidson's written testimony. It was presented as part of his summary testimony. Mr. Davidson did testify to it. He presented it as part of his summary testimony. And I would ask that the Hearing

Officer accept it into the record. Mr. Knights also testified object it and I believe it should be part of the record.

HEARING OFFICER HARWOOD: Well, if it's a different witness that testified about this, at least until now -- why don't you start making a list of these additional exhibits that you'd like moved into evidence and I'll reserve ruling until after there's been further cross-examination and questions from the witness.

MR. RANKIN: Thank you, Mr. Hearing Officer.

BY MR. RANKIN:

Q. Does your testimony and your analysis, Mr. Knights, also match up with the testimony of Mr. McBeath, where he identified in the lower portion of the Grayburg, substantial vertical permeability barriers in the EMSU 211 RFT data set provided by Empire?

A. Yes, it does.

Q. Can you explain how that's the case?

A. The variation in pressures that don't conform to a single pressure gradient indicate that these individual layers are isolated, pressure isolated. And some of these zones are only 10 feet apart, so that means a perm barrier that's going to

support pressure can be relatively thin.

Q. If you would, Mr. Knights, just explain how these pressure differentials in the Lower Grayburg help sustain some of these loss circulation events in the Lower San Andres?

A. I'm not sure. Can you --

Q. Well, I mean, these are in the Lower Grayburg.

A. Yes.

Q. If could you just put them into context. How is it that these substantial pressure differentials in the Lower Grayburg would help explain some of these loss circulation -- this loss circulation zone in the San Andres?

A. I think the individual perm barriers in the Grayburg, in the Lower Grayburg, and then the significant ones in the core analysis in the 679 well indicate that even in between, there's significant other perm barriers or baffles that are throughout the entire section that would inhibit vertical flow.

I think the other thing that would relate is that these high perm streaks, where you lose circulation, could have dramatically different pressures gradients from those above.

Q. Now, I'm going to move off of these to a

different topic, Mr. Knights, that you addressed on your cross-examination.

Do you recall Mr. Wehmeyer asking you, cross-examining you on this Slide Number 14 in your cross-examination?

A. Yes, I do.

Q. Do you recall him asking you about whether the 1939 report that you relied on for your analysis had an reference to edge water encroaching from the east?

A. Yes, I do.

Q. And do you recall what your testimony was at the time?

A. I believe at the time that those arrows, they were my interpretation from the map, which is accurate. But I think after reviewing, I also went back and looked at the paper. And I may have got that implication from the actual write-up.

Q. So I'm presenting here what was previously marked at Goodnight Midstream Cross Exhibit Number 18. Is this the report that we were discussing, the 1939 report?

A. Yes, it is.

Q. Okay. And I think it's starting on Page 12 of that report. Is that where the study addresses

edge water encroachment?

A. It is.

Q. And when I scroll through, at the bottom of Page 12, I'll go ahead and read this into the record. "Water was produced first in the southwest part of Eunice field, probably because that part was drilled first." Did I read that sentence correctly?

A. Correct.

Q. Then it goes on to say, "Water is encroaching on the," and then I'll need to scroll down a couple pages to get to the next part of that sentence, "west, southwest, and southeast edges of the field, but the water drive appears to be most active on the southwest." Did I read that correctly?

A. Correct.

Q. So that sentence is addressing that there is edge water encroachment on the southeast, correct?

A. Correct.

Q. Now the next sentence in the paragraph goes on to say, "It will be noted in figure 10 that water is being produced from a large part of the structurally low portion of zone A." Now, that doesn't address edge water coming in from the east, correct?

A. Correct.

Q. The next sentence goes on to say, "Water is encroaching from the southeast and only recently has made its appearance in the northeastern of the zone." Did I read that correctly?

A. Right.

Q. So here now, it's talking about water encroachment from the edge water on the northeast, correct?

A. Correct.

Q. Now, the next paragraph goes on to say, "On the west water encroachment is active in zone B but is irregular in zone C." Now, that, obviously, doesn't relate to encroachment on the east, correct?

A. Correct.

Q. It goes on to say -- and I'll skip over this middle sentence here, but in the last sentence of that paragraph it says, "On the east side of the field, water has encroached irregularly in zones B and C." Did I read that correctly?

A. Correct.

Q. So I'll go back to your summary slide, which is from Figure 6 in your rebuttal testimony, correct?

A. Correct.

Q. Just explain again, if you would, how that report and the description of the edge water that was

identified in 1939 explains, in your opinion, the water production that has been observed through the course of history and the EMSU and the Grayburg.

A. So the Grayburg -- again, this paper in 1939, these lines and hatched lines are actual encroachment that happened between 1934, '35, '36 and '37. And as you can see on the map, it encroaches from basically all sides, some of them very close to that EMSU 239 well that is the one well that had really high water after it was drilled into the San Andres and completed in 1973.

So it could have -- the high water could be, number one, from the edge water from the north, but also from the deepening into the San Andres. It actually penetrated through the negative 3050 producing oil-water contact of the original oil-water contact and into the top of the San Andres.

So it seems to me, the logical source of water in that well is, number one, edge water, would be my first geologic assumption. And then second would be the deepening of the well into the San Andres on the top of the structure in 1973.

Prior to I think it was 1970, that well had made only 35,000 barrels of water. Once it was deepened between '73 and I believe it was '81, when

the map was made, that is where all the water was produced in that well. So it's, in my opinion, caused by the deepening of the well into the top of the San Andres that brought that high water volume into that well.

Q. Now, Mr. Knights, again, you've been not wanting to talk about tops, you're referring here to the San Andres. I'm just going to kind of scroll down to another one of your exhibits and I want you to explain, when you say San Andres, what it is you're --

A. It's not my San Andres.

Q. So here is a good one, I think. So if you would, just maybe referring to this exhibit, when you talk about the San Andres here, whose San Andres are you talking about?

A. In this one, it's the NuTech top that has the top of the San Andres 1 foot below the producing oil-water contact. So any well penetrating the producing oil-water contact, at least in this area, would be penetrating into the San Andres aquifer.

And I would say the San Andres, this is Upper San Andres. So I still believe there's three distinct units in the San Andres: the Upper San Andres; the perm barrier; and then the Lower San Andres.

Q. And just for purposes of record clarification, this figure from your summary slide is Figure 4 in your rebuttal testimony, correct?

A. Correct.

Q. Very good. Do you recall your testimony when cross-examined yesterday where Mr. Wehmeyer asked you questions about Ops Geologic's determination that some of their highest oil saturations are in the lowest porosity rock?

A. Correct.

Q. Do you recall him asking you how you would get the oil into that type porosity if the San Andres were just migratory pathways?

A. Yes.

Q. Mr. Knights, are you convinced that much of that oil in Ops Geologic's analysis is actually oil?

A. I'm not convinced. I think because the saturations were so high in the intervals where we had core data, that if they're overall optimistic on their oil saturation in where we had core data, in areas that don't have core data and they have high oil saturation, I'm -- I could be skeptical.

Q. Would you mind clarifying your position for the Commission?

A. Well, the very low porosities, if you reduce

the porosity by a small portion, you could eliminate the oil saturation at interval.

Q. Do you recall yesterday, Mr. Knights, cross-examination from Mr. Wehmeyer asking you about whether you relied on Dr. Davidson for picking any of your formation tops?

A. I did not pick any formation tops, and Mr. Davidson did not give me any formation tops.

Q. Did you, in fact, rely on Dr. Davidson for any tops of any kind in your analysis?

A. No.

Q. Is it your understanding that Dr. Davidson even used any tops in his petrophysical analysis at all?

A. No. I know he did not.

Q. Now, his logs, his interpretive logs, did include an indication of where Goodnight's top of San Andres is located, correct?

A. Yes.

Q. But just to be clear, it's your understanding he did not use or rely on those in his interpretation or analysis, correct?

A. Correct.

Q. I want to talk a little bit about sensitivity analyses. Do you recall yesterday

Mr. Wehmeyer cross-examining you extensively over what sensitivities NSAI undertook to test its analysis?

A. Yes.

Q. And do you recall during your testimony that you did identify that Dr. Davidson's analysis included a distribution between plus or minus 10 percent? Do you recall that?

A. Yes.

Q. In fact, that plus or minus 10 percent was based -- you tell me. What is your understanding of what that plus or minus 10 percent was based on from Dr. Davidson's testimony?

A. It was based on reasonable estimates of the pressure differentials that could be used in his B sub o.

Q. And that related to his core corrections, correct?

A. Yes.

Q. So if the Commission were looking for a high estimate of NSAI's petrophysical analysis, they would add 10 percent to Dr. Davidson's analysis, correct?

MR. WEHMEYER: Objection. One, this is not his analysis, so it's not relevant. Secondly, we visited extensively yesterday about any sensitivity analysis he could share with the Commission. The

fact that he's either slept and dreamt it overnight, which is one of his methods he has testified to, to Mr. Rankin supplied it to him, does not allow him to come today with a new sensitivity analysis after I spent 30 minutes trying to get him to tell me about if had done one.

So this is absolutely new. He's not the witness to do it with. That's the objection.

MR. RANKIN: Mr. Hearing Officer, if I may respond.

HEARING OFFICER HARWOOD: Please.

MR. RANKIN: Mr. Knights testified that there were sensitivities included in NSAI's analysis from Dr. Davidson's 10 percent. And I'm just clarifying what that's based on, because the record wasn't clear during cross-examination yesterday. I want to make sure it's clear for the record.

HEARING OFFICER HARWOOD: I'll allow the question and you can make note of it Mr. Wehmeyer and go there again if you would like to.

BY MR. RANKIN:

Q. So, Mr. Knights, so basically, if the Commission wanted to understand the high side of NSAI's petrophysical analysis, they would add 10 percent to Dr. Davidson's petrophysical analysis,

correct?

A. Correct.

Q. And if they want to understand NSAI's low side, based on Dr. Davidson's analysis, they would subtract 10 percent from his analysis, correct?

A. Correct.

Q. Yesterday do you recall being asking by Mr. Wehmeyer if you're aware of any other units that allow commercial SWDs, or saltwater disposals wells, to inject within a unitized interval?

A. I do.

Q. Now, as part of your analysis, Mr. Knights, you study the history of water production, injection, oil production in and around the EMSU as part of your analysis, correct?

A. Correct.

Q. Did you identify any commercial saltwater disposal wells that were disposing of produced water in the San Andres in the acreage that would later become the EMSU as part of your analysis?

A. Prior to the formation of the unit, yes.

Q. And Goodnight's Exhibit B-47, I'm going to just pull that up. This is Mr. McGuire's exhibit. Is the well that I've highlighted here where drilling had commenced injection in 1966; is that the one you're

talking about?

A. Correct.

Q. Okay. What year was the EMSU created, do you recall?

A. 1986, '83, '86.

Q. And the unitization of the EMSU included the San Andres interval, which would have included the zone in which this well had been injecting for nearly 20 years, correct?

A. Correct.

Q. And are you aware of any statutory waterflood unit or any unit that was formed around and included disposal operations from an existing commercial disposal well?

A. No, I'm not.

Q. Are you aware of why anyone would possibly do that?

A. Well, yes. I know why.

Q. Why would a unit operator seek to include an existing commercial saltwater disposal well within their unitized interval?

A. Well, in the process of unitizing, companies try to include all the water source and water injection ability so they can have a complete economic system. So from a water disposal and water source,

they would want to include that in their interval. But not as a producing interval.

Q. Now, you heard testimony from Mr. West. You were present for the testimony of Empire's witnesses, correct?

A. Correct.

Q. Did you hear testimony from Mr. West and Mr. Wheeler that there was no hydrocarbon production from the San Andres at the time the EMSU was created in 1986?

A. Yes.

Q. And you're familiar with the unitization documents stating that the San Andres was being included as a source of water supply?

A. Yes.

Q. Mr. Knights, Goodnight Exhibit B-7, is this part of the unitization documents that you reviewed as part of your work on this case?

A. Correct.

Q. And if I scroll down on that exhibit, is this what you're referring to as you understand the reason that the operator who sought to create the EMSU included the San Andres as part of the unit?

MR. WEHMEYER: Objection. Speculation.

MR. RANKIN: I'm asking what his

understanding is.

MR. WEHMEYER: Speculation. This is a matter of public record. In terms of what the Commission acted on, why, on what basis, it's rank speculation from a witness with no knowledge. And this is certainly not expert.

HEARING OFFICER HARWOOD: Overruled.

BY MR. RANKIN:

Q. Mr. Knights, if you would just read for me the sentence that I've highlighted here, and explain to me how this informs your understanding of why the San Andres was included in the unitization of the EMSU?

A. It was included, you know, basically as a water source and a water disposal interval to make it an economic unit, not necessarily for the hydrocarbon production.

Q. What this sentence says, "The bottom of the interval must be the base of the San Andres formations to include the area's most prolific water production zone." Did I read that correctly?

A. Correct.

Q. And that substantiates your understanding for why the San Andres was included in the EMSU, correct?

A. Correct.

MR. RANKIN: Mr. Hearing Officer, at this time I have no further questions for the witness. Before I make Mr. Knights available for any recross, I guess just for the record, can we make sure we understand what the scope of recross would be?

MR. WEHMEYER: My I respond?

HEARING OFFICER HARWOOD: Yes.

MR. WEHMEYER: It's all been new, so I think pretty much everything you heard today, being all brand new, I'm probably going to have some questions about it.

HEARING OFFICER HARWOOD: I'm going to give Mr. Wehmeyer wide leeway on it.

MR. RANKIN: I appreciate that, Mr. Hearing Officer.

THE HEARING OFFICER: The goal yesterday was when we broke and decided that you would redirect this morning, was hopefully to narrow the scope of redirect, and instead it was expanded.

So in all fairness to everybody, including the Commission, Mr. Wehmeyer and other parties are going to have wide leeway.

MR. WEHMEYER: Thank you. May I proceed, Mr. Hearing Officer?

BY MR. WEHMEYER:

Q. I'm going to be bouncing around a little bit, just to try to move through it and get it done. I'm going to start in the reverse order that counsel went through.

Do you remember I asked you were you aware of, prior to this, EMSU, the Commission approving a saltwater disposal well, commercial saltwater well, within the boundaries of an existing oil unit? Do you remember that question?

A. Yes.

Q. You said you had no such knowledge; is that right?

A. Correct.

Q. And even after the evening with Mr. Rankin, you still have no such knowledge, do you?

A. Correct.

Q. With respect to the 1939 paper, have you heard any other witnesses in this case talk about water coming in from the northeast?

A. No, I have not.

Q. So you would be the first witness that would be offering an opinion about edge water encroaching into the Grayburg from the northeast?

A. Yes, I would.

Q. That would also be inconsistent with Dr. Lindsay's testimony and many other testimony and literature that we've seen about the Grayburg pinching off to the east, and I'm going to misuse our terminology, trapping or at least pinching off to be a barrier?

A. Correct.

Q. Did the paper say the water was encroaching from northeast or southeast?

A. I believe it said it was southeast and the east.

Q. But all of your arrows are not from the southeast. The arrows you added are actually from the northeast. Why?

A. That was basically the major water production.

Q. What type of logs did they have in the year 1939?

A. Some very rudimentary logging tools.

Q. Spontaneous potential log, would that be the only log that existed in 1939?

A. No. There were more logs than that.

Q. Can we agree that over the last approximately 90 years, technology has improved

drastically since your 1939 paper?

A. I would very much agree with that.

Q. And you haven't been able to find anybody else that would have agreed that there was any water entering from the northeast or southeast, and your only basis for it is your 1939 paper?

A. Yes.

Q. With respect to the cores, you wanted to talk today about core, and we covered yesterday that you didn't look at the core and you didn't describe the core, correct?

A. Correct.

Q. Today when you put up your slide with the blue highlighting on it against the core, did you see any descriptions where bedded anhydrite -- was bedded anhydrite discussed anywhere to the core descriptions?

A. No.

Q. And, in fact, where any identification of anhydrite happened, that actually doesn't line up at all with where you placed your blue blocks, does it?

A. I don't specifically remember, but I don't think so.

Q. In addition, just so we can put a -- today we talked a lot about pressures. I thought yesterday you hadn't done any pressures work, you didn't have

any pressures testimony.

A. I think I mentioned pressures yesterday.

Q. What was your methodology and work with respect to pressures as part of your engagement here?

A. I reviewed pressure data as reflected on the geology. Again, the -- the biggest indication is pressure and volume. So material balance is part of a geologic evaluation for myself.

Since I've worked with an engineering firm for 32 years, I've found that to be a critical component in geologic evaluations of reservoirs.

Q. Okay. I'm going to go in now and talk about the barriers. I thought we had visited about that at length yesterday, but apparently, there's new testimony.

First, before even getting into the barrier, have you performed any kind of geomechanical studies --

A. No.

Q. -- anywhere in the EMSU or around it?

A. No.

Q. Not work that you did?

A. No.

Q. And you haven't seen any other work?

A. No.

Q. And we talked about a frac gradient analysis in terms of at what pressures, as this builds, will rock crack?

A. Correct.

Q. And a lot of this rock is dolomite. Yes?

A. Correct.

Q. That's a very easily cracked rock, isn't it?

A. Sometimes.

Q. To the extent that Dr. Davidson wants to talk about anhydrite barriers, which doesn't line up with the core and is not reflected in the core, can anhydrite be broken down by saltwater?

A. Usually fresh water.

Q. Okay. But water can break down anhydrites over time, can't it?

A. Yes.

Q. And you haven't done any studies in terms of -- if you wanted to write into the core description that there is anhydrite bedding and then move your blue blocks to barriers at the anhydrite, we know we don't have frac gradient studies, we know we don't have geomechanical studies, we know water will break down anhydrite over time, you haven't done any kinds of study in terms of the effect of his water injection and those pressures on anhydrites?

A. No, I have not.

Q. Let's talk mapping. The map that I had, I'm going to try to publish this, if you could call this a map. You put the brown permeability barrier. Are you calling this a map? What do you want to call this?

A. Cross-section. There's a map on one side that shows where the cross-section goes. It's the two wells that have spectral gamma rays that are near the EMSU, but outside the boundary.

Q. If we wanted to indulge this as mapping, did you do this kind of mapping anywhere else?

A. I have a number of cross-sections and maps that show wells.

Q. That show a perm barrier like this highlighted in brown?

A. No. I think the one in my summary testimony has them in black and Grayburg and purple, I believe.

Q. That was your work before today, right?

A. Before today, yes.

Q. Before today and yesterday?

A. Yes.

Q. Okay. With respect to the perm barrier that Mr. Rankin chose to show the Commission here, you can tell the Commission that these wells are way off to the east in relation to our EMSU, aren't they?

A. Yes. They are three to four miles east.
Q. Three to four miles east, right?
A. Yes.
Q. And as we talked about the concept of mapping, I asked yesterday, I said, "You're a geologist, geologists love maps," you haven't created one single map here.
With respect to the idea that there is an aerially consistent blanket of a barrier across all of the EMSU, you have never mapped that, have you?
A. Correct.
Q. You've never tried to map that, have you?
A. Correct.
Q. And, in fact, you have seen from logs that there is a lot of heterogeneity in terms of carbonate systems, such as we have here, in the San Andres, isn't there?
A. Yes. Very complex carbonate system.
Q. In terms of being able to say that there is a blanket barrier that goes all the way across the EMSU, that would require extensive mapping in this heterogeneous environment, wouldn't it?
A. No.
Q. Why did you not -- if you want to testify today that there is -- and, again, I asked you

yesterday. Do you remember yesterday I said, "Is it the testimony of Netherland, Sewell, with you here in the seat, that there is, in fact, a barrier that goes all the way across?" and you said you couldn't testify to that one way or the other? Do you remember that?

A. Yes. A barrier.

Q. Are you standing by that sworn testimony or do you have new sworn testimony today?

A. Could you don't repeat that again.

Q. Are you standing by the sworn testimony yesterday, or do you want to have new sworn testimony and change it?

A. Could you repeat what I actually said yesterday, so I could understand.

Q. That you were not sitting here testifying to the New Mexico Oil Conservation Commission --

A. I didn't --

Q. -- that it was the determination of Netherland, Sewell that there is, in fact, an impermeable barrier that separates what you want to call the injection zone from the Grayburg?

MR. RANKIN: Mr. Hearing Officer, object. Mischaracterization of Mr. Knights' testimony, I believe.

HEARING OFFICER HARWOOD: Hold on a second.

Let me try to find my notes.

The collective recollection here is that he said he would not commit to that 100 percent.

MR. RANKIN: I just want to make clear that Mr. Wehmeyer is trying to get Mr. Knights to testify about a single barrier.

And what Mr. Knights is testifying about is that there's multiple barriers in aggregate that substantiate his opinion. And that's my concern, for the record.

HEARING OFFICER HARWOOD: Mr. Wehmeyer, having heard the objection, why don't you just see if you can rephrase the question.

BY MR. WEHMEYER:

Q. We spent a lot of time yesterday talking about an barrier and if there is one and where it is, if there's something that isolates the Grayburg from the San Andres. Do you remember all that testimony?

A. I remember most of it.

Q. And at the end of that, I asked you, "Are you sitting in that chair, for Netherland, Sewell, going to go on the record" -- you know, these transcripts are -- we're reading about 1984 proceedings, right?

A. Yes.

Q. Are you going on the record for Netherland, Sewell that there is an impermeable barrier that isolate all communication between the San Andres and the Grayburg? Yes or no?

A. It's not a yes or no question. Is that nonresponsive?

Q. Yesterday you wanted to say it's gray. Is it gray?

A. Is there other color choices?

Q. There's been a lot of money and time spent at this thing, including written statements that we've had done through rebuttal reports. You've even done a surrebuttal report, haven't you?

A. Correct.

Q. And I don't think it's funny that we're here examining on brand-new opinions while we haven't had experts to help guide the examination or to prepare written responses to it.

So my question is, at this foundational piece -- Number 2 of your very first charge here -- do you remember we looked at your report yesterday?

A. Yes.

Q. Number 2 of your charge was confirm barriers from Goodnight. Do you remember that?

A. Yes.

Q. Did they tell you where the barriers were?
A. No.
Q. Today do you know where Goodnight's claimed barriers are?
A. Not necessarily. I know where my barriers would be.
Q. Well, presumably, they would have had barrier -- they're injecting into the San Andres and they know there's Grayburg oil production immediately above it. Would you hope that they had barriers in their mind somewhere?
A. Yes.
Q. But they didn't tell you where they are?
A. Not specifically, no.
Q. And you have no clue with what you came up with in these two wells here aligns with what they have, do you?
A. I would assume that it would.
Q. You don't know that? You're guessing?
A. Since I haven't seen -- they haven't provided me a perm barrier map or anything of the such, I guess I would not know what their perm barrier looks like.
Q. Additionally, this perm barrier that you want to speak of today, is it not contiguous. You're

saying there's different layers, that if you put them all together, maybe they get there, right?

A. Yes.

Q. And so the idea that somehow, as you talk about different layers of perm barriers alleged, that this they could somehow align with what Goodnight would have come up with, you've certainly not done any of that comparison or work either, have you?

A. I'm very confident of the work that I've looked at. And all data supports a perm barrier between the Goodnight injection zone and all the reservoirs above it.

Q. But that's not true and you know that's not true because I showed you'd the studies from the actual operators in this field, Chevron, in the Technical Committee Report, Dr. Lindsay's Ph.D. work.

How can you say there's no evidence of communication after seeing the bubble maps, after seeing Dr. Buchwalter's material balance simulation? How can you honestly sit here and tell the Commission that there is no evidence, some of this coming from the actual operator in the field, Chevron, of communication?

A. I've seen some interpretations, but me, looking at the data, I don't see any data that

supports that. And I have a different expert opinion on whether there's a barrier or not.

Q. So you agree that's different than saying that there's no evidence, right? You would agree that there's certainly evidence that has been received by this Commission that there is, in fact, communication?

A. No.

Q. Now, as we come back to your work here, I think we talked about this yesterday, you viewed your work as just picking and critiquing what other people did. You did not perform a ground-up analysis here, did you?

A. Well, on my analysis and due diligence is a ground-up from the actual hard physical data and evidence. And I use that to do due diligence on any analysis that I've seen. And in that process, incorporating all that true physical data, I can come up with some conclusions that I feel are valid.

Q. Had you ever, before today, mapped perm barriers within the 679 core?

A. No.

Q. Okay. So if on my fuss that this is all brand new and we haven't had a chance to look at -- core is king. You were in here when Ryan Bailey is like, "It's all about the core," like, we have to come

back to the core. Dr. Lindsay starts this thing with geology from the very jump. You start with literature studies, you have to understand the geology. After you understand the geology, you want to look at the core and study the core and make sure everything correlates to the core. You've heard all that testimony right?

A. Yes.

Q. But you didn't do the geology work out here?

A. I'm a geologist, so I think all my work is geologically rated, and engineering.

Q. In terms of stratigraphic analyses or lithological analyses -- I'm probably mispronounce lithology analyses, facies analyses, you didn't do any of that, did you?

A. No.

Q. Okay. And so coming back to core is king, before last night, you didn't even look in the core to try to see whether there were any barriers, according to you?

A. No. That is wrong.

Q. So why was it that last night you chose to put the blue blocks on there?

A. It was just a visualization of my analysis. I thought it would be representative and it would be

important for the Commission to see where those barriers are and how I came to my decision.

Q. Dr. Davidson talked about barriers, and he used a different methodology than you, didn't he?

A. Yes.

Q. And you have not done -- because you didn't map across the unit, you couldn't say whether your alleged barrier matches up in all respects with Dr. Davidson's alleged barrier, can you?

A. They probably absolutely don't exactly.

Q. As we're looking for a barrier, you don't know what Goodnight would have interpreted as a barrier. What you went off with the Commission on as a barrier -- and you talked about dolomite and the way your would barrier work, it's not like we can just go out there and say at the bottom of the Grayburg, at the top of the San Andres, here it is, we see it in core, this is the barrier, you can correlate it all the way across. That's not the kind of barrier you're talking about, right?

A. That may be present, but I haven't seen that.

Q. You're talking about this stringer-type system?

A. A plethora of baffles in a concentrated

stratigraphic interval that creates a vertical perm barrier.

Q. So as we talk about Dr. Davidson's methodology against yours, you would agree, probably your perm barriers wouldn't align with what he came up with, would they?

A. Not exactly, no.

Q. Additionally, Mr. Rankin showed you this cartoon. I'm going to try to get to it.

MR. RANKIN: Mr. Hearing Officer, object to the characterization of the exhibit as a cartoon.

HEARING OFFICER HARWOOD: Is there a question pending?

MR. WEHMEYER: I think Mr. Rankin just wanted to say this is not a cartoon. I don't think it was an objection in any serious sense, but maybe he wants to explain it.

HEARING OFFICER HARWOOD: Well, yeah, it's overruled. We've used that term before.

BY MR. WEHMEYER:

Q. Who created the cartoon?

A. I believe it was Preston McGuire.

Q. Preston McGuire. Okay. Now, Preston McGuire, do you know other than, like, as an internship, has he ever worked at an oil company, like

someone that would produce and extract oil and gas out of the ground?

A. I don't know.

Q. And as we talk about how one might create a cartoon, was this created before your work or after your work?

A. I actually don't know when it was created.

Q. So you didn't provide input into the creation of the cartoon, did you?

A. No, I did not.

Q. And, again, Mr. Rankin showed it to you. Do you know, did Dr. Davidson provide input to Mr. McGuire for him to create the cartoon?

A. No.

Q. And so I'm just trying to understand the thing. Because Mr. Rankin asked you questions about it. Can you see my cursor down here?

A. Yes.

Q. If the shaded areas is a barrier and water is being injected here -- do you see the little interval where they say there's injection?

A. Yes.

Q. And the water would move over here in baffle fashion, move over here, move over here. Here, there's no connection. You could move through there.

I mean, that is not an impermeable barrier, is it, with the way they've created this?

A. I don't see how fluid would move, as you've designated, through there.

Q. How not?

A. Vertical perm barriers.

Q. Where are the vertical perm barriers shown on here?

A. Well, there's gray lines that Mr. McGuire has put on there.

Q. Are you talking about the color shaded in?

A. Yes.

Q. What was his standard for deciding to shade something in?

A. I have no idea.

Q. What is the aerial distance between these well logs?

A. Probably a mile to half a mile.

Q. So you're talking about an entire mile in between this. And on what basis would you shade in in between? Because you said you've never even tried to map. And, in fact, you're confident you couldn't map barriers in between the various logs, could you?

A. I could. I didn't.

Q. Okay. What would be to basis? For example,

like right here, when you're talking about a distance of mile between logs, what would be the basis for putting a barrier indication right there in that triangle fashion?

A. Extrapolating data outside the wellbore.

Q. But he's got a log immediately to the left of it and it shows no barrier at all there. How would that be extrapolating to a log?

A. I don't know how he created these gray lines, or if these are indications or perm barriers. Is there a legend on here?

Q. I have no idea. You were asking about it and you testified off of this thing. So you're the guy I've got since you're the one under oath and decided to have sworn testimony about this Exhibit B-9 thing.

I'm trying to figure out what is it and how on earth could this thing have been created.

A. Is that a question?

Q. Is the answer you have no idea?

A. No.

Q. You don't know, or you do know?

A. Repeat your question.

Q. As I asked, since he asked you questions about this thing, in terms of what this is --

A. Wait. To the first part. Say the first part again.

Q. Mr. Rankin asked you questions about being -- the only reason --

A. Yes, I --

Q. My next question is, how on earth was this created?

A. As a geologist, this is a common practice. And you try to interpolate between wells, based on the log data. And it's both either stratigraphic, lithostratigraphic, chronostratigraphic, or a physical reservoir, or various techniques in extrapolating across these. It's a common mapping technique.

I'm very used to seeing cross-section and evaluating and looking at them. And right now, for this, as far as I see, this looks very reasonable. I'm not sure of the specific interpretation. You'll have to talk to Mr. McGuire about exactly what he used to extrapolate in between the wells.

But looking at the core data in the 460 well that's right next to the 679 well, I have 175 feet where predominant in that interval is low perm vertical barriers, it seems like his correlation across there, much like on your map over here that has San Andres going across the EMSU and the lost drilling

circulation at a similar depth across the EMSU, all indicates that these things are continuous across the EMSU.

Q. Here's my question. Before today, you have never been engaged here as an expert geologist to assess whatever these colored cartoons on and draw a scientific analysis on them, have you?

A. I don't think I was specifically asked to look at the color on this map.

Q. I would hope that before you would just tell the Commission this thing is accurate, you would do a whole lot of looking at logs, you would go back, look at core, you would go back and perform correlations, you wouldn't sit here and off the cuff look at cartoon, you don't know how it was created, and say this thing is accurate. Do you have that right?

A. I wouldn't say it's inaccurate. I have looked all the core data. I have not looked at these logs. I have not correlated them. I've looked at the perforated intervals on the injection intervals. I've looked at the perforated intervals on the water supply wells. And all of that informed my opinions.

Q. My question is on these cartoons. If I see these cartoons again, Netherland, Sewell has not performed an analysis on the accuracy of these

cartoons, has it?

A. Correct.

Q. And as far as you know, Dr. Davidson had no input on creating the cartoons; is that correct?

A. That's correct.

Q. And in terms of the methodology that Goodnight would use for establishing a, quote, unquote, perm barrier, you don't know that methodology, do you?

A. Not specifically, no.

Q. With respect to the idea that it would be pressure based, based on loss circulation fluid, I want to ask about picking tops off of engineering data, do you ever pick tops of formations? That's part of what you do. Yes?

A. Yes.

Q. Have you ever done it based off of engineering data and mud loses?

MR. RANKIN: Mr. Hearing Officer, I understand wide scope, but I didn't redirect Mr. Knights at all on any of this.

MR. WEHMEYER: If I can respond briefly.

THE HEARING OFFICER: Sure.

MR. WEHMEYER: Today we now have tops. We know what tops are. Yesterday, we didn't know where

the San Andres was, where the Lovington Sand was or where the Grayburg was. But today we do have top information, so I'm exploring how he picks tops.

THE HEARING OFFICER: Okay. Overruled.

BY MR. WEHMEYER:

Q. Have you ever, as a geologist, given a client an analysis in which you picked tops of formations based on mud losses?

A. Tops of reservoirs, not necessarily formations. Tops of reservoirs can cross formations.

Q. So the idea that you would pick formation tops, just using engineering data off of mud losses, that's not anything you've ever done. True?

A. Picking tops of formations, no.

Q. I'm sorry. It's the way I phrased the question. Let me just ask it so we know what the no is. That's my fault.

In the history of your career, you have never picked formation tops using engineering data and mud losses to define a top, have you?

A. To define a formation top, no.

Q. Additionally, you have never mapped formations based on mud loses, have you?

A. Mapped formations, no.

Q. Now, there was discussion about -- do you

remember Mr. Rankin's questions to you about Dr. Davidson's oil in place and the low case and the high case? And we visited about that earlier; do you recall?

A. Yes.

Q. And with respect to the 20 percent, do you remember also visiting about the 20 percent oil saturation?

A. Yes.

Q. You would agree that based on your testimony yesterday, that the feasibility of an ROZ starts -- if there's 20 percent oil saturation, you can start a ROZ under the Melzer and Dr. Trentham analysis?

A. Yeah. That's their definition of the minimum amount of oil you would need to --

Q. To start a ROZ?

A. -- start a ROZ.

Q. And we've covered that Netherland, Sewell's analysis omits all the oil, all the oil in place under 20 percent oil saturation is gone, right?

A. No. It's still there. It's just not in the oil-in-place calculation.

Q. You would agree here --

A. Well --

Q. Go ahead. I'm sorry. I didn't mean to

interrupt you.

A. Well, if you have a net pay and you have 10 feet of 30 percent oil saturation, all that oil from zero to 30 is counted in the oil in place. So your characterization of all the oil from less than 20 percent is excluded is inaccurate.

Q. If it's below a 20 percent saturation over whatever interval, it's out, correct?

A. Well, if you have an oil saturation at 30 percent, all 30 percent. It's not that differential of 10 percent.

Q. Right. But if it's anything under 20 percent, you've taken those volumes out, if that's the average saturation?

A. If that's the average saturation in the interval, then it is excluded as net pay, yes.

Q. But the way that the CO2 injection would work, that CO2 is going to migrate upwards, reducing viscosity as it goes through all the formation, isn't it?

A. Through all the formation is correct.

Q. And so you would agree that that would make the oil-in-place numbers conservative because within that zero to 20 percent, some of that oil is going to be recovered through EOR, isn't it?

A. Yes. That would increase the oil in place and reduce the recovery factor.

Q. You speak in terms of conservative or not all the time, I imagine, as part of your work. Yes?

A. Say that again.

Q. I speaking in terms of is this analysis conservative as a sensitivity analysis, that's something that's part of your day-to-day work?

A. Adjectives are always used, yes.

Q. So to put a point on it here, we know how EOR and CO2 works, that it's going to reduce that viscosity, that it's going to flood bottom to top. And that even if it's below that 20 percent threshold for an interval, CO2 will enter the interval and you will get some of that oil, right?

A. I would not say that that's a certainty.

Q. Is it a likelihood?

A. Probably not.

Q. But you would disagree that that would render the oil-in-place numbers conservative here where we know that everything below 20 percent intervals is excluded from oil in place?

A. In my opinion, they're realistic. But some people call me short for tall, I'm 5'6".

Q. This is this the last I have, just because

we've cracked open this deal with -- on Dr. Davidson.

I just want to be clear, and I think this will be helpful to Dr. Ampomah's questions yesterday, which we want to make sure it gets answered.

In terms of average oil saturations, based on core, did you go back last night and calculate average oil saturations at all?

A. No.

Q. Do you know that was something that Dr. Ampomah was asking about would be helpful?

A. Yes.

Q. Okay. Let's just take it in pieces. Yesterday we were talking about n values, and, in fact, the n values that would come out of Dr. Davidson's work, he didn't exclude any of those oil saturations in the core, right, all of them were used?

MR. RANKIN: Mr. Hearing Officer, I understand the wide leeway on recross, but I don't know how this relates to anything that I engaged with Mr. Knights on on redirect.

MR. WEHMEYER: He's brought back open the issue of volumes. This is a question Dr. Ampomah had yesterday. I think we can get it answered. If

Mr. Rankin can bring in brand-new testimony today, I think indulging three slides that will be less than 10 minutes will be incredibly helpful to the Commission.

MR. RANKIN: I'm trying to understand where I addressed the volumes. I may have misremembered how it brought it to the redirect.

HEARING OFFICER HARWOOD: All right. I'm going to give Mr. Wehmeyer the leeway on this. Overruled.

MR. WEHMEYER: Thank you.

BY MR. WEHMEYER:

Q. I'm not sure I'm going to be able to get this any larger. Can you at least read that there?

A. I think I got it.

Q. In terms of the spectrum of facies, we covered the spectrum of facies yesterday. In that bottom left, this was actually Dr. Davidson, he was speaking about oil saturations from that UT BEG paper. Was that the on Seminole; do you remember that?

A. Yes.

Q. What he was saying was that in wackestone and mud dominated packstone, based on the UT BEG, oil saturations that were reported there were up to 40 percent. That was actually an average. The average

oil saturations in the worst rock, wackestone and mud dominated packstone, on average was 40 percent at Seminole. Do you remember seeing that and hearing him testify about it?

A. I don't remember exactly what that is. There was residual oil zone or total oil?

Q. That was oil saturation -- what's the difference between residual oil zone versus total oil? Help me with that.

A. Well, residual oil zone is basically a residual oil. You can have oil saturations that are significantly higher than that. So I don't know what the average -- I just see residual oil zone saturations down here on the bottom.

Q. Yeah. And again, it's his chart. That's my understanding of what this is. You don't know?

A. You can call Dr. Davidson back. But if you ask questions that I can answer, I know some of what he does.

Q. But we saw yesterday, like, the magenta on the far right, if it's wackestone, based on his model, it immediately puts 92 percent water saturation into it, doesn't it?

MR. RANKIN: Mr. Hearing Officer, Dr. Davidson testified several times yesterday that

they did not use wackestones in the model. If Mr. Wehmeyer wanted to cross Dr. Davidson on this, he could have done so. He crossed Mr. Knights extensively yesterday on Dr. Davidson.

I don't see how this relates to my redirect or how it's appropriate to continue crossing Mr. Knights on something that is Dr. Davidson's work.

HEARING OFFICER HARWOOD: I'll allow it. It goes to weight, not admissibility.

BY MR. WEHMEYER:

Q. Again, all of these volumes, every bit of testimony you have here in terms of volumes, it all comes from Dr. Davidson's work, right?

A. Correct.

Q. And he used the facies model, and you're the geologist, correct?

A. Correct.

Q. And I would hope that you quality checked his data before you just plugged it in and offered sworn testimony. Right?

A. I reviewed it.

Q. Okay. So with respect to wackestone or worse rock, right, wackestone or worse, it immediately starts with 92 percent water saturation, doesn't it?

A. Based on the core data, yes.

Q. And we're going to talk about core data. But just based on these plots, does it appear that this would be consistent with Seminole in the BEG paper, where the worst rock facies has the highest oil saturations and the best rock facies has the worst oil saturations?

A. Can you repeat that question?

Q. Yes. So what the BEG paper documented was that it was the worst rock that would have the highest oil saturations, right?

A. Okay. I think I saw that yesterday. Yes.

Q. But, in fact, the plots that Dr. Davidson uses would never allow the worst rock, that's wackestone or worse, to ever get higher than -- get lower than 92 percent water saturation. Fair?

A. Fair.

Q. The majority of his rock was wackestone or worse, right?

A. No. I don't believe wackestone was even in his model.

Q. Even worse than -- I don't know what to call worse than wackestone. How about that?

A. Nothing to the left on this chart was included in Dr. Davidson's.

Q. It was all the stuff on the right?

A. Yes. Wackestone was not included.

MR. RANKIN: Mr. Hearing Officer, I believe that's a mischaracterization of Dr. Davidson's testimony.

We're getting on a path here where we're trying to retread Dr. Davidson testimony with a witness who did not do the work. If he wants to ask him about how the rock relates to the core, you know, that's fine. But we're totally getting off track here with Dr. Davidson's testimony.

HEARING OFFICER HARWOOD: It's this witness' understanding of Dr. Davidson's testimony. This witness has already testified that his testimony relies upon and was based upon Dr. Davidson's testimony. And he's already answered the question yes. Overruled.

BY MR. WEHMEYER:

Q. What we have here is core data. It has been -- just trying to get it to fit on one slide. Actual core data out of the 679, it's been sorted by rock types, so you can see the different core measurement points and different colors.

Do you see that the X axis is corrected core water saturation?

A. And how was that corrected?

Q. This is off of the Ops Geologic model, where they've corrected oil --

A. Which one?

Q. Ops Geologic's chief case. I'm not sure -- what do you mean, which one?

A. There were two.

Q. Off of the core.

A. Yes. Both of their models had different adjustments to the core.

Q. I'm going to get to the unadjusted next.

A. So is the --

Q. This is the adjusted.

A. -- high side case?

Q. With them correcting, the average oil saturation was 23.94 percent, and the San Andres was 21.44 percent. Do you see that?

A. Yes.

Q. But with respect to the n values, you would agree, if there's an n from the core, and as we bring this back to Lucia, if there's an n that goes over 10 or 11, that's highly suspicious, isn't it?

A. You know, a lot of this stuff is math, and when you start dividing things, you can get some erroneous numbers. But the data behind it is really the problem. So yes, there can be some erroneous

numbers in other calculations.

Q. But, I mean, again, just n -- if you're seeing n values over 11, isn't that going to give you some concern that something is off in this data?

A. I would go back and look at the data.

Q. Do you know that some of the core plots that Dr. Davidson used actually went over 100, went to 113, and he left those data points in?

A. That wouldn't surprise me.

Q. Working off of an analysis in which the n value was over 100, it wouldn't surprise you that he would leave that in?

A. When you look at petrophysical analysis, you have a lot of calculations, and these numbers can get out of whack. And I always go back and look at the actual data. And irrespective if whether the n vector was 200, I would relate that back to the actual core data and correlate it back and see what is validated to the core data.

And then I would go and look at different fields, as Dr. Davidson did, and he did five independent studies of his model. And he accurately predicted the saturations that occurred in five different fields.

So I think no matter how this person got

to the number, I look at the end results and compare and validate it to actual data, production data and other field data. And especially a blind test tells me a lot about the accuracy of the model. And if it had an n of 350 but it predicted all the actual data that I had, I would rely on that model.

Q. So, again, you're the geologist, we know you didn't study the core, but with respect to the core here, we know that you cannot add oil to that core. Whatever you have measured in the core, it's at least that amount or something greater, right?

A. Correct.

Q. And we know that it's going to be variable up and down the core as well, don't we?

A. The correction or just the --

Q. The variability of oil loss based on all sorts of different factors. It's not going to be uniformly lost from the top of the core to the bottom of the core. You're going to have different losses in intervals of the core?

A. You could -- does this analysis incorporate different B sub Os at every foot?

Q. My question is just, as matter of the physics, we know that as you move from top of the core to the bottom of the core, there's going to be

different amounts of oil losses in didn't places. Right?

A. Okay. Yes.

Q. And we also here don't know how the core was handled, do we?

A. I do not.

Q. And so as we talk about unreasonable n values, would you agree that an n value over 11 is unreasonable?

A. No.

Q. So an n value of 113, Dr. Davidson uses, it's not your testimony that that would be an unreasonable n value?

A. No. I would look at the results of the model and validate it.

Q. And, again, as we talk about the core here was handled, you don't know how long the core laid around? Which that can affect the oil measurements, as well, can't it?

A. Yes.

Q. And so you would take issue with Scott Birkhead -- and you issued a surrebuttal to Scott Birkhead, didn't you?

A. Yes.

Q. So Scott Birkhead says, "These ends are

unreasonable, if it's over 11, I'm taking that out. This is suspect data. We can't draw conclusions from this data that is outside" -- you would disagree with that methodology?

A. So he's eliminating that core data from his data set?

Q. If it's coming up with an n value over 11.

A. I think that's his interpretation. I think that's a valid way, his methodology.

Q. So Scott Birkhead is not crazy to eliminate what he's identified, if it's n over 11, this is suspect data, there's some problem here, this is not reasonable, I'm taking it out for purposes of core analysis? You agree that's valid methodology.

A. I think he used that as an interpretation.

Q. Do you agree that's a valid methodology?

A. After reviewing and corroborating it with the actual well data and the areas that we do have, production and core data, I think it didn't validate the analysis as much as Jim Davidson's did.

Q. Do you agree that what Scott Birkhead used in excluding data that was over an 11 n was a valid method? Yes or no?

A. I would say that is a reasonable petrophysical analysis.

Q. Would you agree using n values of 113 would be an unreasonable petrophysical analysis?

A. No.

Q. Now we have uncorrected averages in the Grayburg of 16.2 percent and 14.34 percent in the San Andres. Do you see that?

A. No.

MR. WEHMEYER: We just lost our monitors. I have two minutes and I'm done here.

HEARING OFFICER HARWOOD: Let's come back at 11:30. We'll be off the record.

(Recess held from 11:21 to 11:30 a.m.)

HEARING OFFICER HARWOOD: So before you begin, and hopefully -- I think you said two minutes. We'll try and hold you more or less to that.

Before we got to that, Chairman Rozatos, I'm looking at Goodnight's witness list. We still have Nate Holloman, Preston McGuire, Dr. Larry Lake, Tom Tomastik, and at least half of Mr. McBeath, whatever is left of his testimony, to get through for Goodnight. And we also have OCD with one, possibly two witnesses.

So what we're thinking we should do is, you all at some point, off the record, get together and figure out how you're going to allocate the

remaining time available in this proceeding to get this thing done by -- let me look at my calendar.

We recommence May the 19th, we have that week set. So I'm suggesting that you all compute the time and witnesses between now and, say, May the 21st, which would be the Wednesday of that week. And allocate the time amongst yourselves so that we get this case done by -- I mean, the goal will be by midweek, May the 21st. So if you all would get together and see if you can do the math and maybe come back to us tomorrow and let know if you've been able to reach any kind of agreement on that.

All right. Mr. Wehmeyer, go ahead with your what remains of your cross-examine.

MR. WEHMEYER: Thank you very much.

BY MR. WEHMEYER:

Q. Again, yesterday there was a question from Dr. Ampomah about looking just at core average oil saturations. And if those are average in the Grayburg before any correction whatsoever at 16.2 percent, does that align in general parameters with what you -- or you just never calculated it.

A. No, I had an average of I think it was 14.34 for all of it -- or 37 on one of my exhibits that didn't distinguish between Grayburg and San Andres.

Q. And if Ops Geologic calculated the uncorrected oil saturation in the San Andres as 14.34 percent, you would agree with that, disagree with that?

A. I would have for look. But it seems to me that that's high.

Q. And then if we take out what Scott Birkhead identified as the suspicious saturations in the core that is places that would have required an n over 11, or as high as 113 in Dr. Davidson's work, that would adjust to 17.2 percent uncorrected, but excluding the suspicious data in Grayburg, just eyeballing it, do you disagree with that?

A. The only thing it seems to be eliminating the very low saturations in the core.

Q. Where the n value would go over a 11 on a Lucia curve, right?

A. Yeah, so it's the low oil saturation in the core.

Q. And then, if uncorrected, if you take out those suspicious data points that would have n's over 11 would come to uncorrected oil saturations of 19.5 under Scott Birkhead's work -- and I understand your comment, you're saying, "I wouldn't take them out," but does that look, rough order of magnitude, like

that would be accurate?

A. I do not know.

Q. And then looking at the rock quality index, do you see, as we talk about the different quality of rock that's color coded, at the bottom against the plotted dots out of the core, do you see that?

A. I see the colors. And what are the numbers?

Q. Rock quality index. In terms of just looking at the lower quality rock, is going to be your blues and your teals, and the lower quality rock actually fits nicely with the UT Bureau of Economic Geology paper in terms of the expected 40-ish percent saturations in the lower quality rock and finding the lower saturations in the better quality of rock, or have you not done an analysis like that here?

A. I'm just trying to understand the plots. So the blue dots are poor quality rock?

Q. Yes. That's lower on the rock quality index.

A. The extremely suspicious saturations are all in the low quality rock?

Q. Well, the blue flags show up that way, that's right.

A. And those are the data that excluded from the analysis?

Q. Yes, for the column on the right. But if you look to the left, you can see that lower quality rock, there's plenty of those data points that fit nicely into the curves, don't they?

A. I don't see that really.

Q. I'm just indicating at these dark blue ones. Can you see them?

A. I see some blue ones over there. I see a lot more blue on the other side.

Q. And, again, you don't know how the core was handled. You do know that using those care data points would require extremely high n values, right?

A. Yes.

Q. And we know that based off of those core measurements, it could be significantly additional oil in there, depending on how it was handled, or expulsion, but it certainly can't be at least less, right?

A. Correct.

Q. And then this is literally the last question, I just want to make sure the commissioners are clear.

When you showed the one we were looking at, where you said you had spectral gamma, with the flag barrier on there -- are you with me on what we're

talking about?

A. Yes.

Q. Now, that is significantly farther south and east from the EMSU, correct?

A. That's I think four miles from the north end and three or four miles from the south end.

Q. And you had actually testified that, according to you, that was a completely different depositional environment down there, wasn't it?

A. I don't remember testifying to that.

Q. You've also talked about how nicely Dr. Davidson's model matches other EOR projects. Those are also, according to you, in different depositional environments, aren't they?

A. Yes.

Q. Wouldn't that give you concern, if he's matching that so closely, given that they're in a different depositional environment?

A. No. It seems like it would validate even more his model.

MR. WEHMEYER: Pass the witness.

HEARING OFFICER HARWOOD: Does OCC have any questions?

MR. MOANDER: No, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Rice?

MR. BECK: I do have some questions.

CROSS-EXAMINATION

BY MR. BECK:

Q. Mr. Knights, seems like again today there was confusion about your position yesterday, which I thought we cleared up, about the barrier across the EMSU that prevents communication from the disposal zone above the disposal zone, right?

A. Correct.

Q. And I thought yesterday you said that you can't say for certain that there is, quote, an impermissible barrier?

A. Correct.

Q. And today I think you said something that may have clarified that for me at least, and I just want to make sure that I'm clear on it, which is that you have found through the work that you've done that there's, today you used the phrase, "concentrated strata" that prevent communication, right?

A. Correct.

Q. What does that mean?

A. That means if you have a significant interval that a high percentage of your things are permeability barriers, that that interval would be a significant perm barrier for fluid migration, vertical

fluid migration. It would basically inhibit any fluid migration.

Q. So you're saying that it's possible there is an impermissible barrier that Mr. Wehmeyer has talked to you about, but you just haven't confirmed that?

A. Correct.

Q. But you have confirmed that there's concentrated strata that acts in that strata to prevent communication from the injection zone up above it, right?

A. Correct.

Q. Now, when we look at this map, I think today you talked about -- is this the Andre Dawson here?

A. Yes.

Q. And this purple color, I think you said was the first area that there was a little loss of mud, right, from the drilling?

A. Correct.

Q. And then if you look, the greater loss was at I think 4562; is that right?

A. There were three loss circulation zones in the Dawson. One significantly above at 4,000 feet, where they don't have anything. There's not one at 4,000 -- or 4315, where they had it. The first one that I had was right at the tops, the San Andres tops

by both Goodnight and Empire. And then below that, there was another total loss of circulation. I forget the exact depth, but it was somewhat approximately -- the colors are different on here. So it was right about in this interval that's just above the Ops Lower San Andres pick.

Q. So the third one where there was a total loss is just below that 4500 maybe at 4550 line, somewhere in there?

A. Defer back to the mud log that we showed just a little earlier.

Q. And then the second one we looked at was the Ryno SWD; is that right?

A. Correct.

Q. And so that total loss, according to you, according to the records you reviewed, was about at 4560, you said?

A. It was right about this -- again, the Lower San Andres pick by -- I think it's Ops, so I think it's right in this interval right there.

Q. So if we move that line down, then, this purple line, I think it's fuchsia on the slide, if we move that down to the Lower San Andres pick, it would be right about there where my pen is?

A. Correct.

Q. So that's continuing sort of the lateral or maybe a little bit lower line from those wells to the left. Agree?

A. Correct. And after reviewing the core data, what I see is that when you get close to Goodnight's San Andres pick, there gets to be significantly more perm barriers, but there are also some of those high perm streaks that get progressively, looks like, thicker as you get deeper.

And although we don't have core data, if we did, I think these purple lines would match up with significantly thick high perm intervals that are basically, you know, between 50 and 200, 300 feet below the top of the Goodnight San Andres structure.

Q. And so what I'm suggesting here is that when we look at the significant loss, that purple line, if we use just the significant loss, would be basically lateral and maybe moving down a little bit as we go cross this as opposed to these big up-jumps. Do you agree with that?

A. I agree.

Q. And the strata, I think you said yesterday, was -- I guess you called it the DMZ, the demilitarized zone was about 200 feet; is that right?

A. Correct.

Q. And then if we look at the Goodnight picks, and where that purple line would be, that's all right about 200 feet, right?

A. It's about 200 feet from below that pick.

MR. BECK: That's all I have, Mr. Hearing Officer. Thank you.

HEARING OFFICER HARWOOD: Thank you, Mr. Beck.

Pilot, any questions for Mr. Knights?

MR. SUAZO: No questions, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Back to Dr. Ampomah.

EXAMINATION

BY COMMISSIONER AMPOMAH:

Q. Thank you, Mr. Knights. So I do have a few questions. You know, a lot of different, you know, between yesterday, you know, what we went through and then today. So I just want to clarify that.

Can we have the core data that you showed with the blue boxes on for a moment? I just want to take one of them.

So I just want to clarify that. So you've highlighted the anhydrites. So just point out to the Commission how the anhydrite that we are seeing

here supports your perm barrier that you are using as a permeability to establish.

A. Using this core data, basically relied on the vertical perm and not a lithology.

Q. Do you review Dr. Lindsay's testimony about how he described the anhydrites that were shown on the core?

A. I'm not sure. Which?

Q. Okay. Do you know the type of anhydrite that we have here?

A. I do not know.

Q. Now, you are saying that these anhydrites -- so you are corroborating Dr. Davidson's testimony that these anhydrites are all classified as barriers and all of that.

I mean, you see anhydrite just beneath your minus 600 TVDSS, just the one that is highlights, and then you have bugs. You have a bug there.

A. Yes.

Q. So explain to the Commission how anhydrite being there and then a bug becomes something that you are certain that is a barrier?

A. Well, I think in the core photo I showed before, you had dolomite and bugs filling with anhydrite. So I don't think it's, you know, in

opposition to have anhydrite and a bug in a low perm interval.

Q. And you know that it's not all anhydrites that are classified as a perm barrier?

A. Correct. I think one thing I'd like to state is that there is a number of ways you can calculate a perm barrier. We had Ops Geologic use a method. Dr. Davidson used a method using log analysis and determining what he called from high density anhydrite layers, he interpreted those as anhydrite layers.

But, again, I think I go back to the actual physical data of the actual core. So this may not corroborate, and I think if I did another perm measurement using log data, I could come up with another interpretation of perm barriers.

But in aggregate, when you have multiple different analysis techniques, they come up with a significant number of perm barriers over a small stratigraphic interval, that those are just demonstrative of a vertical perm barrier.

Q. So the blue boxes that you've picked, is it your testimony to the Commission that these blue boxes, you know, where you do have Kv, let's say, and the 1 millidarcy, is truly a perm barrier?

A. Yes, I believe so.

Q. So would you invest -- assuming, let's say, you are going to delineate your area for your project, would you all use a perm barrier of, like, let's say, 1 feet, 2 feet, isolated to establish a perm barrier?

A. Maybe not a single 1-foot interval, but a number of 1-foot intervals over a relatively thin stratigraphic interval, I would. And there are some places where very thin layers are incredibly strong perm barriers.

Q. So you are using this to establish that there is perm barrier. Is this across the entire EMSU?

A. Using the data and the depth and the 460 log that is very close to this, and then after reviewing Preston McGuire's cross-section, it does seem like there's a lateral continuity in that zone across the EMSU.

Q. So if we dig deeper into Mr. McGuire's cartoon that was shown, I don't want to go much details with you on that, but if we review that, do you believe that it will corroborate this?

A. I believe so, yes.

Q. So, sir, is it your testimony that in our industry, we use loss circulation to identify

barriers?

A. Yes.

Q. Do we have reference?

A. Not that I know of, no.

Q. So then how do you convince the Commission without any well-established reference for us to more or less agree to that?

A. It's difficult for me to come up with a scenario where there's not a perm barrier, because the physical process are so dramatically different from the feet above it and the -- to me, it's impractical not to think of those as perm barriers.

Q. Yeah, I didn't want to go into the pressure discussion with you, but you brought it up again today. So you are able to use the pressure differences to more or less come up with different gradients within even the Grayburg. And then are you saying that this is attributed to the potential perm barriers?

A. Correct.

Q. Did you research into that to corroborate that with the production history?

A. No. I used the difference in pressure gradient, assuming that the entire Grayburg was at some state in 1926 before any well was drilled, that

it was in pressure communication and a constant. And so any differential in pressures would be obviously from the production that was done.

Q. And then did you also analyze the waterflood performance and attribute that to your assessment?

A. Repeat that one.

Q. Did you also utilize the waterflood, the four-month period, to support your claim within, let's say, these perm barriers?

A. Yes. I mean, the waterflood within the Grayburg showed very isolation and different depletion in multiple intervals, indicating that there were perm barriers even within the Grayburg, and then extending down in the core, seeing that it's in the Grayburg.

And as you go towards the San Andres, the top of the San Andres, as Goodnight picked it, and as the Empire group picked it on this cross-section behind me, that as you approach that, these perm barriers become increasingly frequent.

And I think it's pretty much credibly strong evidence that around the top of the San Andres that that is a perm barrier in aggregate and in individual across the EMSU.

Q. So you talked about the unitization documentation, and I think I have that. You said the

San Andres -- or you read that the San Andres was included in the unit because of the water supply?

A. Correct.

Q. I want to ask you, was it to the benefit of the unit holder, or to everybody?

A. To include it as the operator of the unit, would benefit if they had both the water supply, water disposal and the oil and gas unit.

Q. So it was specifically to the unit holder?

A. Specifically to the unit holder?

Q. Yeah, to the unit operator?

A. Yes.

Q. Now, if we are using that as a criteria, explain to the Commission why the Commission should allow external water with exceedingly high TDS comparable to even that salinity within that area. You know, would that not defeat the purpose of the -- in the long term, the water supply wells?

A. If there was a large continuing waterflood, I would say it would be. But I think there are probably other sources of water.

Q. So compatibility will not be an issue here, or shouldn't the Commission even consider compatibility of water that is coming in and the water that is there that could be utilized as a waterflood

in the Grayburg?

A. Yeah, I think the Commission should consider the availability of water compatibility in the waterflood and where that alternative water may come from.

Q. So when Empire talks about there's a high possibility that there could be some high level of scales, that even is not easy to treat, should the Commission not consider that?

A. I think the Commission should consider everything possible.

Q. My last question to you, when Mr. Beck talked about concentrated strata that represents communication barrier, I mean, can you show the Commission a cross-section to really establish this?

A. Across -- could you repeat that question?

Q. So he said -- you've testified that you support the assessment that there's a concentrated strata that represents the communication barrier; is that correct?

A. Yes. Correctly.

Q. And I'm asking you can you show a cross-section, a well established cross-section that is supported by a core, that is supported to mud logs, that is supported by logs to establish this statement?

A. Yes. I think the 679 core establishes the vertical perm barriers towards the top of the San Andres in this well. I think the 300-foot well on the EMSU 460 that's 300 feet away says this interval is correlatable if you -- if I could corroborate Preston's cross-section or if you believe that cross-section that this interval that has established perm barriers from this core data is correlative across the EMSU.

And I think the cross-section provided by Empire here shows that all of the geologists previous that have picked the San Andres, I didn't, but that is kind of continuous across the EMSU.

Q. Thank you.

HEARING OFFICER HARWOOD: Thank you, Dr. Ampomah.

Mr. Lamkin, any additional questions for Mr. Knights.

COMMISSIONER LAMKIN: I just have one question.

EXAMINATION

BY COMMISSIONER LAMKIN:

Q. Would the heterogeneity of this interval that we've been discussing and the inconsistency of these low permeability zones affect formation parting

pressure?

A. I would assume it would, but I do not know. That's not my expertise.

COMMISSIONER LAMKIN: Thank you.

HEARING OFFICER HARWOOD: Mr. Rozatos, any questions for Mr. Knights.

CHAIR ROZATOS: I do not, but thank you Mr. Knights for your time. We appreciate it.

HEARING OFFICER HARWOOD: Mr. Shandler, don't want to leave you out.

May this witness be excused?

MR. WEHMEYER: Yes, on behalf of Empire.

MR. RANKIN: Mr. Hearing Officer, I'm sure Mr. Knights has far better things to do at this in his life, so yes, I ask that he be excused.

HEARING OFFICER HARWOOD: Before we break for lunch, you can you tell us who your next witness will be.

MR. RANKIN: In consultation with Empire's counsel, Mr. Hearing Officer, we were going to resume the cross of Mr. McBeath. I'm going to make sure during the lunch break that he's available. And depending on how long that goes, then we would move into the direct testimony of Mr. Nate Allman. And then we were hoping to have Mr. Lake available if

necessary this afternoon, because he's scheduled to fly in this afternoon and arrive in Santa Fe at 1:30. However, his flight had issues so he had to take another route and he's arriving in Albuquerque this evening at 8:00.

So if we happen to finish Mr. Allman early, I would ask that we be able to resume with Dr. Lake in the morning. I know that we can't start till 10:30. But that's my request of the Commission.

HEARING OFFICER HARWOOD: So after lunch, you'll be back up with Mr. McBeath. All right.

MR. RANKIN: And just to be clear, Mr. Hearing Officer, and counsel understands this as well, Mr. McBeath will be testifying via the Teams platform.

HEARING OFFICER HARWOOD: Well, we hope he will, given this morning's technical activities.

Mr. Chairman, what's your pleasure in terms of when we should be back here.

CHAIR ROZATOS: Let's come back at 1:15.

HEARING OFFICER HARWOOD: And if you all have time or the opportunity to discuss scheduling of the remaining witnesses over lunch, that would be appreciated. All right. Thank you we'll be adjourned till 1:15.

(Lunch recess was held from
12:00 to 1:15 p.m.)

HEARING OFFICER HARWOOD: I believe I see a familiar face there on the platform. Is that John McBeath I see?

MR. RANKIN: Yes, it is, Mr. Hearing Officer. Mr. McBeath is on the platform.

HEARING OFFICER HARWOOD: Mr. McBeath, you're on mute.

MR. RANKIN: Mr. MacBeath, can you hear us.

CHAIR ROZATOS: Mr. Rankin, you may want to double alcoholic that he's connected to the sound.

MR. RANKIN: Mr. MacBeath, can you hear us now.

HEARING OFFICER HARWOOD: Mr. MacBeath, it's been a few days, so just to err on the side of caution I'm going to put you under oath again, if you would raise your right hand.

Mr. Wehmeyer, take it away with your cross-examination.

JOHN MCBEATH,

having first been duly sworn, testified as follows:

CROSS EXAMINATION (Cont'd)

BY MR. WEHMEYER:

Q. Mr. MacBeath, can you hear me okay?

A. I can hear you fine.

Q. I'll apologize in advance with the cumbersome procedure with doing this remotely.

And so much time has passed. I think when we left off last time, we had moved in your analysis over to talking about commodity price as part of the economic case. Does that square with roughly where you think maybe we left off, we were talking on price?

A. I think that's right.

Q. And just in terms of your economic model, we did cover this, but I just want to hit a couple high points so that the commissioners understand what you did.

You obviously had the economic case that was prepared by Empire in the first instance which had, as part of the economic case, assumptions in like pricing and had assumptions in it like operating costs, had CapEx in it, had curves for recovery factor, and then obviously has volumes, oil-in-place

volumes to start with.

Does that generally square with what you remember in terms of the economic case you had from Empire?

A. With a couple of little comments or corrections. So there's not really a recovery curve. There's a dimensionless curve. And if you stop the CO2 injection at a particular time, that will define recovery. That's how it works in the model. And so with that clarification, I think I agree with what you said.

Q. Okay. And so just coming back, obviously you had critiques of the model. But you did not build your own ground-up economic case here as part of your work, did you?

A. I did not build an independent model. I used Empire's as a starting point and then made corrections to it.

Q. So we talked last time, and again, I'm not going to rehash everything we covered last round, but at a real high level, you critiqued the dimensionless curve, but didn't build your own curve?

A. No, I did not.

Q. Then with respect to operating expenses, you didn't do a ground-up operating expense analysis.

Basically, your chief criticism of Empire here was their use of a dollar MCF on CO2?

A. Okay. So you're calling the CO2 expense an operating expense. That's right, because the assumption was, and this comes from Mr. West's deposition, that because of 45Q tax credits, that he thinks he can get the CO2 for 50 cents and MCF cheaper.

And so I was concerned about the certainty of that assumption. So to show the show sensitivity of economics to this factor, I ran it with and without that 50 cents.

Q. So basically, the difference between $1 and $1.50?

A. That's one of the variables I changed, that's right.

Q. And I'm just trying to bracket this for the commissioners to simplify the remainder of the testimony so we know the points we're fussing over and not.

Other than moving CO2 from $1 to $1.50, and I put it in an OpEx or an expense category, is there a better way I can speak to this to be more accurate?

A. I think it's broken out as a separate CO2 expense in the model. But I just wanted to make sure

we were on the same page, because I didn't change any of the other OpEx numbers in their model.

Q. So as we talk about the expense case, you didn't change anything on CapEx, did you?

A. I did not.

Q. And you didn't change anything in any of OpEx case except for under your model, you ran it as $1.50 CO2 instead of $1 CO2?

A. Correct.

Q. Was there any fuss on the volumes of CO2? Did you quantify that in your analysis?

A. I did not. I did not touch the volumes versus recovered oil. Well, let me just make a clarification.

In my corrections, because you changed the hydrocarbon pore volume of each pattern when you changed the porosity and the saturation, you reach the -- the amount of CO2 that's required for those lower hydrocarbon pore volume runs is going to be less just because you've reduced it. And the model is set up to shut off after three pore volumes, hydrocarbon pore volumes of CO2.

Q. Whose model?

A. Empire's model.

Q. And in your model, did you adjust that?

A. It automatically adjusts so that it stops at three hydrocarbon pore volumes of CO2.

Q. So your model is the same or different? And if it's different, in what way?

A. Well, I think we're talking past each other. I was trying to be helpful with this clarification, but maybe it wasn't all that helpful.

All I'm saying is, if you compare the unadjusted West run, the one that we were given from Empire, if you compare that to my runs, there's less CO2 because the hydrocarbon pore volume is reduced when I adjust the porosity and the oil saturation. Because I stopped it at the same hydrocarbon pore volumes, three pore volumes, which equates to the same recovery factor.

Q. Okay. So you actually use less CO2 in your model?

A. Yes, that's correct. In certain runs, that's right.

Q. Just as we talked about variables, for the commissioners, to simply this down in terms of what the fuss is, really on all that expense case, the volumes of CO2 are pretty close, don't, you know, move the end point that much. It really here is that change over $1 CO2 versus $1.50. Is that generally

fair?

A. I don't think I made the runs with only the CO2 price change, which I'd have to do to answer that question, because I kind of accumulate the changes. I either use a flat price, a futures price, and then with and without the CO2 change.

Q. And now I'm confident we talked past each other. I'm not getting to revenue yet. I'm just focused on the expense side. So we're just talking about everything on the expense side, and we've covered you didn't build your own model, what you've done is started with the Empire model and critiqued it and adjusted dials as you saw appropriate.

On the expense side, is the only dial you adjusted the cost of CO2?

A. That's true on the expense side.

Q. Again, we'll just cover this at a high level so we've got it framed up.

On the revenue side, the only thing you changed was running it at a couple different price tags. One would be a flat deck and one would be a Nymex that actually would move oil prices to less than a flat deck on yours?

A. Those are the changes I made to the price deck. But, again, you mentioned revenue in the first

part of that question, and price definitely affects revenue, but so does produced volume. And when I adjust the hydrocarbon pore volume for each pattern, that means we're producing less oil, so that has an effect of revenue, too.

Q. And then by way of volumes, the volumes of recoverable hydrocarbon, all of your volumes, you didn't do a ground-up reserve analysis there. You used the volumes that came from the work of Dr. Davidson and Mr. Knights; is that right?

A. I think it's going to be exclusively Dr. Davidson.

Q. Okay. So now I kind of just want to dig into each of these, but are there any other variables between the work that Empire did versus the work that you did that you think is important to point out before we start talking about these categories of differences?

A. On economics?

Q. Yes. I'm not talking about barriers or anything at this point. Just economics of the CO2 EOR project that Empire has presented to the Commission that it intends to carry out.

A. You've covered all the changes I've made to their economics.

Q. So let's just take the volumes very briefly. You heard that came from -- you said you got those straight from Dr. Davidson?

A. Well, I got the log files from him. And then I did the averaging myself.

Q. Okay. But, again, that was all of his work, that was what we heard here in terms of the petrophysical analysis and facies changes and sort of thing, right?

A. That's right.

Q. And so I know how much you've hear, and I know you've been remote here, have you been monitoring all these proceedings, since you haven't been here in the examination room?

A. For the most part. Not every single minute. But for the most part, I either had my phone with me or here at my computer.

Q. Very good. Now, by way of facies selection, you, by training and education and certification, are an engineer, right?

A. That's true.

Q. And I think it was covered at the deposition that you could look at a log, but you being an engineer, you're never going to be the guy that actually goes in and is picking tops, right?

A. I don't recall if that came up at the depo, but I mean, I do pick tops in my work sometimes. Sometimes they're easy, sometimes they're not easy.

Q. In a situation like this, in terms of picking the top of the San Andres or the Lovington Sand, the Lower San Andres, that's nothing you've done here, correct?

A. Except for three wells that are mentioned in my original statement that surround the 211.

Q. Those three wells being what?

A. They're three water supply wells.

Q. And what --

A. 457, 458 and 159, from memory. But they sort of form a triangle around the 211.

Q. What was your methodology used for picking those tops?

A. Well, on those, I went and looked at what the original operators had picked and used those tops. If that's not picking the top, then I'm not going to argue with you.

Q. And I think we talked a little bit about, you know, looking at and analyzing. But in those instances, you just went to the Commission file, took what the operators used and adopted that?

A. That's true, yes.

Q. You weren't looking at core, you weren't correlating logs; there was none of that kind of work as part of that?

A. Yes. Absolutely true.

Q. Given that Dr. Davidson chose a facies model -- and you heard that he didn't do any of the geology work here. Did you actually hear his testimony that he is not a geologist and not purport to opine as a geologist?

A. I think I remember him saying he wasn't a geologist.

Q. Doesn't that give you concern, that he built an entire facies model with respect to his petrophysical evaluation and is not a geologist and didn't do any of the literature searches and outcrops studies, lay eyes on the actual cores? In terms of your model being -- your economic case being wholly dependent on his work, doesn't that give you concern?

A. No. My discussions with him about the way he analyzed the different intervals suggests that it was rigorous, that it was based on standards that have been around for a long time. Yeah, it doesn't give me any concern at all.

Q. With respect to n values, in an Archie's equation those are things you use as part of your

work?

A. Yes.

Q. If you're seeing n values that are between 10 and 113, would that give you concern about the reliability of that data and how it should be used?

A. Well, tell me what formation we're in and I'll answer that.

Q. San Andres.

A. Well, I think there's a really good discussion in Dr. Davidson's original statement. There's an appendix about the different types of saturation models that have been developed. He discusses why Archie's doesn't work well in oil wet intervals.

So you know, we're talking about Archie's and maybe back calculating n zones that are either not reservoir or very poor reservoir or perhaps leaning towards an unconventional zone. So I don't know the utility of back calculating an n and then using that as a basis to throw away some core information.

Q. With respect to Dr. Davidson's work, you certainly can back calculate and n out of that, can't you?

A. I suppose -- it looks like somebody did it.

I haven't done that. I haven't looked at it.

Q. With respect to plotting the measurements from core, and I don't want to beat this dead horse, but, you know, with respect to the core here that we have out of the 679, you don't know how the core was handled, right, how long it sat around before they got around to measuring?

A. Personally, I don't, no.

Q. So you know that the lost oil will vary by a number of factors, including things like gas expulsion?

A. I generally know that, but that's not to huge portion of my practice, looking at cores and thinking about cores.

Q. Additionally, just in terms of how long the core sat around, that could also, through evaporation or otherwise, lead to loss?

A. I suppose it could if there were extremes to that. In my experience with cores, you're taking -- they're expensive so they're handled carefully and sent off to labs pretty quickly.

Q. In this particular instance, so on the plot where you have ends up to 113, that would be part of the data plot that Dr. Davidson used. Again, just the first question I had that kind of started this, based

on your work, I mean, if you're seeing an n that high, isn't that kind of a red flag that you think something is wrong here with the data point?

A. Honestly, I didn't see a chart that had n equals 113. And maybe I missed it when you were showing that to Mr. Knights.

But I think back calculating n's using Archie's in an oil wet carbonate, I don't really understand the utility of that.

Q. As we continue to talk about volumes, you heard the testimony that if something had -- if it had less than a 20 percent oil saturation for the interval, all of that oil would be excluded from the oil-in-place case of what Dr. Davidson gave you. Yes?

A. I heard a lot of questions about that. I'm not sure I'm familiar with how that map or those summations were done. I just don't know.

Q. Stated differently, in terms of your opinions here in the economic case, you don't know whether oil saturations below 20 percent would have been excluded from the oil-in-place volumes that you used for your economics. True?

A. Oil in place. So I took my averages directly from the LAS files that I got from Dr. Davidson. I don't know if those LAS files in that

process is where this reduction that you're suggesting occurred or if it occurred once a subsequent calculation was made for oil in place. I don't know.

Q. And, again, that's I think exactly the question here, is with respect to the files that you've got and the oil-in-place volumes that you used for your economics, you don't know one way or the other whether all of the oil under 20 percent saturation interval would have been excluded from that, you don't know that one way or the other as you sit here, do you?

A. I don't, no.

Q. If it was excluded, you would agree that some of that oil in an EOR is actually going to be recovered here, wouldn't it?

A. Which oil are we talking about?

Q. Oil that would be between zero and 20 percent in saturation intervals of zero to 20 percent. And I'm not saying you're recovering all of it. But some of those volumes would be recovered?

A. Depends on if you could efficiently and effectively contact it with CO2.

Q. With respect to miscibility studies or the effective contact, is that anything that you've done here?

A. I have not. I have noted the absence of miscibility studies in the work that Empire presented and the data they gave to us and --

Q. And, again --

A. -- the importance of miscibility.

Q. I apologize, I'm stepping on your answer just with this remote procedure. I apologize for that.

A. I paused. It's my fault.

Q. Now, so, again, if the Commission wants to see a recovery factor here, in your models, that's not work you've done, that's a variable between the Empire work and your work that we have to fuss over, is it?

A. In the economics?

Q. Yes.

A. That's true in the economics. I did some recovery calculations on the Tall Cotton.

Q. But, again, in terms of the economics presented to the commissioners here for the actual EOR development of the EMSU, you haven't done that. True?

A. That's true. I didn't mess with their recovery factor. I didn't. I left it alone.

Q. And we talked about Tall Cotton, and that has come up in both Dr. Davidson and Mr. Knights' testimony. I'm not going to beat that dead horse

again. But when we showed the graph that came out of the Goodnight presentation, do you remember it tracks that Tall Cotton production and then it falls off?

A. Which Goodnight presentation are you talking about?

Q. I actually think the same graph that's been shown multiple times, but I think maybe even you showed it. It's the green plotted graph of Tall Cotton oil production.

A. My graph is different than Mr. Knights'. He did it on a log scale. Mine is Artesian rate versus cum. But they are both green, I'll give you that.

Q. Let's talk about yours because you're familiar with that one for sure. And I just want a reality check, because there's been testimony from Mr. Melzer about fracking in the injection wells.

But as an engineer, just knowing what you know about EOR projects, if you're looking at that curve off of actual data points, wouldn't some flag go off in your head that's there's an engineering technical explanation for this, as opposed to, you know, a typical decline that you would expect through the production of hydrocarbon?

A. I mean, there are some jumps in that curve. It's a relatively small project. Normally when we're

looking at data relating to a CO2 project, there's going to be many more wells, injectors and producers. So the effect of one or two wells would probably be muted on most of the curves we look at. Tall Cotton is a little smaller, so one or two wells coming on or off or having a problem could impact that curve like we see those changes.

Q. And just in terms of reality checks here, as an engineer, if you just look at that graph, you're going to go looking for some kind of a technical engineering operational explanation as opposed to there just being no more hydrocarbon to be recovered? Wouldn't that flag to you that this is something that needs to be investigated from an operations technical perspective?

A. Well, the reason we looked at Tall Cotton is its unique because you don't have very many opportunities to look at production data and know that it only came from an ROZ. If you're in a field like Wasson or Seminole San Andres, where there has been ROZs, they're almost always lumped with the main pay. And they're also -- you have the problem in Texas where you don't have individual well production, you've got one production number for the entire unit for the month. That's why I looked at it.

Now, I heard one of Empire's witnesses talk about the allegations of problems with wells. But, typically, when stuff like that happens, there's not going to be a filing at the Railroad Commission for me to go look at. Operators don't memorialize failures like that, typically. So I don't know where I'd go to look to investigate that.

Q. And I don't think I got an answer to my question. This is a simple yes or no.

As an engineer if somebody brings it to you and says, "Look at this curve," just looking at that curve and how drastically the parts -- you can't draw a nice clean line through it, as a good engineer, isn't there going to be a flat that you say, "I want to dig farther into this"?

Now, I'm not asking about what's publicly available, but wouldn't you have a flag that makes you suspect that there's something, technical ops, engineering, that would explain that decline?

A. I don't have it in front of me, but if you look at that part of that curve where I did put the line, I am comfortable extrapolating those operations out into the future. And I took it to a zero rate, which is conservative. Nobody is going to produce down to zero because they can't afford the OpEx to do

that.

So if there's some stuff going on prior to that, but that's also in times where we're adding ten-acre changes and we're adding additional wells, so I really don't see anything in that plot that tells me I shouldn't extrapolate that into the future.

Q. And my question s if you looking at this for a client, you're telling this Commission that that graph is not anything that would trigger something in your head that says I need to investigate this from an ops technical? Is that the answer to that no, you're satisfied with it? You would take --

A. If you look at where I extrapolated that, there's nice smooth data, so the answer is no.

Q. Now, moving over to the CO2 case and that variable, you say not a buck, a buck-50, and the 45Q credits is your basis for that difference?

A. For that difference, yes.

Q. Now in terms of actually assisting client in securing 45Q credits, that anything you've ever done?

A. So we've had a number of discussions about that with clients, and I don't think we've ever been involved in the actual, I don't know what they call it, accounting or tax filings for that. But we've helped people look at what could be required for proof

that the CO2 is going to stay where you're injecting it.

Q. But the actual process of seeing it all the way through to secure the credits, have you done that all the way through a project for a client?

A. I don't think very many people have done that yet.

Q. And so here, in terms of telling the Commission about your practical experience about being unsuccessful in securing 45Q credits or successful, you can't share with the Commission any personal experience with that, can you?

A. The reason I did that change to the variable was because if you look at the economics from the standpoint of an investor, sort of kicking the tires, that's a pretty unsupported assumption to just remove 50 cents or MCF for the CO2 price. And so I wanted to see the effect of that on the economics, so you put the 50 cents back in.

Q. And, again, Mr. McBeath, if you'll just help me by answering the question I'm asking, and then we can move on to the next one, and this will all go quicker.

My question was, in terms of actually seeing a 45Q project through for a client and being

successful or unsuccessful securing those, that's nothing that you have experience with that you could tell the Commission about?

A. Not with the actual tax credit, that's right.

Q. And then you said it would just be something an investor would want to consider, that it would not be a certain of getting that 45Q tax credit to bring CO2 down to a buck. That's basically what you were conveying there?

A. Sure. I think any investor would want to know how certain that was.

Q. Wouldn't they want to also know if a commercial saltwater disposal operator is injecting hundreds of thousands of barrels of saltwater into the recovery unit?

A. If the injection is taking place in a zone that you're going to try to do a CO2 flood in, that's right.

Q. So that the commissioners, as they make their decisions in this case, in talking about what an investor would want to know about before starting a tertiary project here in the San Andres -- are you be me so far on what we're talking about?

A. Yes.

Q. -- you can tell them that an investor would absolutely be aware of and concerned about saltwater injection into the EOR tertiary flood area. Yes?

A. Yes. As long as we're on the same page. As long as that hypothetical CO2 flood is in the zone where the saltwater is being disposed of.

Q. And you've heard Empire's testimony that their intention is to flood the entire San Andres, lower and upper, right?

A. I've heard two version of that testimony. One at a deposition in December, where Mr. West said the model was the top 400 feet of the San Andres, "which we relied upon to do our work." And then I heard that changed to include the whole San Andres.

Q. And, again, in terms of investors, you understand that Empire here is publicly traded. And there has been discussion about whether they would need to raise money or not to pursue the project, correct?

A. I know they're publicly traded.

Q. Just bringing this back to reality checks. They wouldn't have to bite off on $1.2 billion of CapEx to carry the project out. You would probably start it at a far smaller capital expenditure on 10- or 40-acre spacing across a section, you know, high

grading based on your what you think the best areas are, wouldn't you?

A. That's possible, as long as you can contain the CO2 on the lateral edges of that.

Q. Okay. And so, again, as we bring it back here to just giving Empire a chance, I do remember we covered this. The minerals here are owned approximately 60 percent by the State of New Mexico, about 20 percent by the BLM, and about 20 percent by fee, right?

A. I think you reminded me that those numbers came from the unitization proceeding. So I don't recall them exactly, but I'll take your word for it.

Q. Okay. And the concept, we all agree here that what would be the most likely case is you would go in on 10- or 40-acre spacing across the section or more or less in terms of proving up the concept. And I guess just in terms of that, obviously, there's going to be a lot of engineering, a lot of geology, a lot of petrophysical analyses, where they're going to try to pick their best spot, right?

A. I expected to see a lot of that prior to this hearing. But if you tell me -- if I assume that there's a project going forward, I can also assume there's a lot of work to be done.

Q. This EMSU, this field -- not the EMSU. But this area has been producing since the '30s, yeah?

A. Maybe even before the '30s, yes.

Q. Was it late '20s, early '30?

A. I think early '20s some of the discovery wells.

Q. Isn't that one the prerogatives of an oil and gas operator, when they own that oil and gas lease, is to develop and plan their developments, you know, at the pleasure of their own timing as long as the lease is being held?

A. There might be some royalty owners that would disagree with you on that.

Q. You're not aware of any failure-to-develop lawsuits out here, are you?

A. No, I'm not.

Q. Again, coming back here, in terms of the tertiary recovery, it's not a fair criticism of Empire that they don't have all the models built to your satisfaction from an economic case because this has all been rushed as a result of this injection of this saltwater disposal. Empire has not been allowed --

MR. RANKIN: Objection to testifying by Mr. Wehmeyer.

HEARING OFFICER HARWOOD: It is a bit of a

narrative, Mr. Wehmeyer. Maybe you can break it up.
BY MR. WEHMEYER:
Q. So part of your fuss, and you've talked about this in your filed papers with the Commission, is that you expect more data, right, from Empire?
A. More analysis, I would say.
Q. With respect to more analysis, again, you understand that there is an urgency here to Empire bringing this to the Commission as a result of these vast volumes of saltwater disposal being injected into the San Andres, correct?
A. I mean, I can -- you're telling me that Empire has urgency? I don't know. That's not an engineering term. I'm not sure how I'd incorporate that into my work.
Q. But in terms of the relative volumes, which I don't want to show the graph again, but you've seen that stacked graph with the orange on top and the blue on bottom. I mean, these volumes that Goodnight is bringing into the EMSU are in scales vastly more than what has ever happened historically here, right?
A. Well, I mean, there's been a longer time historically. So you'd have to add up all the disposal in the past and compare it with what has happened in a relatively short time. I haven't done

that.

Q. Now, coming back to the $1.50, just as we talk about the expense side, the $1.50 versus a buck, you said, well, an investor might not be willing to take the uncertainty of this being dollar CO2 with the 45Q credits, and they might want to model in a buck-50, right?

A. Or more. I even think the $1.50 base number is kind of low.

Q. Have you brought any studies or anything in your written filed statements that explain how the buck-50 is low?

A. Now, I haven't. There's very little public data on CO2 prices. So you can hear stuff on the street, but that's about it.

Q. So as we talk about CO2 prices at a buck-50, you just said there's very little data on it, what you hear on the street. As we talk about uncertainties in your assumptions in your model, you can give me that a buck-50 is also an uncertainty in your model. Yes?

A. Well, in mine and in Empire's, that's right.

Q. And Empire could look at this from the economic perspective of: We're confident, we're going to get the 45Q credit and $1 good for us to proceed. Right?

A. Yeah, they can do whatever they want, I guess.

Q. And, again, this comes back to shouldn't they at least be given the chance, given that they own these leases and this unit has been established for decades?

A. So I think that's a question that the Commission will struggle with. But my analysis was to look at the information available to try to see -- the reason I only messed with, you know, three components, with three variables in the economics, is I looked at those three obvious ones and it drove the economics south.

If I had sharpened my pencil and did more work on the recovery which I think is too strong at 18 and a half percent, I would have gotten even further sort of negative. So my understanding is, and I'm not a lawyer, but we're talking about whether there's really waste here or not, and my understanding is that for something to really be waste it has to be economically viable. And that was the purpose of my looking at those economic calculations.

Q. As we talk about economic viability in this variable of the cost of CO2, you've already given me that, according to you, that's uncertain, not a lot of

public data, what you're working off of is, quote, word on the street, right?

A. No. What I said was I think that the $1.50 is low and I think if we were to investigate that, you know, either get information from suppliers, it would be higher than that, which would drive the economics down.

Q. If Empire is successful getting the 45Q credits to bring CO2 down to a buck -- you with me so far on the assumption?

A. Yes.

Q. -- you have not offered the Commission any opinions under the hypothetical that they're successful with the 45Q credit that the dollar is wrong, have you?

A. I have not.

Q. So, again, if Empire is willing to accept the case that it will get those 45Q credits and bring it down to $1, I mean, I guess really what we're fussing over at this point then, is whether they can get the 45Q credits, because if they get them -- are you with me so far on the hypothetical?

A. If they get the credits?

Q. Yes.

A. Yes, I'm with you.

Q. -- you would not have a different CO2 price to share with the Commission besides the buck that is in the Empire model that they've already testified to; isn't that right?

A. Well, assuming I wasn't allowed to revise my calculations, I guess you're right.

Q. Now I want to move on -- and I'm sorry, I jumped over the buck-50 where I wanted to tie the loop around this.

As you talk about initial development of a section or more than a section or maybe a little less than a section, if we're focused on that, obviously there's going to be a lot of science and a lot of engineering that would go into picking what section that happens on, right?

A. Okay. You said I talked about development of a section?

Q. No, sir, I'm sorry. I missed on the question.

Earlier, we were talking about just the development, that you wouldn't do this across 14,000 acres or 10,000 acres on the first day. You don't go out with $1.2 billion on day one. You're going to start on smaller scale, right?

A. It's possible you would implement areas of

the field sequentially, that's true.

Q. And as you work sequentially, I'm just trying to get the Commission a rough sense on geography, are we talking here 640 acres? Would that be reasonable to you? Bigger? Smaller?

A. I can't really answer that, as I sit here. I'm not sure.

Q. Is that just because you don't have experience with actual EOR and tertiary projects in terms of, you know, the startup of the project?

A. No. It really turns on -- so if you're in a field where you have many acres, like we have here, to do that, there is some downside to doing pilot projects because you have boundary effects where you're going to loose recovery. You know, as long as you have injectors surrounding producers, you're probably going to be able to capture CO2 on the interior. Obviously this a hypothetical about some generic CO2 flood.

But on boundaries, you kind of lose out. So there would have to be some kind of analysis of where to do that, where to start if you could do that. And I'll note that even the economic spreadsheet that was provided, it goes pattern by pattern and moves each pattern out in time by some amount. So it is

kind of staged already in the economics.

Q. Yes, sir. And so what I'm coming back to, though, is in selecting that location where you start, aren't you going to want to pick the location that, based on your science and engineering, you think is your best spot for all the reasons you just spoke to?

A. Could be, yes. It's likely. Let me say likely.

Q. And just the way the San Andres works out here, there are going to be sections of land that have higher oil in place in them than other sections of land, aren't there?

A. Which San Andres are we talking about?

Q. All of it.

A. I suspect there will be variations, even under Dr. Davidson's analysis.

Q. So I would call that high grading. I don't know -- if we talk about the best spots based on the petrophysical work of Empire, can we be on the same thing that I'm talking about high graded spots?

A. Yeah. I don't have a problem with that term.

Q. So as we talk about high grading, now, with respect to your economic case, your economic case did a blanket assessment across the entire EMSU, correct?

MR. RANKIN: Objection. Mischaracterizing Mr. McBeath's testimony. Mr. McBeath's testimony was that he applied Empire's economic model that they planned to implement.

HEARING OFFICER HARWOOD: Well, he can say that.

THE WITNESS: Do you want me to answer it?

HEARING OFFICER HARWOOD: Yes, sir. Overruled.

A. So actually, the 72-pattern model does not cover all of the EMSU. And it's not my model. It's Empire's with adjustments.

Q. That's because yaw didn't build your own model here as part of Goodnight's application for the saltwater disposal wells, right?

A. That's true.

Q. Okay. And you understand part of this proceeding are these new application from Goodnight for even more saltwater disposal wells inside the EMSU? You understand that?

A. I do.

Q. If the commissioners wanted to know as part of that application, where they would go to find a ground-up economic analysis built by a petroleum engineer, you're not aware of any such analysis?

True?

A. And what kind of economic analysis are you asking about?

Q. To assess whether there's waste. An actual model built from the ground up by an engineer that going to come in for Goodnight as part of its application for SWDs and say, "This is our model. This is what we think is reasonable." Have you done that or have you seen one?

A. I think my adjustments to Empire's model fulfill what you've just asked. They show that their assumptions are not economic.

Q. We're going to dig more into that. But, again, really the variable there is chiefly price, volume and the cost of CO2, commodity price and volume of hydrocarbon, right?

A. Did you say oil price?

Q. Yes. Commodity price.

A. Oh, commodity price. Those are the variables I changed, yes.

Q. And we've already talked at length about the buck-50, and I'm done talking on that.

But now I'm just getting to this high grading. And so if the Commission wants to know, take your 72 pattern, are there places in the 72 pattern

that has more oil in place than others, or is it uniform across?

A. In that model, every pattern is identical in recovery.

Q. But you can tell the commissioners that that's not how the oil under the EMSU actually works. There are going to be high graded areas where are sections that have more oil in place than others, isn't there?

A. Well, because I averaged all of the logs I was given by Dr. Davidson, every calculation he made in the upper 400 feet of the San Andres, that does aerially capture the average saturation for all the penetrations we have at this point. So I would say that it does cover the average.

Q. I think we're missing. If the commissioners want to go to one particular place, for example, right where there's SWD well -- you with me right there?

A. The commissioners want to go to the SWD well?

Q. If they want to put their finger on the SWD well and say, "How much oil in place is under this particular section as opposed to a section on the other side of the EMSU?" the way your volumes are built, you can't do that, can you?

A. The way it's built is based on an average. I think one of the wells that Dr. Davidson analyzed was a SWD well. So you could look at that well.

Q. My point is, because this average that you've used is section by section across the EMSU or a little bit smaller than EMSU on your 72 pattern, right?

A. S I didn't follow that. I'm sorry.

Q. The point is, the oil in place is not going to be the same as you move section to section, is it, on what's actually under the ground right now?

A. It will probably not be exactly the same. That's right?

Q. And, again, with respect to the model that you all built by way of volumes, if there's a high graded area, based on Empire's science or engineering other both, obviously there's going to be sections that have higher oil in place in them than the average, aren't there?

A. Yeah, I agree with that. That's how averages work.

Q. Which, as we talk about the volumes that are in your analysis, you would agree that there's certainly going to be sections where Empire could go carry out its tertiary project, and even under you

analysis, the oil in place under that particular section would be higher than the average used in your economics? True?

A. If you say patterns, I will agree with you, instead of sections.

Q. Perfect, I'll take that. And how many acres does a 72 pattern cover?

A. It's about 10,000, I think. It's 72 times 40.

Q. Now moving over to price. We covered price last time a little bit, and I think that's where we ended for the weekend.

Just in terms of, you know, giving the commissioners a sense of the forest for the trees, as we talk about forest, we've now talked about the expense case one CO2. We've talked about the volume case that you got from Dr. Davidson and how fits in.

This is from your deposition, and you were asked, "And economics can change also over time, right?"

And your answer was, "The biggest driver of economics for CO2 floods is the price of oil." Do you remember testifying to that?

A. Yes.

Q. Do you stand by that testimony today?

A. I don't have context here about what we were talking about, but it is. It's that, plus the price of CO2. Those are the two biggest things.

Q. And with respect to economics, you had two models, you didn't like Empire's pricing. And Empire started their pricing at 75 and then escalated it to the out-years at 1 percent annually, correct?

A. Yes.

Q. You held a flat $75 deck, and at a $75 deck, you understand we are not here reporting these to the SEC as part of reserves that Empire is reporting? You understand this is completely different than an SEC, PDP or PUD analysis, right?

A. Absolutely.

Q. Because we're not dealing in SEC, you also know that we're not asking a bank for money as part of this? We're not using our oil and gas lease as collateral, and so we don't have to have Netherland, Sewell satisfy JP Morgan? You understand that's not this environment either, right?

A. I really have no information on that.

Q. Different oil and gas operators, you know have internal price decks that they use, don't they?

A. That's true.

Q. And that's going to vary from operator to

operator, isn't it?

A. It can, and it can be based on hedging and a lot of different things.

Q. But, again, in terms of the internal price decks, so I'm setting aside bank lending, I'm setting aside SEC reserve reporting for PDP or PUD, and I'm just talking about the internal economic analyses, you know that operator to operator, they will have their own internal commodity deck where they forecast into the future that helps guide their internal investment decisions, don't they?

A. They do. As one of the runs, they usually do, yes.

Q. And obviously those internal decks will vary wildly between operator to operator, won't they?

A. Not wildly, no. I don't think so.

Q. In terms of just giving the commissioners the sense of how far out these out-years are, where does ends of economic life on the project terminate under your model?

A. Which version do you mean?

Q. I guess any. In terms of Empire's model that you began with, you know that that model runs over 40-something years in out-years, doesn't it?

A. Yes.

Q. Which would be consistent with how EOR tertiary projects are carried out. This is not you go in, you crack the Wolfcamp and the Spraberry and you wine-rack it and you're getting 80 percent of your production out in the first three years and you've moved on to something else. That is not how this kind of a project works?

A. They are usually long-lived, that's correct.

Q. So as we talk about long-lived, we showed this slide last time. And this was just saying -- I know you don't want to look at historical, but if you're looking back historically to '86, or wherever you want to cut it, there's a 2.77 percent escalation over that period of time, right?

A. According to this, you can also draw that line from the peak down to the -- and it would be a negative number.

Q. Just arbitrarily start in 2009?

A. You certainly have oil prices before '86, so there's some arbitrariness in the way you've drawn it, as well.

Q. Pre '86, were those good years for oil prices or were they lower?

A. I graduated in '87, so those were bad prices.

Q. I mean, you could have drawn your own line, if you wanted to.

A. My real concern about this is looking backwards and trying to say that that suggests what's going to happen with future price.

Q. Additionally, I mentioned EIA data last time. You know they have long term outlook price decks, don't they?

A. Yes.

Q. Have you done any analysis in terms of EIA's long term forecast looks like?

A. No, I have not. I don't use the EIA price deck.

Q. You know EIA price deck is going to be far more aggressive that what you used in your model, don't you?

A. Well, it's going to be more than flat, probably, yes.

Q. And these were some of the publications that have been admitted into evidence in the case at this point. Do you remember looking at the four-county appraisal of the San Andres fairway of the Permian Basin paper?

A. I'm not sure that I did.

Q. And, again, these have come into evidence

already. But here, they had oil price of 75 a barrel, escalating at 2.3 percent per year. The oil price selected for the analysis is consistent with the mid-term outlook for oil prices to the Energy Information Administration's 2018 annual energy outlook. The author had noted that EIA has a 2.3 escalation on its mid-term outlook. And that escalation is 2.3 percent, right?

A. That's what he says here. I haven't double checked this.

Q. Conservative to the 2.77 that was shown on the earlier graph, and literally, a multiple of double of what Empire's built its economic case on, true?

A. Are you saying 2 percent is double 1 percent? Yes.

Q. Yes. This is another one. This is a 1987 Cobb & Associates paper that came out in evidence in the case already. And here they were using an $18 a barrel deck, escalated to 20, price held constant until January '91, escalated to 22 bucks a barrel, held constant to '92, and then escalated at 5 percent per year. Do you see that?

A. Yes. This is the -- I was driving when this was presented. I thought I heard some discussion of a flat price, too. But if this is the Cobb stuff, I see

they escalated in part of their analysis, too.

Q. This escalation would be multiples more aggressive than what Empire has used here in its model, true?

A. That's true.

Q. And what they did there in '87, as they're predicting the future in 1987, they held it flat at $45 once they got to the year 2006; do you see that?

A. Yeah, I do.

Q. So even in all of those escalations which reached 5 percent per year, that would have been quite conservative to what was achieved in 2006 and the average of commodity prices since 2006, wouldn't it?

A. I'm sorry. Compared to what?

Q. Compared to what actually -- so if we go back to 1987 and says, "Was Cobb & Associates, were these guys just crazy when they predicted this escalation through 2006?" they were actually conservative to what has borne out by way of experience history, weren't they?

A. Yeah. But they only escalated for a few years compared to the number of years that Empire did.

Q. Well, let's put this in terms of relativeness so that the commissioners aren't mislead. They started at 18 a barrel, right?

A. Yes.

Q. And then not that distant out-years of 2006, they get to 45, right?

A. Apparently they do, yeah, in 2006.

Q. So a multiple of about 2.5? I'm eye-balling that. You're the math guy.

A. Yeah.

Q. A little over 2. Empire's case starts at 75, right?

A. Yes.

Q. And what is the highest price that ever works its way into the Empire model at the 40-plus out-years?

A. I think it's 118.

Q. Which would be not even nearly double? That would be conservative to what Cobb & Associates predicted in '87 and what was experienced in actual reality. True?

A. With that sort of tortured comparison, yes.

Q. Now, I just want to put a little bit of the sensitivities here into focus for the commissioners. We've done some different sensitivity analysis to just show them how the numbers change. And, again, all the numbers that have been presented here by Empire have been in net present value, right? Those are

discounted dollars?

A. Actually, the model has both cash and present value numbers. As far as presented, I'm not sure.

Q. But if we put our hat on for the mineral owner being the State of New Mexico, they don't have to look at this in terms of net present value. This would be a royalty strain that would be established for the State of New Mexico and BLM that would continue for 40-plus years, with royalty dollars received in real time over the next four-plus decades, wouldn't it?

A. I'm confused by why you say they don't have to look at present values.

Q. The royalty owners would -- the State of New Mexico here would be receiving royalties on Empire's EOR and tertiary development of the San Andres for 40-plus more years, wouldn't they?

A. Under these hypotheticals, that's true. But I think you're confusing two concepts. If you wanted to say how much it's worth today to any royalty owner, you'd still have to do it on a present value basis.

Q. But the State of New Mexico isn't looking to sell these minerals to anybody. It doesn't need a net present value today in terms of selling these, right?

A. No. I don't think they sell royalties.

Q. Now, looking at the economic sensitivities, here on a base case, do you see we've got 300 percent thickness? We're looking at oil in place. The oil in price per barrel and CO2 price. With respect to varying those, even if we use your volumes -- are you with me so far on using your volumes?

A. So can you help me with what you guys did to make these adjustments to the model?

Q. This is actually Exxon's ROZ case. I grabbed the wrong slide. This was Exxon's ROZ case. I'm going to skip that one and go to the next one. I've got more slides that you can imagine.

So on the economic sensitivity, if you start with base case on a 100 percent CO2 injection versus a WAG, if you go at 49 million barrels in place per 640 section, at 75 bucks and a 1 percent escalator with dollar CO2, you see that's a net present value of 585 million?

A. I see the number, but I have no idea how you did this. And if you were using that same economic model, it says 100 percent. I'm assuming there's WAG and not WAG. But that model isn't set up for that.

Q. If you can even use a flat price deck for Empire's volumes and at $1 CO2, it's still profitable,

isn't it?

A. I don't know without looking at the model. I mean, this has a positive number.

Q. In terms of all of your work here, you really didn't run these models or check to see, let's say Empire's right on its CO2 price but I hold their deck flat at 75, are they profitable.

I mean, you did these calculations to see where these analyses land under the different variables that we're fussing over, haven't you?

A. I lumped them all together for the calculations I did.

Q. You didn't run them to see if I'm right on oil price but wrong to CO2, this is where it lands, or if I'm wrong on price, but correct on CO2, this is where it lands?

A. No. I was trying to look at the variables I thought were least supported with a price deck that goes up to about 120 bucks, the flat price. And, you know, we a ran these things about the time we did the rebuttal reports in early January. The prices have fallen since then, so I think the flat 75 is kind of strong today.

Q. You're saying everything should be rerun because of the tariff situation that on April 23rd we

have 64-ish WTI, or whatever it was this morning?

A. No. I'm saying that you want to get a sense for the economics of a project, you better keep up with what the market is saying the price of oil is.

Q. In terms of other sensitivities here, I might be able to shortcut a lot of this. Surely you ran this one to be able to confirm. You can take Dr. Davidson's volumes, your volumes that you use -- are you with me so far?

A. Which line are you looking at?

Q. I'm actually off of this.

A. Okay.

Q. If we assume your volumes -- are you with me so far?

A. So my porosity and my oil saturations?

Q. Let's just assume that Dr. Davidson is right and that all of Exxon and NuTech and Ops Geologic are completely wrong. Are you with me so far?

A. Yes.

Q. So all of NuTech, all of Ops Geologic, all of Exxon, you guys just blew it, but Dr. Davidson did it right with his facies model.

If you used the $1 CO2 price that we've already talked about, and if you used the 1 percent escalation off of 75 WTI -- are you with me on those

two assumptions?

A. I think so. I think you're on the second row of this exhibit.

Q. -- you can tell the commissioners it is a present net present value case here, isn't it?

A. Looks like it shows eight and a half million dollars for investing hundreds of millions of dollars.

Q. We don't have to invest hundreds of millions -- again, this is taking your volumes -- as we talk about why on earth wouldn't Empire get an opportunity to develop its and the State of New Mexico's minerals, using your volumes, if the a 1 percent escalation off of 75 dollar WTI is applied and $1 CO2 price, you can tell the commissioners that that is positive net present value case, isn't it?

A. That one looks like it calculates out slightly positive.

Q. And you can tell the commissioners that as pressure increases, that decreases the economic feasibility of the project; isn't that right?

A. That's a complicated question that has to do with miscibility.

Q. You're not willing to agree to the simple fact, to the commissioners, that as pressure in the San Andres builds, it will impair and impede the

economic project that Empire intends to carry out here in the San Andres?

A. Well, let me state this again. It's complicated because you want to ensure that you have miscibility. So I think what you're alluding to is, if you have really high pressure then you have to use more CO2 for each hydrocarbon pore volume.

But when we look at the disposal that has occurred and the relative lack of change of pressure in the San Andres disposal zone, I really don't think changes in pressure are a big concern.

Q. Does higher pressure mean that significantly more CO2 is required for compression?

A. That doesn't make any sense. I think I covered this just a second ago. If you have higher downhole pressure, you need more CO2 for every pore volume.

Q. And earlier I showed you your deposition where you said the biggest issue is WTI price. But then today, you said also cost of CO2 is the other one, isn't it?

A. Yes.

Q. I was already firmly waded out into your expertise and into your pool to be drowned, but I'm going further here, so I'm acknowledging this right

off the jump. We're going to talk about pressure. I'll move through this quickly.

We talked about this slide last time. In terms of this -- is it publishing? And this is a slide you're familiar with?

A. Yes, I can see it. I'm familiar with it.

Q. So we have from the Technical Committee Report, the original pressure reading from the San Andres. And in terms of just bringing that down -- I'm sorry, from the Grayburg. And in terms of bringing that down from the San Andres, do you agree that this would be a conservative gradient, pressure gradient, in terms of measuring that 1527 psi?

A. It doesn't say what gradient he used there, but I think he testified to a .38 gradient. It's more conservative than using a water gradient, I'll give you that.

Q. Do you dispute that what the RFT tool in the 211 well, a pressure of 1245 psi was measured in the San Andres?

A. I don't dispute that it was measured at 4006. There is a dispute about whether or not that's in the San Andres or not.

Q. Explain what that depletion -- how does that depletion occur?

A. That would be from production of oil, I believe, or lateral zones in other wells that penetrated that same zone nearby or within a few well locations.

Q. And fresh water, is that a gradient of .433?

A. Yes.

Q. And that would be worked out from the original point at subsea 250, right?

A. You mean for this adjustment?

Q. Yes.

A. I assume that's what he did, yes.

Q. And so your explanation in terms of that would be that that depletion is explained by the production from the Grayburg above, correct?

A. Well, I've got a couple comments about it. First of all, we don't have an original measurement in 1921 or 1936 or whatever the beginning of time is for this area in the San Andres. The earliest measurement we have is in the Rice H-20 well, and it measures out to a gradient of about .38 of 1800 psi at 5000 feet.

So when you're comparing those two numbers, you have to understand that there's uncertainty in the first number.

Q. Dr. Buchwalter, he didn't know that the Rice well that you're mentioning, that we were going to get

that pressure reading out, did he, when he prepared his model?

A. Probably not.

Q. Do you realize that that Rice well matches perfectly within 12 psi of Dr. Buchwalter's model? Have you tried to take that pressure reading and compare it against what's in his model?

A. He didn't give us the information to the that. He only gave us particular time steps. And so 1959 was not one of them, so we weren't able to do that.

Q. So at depth layer 10 in his model, it says 4921 feet. We're working off of the 1959 pressure calculation from the EME 20. In 1938, the pressure at 4921 feet in the model is 2058 psi. In 1959, the pressure in the model at 4921 feet is 1754 psi. In 1959, the corrected model pressure to 5000 feet, that's a function of that 1754 psi, plus 5000 minus 4921, because we've got to make the depth adjustment, times .43, that would come out to 1788 psi. And in 1959, you know that that measured pressure of 5000 feet was 1800 psi, right? We agree?

A. That one I can agree on. But in 1959, it was measured at 1800 psi.

Q. Which would only be a pressure variance of

12 psi out of Dr. Buchwalter's model when he had no idea that Goodnight or Rice, or some combination of them, was going to pull out this Rice pressure reading from the EME Number 20?

A. But that assumes that he's correct about the beginning pressure, and every other pressure he delivered to us or charted was not over 2,000 psi. The San Andres pressure was identified at 1527.

Q. Can we agree that this variance of 12 psi -- I mean, that is as close to be being dead on the money as you possibly could be?

A. I mean, 1788 is close to 1800. But we were not given the data or information to dig into this.

Q. Now, you've said you weren't given the data. You acknowledge you were provided all of the input and export files, weren't you?

A. That's not true.

Q. What import files did you not receive?

A. I'm focusing on the export files.

Q. What export files did you not receive?

A. We only received an initialization file. We received time steps at 1986, where we could look at the grids and figure out the pressures of 1986.

But he did not give us, like, annual time steps where we could go in and figure out at

different parts of the grid what the pressures were.

Q. And this is way past my technical ability here. For whatever you're claiming now that you lacked, did you ask for it.

A. I don't know. At this point, I don't know if it was asked for, if there was an obligation to provide it. I'm not sure.

Q. Going back to Dr. Buchwalter's model, do you remember a version of this was shown during Mr. West's testimony?

A. I thought you showed that to me a week and a half ago. Maybe not. Maybe not.

Q. I certainly needed to show it to you. I think the one that was shown during Mr. West -- so basically, you understand these comprise two-acre blocks. There's 34,500 grids that would have come out of the model. Do you generally understand that's what we're looking at here?

A. Yes.

Q. And what happened was, again with the confusion, when the zeros were turned into dots, to make this more readable, the program moved the decimal over by 2. This one is corrected for the program moving the decimal over by 2 on the vertical permeability. Do you see that?

A. Well, that's reassuring. Because I think I testified in my direct that I was prepared to say the range was .01 to 12.8.

Q. So these would be the range of vertical permeability, wouldn't they be?

A. Well, but this is in the entire -- this is a connection between layers 8 and 7.

Q. And just moving the --

A. Not --

Q. I'm sorry. Go ahead.

A. Not just a single well, but over the entire two-acre plot.

Q. And you understand it was not a uniform change in vertical permeability across 34,500 blocks. It was only 99 grid blocks that were changed by these intervals of permeability?

A. I understand that, yes.

Q. And then if we go up in terms of the vertical permeability distribution, there were only 99 grids changed, and, again, just moving the decimal over two places to get the correct millidarcy here, those adjustments ranged from .05 millidarcy to 12.5 millidarcy. You see that?

A. I see it. The numbers we pulled out were .01 to 12.8.

Q. Millidarcy?

A. Yes.

Q. Which would be very close here to what we have?

A. Very close, yes.

Q. Now, going back to Dr. Buchwalter's model, as we talk about vertical permeability, coming back to core, we have actual core measurements here to just put into perspective the vertical permeability that's been measured in core, is that the far right column, is what we're looking at, for vertical permeability out of the 649 core?

A. The far right in the black box?

Q. Yes. You can tell the commissioners that some of the vertical permeabilities measured in the EMSU 649 core are very high? We've got 181, 162, 196?

A. These seem pretty shallow to be attributable to the San Andres.

Q. And we're going to work our way down. In the left column, can you explain the left column, K max?

A. The maximum measured permeability in the core without regard to direction.

Q. Very high permeabilities there. Yes?

A. Yes. More than likely, they're horizontal.

Q. And then we move down. Other permeabilities measured in the EMSU 650?

A. Would you make it just a little bit bigger?

Q. I'm going to try.

A. Okay. Thank you.

Q. Is that any better?

A. Yes.

Q. Very large permeabilities in the 650 core, as well. Yes?

A. I messed myself up because now I can't see the label. If you tell me it's the 650, then the answer is yes.

Q. It's the 650.

A. Okay.

Q. The EMSU 653 core, again, vertical permeability, we've got 914, 1422. There's some very large vertical permeability numbers observed in there, aren't there?

A. According to this summary, that's true.

Q. As we talk about going back to -- and I'm close to wrapping up here. But on Dr. Buchwalter's model, again, Goodnight here is injecting vast sums of saltwater and is proposing to inject even more saltwater. You understand that's what this proceeding is over?

A. The additional wells, yes.
Q. In terms of a material balance simulation, is that anything you have ever prepared before as an expert?
A. Well, I've done material balance for sure. I guess you're saying kind of a rough -- using a simulator as a rough way to do material balance?
Q. Yes.
A. Yes, I've done that.
Q. How recently?
A. It's probably been six or seven years.
Q. There are certainly simulation modeling experts that are available to be hired out there, such as Dr. Buchwalter. Yes?
A. That's true.
Q. Do you know if Dr. Buchwalter has a good reputation in the industry for that work?
A. As far as I know, he does, yes.
Q. Would you hold yourself out as a simulation modeling expert?
A. Well, it seems like from listening to his testimony, that's kind of the vast majority of what he does. It's not the vast majority of what I do anymore. I've done that in the past, and so it's part of my practice, but not to the extent it is with

Dr. Buchwalter.

Q. And do I understand the direct testimony you gave here that basically you would have had and modeled the southeast quadrant of New Mexico and like half of Texas panhandle, or somewhere around that? How big of a model, according to you, should Dr. Buchwalter have built, geographically speaking?

A. So the size -- and you're going back to where I had highlighted the migration pathways in relationship to some of the testimony from Steve Melzer. And it's not that we want that model, but that's the size of the San Andres zone as evidence by the ability to dispose into it on a vacuum for long periods of time, as evidence by the water apply wells to produce without any change in their production characteristics for decades.

And so it's not that we want him to build a model the size of Texas. But where he bolted on a San Andres aquifer that was 38 miles by 17 miles, there needs to be orders of magnitude bigger than that so that when you inject into it or pull out of it, you honor the data we have that shows that the pressure response is much more muted than what his is.

Q. Who is the witness that built Goodnight's simulation model?

A. As far as I know, we do not have a competing model.

Q. So you remember the last time we visited here, it's easy to tear things down, rip them apart, critique, fuss, criticize. It's harder to build something. And if the commissioners would like to know as part of Goodnight's application here to inject into a designated oil recovery unit, where the model is, after the passage of time and all the expert work, there's no witness going to do that?

A. We didn't build an independent model.

MR. WEHMEYER: I would love five minutes to visit with my client just to make sure that if they have questions, that I've gotten them out. But I think I'm real close to being wrapped up here.

If now would please the Commission for the afternoon break, that would be certainly welcome here. But if not, I can make due.

HEARING OFFICER HARWOOD: All right. Let's take our afternoon break. Let's be back by 2:55.

(Recess held from 2:41 to 2:55 p.m.)

HEARING OFFICER HARWOOD: Mr. Wehmeyer, I hope we're close to the magic phrase.

MR. WEHMEYER: We're very close. We're within ten of it. I just can't say yet. I've got a

couple notes from my folks, and I'll go through those quickly.

HEARING OFFICER HARWOOD: All right.

BY MR. WEHMEYER:

Q. Mr. McBeath, you can hear me?

A. I can hear you.

Q. Earlier, as we were talking about the effect of pressuring out the San Andres, you gave me that it would require the use of more CO2 by Empire, right?

A. If the San Andres pressured up it would require more CO2.

Q. Additionally, it would require more cost to actually compress it down the hole, wouldn't it?

A. You mean to compress it so you could push it downhole? Yes.

Q. Now, earlier we talked about that Rice well and the bottom hole pressure report that came in late. And we talked about Buchwalter's model and how it fit into that.

Now I want to talk about how it fits into that 211 measurement from the RFT tool. Is it publishing? Can you see the Bottom Hole Pressure Survey Report?

A. Yes, I can.

Q. And do you see that it's calculated to

gradient here, overall gradient, of about .36 psi, and for sea water, we know that would be about .44 psi per foot?

A. You don't really have to do that because the different stations of that bottom hole pressure survey tell you fluid that's in the wellbore.

Q. How deep was this Rice bottom hole pressure taken?

A. The deepest measurement is 5000 feet.

Q. That's very deep here. Yes?

A. Yes.

Q. In relation to the depths we're talking about. And here I'm just publishing the arrow. Does that correspond with where you understood that pressure reading was taken from?

A. If that's 5000 feet, that's right. I can't really see it.

Q. You know it certainly was down into the Lower San Andres, correct?

A. Yes. For sure.

Q. Perfect. Now we're just going to go through the exercise of working the math the other way and work it up to.

If you have that EME depth, and we know that the top of the San Andres, if you do 1800 psi

minus 5000 feet minus 3896 feet times .442 psi per foot for a pressure gradient, as we work up to get it up here to where the 211 RFT was taken, that would be a psi of 1312 psi at that depth, wouldn't it?

A. You're doing it at the top of the San Andres?

Q. To get it up to the 211 RFT measurement in the San Andres, yes. I'm working the pressure the other way. Earlier we talked through it and worked it down from the Grayburg into the San Andres. Now we're working it from the 5000 feet it was taken up to the depth interval where the 211 was measured to get it here.

A. The 211's measurement was at 4006, the deepest measurement.

Q. So the 1312 psi calculated here, you're saying, is off?

A. I'm trying to understand what you're doing and trying to understand where the 3896 is coming from if you're trying to compare it to this RFT.

Q. And, again, this has been correlated for the different points on the structure. If the math works from the other way, if the commissioners want to do the math on this and work that back up on that pressure gradient to get it to the same place on

structure, if that works, the 1312 psi, the RFT measurement and the 211 and 1245, that would also indicate a depletion if you work it from the other direction as opposed to surface down, work it from down to up?

A. Well, it looks like about that. So the measurement in the H-20 was made in 1959.

Q. Right.

A. So, under your method, you would be disagreeing with Dr. Buchwalter and you'd say that the depletion had occurred by 1959. So the time aspect of these pressure measurements has to be considered as well.

Q. Have you given any considering to the Rice measurement? Have you done any work on the pressures off of the Rice measurement?

A. Yes. I've compared it to two other groups of pressures, and I call them the "undisturbed pressures." So we've got Rice 12 at -- it's noted on survey and we know that was only, like, four days after the log was run, but it was before injection, so it's a pristine measurement. We've got that in 1959.

We've got a group of water supply wells in 1987 and '87 that had fluid levels.

And then we had current pressures from a

well that Goodnight operates but it's been inactive for, in one case, one month and, in another case, two months.

So you have a nice static level, and all of those pressures are within about 30 psi of each other over that time period from 1959 to 2024. They all calculate out to about .37 or 38. I guess 1959 is .36.

So the best measurements we have in the San Andres show that there's been very little change in the pressure.

Q. In terms of actually performing the calculations to bring it up to the location of this RFT measurement in the San Andres out of the 211 well, have you actually created any work product on that?

A. To adjust the Rice well?

Q. Yes.

A. No, because it's, you know, many, many years apart.

Q. If Empire's calculation brings it to 1312 psi there and there's a difference of whatever that is, about 70 psi, that indicates depletion -- are you with me on the assumption?

A. Yeah. But it's confusing. But I'm with you.

Q. I give you that for sure. Again, the depletion, as I asked about the depletion reflected here on the slide on the bottom right, you explained that depletion as being attributable to drawdowns in the Grayburg above, correct?

A. Or lateral. Because you're only 7 feet -- even under your top analysis, you're only 7 feet into the San Andres. And there have been work-overs, deepenings, completions of wells using nitroglycerin. So the chances that there's some lateral movement of fluid that could explain that, that's what I think happened.

Q. But when we visited before the break and I asked how would you explain that depletion, the only answer I heard was likely from lower pressure above in the Grayburg. Wasn't that the testimony before the break?

A. If I said that, I misspoke. I meant lateral aerial drainage around that.

MR. WEHMEYER: I'll pass the witness.

HEARING OFFICER HARWOOD: Thank you.

OCD.

MR. MOANDER: Thank you, Mr. Hearing Officer.

CROSS-EXAMINATION

BY MR. MOANDER:

Q. Good afternoon, Dr. McBeath. Thank you for coming back today.

A. Thank you for the honorific, but it's Mr.

Q. Sorry, Mr. McBeath. This hearing has gone on a while and I'm starting to get a little sloppy on that. This should be fairly brief.

So do you recall back on April 11th of 2025, you were under oath. Do you recall that?

A. Yes, I do.

Q. And you were being cross-examined by counsel for Empire. Do you recall that?

A. I certainly do.

Q. And do you recall during that examination, Mr. Wehmeyer informed the OCC that you two were friends. Do you recall that?

A. I do.

MR. MOANDER: Thank you. I'll pass the witness.

HEARING OFFICER HARWOOD: Mr. Beck or Rice Operating and Permian Line Service.

CROSS-EXAMINATION

BY MR. BECK:

Q. Mr. McBeath, you discussed with Mr. Wehmeyer

a bit about the 45Q tax credits. Remember that?

A. Yes, I do.

Q. And how much is Empire getting its CO2 under those 45Q tax credits?

A. If you assume that their starting price is a correct and a reduction attributable to a tax credit is correct, it would become -- the net price is $1 and MCF.

Q. And I'm not asking for any assumptions. I'm saying today, what are they getting their CO2 for?

A. I don't think they have any contracts for CO2, as far as I'm aware.

Q. That's what I'm aware of. And the 45Q tax credits, I'm not totally familiar with that, but I understand that to be part of the tax code. And 45Q is under the tax code; is that right?

A. That's right.

Q. And those tax credits are administered by the IRS, the Internal Revenue Service?

A. That' true.

Q. And the 45Q tax credits were created to push for more clean energy in the oil space; is that true?

A. That's true for mainly carbon sequestration in this particular application.

Q. And have you heard how the IRS is

administering that 45Q tax credit this year, under the new administration?

A. No. I don't have any information on that.

Q. So you don't know whether it will go up in use or down in use in the future?

MR. WEHMEYER: Objection. Lacks foundation. The witness has testified to lack of personal knowledge.

MR. BECK: I think that's what I'm asking him.

THE HEARING OFFICER: Overruled.

BY MR. BECK:

Q. So you don't have any information that would tell you whether those 45Q tax credit use will go up or down in the future?

A. That's right, I don't.

Q. You also talked with Mr. Wehmeyer, he talked with you about Empire's plan to go and exploit the oil all the way down to the bottom of the San Andres, right?

A. He questioned me about that. And that was an assumption that he directed me to make, yes.

Q. I think you said that you know that they wouldn't go and just spend that 1.5 or $1.2 billion wholesale. They would do it maybe sequentially,

right?

A. Well, that is what's built into the economic model. The patterns are consequential. In a CO2 flood, some of the things you have an opportunity to dribble the money out as you build patterns.

Other things, like building a CO2 lateral of building a recycle plant, you can't really do that in pieces. It's all or nothing.

Q. Part of that, I think he said and you agreed with, was that they would select the best location to start, right?

A. Yeah. I would expect that, yes.

Q. And then would you expect that if in that best location to start, they weren't able to exploit the oil out of the bottom of the San Andres, they'd stop?

A. Yeah, that's true. If you went to the best spot and it was a failure, there's no reason to go to the spots that are worse.

Q. And where is Empire starting this project to go to the bottom of the San Andres?

A. The information I had doesn't tell us that. We don't know the sequence of the patterns. They're just numbered patterns, 1 through 72, in the spreadsheet.

Q. So from the time that they acquired this property in 2021, sitting here today in 2025, you don't have any information that would tell you they even have a starting point for this project. Is that true?

A. If they do, they didn't share it in the discovery in this matter.

Q. Now, Mr. Wehmeyer said at the beginning of your examination last week that it would be -- it would be a great benefit to the people if Empire was permitted to do this project. Remember that?

A. He asked me to agree with that, yes.

Q. Okay. And you agreed, because the potential is immense and there would be no cost, at least as we're sitting here today, to the public, right?

A. If you assume success, yes, it would be a big benefit.

Q. And he asked you to assume that, right?

A. He did.

Q. Now, he talked about that Goodnight is a Texas company, and the profits presumably would go out to Texas, right?

A. He asked me some questions about that. Not this session, but ten days ago.

Q. Do you know that Empire is not a New Mexico

based company?

A. I don't really know for sure.

Q. Do you know that Goodnight employs people in New Mexico?

A. I would expect so, yes.

Q. To operate its operations here, right?

A. Yes.

Q. And those people pay taxes here in New Mexico, right?

A. I hope so, yes.

Q. And presumably, Goodnight pays gross receipts tax here in New Mexico?

A. You're getting on the edges of my accounting expertise, but I think so, yes.

Q. And my understanding of Goodnight's operations is that it takes wastewater from oil and gas operations in New Mexico. Right?

A. That is true, yes.

Q. We presume that those oil and gas operations that provide wastewater pay royalties and severance taxes, true?

A. Absolutely.

Q. So as I sit here today, I think the truth is, is that -- tell me if you agree with me, that there's nothing today preventing at least

regulatory-wise, this Commission preventing Empire from going and drilling down to the bottom of the San Andres and starting its project. True?

A. I think that's true. They have the rights to operate there.

Q. And did you hear the testimony that what's preventing them is an order from the company saying don't do this until all injection in the San Andres has stopped?

A. Yes, I heard that testimony.

Q. So if all disposal in the San Andres is stopped, then all operations of Goodnight are stopped, right?

A. I think that's correct.

Q. At least within the EMSU?

A. Yes.

Q. Right. And so the taxes we talked about that Goodnight and its employees pay, those aren't being paid?

MR. WEHMEYER: This is so far outside of anything that is in his opinions. Employee taxes would require rank speculation on number of employees, how much they're paying in taxes. This is so far afield of what a petroleum engineer has opinions on. And it's outside of his written

testimony. I don't want to have to go back and redirect him on this -- recross him on this.

HEARING OFFICER HARWOOD: You're not going to get the chance.

MR. WEHMEYER: So I would ask that this be limited to what's in his direct testimony and what was fairly in cross, which this is not.

THE HEARING OFFICER: All right. You brought up the issue. I think you opened to door.

Mr. Beck, by the same token, I think we get the point. So I'm not going to sustain or not sustain the objection. But I would ask you to move on.

BY MR. BECK:

Q. So just that last question, those taxes would not be paid when Goodnight is not operating. True?

A. Under that scenario, that's true.

Q. Now, so we talked about that there's nothing regulatory preventing Empire from going down and exploiting those minerals at the bottom of San Andres, right?

MR. WEHMEYER: I object. That mischaracterizes it. I think for an EOR project, we do have to go through a regulatory process.

HEARING OFFICER HARWOOD: Well, I think the objection was asked and answered, and I think it's been answered. So I'll sustain the objection.

BY MR. BECK:

Q. So, hypothetically, if Empire wanted to go and start a small test place in the best spot it picked, it could negotiate with injection operators down there to stop injecting into a portion of that space down in the San Andres?

MR. WEHMEYER: Two objections. One, rank speculation from this witness. Two, Empire is under no obligation to negotiate for just a little bit of waste or a lot of waste, but not as much waste.

There is no basis on the planet that Empire would have an obligation to negotiate with these people for only some amount of waste of New Mexico's resource.

MR. BECK: I can lay some more foundation.

THE HEARING OFFICER: Okay, Mr. Beck. But, again, I think we get the point. So do your best not belabor it.

BY MR. BECK:

Q. Mr. McBeath, I think we heard you provided consulting service to lots of oil and gas companies, right?

A. Yes, I have. And I continue to do so.
Q. Including for example, Exxon Mobile, right?
A. Yes, that's true.
Q. Have you seen, in your experience, when operators are in the same space, they negotiate to stop work in part of the space and exchange for concessions from the other party?
MR. WEHMEYER: Same objection. He's getting into 408 suggestions that Empire was under some obligation to allow waste of New Mexico minerals through a settlement. It's irrelevant. It's inappropriate.
HEARING OFFICER HARWOOD: Overruled.
BY MR. BECK:
Q. Do you remember my question, Mr. McBeath?
A. I do. I've been involved in a number of matters where producers and disposers work together with either shut-in agreements or other types of arrangements to provide co-existence of operations.
Q. You talked to counsel about who knows the most about the Grayburg and the San Andres, and you made a list. Do you remember that?
A. No, I don't. Can you remind me?
Q. Sure. I have written down that you agreed with him that the list included Chevron and Exxon

Mobile.

A. Okay. Yeah, we're talking about operators? Yes.

Q. And then he talked about the brochure from Exxon Mobile that we've all seen. Do you remember that?

A. Yes.

Q. And do you remember that the ROZ in that brochure went down to negative 700 subsea?

A. I think that's right. I can picture it. I think that's right.

Q. And then you talked at length about getting investors to invest in this ROZ recovery project, right?

A. I did in the context of the economic analysis that I did.

Q. Okay. And I think you talked about that it would be tough to do that if investors knew that there was saltwater going on, right?

A. I think I was careful that if it was in the same zone, yes, that could be a problem.

Q. And when Empire purchased the EMSU, saltwater disposal was going on in the San Andres, true?

A. True.

Q. I think Mr. Wehmeyer asked you about your experience with Exxon Mobile as a very successful oil and gas company, right?

A. Yes.

Q. One of the largest corporations in the United States?

A. That's true also, yes.

Q. And if it's not the largest, it's one of the top two largest oil and gas operations in the United States, right, corporations?

A. They're very big. I haven't double checked those numbers recently, but they're very big.

Q. And its duty as a corporation, if you know, is to provide return to its shareholders, right?

A. Absolutely. Yes.

Q. And you're aware, through your work on this, that Exxon Mobile decided to sell the EMSU, AGU and EMSU-B with this potential for ROZ, right?

A. Yes, I'm aware of the sale that occurred.

Q. And they decided to sell it instead of exploit it and take on that project itself, right?

A. That's true.

MR. BECK: No further questions.

HEARING OFFICER HARWOOD: Thank you, Mr. Beck.

Mr. Suazo for Pilot Water Solutions?

MR. SUAZO: No questions for Mr. McBeath, Mr. Hearing Officer.

HEARING OFFICER HARWOOD: Thank you, sir.

We're back to the Commission. This time, let me start at the top with the chairman. Chairman Rozatos, do you have questions for Mr. McBeath?

CHAIR ROZATOS: Thank you, Mr. Hearing Officer. No, I do not.

Mr. McBeath, thank you for your time.

HEARING OFFICER HARWOOD: Mr. Lamkin.

COMMISSIONER LAMKIN: I do have a couple questions.

EXAMINATION

BY COMMISSIONER LAMKIN:

Q. Good afternoon, Mr. McBeath. Thank you for returning to finish your cross-examination. Just one clarifying question in regard to something that Mr. Beck asked.

You understand that in order to implement a tertiary recovery project in the EMSU or for Goodnight to spot a new disposal well on or adjacent to State land, that they would need approval of the commissioner of Public Lands?

A. Yes, I understand both of those things. The one nuance to that is, I don't know what the rules are for like a pilot project or something that wasn't a full-blown EOR project.

Q. My other question was regarding something that you testified about previously with regard to CO2 loss to the formation. What is a reasonable percentage of CO2 that you would expect to lose to formation in an EOR project like this?

A. In one like this, that has disperse shows of oil, that they're not all bunched together in one zone, they could be very significant. Because the CO2 is going to go into any porosity that has permeability, regardless of the oil saturation.

So it would be a function of kind of the net to gross in a particular zone; very significant when you compare it to something like Tall Cotton or SSAU that had relatively continuous thick intervals of ROZ, where if you're putting CO2 in, you're contacting oil.

Q. Do you care to venture a ballpark percentage?

A. I think it could be, you know, factors of two or three times the expected amount. Really, to answer it well, I would need to look at a log and the

distribution of those CO2 volumes. But it's going to be on the order of two or three times the CO2.

COMMISSIONER LAMKIN: Thank you. That's all my questions.

HEARING OFFICER HARWOOD: Thank you Mr. Lamkin.

Dr. Ampomah.

EXAMINATION

BY COMMISSIONER AMPOMAH:

Q. Mr. McBeath, thanks so much for your testimony.

A. You're welcome.

Q. I don't have your slides, so I'm trying to mind myself, you know, all the testimony. But I'll try my best.

Now, I reviewed your direct testimony. I did review that, so I'm just going to start with Page 5 of that, and I'm reading on -- so it's going to be Number 6 and the potential impacts of EMSU's operations well integrity?

A. Okay. Yes.

Q. Okay.

MR. RANKIN: Dr. Ampomah, if it's helpful, I'm happy to anything on the screen of Mr. McBeath, if it's helpful.

COMMISSIONER AMPOMAH: That would be helpful.

MR. RANKIN: Please direct me to what to show. I can do that.

COMMISSIONER AMPOMAH: I'm looking at direct testimony, so I'm looking at a potential impacts of EMSU's operations well integrity. That would be Page 4 of his direct testimony.

MR. RANKIN: Commissioner Ampomah, just so you're aware, I've got this up, but it doesn't have every one of his exhibits because it's a very large file. So if there's a specific exhibit, let me know and I'll pull that up. I will share his testimony and then if we need to go to specific exhibits, I can do that, as well.

COMMISSIONER AMPOMAH: So this would be a self-affirmed statement. So let's go to Page 5. Yeah, right down there, A.

BY COMMISSIONER AMPOMAH:

Q. So I'm just going to pick a sentence after the API number, under A. So you said you have reviewed the video from the Ernie Banks Well 1. And then you're saying that indicates that injection is contained within the perforated interval in the San Andres.

Now, my question to you is, if you're saying that it is contained, do you know the boundary condition for the San Andres?

A. Are you talking about the tops and bottoms of the San Andres?

Q. No. Even the lateral extent. Because you're saying that you've reviewed the wellbore analysis, the variable density log. And then you're saying that it indicates that injection is contained within the perforated interval within the San Andres. So I'm asking you, do you know the lateral extent of the San Andres?

A. Can I give you a little context for this paragraph and others that relate to other wells, if that's an all right?

Q. Yeah. And even now, I was surprised that, you know, as I read through your testimony, I thought you were going to talk to the Commission taking of the wells, one after the other, telling the Commission about how these wells are not impeding into, let's say, or impacting Empire's operations.

But instead, you more or less focused on criticizing what we already heard before, without even focusing on this particular so much important point. So yeah, I'm willing to listen to that?

A. So I kind of introduced this topic just above here, and I say that I've been involved in other disputes between, you know, producers and disposal companies. And one of the first things I do is to check the manmade penetrations.

So I did look at the bond logs, amplitude readings, the VDL forms for the wells that -- I had that available. I also looked at the water supply wells, which are a bit older, so they have kind of older versions of those logs. Where we didn't have logs, I had cement information. So I prepared to talk about that.

I went to my deposition and was asked, "Well, don't you know that that's not even an issue that Empire is worried about?"

And so in the interest of not belaboring it, although I do believe these wellbores show integrity, and I've eliminated them as a manmade path between the San Andres and Grayburg, it was basically a one-sided argument. So I didn't include it in my summary slide since we were already running short of time and taking up too much time with those direct summaries.

Q. I appreciate that. Now, my question to you is, so are you saying the fluid is more or less

contained within the wellbore, or, let's say, within that zone?

A. Yes.

Q. Do you know where the displaced fluid is going?

A. It's going out radially from the perforations into the zone.

Q. No, I'm asking about, you do have water already in there, and then you are injecting the water to displace. So you have to displace the water that is already there before you can fill that void with, let's say, the saltwater; is that correct?

A. I think there will be -- I don't think it will be a perfect piston-like displacement. I think there will be mixing and I think there will be some amount of the water that's already there that may not move. But there will be movement of water away from the wellbores into that zone and away from the wells.

Q. So, sir, you know, based on your testimony and even some of the testimonies that we've heard, when you test these injection wells, when you test the wells, or let's say when some of these wells were tested, some of the wells that were drilled were tested, it was producing, more or less, water, right?

A. The producing wells, yes.

Q. Yes. So what that means is that there is a movable water available in there. So my question to you is, you are saying that, you know, based on your analysis, the fluid that is being injected is all contained, my question is what about the native fluid? Where is it going? Did you do analysis to know the path where it is going?

A. I did not. I did not. This part of my testimony was designed to look at the possible movement up and down the wellbore based on the quality of the cement job. And looking at the quality of those bond logs, I eliminated that.

So the movement, when I say it's contained, it means it'll go into the perforations and then out into that zone as permitted, as the intention was in completing the well.

Q. Thank you.

COMMISSIONER AMPOMAH: Mr. Rankin, can we go to the slides that were shown, Slide Number 10.

BY COMMISSIONER AMPOMAH:

Q. And I have to look at it to just remind myself. Now, so let's talk a little bit about the economic analysis that Mr. West did that you criticized. And you have a lot of experience in the business, so I'm asking you, are you familiar with the

Kinder Morgan CO2 screening tool?

A. I am. Although it was not until at this hearing that I was made aware that this model was based on their tool.

Q. But you are aware of the tool; is that correct?

A. Yes.

Q. And the outputs that were shown from Mr. West's testimony, you couldn't attribute that to Kinder Morgan's CO2 screening tool outputs?

A. The outputs, no, I could not without hearing that it was from them.

Q. And don't you agree with me that in our business, that tool has been one of the most -- let's say the basic tool that most companies will normally use as a first-pass analysis to analyze a potential CO2 project?

A. I agree with a main pay project. I don't know that I've seen that used for an ROZ.

Q. Okay. Now, in that CO2 screening tool, do you believe that there's any distinction between how you would handle an ROZ compared to main pay?

A. Yes, I do, because of the dimensionless curve that's implicit in that spreadsheet.

Q. Now, we talked about the oil prices. And

for folks that have a lot of experience in the CO2 EOR business, you know, let me ask you, what is a typical price for a successful CO2 EOR project?

A. It's generally much higher than primary production or current horizontal development. So, you know, a lot of these folks get into it and then the analysis becomes sort of a point forward sunk-cost analysis where you're not really considering what you've already spent because you're already in it.

But for new projects, you know, based on current prices and current -- I really haven't run those very recently, but I would guess that the starting prices would need to be in the hundred-dollar-a-barrel range.

Q. So you don't necessarily have a number that has been, more or less, utilized in the industry as a basic price?

A. No, no. I don't think there is a rule of thumb just straight up on what the price of oil is required to put in a new ROZ project or a new main pay project.

COMMISSIONER AMPOMAH: Mr. Rankin, let's go to Slide Number 14.

BY COMMISSIONER AMPOMAH:

Q. So on this slide, you are using, more or

less, 10 percent oil saturation. Now, my question to you is, why did you at least not try 20 percent?

A. Well, I wanted it to be based on rigorous analysis. I wanted it to be based on what we asked Mr. West at his deposition, where within the San Andres would this economic calculation relate to.

And the way I could do that is to take the log analysis from Dr. Davidson and average the saturations in the top 100 feet of San Andres, along with the porosity.

Q. Did you also average the oil saturation from the core?

A. Well, I didn't do that for my rebuttal statement, but I did it last night after you quizzed Mr. Knights about the oil saturation.

Q. Tell me about that. What was the number you got?

A. So if I averaged it two ways, and I got some help from some folks that were more familiar with the core, we averaged the oil saturation in the San Andres using -- first of all, using Empire's tops and also using Goodnight's tops.

The Goodnight top, the average was less than this 10.39 number, so I didn't feel like I needed to rerun that; it would just be further negative.

If we averaged the entire San Andres using the Empire tops, the oil saturation number went to 14.86, I believe.

Q. Okay. So if we go back to the number that Mr. Knights gave us, and if you say something different, then probably my counsel will step in and say, "No, no, no." So you gave me a number that I can work with, that is 14.86, which was similar to what Mr. Knights provided.

But Mr. Knights also said that he included that to the Grayburg, to that number. So which one is which?

A. Can I correct myself. You're right, the 14.86 was from Mr. Knights' summary.

When we did it with the tops from Empire, it was slightly less. It was 14.4.

Q. Okay. I think the Commission will look into that. I do appreciate that.

A. Do you want to hear the results of those economic runs?

Q. No, I don't. My counsel doesn't want me to go there. So let me just hold it there. Thank you.

But I was curious that at least if you could have tried 20 percent, which we all agree that that is the basic definition of the ROZ, and you did a

percent and you still got negative number, then that would be something that we could have really, really paid much attention. Would you agree with that?

A. I agree. If it showed that, that would be important. I think it would also be important to still consider how that 20 percent is distributed across the logs and consider that the model itself doesn't recognize that some part of the non -- you know, the non-oil-bearing zone that's going to take CO2.

Q. Let me ask you, did you review the core analysis for the EMSU 679 yourself?

A. No. That was not part of my work.

Q. So you did not calculate any saturations and compare to any of the core data?

A. I did not make those comparisons. Others on the team were focussed on the cores.

Q. You presented your criticisms of Dr. Buchwalter's model that he worked on. Based on the back and forth that we've heard, even Goodnight's counsel showed us the permeabilities from the core. It was shown to us today. Do you still believe that his permeabilities that he used in his model is not justified?

A. You're talking about Empire's counsel that

showed the permeabilities today?

Q. Yeah. Let me repeat that. So during the redirect of Mr. Knights, Goodnight's counsel showed us the permeability from the core where they were trying to establish the impermeable zones.

Were you around when we were going through the discussion?

A. Yes. I'm with you now. Yes.

Q. Thank you. So if you look at those permeability numbers, especially for the Kv is Dr. Buchwalter not justified?

A. Well, my problem with the way that he adjusted those Kv's is not so much the actual number he used, it's the fact that it was over the entire cell. So if the whole cell, two acres, gets its vertical permeability changed, not just at the wellbore, and the fact that its done sporadically, you know, sort of a heavy-handed way of adjusting.

We heard from Mr. Knights that there are other explanations for that water, based on the 1939 paper. And I would have expected at least some analysis that tried to look at not just a single solution for getting that water, those water numbers to match, but other solutions, like stochastic array of permeability that could have had a channel coming

from any direction to get water into those wells.

So that's the main criticism I have, not the actual numbers he used.

You know, we went back and forth thinking that those were 0.01 to 12.8. And then there was an exhibit put up that said it was a darcy. Obviously that would have been something, but it turns out those numbers were shifted. So it's really not the number, it's just the fact that it's sporadically done throughout the reservoir to make those matches.

Q. So I got to know that you've also run simulation models in the past. And as a modeler myself, normally we list all the potential options that we have, you know, to be able to achieve a history match based on the data that we have available. Right?

A. Yes.

Q. So the strategy that Dr. Buchwalter used, don't you believe was an option?

A. It's an option, but I don't think he exhausted all the options of how it could have moved.

The other thing I'll say about the model, when he uses that high residual water saturation and he drops the oil-water contact, you're basically starving the Grayburg for water. And then

you go searching for that water and you find it in the San Andres.

Q. Did you review his relative perm curve?

A. I did, yes.

Q. When you say that he starved the water, do you have the residual oil saturation or the water on top of your head that he used for his model?

A. I think he used 35, from memory.

Q. And that is oil?

A. No, no, no. That would be the connate water.

Q. And are you saying that 35 percent connate water, which is the initial water saturation, is low, or high?

A. It's basically the irreducible water that doesn't move, and it's high. So he's freezing up that water. And based on information I've seen, it should be lower, 25, maybe even lower. That would free up water to move, which would solve some of his problem of not seeing water.

Q. So is it your testimony to the Commission that you are not aware of any reservoir that do have a quantity of water of, let's say, about 35 percent?

A. No. Any reservoir? No, I can't say that. But what I've seen in the published information that

was put on at the unitization hearing, he didn't use that number.

And at some point, in a model, you have to decide what are the numbers you're going to believe and not change everything. So he moved those numbers around. He starved it for gas by reducing the gas-oil ratio. Just a number of things that I was confused about why he chose to move those numbers as opposed to changing things like -- you know, that unitization hearing very clearly said they didn't have a good handle on the original oil in place, but he used that as an absolute ground truth and then forced other variables to fit that.

Q. So, sir, don't you believe that, you know, Goodnight could have done more by at least presenting an alternative model to dispute or at least present alternative strategy to the Commission for consideration?

A. Well, we did consider building our own model. But we looked at the available date -- now, Dr. Buchwalter's model has a lot of information in the Grayburg. But the real critical part of it is, is how the San Andres and the Grayburg interact. And we have just very little data to match the pressures in the San Andres.

We have enough to say I know what it is in 1959. I know that it is in '87, '86, and I know what it is today, and those haven't changed very much.

But as far as matching, I think it's a stretch for him to say that he pressured matched the San Andres, because he has so few points, and one of those points is assumed at the very beginning.

So we looked at all of that and we said there's not enough data to have the appearance of precision by doing an alternative model. We're going to present the actual information.

COMMISSIONER AMPOMAH: Can we go to Slide Number 23?

BY COMMISSIONER AMPOMAH:

Q. So, sir, I just want to discuss this with you. I think, based on your discussion earlier on the last time, you said that there were not actual production history for each of the wells.

Now, my question to you is, in our business, is it not possible to reallocate production data, you know, back to the wells?

A. It is possible as long as you honor or have some information about how that allocation is done.

There's a figure in Dr. Buchwalter's original statement where he shows a field-wide oil

rate. And if you look at that, the initial rate is 10,000 barrels per day. But we know that -- and that goes all the way back to 1938. If you look at the history that's described in the unitization hearing, the biggest month's production, I think was in 1940, was about just shy of 800,000 barrels per month. That calculates out to about 25,000 barrels per day.

And so he missed the initial potential on average by a factor of about 2. And I think that's really important, that most of the withdrawal would have occurred in the first two decades. He spread it out over a much longer period, and that's got to have an impact on the model.

COMMISSIONER AMPOMAH: Can we go to the conclusion slide?

BY COMMISSIONER AMPOMAH:

Q. So on Number 3, you said RFT pressure measurements contradict both West and Buchwalter's conclusion.

Now, let me ask you, based on the redirect, the cross-examination, all the information that we've listened to today, is it your testimony that the San Andres is an under-pressured reservoir?

A. The disposal zone is, the zone that Goodnight is disposing into and Rice is disposing into

and where the water supply wells were.

Q. Even after counsel for Empire showed us the Rice well with those pressures, do you still stand by that?

A. Can you repeat that one more time?

Q. So I'm referring to Empire's counsel showed the pressure information at different ES from one of Rice wells that there was a discussion back and forth on that, with you on that. Do you remember that one?

A. I do. But that was the single measurement in that Rice well.

Q. So even with that particular information, is it still your testimony that the San Andres is an under-pressured reservoir?

A. Absolutely. The deepest pressure there is 1800 psi at 5000 feet, which calculates out to .36 psi per foot. And there are published studies that show that the San Andres is under-pressured regionally.

Q. So is Goodnight going to show us actual reservoir pressures, you know, from other witnesses to, more or less, solidify that claim?

A. I think you're definitely going to see current pressures from Mr. McGuire on his wells. He has one well that has been inactive for a couple of months, and so it's a good static measurement. And it

calculates at an under-pressured gradient, as well.

Q. So I'm going to go to Page 18 of self-affirmed direct statement. I'm just going to look at the last statement where you bolded that. And then we'll probably pick it up from the next page.

So you're saying that without undertaking critical laboratory testing or other validation of MMP correlations -- that would be on 19 -- MMP correlations, Empire's assumption of miscibility and, therefore, the estimated recovery factors are not reliable.

So is that not what they're asking, for the Commission to give them the opportunity to do this?

A. I don't know that you would need to acquire data to do that. To do the slim tube test, you would. But there are correlations you could use.

But my comment here related to, this is prior to us seeing their economic analysis, that we expected to see some discussion of this. There was none. And that's an important parameter in their analysis. And so it was surprising not to see it.

Q. So would you agree with me that when I say that they should at least be given the opportunity to embark on detailed analysis to fully understand the

feasibility of this project?

A. I mean, can you help me with what you mean by "this project"? If it's to the entire San Andres zone, I can't agree. If it's a portion of the Upper San Andres, I can agree to that.

Q. Now, you said if it is a portion of the San Andres, you will agree to that. Now, assuming that the Commission, more or less, aligns with your thoughts, saying that okay, focus on the Upper San Andres, do you believe there has been an established boundary between the Upper San Andres and then the Lower San Andres that will support the effective CO2 EOR in the Upper San Andres?

A. Yes. I do believe that the data shows that there's a separation between the disposal zone in the Upper San Andres. And it's because of that, that if Empire wanted to do an ROZ project in the Upper San Andres, that it can be done without impact from the Goodnight wells.

Q. So when Mr. Knights testified that he used -- you know, he supposed the permeability barrier based on, let's say, 0.1 millidarcy or even lower permeability. He classified that as a barrier. Do you also agree to that?

A. Well, I think so. But I didn't approach it

from that standpoint. I look at the characteristics of that disposal zone and the fact that it can take water on a vacuum for decades and decades and the water supply wells can supply -- must be very, very large. And the fact that we drill into it and have loses that you don't have above, to me, that's saying that there's a separation between those zones.

So I don't do it by looking at perms like he does, but I get to the same place.

Q. So assuming we are using the perm, you know, to delineate the barrier, I mean, the perm of 0.1, you and I agree that CO2 will, more or less, pass through that. So are they not going to lose CO2 into the bottom part of, let's say, the Lower -- or let's say, into the Lower San Andres?

A. I think gravity is going to help you in that case, because the CO2 is going to want to go up. So in the abstract, I agree that a gas can move through that. But I think it will more than likely move up structure.

Q. Mr. Beck tried to go back and forth with you on a subject that really concerns me. That is, has Goodnight done any analysis and presented it to the Commission of the impact that, lets say, if the Commission was to revoke the existing injection wells

and even deny the newly proposed wells, the actual impact that is going to have on Goodnight and then also on the State?

A. Well, I haven't done that and I don't think it's been done by any of the witnesses that have testified so far. But I think you're going to hear -- I don't know about analysis, but I think you're going to hear testimony about that.

Q. Let me try to wrap up here. Now there was a discussion that I'm really, really interested in.

So I'll ask you, based on your experience, and you've also the economic analysis, can you comment on the subject that when I say that when a significant amount of water has been injected into the San Andres, using that scenario, can you describe to the Commission if there could be any impact on the economic value of the ROZ?

A. On the economic value, you say?

Q. Yes. Yes.

A. And for the purposes of this question, am I assuming it's in the disposal zone?

Q. It is in the San Andres, so both -- I mean, this question is from the fact that I think there has been -- I think Mr. Knights talked about and probably you also, that the ROZ and then injection cannot

coexist, right?

A. Right.

Q. So if they can coexist, I'm asking you if there is any impact on the economics, the economical value of that ROZ that is alleged to be there?

A. So I think there are two factors to consider. One would be whether or not the pressure would increase. And I think based on all the information we've seen, whether it's large withdrawals from water supply wells or large injections from disposal wells over time, the pressure has not changed. So from that standpoint, the change in pressure I think can be eliminated as a concern for the effect on the ROZ project.

The second thing would be whether or not the water that's injected could move any of the oil. I think most witnesses have said no. I think there's one witness that said it would move oil off the property, which doesn't make a lot of sense. If it's a residual oil zone, it's not going to move. So I think you can eliminate that as a concern, too.

So my conclusion is that the injection of water would not impact their ability.

Q. What about the amount of water that the operator has to remove before they can get to the oil?

A. So I know that's come up a couple of times. And I don't fully understand that assumption, and which water we're talking about. Because removing water is something that happens -- are you talking about what you would do with it after you remove it, where would you dispose of it? I'm not sure of the consequences or the real basis of that question.

Q. So don't you believe that, let's say, if you are injecting water into the system, we don't know the boundary -- you know, I've asked about whether we do know an established boundary for the San Andres. We don't know the boundary. So don't you believe that the operator would have to spend more money to remove -- or to produce more water before they get, let's say, a barrel of oil?

A. Okay. So the assumption is, if Goodnight injects water, that would cause Empire to remove more water in their operation?

Q. That is where I'm going with that.

A. Okay. Now I understand. I think I would fall back on the pressure again, that if there's no pressure increase and you're just displacing water, I don't see how that impacts Empire's ability to implement an ROZ project.

Q. So when Mr. West was testifying, I asked him

did he include the withdrawal of the water, the amount of water that needs to be withdrawn from the San Andres before they start producing one barrel of oil. He said yes. So do you disagree with that?

A. If he's saying that that's in the economic model, I disagree with that.

COMMISSIONER AMPOMAH: Thank you, sir. I do appreciate your time.

THE WITNESS: Thank you.

HEARING OFFICER HARWOOD: Okay. Redirect, Mr. McBeath.

MR. RANKIN: Thank you, Mr. Hearing Officer.

REDIRECT EXAMINATION

BY MR. RANKIN:

Q. Mr. McBeath, do you recall during your last session of cross-examination with Mr. Wehmeyer, you were asked questions about PPQ analysis, or -- do you recall that testimony?

A. I do.

Q. And what's your understanding of what PPQ stands for?

A. Production in paying quantities.

Q. And you understand that Mr. Wehmeyer was asking you about whether you've done that analysis. What's context in which that analysis is done?

A. It's usually done in the context of a lease that the lessor is alleging has lapsed because of a failure of production in paying quantities. It normally happens with the last well on the least, where there's very little production. And there's analyses that are laid out in case law and pattern jury charges that show what cost you should include and should not include to figure out whether or not the well is producing in paying quantities. And if it is, then the leases saved. And if it's not, with some other extenuating circumstances, like prong two, then the lease is lapsed.

But it has no applicability to a project that has not been implemented and considering large capital expenses and making a decision on whether to move forward.

Q. To that point, did Empire conclude capital expenses in its economic analysis?

A. Yes, they did. I didn't change any of those.

Q. Okay. And you just used what Empire had done and so you did not exclude any capital expenses from your analysis, right?

A. That's true, yes.

Q. I think you testified, as you just explained

to me, that you're familiar with PPQ analysis, at least under Texas law, right?

A. That's true. I've had a couple cases in New Mexico that never made it to trial. So we noodled on it, and I'm aware that maybe the case law is thinner in New Mexico on this issue.

Q. Based on your understanding of what PPQ analysis is, did Empire, itself, undertake a PPQ analysis?

A. No, they didn't. And I don't think it's appropriate here, but no, they did not.

Q. Okay. Do you recall questions during your last session from Mr. Wehmeyer about who was in the best position to do a coring analysis in the EMSU, Empire or Goodnight; do you recall that series of questions?

A. I do.

Q. And do you recall the previous testimony that Empire acquired the EMSU in March of 2021?

A. Yes, I do.

Q. Are you aware of any reason that Empire could not have cored a well at any time between the time they acquired the unit and today?

A. I'm not aware of any reason they couldn't have drilled a well and cored it.

Q. Are you aware of any reason that they cannot go out and core a well now?

A. No, I'm not.

Q. And that would be true for any of the three units that they operate, the EMSU, the EMSU-B or the AGU, correct?

A. That's correct.

Q. And, Mr. McBeath, you did some review of where Goodnight's injection wells are located, correct?

A. I did, yes.

Q. Do they have any disposal wells or injection wells operating within Empire's AGU unit?

A. No, they're all limited to the EMSU unit.

Q. Do they have any disposal wells operating within the EMSU-B unit?

A. They do not.

Q. Did you hear testimony from Empire's witnesses that they were ordered not to do any further work on their CO2 project until disposal was ceased in all of their units?

A. Ceased? I don't remember the distinction of all of their units, but yes, ceased.

Q. And do your knowledge, Goodnight is not injecting any disposal water or produced water the

EMSU-B or AGU, correct?

A. That's right. You're right, it's a moot point on those, yes.

Q. Okay. Today, Mr. McBeath, when Mr. Wehmeyer was asking you about whether you conducted any analysis to determine volumes of CO2 -- I'm sorry. Strike that.

Do you recall during Mr. Wehmeyer's cross-examination of you where he was asking you whether you evaluated or changed the amounts of CO2 that might be needed under Mr. West's economic analysis?

A. I do with respect to the pressure issue, yes.

Q. And do you recall Commissioner Lamkin's questions about what your estimate is for what the additional volumes might be needed -- or how much volume of CO2 might be lost in the formation in this particular area? Do you recall that?

A. I do.

Q. And you said you expected it to be somewhere on the order of 2 to 3 times. My question is 2 to 3 times what?

A. 2 to 3 times more than is assumed in the economic model of Empire, based on that dimensionless

curve.

Q. Okay. And you didn't run an economic analysis based on your estimate that 2 to 3 times more CO2 would be required, did you?

A. No, I did not.

Q. Okay. Do you recall Mr. Wehmeyer asking you today about the variables that you analyzed in Mr. West's economic models -- or model, rather?

A. I do, yes.

Q. Do you recall Mr. Wehmeyer stating that that economic model was representative of a project that Empire intended to carry out?

A. That was certainly the implication of his questions.

Q. Based on the economic model that you reviewed, in your opinion, Mr. McBeath, is there sufficient analysis in order to carry out a CO2 project based on that economic model that you reviewed?

A. No. I would characterize that calculation spreadsheet analysis as, at best, the beginnings of a scoping analysis.

Q. Now, do you recall Mr. Wehmeyer's cross-examination of you where he was asking whether you, yourself, had calculated a recovery factor? Do you recall that?

A. I do.

Q. And I want to make clear, Mr. McBeath, did Empire, itself, calculate a recovery factor?

A. I don't think I'd say they calculated one. There is one implicit in the dimensionless curve that they used. And I talked about the genesis of that curve. But if they just assumed three pore volumes, hydrocarbon pore volumes of CO2, it would equate to a recovery factor of 18.5 percent.

Q. You may not recall this, Mr. McBeath, but do you recall the slide that Mr. Wehmeyer showed you where he was asking you about whether or not or why you didn't use EIA pricing in your economic analysis?

A. I recall a slide with some yellow highlighting on it, yes.

Q. Do you recall below that yellow highlighting there was some information about what that four-county study used in terms of a price escalator for CO2?

A. I don't, no.

Q. Does Empire use a price escalator for CO2?

A. No. It was a flat CO2 price. Whether it was $1 or $1.50, it was flat. Their's was flat at $1.

Q. Whose was flat at $1?

A. Empire's was flat at $1.

Q. But they used a escalator for their oil

pricing, correct?

A. That's right.

Q. But they didn't use any escalator to account for increasing CO2 costs, did they?

A. That's correct.

Q. What's your opinion on whether it's reasonable to assume that CO2 pricing is going to stay flat? Is it conservative, or what's your opinion?

A. Well, it's -- the longest term CO2 contract I've seen in all the work I've done, whether it's sourced out of McElmo Dome or Bravo Dome or Sheep Mountain, is, I think 15 years. At some point you're going to be renegotiating. And I doubt very seriously that the price is going to be the same.

Q. During the cross-examination today from Mr. Wehmeyer, he mentioned, at least at one point, that Empire might be considering 10-acre to 40-acre spacing for it's CO2 injection project. Do you recall him asking you about that range of spacing?

A. I recall him mentioning 10 acres, yes.

Q. Have you seen anything in any of the materials records, testimony about Empire considering or looking at 10-acre spacing?

A. No, I have not. And economic model assumes 40 acres.

Q. What would it do to the economics if you were to -- what would it require to go down to 10-acre spacing?

A. Requires a lot more wells, new wells, more expense, and you hope it increases the recovery.

Q. But you haven't seen any analysis from Empire reflecting any consideration of 10-acre spacing, correct?

A. That's right, I haven't.

Q. There was some discussion about your effort to substantiate CO2 pricing in your criticism of Mr. West's analysis. Do you recall that cross-examination today?

A. I do.

Q. Do you recall seeing anything in Mr. West's testimony or Empire's materials substantiating their basis for their assumption of their CO2 pricing?

A. I do not. Only that it was stated.

Q. Do you recall cross-examination today, Mr. McBeath, where Mr. Wehmeyer was discussing about the potential for high grading location for a one-section project within the EMSU? Do you recall that cross-examination?

A. I do, yes.

Q. Are you aware of any effort or report, study

analysis on Empire's part to identify or high grade locations with the EMSU?

A. Not in the documents I've seen in this matter or in the testimony so far.

Q. Do you recall the testimony from Mr. Wehmeyer about the potential benefits to New Mexico in terms of royalty?

A. Yes.

Q. And Mr. Wehmeyer asked you that -- that that would be a substantial benefit to the State to be able to -- he showed you a chart, I think, that had some royalty values on it. Do you recall that?

A. I don't recall the values. I remember him asking me about it, though.

Q. Now, isn't it true that in order to receive any royalties, there actually has to be production, correct?

A. That's right. You have to have a successful project for those great benefits.

Q. And referring to that chart, Mr. Wehmeyer was asking about the benefit of royalty over a 40-year period, which is a long period of time, isn't it?

A. It is, yes.

Q. And, again, you'd have to have production over that entire 40-year period to see any benefits,

wouldn't you?

A. You would for royalties or taxes or things like that.

Q. Mr. McBeath, during Dr. Ampomah's discourse with you, his questions, he asked you whether you had conducted an economic analysis using Empire's model to evaluate what the model would say about a 20 percent oil saturation. Do you recall that?

A. I do, yes.

Q. And you discussed some of the considerations about using a 20 percent oil saturation. But one thing you didn't mention was one of the assumptions you discussed in your testimony, which is the use of a dimensionless curve. Explain, if you would, how you would -- what consideration you would give to just relying on a 20 percent oil saturation analysis, and using Empire's economic model, while also relying on the dimensionless curve that's inherent in that model?

A. So the genesis of that curve is not well understood. When we asked about it, we were given a paper, and I've gone over this a couple of times, that principally uses the curve to calculate how much CO2 would be needed to theoretically flood all the fields in Wyoming under miscible and immiscible conditions.

And in the curve that's presented in I

think it's Figure 4 of the paperwork, there's kind of a comparison to a San Andres curve. And there's no discussion of where that comes from.

Based on the age of the paper, it's more than likely that that's a main pay paper, because there weren't a lot of ROZ projects around when that paper was published.

So main pay is going to have a lot more continuous oil saturation. There will be a lot of data to back up the dimensionless curve like that. Many fields, many projects, much less so when you come to an ROZ project, and in particular, an ROZ project that starts getting on the boundaries of what's been shown to be economic.

So I have some real concerns of just blindly using that curve to estimate that.

Q. I think we'll hear more from Dr. Lake on some aspects of that, correct?

A. I believe so, that's true.

Q. Now, another question that Dr. Ampomah was asking about, it was about potential impacts to a CO2 project relating to the need of Empire to have to remove additional water.

So if Goodnight continues to inject into the zone and if Empire would proceed with the CO2

project, wouldn't they have to remove water, and you responded that based on the pressures, it's not your expectation that that would be an impact, correct?

A. That's true, yes.

Q. Just so I'm understanding, is the point that -- the disagreement you have with Mr. West is because Mr. West is assuming that the San Andres disposal zone would be pressuring up? Is that the genesis of the disagreement?

A. I think so. I believe that's right. This issue kind of popped up near the end of his testimony, and all of a sudden there was discussion about removing water. I presume it has to do with his assumption that you'd be pressuring up and, therefore, have to remove water to get down to the same pressure. I don't think that's an issue based on the performance of the San Andres disposal zone.

HEARING OFFICER HARWOOD: Mr. Rankin, could you just stop screen-sharing so we could see the witness.

MR. RANKIN: Mr. Hearing Officer, I have no further questions of Mr. McBeath.

HEARING OFFICER HARWOOD: Thank you, then. May this witness be excused?

MR. WEHMEYER: For Empire, yes.

HEARING OFFICER HARWOOD: OCD?

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

HEARING OFFICER HARWOOD: Rice?

MR. BECK: No objection.

HEARING OFFICER HARWOOD: Pilot?

MR. SUAZO: No objection.

HEARING OFFICER HARWOOD: Mr. McBeath, thank you for your time here and last time we saw you.

THE WITNESS: Thank you.

HEARING OFFICER HARWOOD: All right. So it's 4:20 p.m. Let me look at see who I have on your witness list. Who would be your next witness?

MR. RANKIN: Mr. Hearing Officer, next witness would be Mr. Allman, who is available, I think. I would ask just for a moment so I could use the restroom and maybe talk to Mr. Allman and make sure he's also ready and make sure we have our materials ready to present.

I think we could probably get it done by 5 o'clock, at least intro slides. That's my expectation.

HEARING OFFICER HARWOOD: That would certainly set a record in this case.

MR. RANKIN: There are some witnesses that

have more materials.

HEARING OFFICER HARWOOD: Let me hear from Mr. Rozatos. What are your thoughts on this?

CHAIR ROZATOS: I'm okay with that, if Mr. Rankin thinks that he will finish in time. As you said, Mr. Hearing Officer, that would be definitely a record if that were to happen. Especially with our track record in this case. So I leave it to your discretion.

MR. RANKIN: May I make a small interjection? I guess my thought is, if I take 10-minute break, that's 4:30. I hate to disappoint anybody by going past 5:00. I know we have to start -- not start until 10:30 tomorrow, which is a factor, and totally understandable.

I'll leave it to the Hearing Officer. I'm happy to go forward at 4:30, but I'm also happy to start at 10:30 tomorrow morning.

HEARING OFFICER HARWOOD: Well, let me ask you. You guys haven't had much time to talk about the scheduling issue that we raised, that I raised earlier today. So one option is you could use the rest of -- we could clear out and you guys could use the rest of today to discuss those issues and maybe agree on time limits.

Since this case is heavy on modeling, I've done a middle modeling of my own in terms of time and numbers and of witnesses. I think we have either five or six witnesses left, four for Goodnight and possibly two for OCD, although it may be one. But if we err on the side of caution, it's a total of six more witnesses.

We have a total of about -- through Wednesday of next week, if my arithmetic is -- not next week, but next time we meet in May, if my arithmetic is correct, it's about 31 hours. So with six witnesses, that's about five hours per witness, and that would mean maybe an hour and a half on direct, an hour for cross for Empire, half an hour for cross for other parties and intervenors, an hour for the Commission and hour for redirect.

These are just numbers I'm throwing out for discussion purposes, although the amount of hours in our day are pretty well settled. So that's the option.

We can start with the witness today or you guys could use the time to discuss whether or not you could agree to time frames for the rest of this proceeding so that we can get through it by no later than Wednesday of the week of the 19th of May.

MR. RANKIN: Appreciate that, Mr. Hearing Officer, appreciate your modeling. Would you mind sharing your model with us so we can do some due diligence?

HEARING OFFICER HARWOOD: Let's do it. I'll give you my Post-it notes.

MR. WEHMEYER: And that was actually going to be the subject of = a motion from Empire, and we'll certainly confer. But just given the incredibly lengthy direct examinations that have occurred during the Goodnight case in chief, we were going to make a motion that directs be limited to an hour.

I eman, this started at 15 minutes. Some of these things have gone two and a half hours on direct, which is far afield of what was laid out additionally.

The cross-examination -- part of why we're at this place timewise, the cross-examination of the Empire witnesses were quite lengthy and meandering. And I think for the part of Empire, we've done a better job of keeping this narrowed down by way of time and focusing on relevant things.

So we will confer. I think there's going to be a motion to limit direct from here out to

hour so we can get these things done.

And, again, these are witness statements that have been filed, so the testimony that they're giving by way of their case in chief should be in the record. And that was reflected in the Empire case; the redirects were quite tight and compressed.

So we'll confer with Mr. Rankin, but I think what you'll be hearing back, failing agreement, is something in those lines.

HEARING OFFICER HARWOOD: Hopefully you guys will be able to agree on something, you know, given the time frame, so that you don't have to have a motion. But of course if you do, you do.

I do remember Ms. Hardy at the outset saying that direction examinations would be about 15 minutes each. So I think there's enough guilt to go around on both sides for lengthy direct and cross-examinations.

You know, I've handled a lot of cases myself and, you know, significant, important, big cases, and I don't think I've ever seen cross-examinations that went this long. But, you know, my cases didn't involve these kind of complex, technical issues. So I understand the need for people to take time in these cases. But hopefully

you can work it out.

CHAIR ROZATOS: Mr. Hearing Officer, I apologize to interrupt. But, I mean, we've already now been talking for a little over five minutes, it's already pushing us to the 4:30 time mark, and then with a 10-minute break, it would probably be best that we follow your direction, we break here, let the parties meet together to try to find a consensus for the time frame, and then we can start up first thing in the morning at 10:30.

THE HEARING OFFICER: Works for me. I'll provide everybody my, quote, unquote, model and you guys can take it from there.

Thank you, everybody, for your time here today. We'll be off the record today. We'll be back tomorrow not so bright and early at 10:30 a.m.

Thank you.

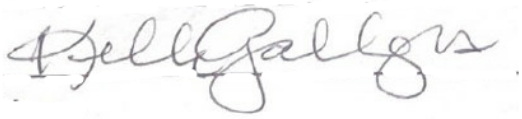
(Proceedings adjourned 4:27 p.m.)

AFFIRMATION OF COMPLETION OF TRANSCRIPT

I, Kelli Gallegos, DO HEREBY AFFIRM that on April 23, 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.



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