APPLICATION OF THE NEW MEXICO OIL AND GAS ASSOCIATION FOR AMENDMENT OF CERTAIN PROVISIONS OF TITLE 19, CHAPTER 15 OF THE NEW MEXICO ADMINISTRATIVE CODE CONCERNING PITS, CLOSED-LOOP SYSTEMS, BELOW-GRADE TANKS AND SUMPS AND OTHER ALTERNATIVE METHODS RELATED TO THE FOREGOING MATTERS, STATEWIDE.

CASE NOs. 14784 and 14785

ORIGINAL

VOLUME 3

May 16, 2012
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Oil Conservation Commission
Wendell Chino Building
1220 South St. Francis Drive
Porter Hall, Room 102
Santa Fe, New Mexico 87505

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VOLUME 3 - INDEX

EXHIBITS OFFERED AND ADMITTED

CHAIRPERSON BAILEY: Good morning. This is a continuation of the Oil Conservation Commission hearing on Consolidated Cases Numbers 14784 and 14785. All three commissioners are here today, so we do have a quorum.

We broke yesterday afternoon with Daniel Arthur who was giving his testimony. We will resume with the direct testimony of Daniel Arthur.

You are still under oath.

And, Mr. Hiser, if you would begin your examination.

MR. HISER: Thank you, Madam Chair.

JAMES DANIEL ARTHUR,

after having been previously sworn under oath, was questioned and testified as follows:

CONTINUED DIRECT EXAMINATION

BY MR. HISER:

Q. Mr. Arthur, yesterday we were discussing some of the historic statistics surrounding pit failures; were we not?

A. Yes, we were.

Q. And as a result of that evaluation, you were looking at -- you were talking about why it was important to consider those historic problems that had been in pits, but also looking at where there hadn't

been problems with pits; is that correct?

A. Yes.

Q. And why is that important for you when you look at the changes in the proposed rule? I believe that we were at slide 1114-7.

A. Yes. So when -- when we look at those -- you know, we talked a little bit yesterday, you know, about historical perspectives and, you know, understanding how things have changed over the years from, you know, maybe some of the very early pits and over time to, you know, newer regulations, newer activities and so forth, to looking at both the current and proposed rule.

You know, there are a few key things that the rules include that you want to look at for any -- really any pit program, and that includes, you know, permit and/or registration requirements, siting requirements, design and construction requirements, operational requirements, closure and reclamation requirements. And also, because, in my experience, in any regulatory program -- this is common through states, the federal government, EPA -- it is -- it's really tough to have any set of regulations encompass any possible thing that can happen. You try to -- you try to do, you know, the best that you can to get a rule to address the vast majority, but, you know, there's always

situations that are a little different, and so having an exception of variance program is also an important part of a regulatory program. So those are kind of the key things that I looked at from that perspective, I guess.

Q. And so a good variance or exception program is able to address sort of the overinclusive, underinclusivity that otherwise might arise in a regulatory program?

A. Correct.

Q. What I'd like to do now is turn from the slides back to our Exhibit A, our attachment one, which is the -- Attachment A, which is the provisions to the rule, and to flip, then, to Attachment A, which is the definitions. And there's been some discussion in this hearing already, Mr. Arthur, about the difference between confined and unconfined groundwater. And the definition of groundwater is found in Section D, on page 1, and the definitions of unconfined groundwater are on page 3.

Can you tell us what confined versus unconfined groundwater is, and why that's an important distinction for us?

A. I think that, you know, outside of getting into a debate of definitions, you know, we have a definition here of confined groundwater: "Means water contained

within soil or rock below the land surface that is saturated with water where there are layers of impermeable material both above and below" the water is under -- "above and below and the water is under pressure so that when penetrated by a well, the ground water will rise."

So, you know, I've seen, you know, slightly different interpretations of confined groundwater, but in the terms of the rule, we're looking at, you know, at a confined groundwater aquifer that is really protected by impermeable layers both from above and below, but most importantly, relative to the rule, from above.

So the thing that that provides us and is really a vast difference to an unconfined groundwater aquifer, where there is no impermeable barrier from the surface, and, hence, would have a greater susceptibility to risk or endangerment by contamination or something like that.

Q. So does the impermeable layer between the confined groundwater and the upper environment, or the land surface, provide protection to that water as opposed to the water that might be above that confining layer?

A. That's exactly the point and I think why the two are differentiated in the rules.

Q. And this definition actually is a double trigger, is it not, both with confining layers and with the pressure in a confined aquifer?

A. Yes, sir.

Q. And does the difference in pressure between the confined aquifer and the surficial aquifer make any difference?

A. Well, clearly in the way that this definition is, is that the aquifer would be an artesian aquifer so that if there were any sort of penetration in that impermeable barrier, flow would be from down to up. So if there were a situation where -- where, for some reason, there was groundwater contamination, flow would be going into the -- into the above aquifer as opposed to into the confined aquifer.

Now, you can look at this on a case of a, you know, significant time period. You know, will -- will an artesian aquifer or confined aquifer be confined forever? And certainly that may or may not be the case. So it could be that a thousand years from now or whatever years from now, that it's somehow tapped and pumped or whatever, so it could change from that. But the point is, is that as we look at the time period where we are most seeing susceptibility of risk from pits or multiwell fluid management systems, during those

periods when we're siting those pits, that's the situation.

So if we have even a confined aquifer that may go from artesian to nonartesian, you know, 100 years from now, at that point, it really doesn't matter. So the key point is that at the time we're doing this, when we're siting, when we're operating that impoundment, that's really -- you know, that's where we see the -- you know, the most risk, the most issue of problems, really virtually all. So at that point, in that time period, is important in why this definition comes into play and why we're also not trying to say it's going to be, you know, where -- where -- where the pressure is going to rise for 1,000 years or -- there is not a need to look at it from that perspective.

Q. On page 2 of Attachment A, there is a definition of a couple different types of watercourses, and let's just sort of -- there is a continuously flowing watercourse. There is a significant watercourse, and there is a playa lake. Why are these terms defined?

A. Well, for practical matter, I think that as we get into the proposed rules -- and we'll talk about this more as we go forward. But the rules have really tried to be -- I think, be developed using a risk-based

methodology, which I like. And as we -- as we get into defining some of these, as we're putting into perspective some of the definitions that can be used relative to setback siting and implementing the other parts and rule. So that's why they're significant.

Q. And does the definition of continuously flowing watercourse seem appropriate based on your experience as a regulator and as a person who does hydrogeology and all?

A. You know, if you look at definitions of -- I mean, there are a lot of definitions that change over time, and, you know, waters of the state and -- I mean, it gets tough to find definitions, and they're certainly not always consistent throughout the country.

What I like about this is, we define a continuously flowing watercourse, meaning "a river, stream or creek that is named or delineated by a solid blue line on a USGS quadrangle map...." So if -- if -- you know, if you look in practical terms, when we're doing siting and that, you know, I mean, in industry and really in a lot of activities where, you know, you want to say -- you know, you don't want to have a blue line pit, you know. So it makes it kind of an easy thing from a planning perspective. And -- and we put some details on that.

And also we say: "That typically has water flowing during the majority of the days of the year. This does not include," you know, "washes, arroyos, and similar depressions that do not have flowing water during the majority of the days of the year." So I think from that, it gives you a pretty good definition that I think is easily understandable and followable.

Q. This would, in fact, be helpful to the Division as well because what's on the USGS map -- it's centered around the USGS map, and so at that point it creates a presumption that the Division can use to say, Well, this has to be set back from here, and if the operator wants to do anything else, the burden obviously shifts to the operator?

A. Obviously, yes.

Q. The definition of playa lake, does this comport with your understanding of what a playa lake generally is?

A. Yes, it does.

Q. And the definition of significant watercourse, the major change here is the definition of bed and bank. Why is that important? This is on the top of page 3.

A. It really -- for me, this is a -- this is a clarity issue for me, and the issue of, you know, defined -- with the defined bed and bank makes it more

easily identifiable to make sure that you're addressing those. So to me, this is a clarification.

Q. And then back on page 2 -- I apologize for jumping back and forth -- there is a definition of low-chloride fluids. And what's the reason that the proposed industry revisions differentiate between low chloride and nonchloride fluids?

A. You know, when -- when you're -- when you're dealing with water, really, from a number of different perspectives, and not just with pits, but in this perspective pit, is that if I have a low-chloride fluid versus a fluid that maybe is very high in chlorides, 200,000 milligrams per liter TDS, treating those the same, managing those the same, it really doesn't make sense technically.

So if he can put something in place where we're managing waters based on their characterization appropriately, that makes a lot of sense. And it takes an unnecessary burden from treating a low-chloride solution similar to what you would with a very high-chloride solution, for example. So the idea is, this really kind of sets the basis so that you can understand how to differentiate the two and then implement details of a rule, and then, furthermore, how it's implemented in the field based on, really, the

types of risks or endangerment that you're looking at.

Q. And as both a petroleum and environmental engineer, does the level at which this distinction is set, 15,000 milligrams per liter, make sense to you?

A. It does. You know, when -- and I could just think of a number of different contexts, but relative to what we're dealing with and what I've seen from EPA and a number of states, that's a pretty good cutoff.

I mean, you know, seawater is maybe, you know, 30,000, you know, milligrams per liter TDS, mostly chlorides, you know. So this is really trying to scale that down to something that is meaningful. And probably you could look at other different definitions, like the underground source of drinking water, something like that, as being low chloride.

Q. Thank you.

If we turn ahead, then, Section 19.15.17.9, Permit Application and Registration, there has been some discussion on pages 6 and, really, 7 of this about how does one appropriately determine depth to groundwater. So this is found, I believe, first off, in Section B(2) for temporary pits. And the same language appears in B(3) for below-grade tanks, and B(4) multi-well fluid management pits.

And the rule provides that there are

certain things that can be used in the absence of site-specific groundwater data. Are the information sources that are provided things that would typically be looked at by a professional in the field of depth to groundwater in the absence of site-specific information?

A. Yes.

Q. Do they provide reasonably good data that you have reasonably good assurance that the data will give you a good value?

A. It may not give you an exact value, but it should give you a good idea of where that is.

Q. And is there a safety valve built into this, when you use an alternative method, that the Commission can review and concur that that method is reasonable?

A. Of course.

Q. Does that seem to you to be an appropriate way to address the depth to groundwater in siting purposes found in this rule?

A. It not only does, and it also is consistent with what I've seen in other states.

Q. Thank you.

If we turn, then, to Section 17.10, Siting Requirements, there's been a lot of discussion about siting and whether it's appropriate. I was wondering if you could answer a question about siting or temporary

pit or a multi-well fluid management pit, both of which are found at page 9 of our exhibit, under Section A. And the first thing is, they talk about combining the multi-well fluid management pit with the temporary pit. Is it appropriate to use the temporary pit siting criteria or, as Mr. Dangler from the Land Department suggested, maybe look at the permanent pit siting criteria? Which is more appropriate in your mind?

A. You know, I've been involved in a number of -- of kinds of pits, both temporary pits and a lot of multi-well fluid management pits and other pits even used for containment or infiltration, but to me, there seems to be a very big gap between temporary pits and multi-well fluid management pits versus permanent pits. They seem to be very different.

In both cases, both the temporary pits, obviously in their name, but the multi-well fluid management pits, are temporary in nature and probably not going to be around for, you know, 20 or 30 years.

What I've typically seen -- and I know there was discussion about, well, they could be around for years. But yet when I look at the criteria that we have for the temporary pits, I've seen multi-well fluid management pits used in a number of different places. Certainly, you can have situations where one of those

pits could be around for, you know, five years, maybe, you know. I mean, it really -- it really depends. But more so what happens is that when -- you know, when you -- when you look at how those pits are used, they're generally staged within a set of well pads.

If you look at even industry planning for their well pad sites and generally from a -- from a lot of these continuous reservoir plays -- do you mind if I draw a picture to -- would that be acceptable?

CHAIRPERSON BAILEY: Of course. Be sure to label it clearly, because it will become a part of the record.

THE WITNESS: Okay.

A. So one of the differences that's happened, as we've gotten into unconventional resource development versus historic, kind of, conventional resource development, is that you're developing a region, which may be your acreage. And how you develop that may depend on if you're, you know, a small operator and you have a little bit of acreage versus a big operator that maybe has a big-acreage play. And also there could be variations if you're doing, you know, kind of exploration to prove up production versus when you get into what's more of a -- more of a kind of a hydrocarbon -- almost a hydrocarbon mining process.

So you may have pads that you put a well on, where you're proving up reserves, versus when you get to the point where you know what's there and you're putting pads in with lots of wells on them and moving forward. When you -- when you -- when you actually get to that point, that's when -- when you use the pad.

So what you might do is, you might have, you know, a pad (drawing) and the wells from the pad, you know, and you could have -- you know, you could look at this as -- you know, I call it like a candelabra, that comes off itself (drawing). But that's generally how the wells will come off the pad.

And you really can't -- it's pretty tough to do this sort of thing from one wellbore, so they'll typically do these from individual wells at the surface that may be real close to each other. But when you think about that and how they wind up developing these is -- and once you -- you know, so this is kind of when you get into the more -- the perspective when you're needing multi-well fluid management pits. Okay?

So when you do that, then you start thinking, okay, I'm going to have my other pad (drawing), you know. And you kind of -- you kind of get the idea here (drawing). And that may go on to, you know, multiple pad sites. So unlike if you're trying to

explore an anticline or some trap in these continuous reservoir plays, you're looking at trying to get your acreage set up so you can do that. And this might vary based on jointing or compartmentalization of the reservoir itself, but this is what you have.

So when you start looking at this, you go, Okay; I want to have a multi-well fluid management pit that I can -- that I can easily access multiple pads. You know, so the example that was given, you know, earlier in the testimony was one multi-well fluid management pit servicing four -- four pad sites. So if you kind of look at that -- and, you know, if I'm looking here (drawing), I might -- I might put my pad site here (drawing), so "multi-well fluid management pit."

And I'll look at that depending on topography, roads, you know, all that, you know, on just how I locate it, as well as setbacks, and I may set up either where I can get to this with trucks. But, ideally, what you'd like to do is to be able to minimize truck traffic and all the other things that you have to deal with, you know. And considering that it's kind of a temporary thing in nature, I might set fast lines. I might set below-ground lines. But a lot of times, what I've seen around the country is, they'll set up fast

lines. So fast lines are aboveground pipelines. So I might build it to run, you know, a pipeline pretty easily to those four -- you know, to those four pads.

Where it may be -- if I try to -- you know, let's say that there's a river here (drawing), you know, or some feature that I don't want to cross with a pipeline, I may not be able to do that. So I've got to be able to consider all those things as I'm -- as I'm looking at how I do that. So I might build a -- you know, get this to go to a pad down here (indicating), but that's going to depend on my acreage and the topography.

And what winds up happening is that usually four or five pads, you know, I'd say in general, are about what you can manage with a single multi-well fluid management pit.

I will tell you that in some places like in the Marcellus Shale, you've had some of the larger companies that have really big leaseholds; they've put in and have done stuff where they've actually put in permanent pipelines to manage water. So they can manage both produced water and freshwater that they may get or water from other sources.

But in doing this (indicating), they really -- from -- from how -- if you can use these --

you know, what I look at is mostly from an environmental perspective and a feasibility of putting them in. They're about that.

So -- so -- so ultimately, when you look at the idea of, well, it could be there for years and years and years, typically what happens is, you may have these pads. And let's say while this is going on, I drill one well here (drawing), and I drill one well maybe here (indicating). On those, I don't -- I'm not into this situation here. So what I've done on these, because I'm not ready for this, I just put in some temporary, you know, pit, or I'm using tanks and stuff, so I haven't gone to that next step of having a multi-well fluid management pit that's going to sit there for five or ten years or some indefinite amount of time. And typically, that's what I've seen. You know, so when I look at kind of the -- that's why and how I'm distinguishing that. So in my view, I look at the temporary pits and the multi-well fluid management pits more similarly than maybe might be obvious.

So to your question --

Q. Okay. Thanks.

In the first section here under 1A, we talk about changing the depth to groundwater from 50 to 25 feet below the pits. And there is a distinction there

for low-chloride fluids, and again for 50 feet if it's not a low-chloride fluid. What's the rationale for that change?

A. When we look at some of the setback requirements -- and this occurs, Eric, really kind of throughout these -- this part of the rule section. But what we're really trying to do is distinguish -- really a couple of things. But one is that we have low-chloride fluids versus fluids that are not low-chloride fluids. So we're trying to adjust for those, and then to look at what is appropriate based on -- based on what we believe is appropriate.

Q. And why would be it appropriate to have a lower depth to a low-chloride fluid?

A. Because there is less -- less risk, less -- you know, less perceived risk, less endangerment. It's a fresher water.

As you even start looking at -- at -- at what you think about when you -- when you -- when you look at -- at kind of the design of setbacks and -- and managing risks and all that, what happens and what you want to try to plan for is -- if you have a pit or something, you don't typically see, you know, if the pit has, you know, 15,000 milligrams per liter chlorides versus 100,000 milligrams per liter chlorides and some

fluid, let's say, even if we put it in a worst case, you know, during operation. You wouldn't typically see, you know -- you know, from a -- from a closure and all that, that you're going to have, you know, that slug flow moving.

What typically happens, even if you have, say, some leak or something like that, unless it's a drastic leak, you want to have -- you want to be able to have time to be able to respond, and the importance and significance of response, you know, I think depends a little bit on the chloride content.

But even from a longer-term period after closure, when we talk about, you know -- you know, once we've gotten a closure, you know, and just what you see is, you don't tend to see from, say, a closed pit that you're going to have 100,000, say, milligrams per liter chlorides moving down and going on forever. It -- it -- you know, it goes -- it equalizes. It disperses. It dilutes, you know. So we see it getting smaller and smaller over time. And that's less of an issue with a low-chloride fluid than a high-chloride fluid.

Q. And everybody talked about some of the specific mechanics of how --

A. Yes.

Q. -- the groundwater on Table 1 and, I believe,

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Table 2 in the closure standards.

A. Yes.

Q. But for purposes of siting, the other thing that we're really looking for is to be able to provide a response time?

A. Yes.

Q. So does this -- in your view, does this distance provide for a response time?

A. Yes, it does.

Q. When we look at the continuously flowing watercourse, there are some changes there. Is that a similar concept looking at risk? Once again, we've made it closer for a low chloride fluid?

A. Yes, exactly.

Q. Does that seem effective, in your view, as a environmental engineer, environmental professional?

A. It does.

Q. So the primary concern here with the continuously flowing watercourse is a seepage into that watercourse, or is there overland flow into it?

A. Generally, the concern is overland flow.

Q. And in your experience, would the distance there provide time for the prevention and probable prevention of that release reaching that continuously flowing watercourse?

A. You know, I've -- I've -- I've -- you know, one of the things I've done over time in the last couple of decades has been emergency response, so I've actually responded to a number of instances where they've had leaks, overflows.

The other thing that I did more recently -- and it's not necessarily a pit, but I think it's a good example. I was one of the professionals that got to respond to the -- to the Chesapeake's ATGAS blowout in Bradford County, Pennsylvania. And what we saw there was kind of, you know, a number of things that -- you know, a massive rainstorm, a blowout occurring, and still, yet, we're able to -- Chesapeake was able to respond pretty quickly within that. So the setbacks that you have from that, in my experience, is more than adequate to allow a response.

Q. In Section D, there are setbacks from private domestic freshwater wells, and there is a distinction made for low chloride. And also there is a deletion of "less than five households." Does the deletion of "less than five households" make this more a protective number in some ways or --

A. Yeah. I think by -- you know, really by doing that, if you look at this, we're really saying any spring, as opposed to one that's -- so this is actually

really a more stringent setback.

Q. And in your view, is the setback here an appropriate protection --

A. Yes.

Q. -- to provide time for response?

A. Yes, sir.

Q. And we'll talk about the groundwater mechanisms when we get to Table 1 and Table 2.

And then in Section E, there is a change from "fresh water well field" to "well head protection area," as defined by New Mexico Code Section 3-27-3. What's the purpose of that change?

A. Really, I think this is a -- in my view, this is really a clarification and, I think, something to allow to be better defined.

Q. And that's because the wellhead protection area has a regulatory definition?

A. Exactly.

Q. So it eliminates some of the ambiguity in the term "well field"?

A. Uh-huh.

Q. In F, there is 100 feet of wetland. And this is the same type of idea. In your mind, is this an appropriate distinction between low-chloride and high-chloride fluids?

A. Absolutely.
Q. And do these levels seem to be protective --
A. Yes, they do.
Q. -- and to provide adequate time for response?
A. Yes.
Q. I believe that that is the extent of the industry changes to Section A(1).

If we flip the page over to page 10, there is discussion about excavated materials from a pit's construction. There are a couple of changes here. Do you see any risk that would increase from having the excavated [sic] material stockpiled --
A. No.
Q. -- to be setback distances?

And then there is new paragraph 4, which talks about the location criteria for a below-grade tank. In your experience and based on your knowledge of what those tanks are used for in these setback levels, are they protective?
A. Yes.
Q. Do they provide adequate time for response?
A. Yes.
Q. Do they provide a reasonable assurance that we would be able to prevent contamination of freshwater and protect public health?

A. Yes.

Q. If we then turn on to page number 11, we've now reached a point where we're going to implement an on-site closure method. Here there is, in Section C(1), a change to unconfined groundwater, which I believe you've already discussed, and the change is in the bottom distance. Do you believe that these are still protective?

A. Could you repeat the question?

Q. Absolutely.

In Section C, which addresses where an operator may not implement on-site closure methods -- this would be where you would be leaving pit solids on site -- there has been a change to the distance to groundwater from 15 to 25 feet. There's also concentration limits that are set forth in Table 1 and Table 2, which will play into this table, too.

In your opinion, is the combination of the distance provided here and the concentration limits provided to Table 1 and Table 2 going to be protective of the public health and the groundwater?

A. Yes.

Q. And when we talk about Table 1 and 2, you're going to talk about the mechanics of exactly how that protection occurs; is that correct?

A. Yes.

Q. Now, there are a couple of deletions in paragraph one and paragraphs two through four. And in large part, are those provisions now being carried over and into Table 1 and Table 2 where we have the gradations and depth of groundwater?

A. Yes.

Q. So the substantive table and text are narrative provisions found in the existing rule?

A. Yes.

Q. And then there is a series of siting criteria starting on new paragraphs two through five, and these seem similar to the criteria for a basic pit; is that correct?

A. Yes.

Q. And rather than go through each one, I'll simply ask the generic question: In your opinion, are those going to be protective of groundwater and public health?

A. Yes.

Q. So they provide adequate time for response?

A. Yes.

Q. If we then turn to Section 11, which is Design and Construction Specifications, I want to direct your attention to the provisions of E, which is found on page

14. There's been some discussion about netting for pits, and certainly there's been discussion for the multi-well fluid management pits that Mr. Lane spoke about. Do you have an opinion on netting?

A. Yes. Netting has been a controversial issue forever; I think as long as we've had birds. But, you know, if you look at netting from the perspective -- especially a lot of western states, the Bureau of Land Management and so forth, you know, the idea of netting -- and I know that, you know, you've had some discussion about, you know, whether it's impossible or possible or feasible or whatever. And really, netting winds up being a bit of an issue almost, I think, on a site-by-site basis, and that's just in my opinion.

Because what -- what happens is, when you start looking at -- at -- say, Well, if you don't net, you just go count dead birds. Well, if you put netting on, you may be counting dead birds. So you can have impacts to birds from netting.

But the other thing that happens is, netting can be a real tough thing, depending on where you are, to maintain. It can be -- in some cases, it can be pretty easy, but in some cases, it can also be a maintenance nightmare. And so what you want to look at with netting is, you want to have netting where it's

appropriate, and you want to have netting -- I mean, if you -- and depending on the type of fluids that you have.

You know, one of the -- one of the first, you know, netting issues that I got to deal with was at Rocky Mountain Arsenal, and they had -- they were storing hazardous fluids. And the birds would fly in, and they had video of them just dying by the time they got to the water. And that's not necessarily what we're talking about here, but you can have some pits that have -- that have oily waste in them that certainly is a problem. And I've seen that -- I've seen that be an issue.

But when we look at the types of pits, you want to make sure that you've got pits where there's an endangerment issue or where there is something that you need to be worried about for those birds. If you have some of the larger pits, netting can be really tough. Wind is an issue, you know. So it just depends where you're at, how you're sited. There are a lot of those things that can be a challenge.

So my -- my feeling on netting is that you need to look at the situation. You need to look at the size of your pit. You need to look at what's in the pit, and you need to make a decision based on those

sorts of things to decide, Okay; do I need to have netting here? And if you say -- well, based on the contents of the pit, regardless of how big it is or whatever, you know, you've got -- you know, this is storing, you know, oily waste or something like that, you need to have netting.

But if you're looking at, say, a large multi-well fluid management pit, in my mind, those are -- those are types of things really that, you know, to me, don't need netting. You're generally looking at taking produced water and other waters, and so what you generally see is the TDS not really being that great. And you don't -- you typically also don't see something where those are having oily waste on top of them, or if they do, they're cleaned up pretty quick.

So the risk that you're posing from having netting, say, on a -- you know, just simply saying, You've got to have netting, is that you're going to have instances where you're doing it really without a basis, and, in actuality, you may be causing more harm than good.

So that's, you know, part of why I say that it should be -- you know, there should be, you know, a basis for when you look at that and, you know, where you require netting. I mean, you know -- so that's really

my thought on that.

Q. But for purposes of this rulemaking proceeding, the industry's position is that we simply want the multi-well fluid management pits to conform to the existing netting rules and regulations of the state?

A. And so I think that what we have right here now seems -- seems very appropriate.

Q. And then in the case where, as you're indicating, there may be greater risk, that would be a possible case where a variance or an exception could be taken to the Commission and an appropriate decision made?

A. Exactly.

Q. One thing struck me as I was thinking and getting ready to go on to designs and things. Maybe we should come back and answer a question that Commissioner Bailey had asked yesterday of Dr. Thomas. And she had said, in the context of the case of the chemical exposure that may exist in pits, can you take them and compare it to something else that is part of everyday life? Is there a similar-type thing we can do with siting restrictions so that it's more of an everyday-life thing in looking at the comparative risks?

A. On multi-well fluid management pits?

Q. Or for regular pits or whatever. I was

thinking, for example, if you were to compare a pit with, say, a septic tank, what would you see?

A. You know, those are a couple of interesting -- interesting things, and if I can address them separately, that's how I'd like to do that.

First, if I look at septic tanks -- you know, I've been a member of the Ground Water Protection Council now since about 1986. That's where I met Dick Samans at, initially. He was, I think, the first president. And the -- and the GWPC came out with, I think, an interesting statement, that they said that septic tanks were probably the greatest risk in America to groundwater.

And as I -- and as I look at that -- you know, I've actually done a number of studies relative to septic tanks that I think are kind of interesting. As you look at -- even in New Mexico, you can have a septic tank within four feet of groundwater, and that's not really unlike what a lot of other states are. And what I've seen -- I've done three site investigations now where there was a homeowner complaint about their water well, that their water well began tasting bad, and it was salty. And they were in a historical oil and gas-producing area. They made a complaint to the state, and an investigation ensued.

And what we found in the three cases that we looked at was that the homeowner had a septic tank. In all these cases, they were pretty nice houses, but kind of out, you know, where you weren't on city sewer and so forth. And in each case, the homeowner also had a water-softening system.

And what we found is that there wasn't confinement between where they were getting their groundwater from their water well and their septic system. They were backflushing their water-softening system, and those salts, as well the other things that I don't really want to talk about that go into a septic tank, were getting down into their groundwater. And the septic tank, you know, has a head, so it was pushing downward. And what we found is, it wasn't -- it wasn't oil-and-gas activities, even though it was right in the middle of -- one of them was in an Oklahoma City field, where there was a lot of historic practices that would never be tolerated today. But in all three of the cases that we looked at, it was the septic tank.

And, you know, so when I looked at some of the concerns of those issues, that's certainly one that really pops out to me as, you know -- we're looking at, you know, pits that have liners and we pull the water out and solidify, et cetera, et cetera, versus -- versus

septic tanks. And I see the septic tanks as much more of a threat.

In relation to the pit contents, if you look at -- you know, I've done a good bit of analysis on fluids used for drilling and hydraulic fracturing, and I've been involved in the sampling of produced water from flowback all over the country. And as you start looking at the types of fluids that you use in hydraulic fracturing, it's -- it's -- it's kind of interesting.

So you may -- you may have acid, you know, so you may -- you may pump down a well hydraulic -- HCL acid, and you start thinking, well, you know, that's bad stuff. But what happens is, you inject that down. It goes through the perforations, reacts with the cement and, essentially, changes into saltwater. So it turns into a brine.

When you -- when you look at your -- the injection portion of hydraulic fracturing -- we're actually -- my firm is doing a research study. It's kind of a permaron [sic;phonetic] hydraulic fracturing for a couple of Canadian research organizations. But when you look at it, about 99-and-a-half percent of fracturing fluid is generally water and sand. It has chemical additives. And -- and -- and -- and when you look at the process, you're trying to inject water and

sand into a formation in a gel. So you have things like guar gum in there.

And in relation to what you were talking about, Eric, is, you know, guar gum is something that -- nobody knew it -- you can find in Jello and ice cream. That's what, you know, gels that stuff up for us, and the same thing is used in fracturing.

You can have things to reduce friction, because, as you can image, you're pumping and that. And in historic time, I'd say one of the chief friction reducers was diesel fuel. When I was employed with Halliburton, that was -- that was the friction reducer that they used.

And really, as we come into more modern times, and what EPA has done, diesel fuel has really been eliminated from everywhere, because if you use that now, you're going -- you're going to get an EPA UIC permit for that process. So they've substituted other things. So I've seen mineral oil used as a friction reducer. I've actually seen -- kind of interesting, but I've seen service companies mix up a batch of water and a bottle of Dawn dish soap in there. And you may have other things like biocides. So you can have -- a primary biocide that you may have is glutaraldehyde. So you certainly don't want to drink glutaraldehyde.

But what happens with -- when you look at the injection of those chemicals versus what's produced back, most of the biocide gets expended in there. So you may -- it's not to say that you're not going to see glutaraldehyde in the produced water. You may. But keep in mind that we have biocides in our bathroom cleaners that we're exposed to. I put biocides -- I don't know, you know, if anybody here has a swimming pool, but I put biocides in my swimming pool. You know, chlorine is another biocide. So there are a number of things that we have that we utilize in really our everyday lives that -- you know, that -- you know, it's not like there's these chemicals we import from Mars to come in to use for hydraulic fracturing.

The other -- the other big advantage that I'm surprised nobody's talked about here is -- I was really -- I don't know if everybody understands the significance of what Williams was talking about. You know, I spent a lot of time -- and really where I first met Glen was dealing with coalbed methane issues. And, you know, we've done some Department of Energy projects on BMPs for coalbed methane development and, you know, beneficial use of produced water for coalbed methane. And, you know, Steve Henke, back in his BLM days, actually worked with us a good bit in the San Juan

Basin, because we did multiple basins.

But if you look at fracturing, one of the big pushes here is to reduce the amount and type of chemicals that you utilize. And a key factor of that is the water that you use. So, for instance, we did a U.S. Department of Energy research project that multiple companies participated in. Probably the chief one was Southwestern Energy. But what we looked at was -- and this kind of came from -- Southwestern Energy's CEO said they had two -- two chief concerns. One is, they wanted to get where -- if they could get to where they could use a service company to only pump water and sand and they didn't have to have any chemicals, they would be really happy. And, furthermore, they said their two chief concerns or issues with -- with shale gas development in the Fayetteville Shale -- so this is not in New Mexico, but I think it plays into that -- was bacteria and scale.

So what you can do with water in a multi-well fluid management pit is that by blending, you can actually engineer water to have less scaling tendencies, for example, so that you can add less scale inhibitor. I mean, there are things, that by having a tool like a multi-well fluid management pit, that -- that -- that allows you to reduce truck traffic and air

emissions and all that kind of stuff, but it also aids your ability to do other things with fracturing that you may not -- that may not always work but has the opportunity to work.

So I don't want to take up the whole day here. I know we're in a hurry, so I'll get off my soapbox.

Q. Thank you.

But just to return to my setback question, for example, in New Mexico, it's like four feet to groundwater for a septic tank, 100-foot to a private well; is that correct?

A. Yeah. It seems a little ridiculous, but yeah.

Q. And that's for a discharging body as opposed to a pit, which is a confined?

A. Yes.

Q. If we flip back, then, to where we were, looking at the construction and design -- or design and construction standards, yesterday there were a number of questions from Commissioner Bloom about liners and stress upon liners and whether we should simply stick with the two horizontal feet to one vertical foot of repose. Now, you said that in your past environmental and engineering experience, you've worked with liners; is that correct?

A. Yes.

Q. And from the engineering perspective, when you specify a performance standard, normally you stress the kind of liner. Is that a well-understood term within the oil and gas industry?

A. Yes.

Q. So there is not ambiguity of what they need to do?

A. Correct.

Q. And why is the performance standard with other entities cookie-cutter stuff of the standard of the two-foot, one-foot?

A. Well, I think it winds up getting into, perhaps, a little broader point of discussion than you might think. So when you look at -- at pits and construction of pits, generally what you want to do is -- and I think what at least most of the larger oil and gas developers are trying to do is, they have -- with their shareholders, which may be everybody or some of the people in this room, is, they're trying to continue their development on an -- on an environmentally sustainable basis, you know. So there's a lot of pressure, whether you think it or not, on every oil and gas company to -- to improve and have a continuously improving environmental program in how they

do things. It's just a -- you know, it's a massively huge deal.

So you may -- you know, the -- the -- the -- one of the -- you know, I made a presentation at a shareholder meeting for an oil and gas company to a fund that was actually the State of New York Workers -- I can't remember exactly what it was, but it was, you know, their state -- all the state employees, their fund, their retirement fund. And they wanted -- you know, they were pushing the gas company that they were investing in to continue -- they wanted a continuously improving program. The company took that seriously. And that relates into many areas, but it specifically relates to the pits and how they're constructed.

So if we have a standard -- you know, what I see as a standard, kind of, arbitrary basis that might be easy to -- you know, or may be perceived to be easier to look at and measure compliance, it also may take away from us the best way that we can design, construct and operate that pit.

So by doing this, it may mean that, okay, in a number of circumstances where we have competent rock, where we can -- can -- can -- can design it to where we can maybe have a smaller footprint, the existing rule leaves us no option but to have a bigger

pit than we need, so bigger footprint, more disturbed acreage, more difficulty in, say, netting something, more maintenance. You know, the -- you know, the bigger you get, it just -- there's more things -- you know, it's just a bigger area to manage.

So ideally, we want to try to put things into perspective. We may want to make them, you know, smaller, if we can, or if there is a reason to have it big, to be able to have that, if I can have steeper slopes based on the rock and soil and so forth that I'm dealing with; really what is best from an environmentally perspective.

And -- and -- and I used to work with EPA, and I've been doing this a long time, but, you know -- you know, I know there is a lot of focus on, say, well, any time you change anything, well, does that mean it's going to be cheaper or more expensive or whatever? And I don't look at -- I look at the point of -- really, the focus for me is, you know, do what makes sense, you know. And to me, being able to have the flexibility to be able to say, I can make a smaller pit, or depending on where my pad is. And I may want to do something that has a different slope or whatever that's going to work best for me, to be able to provide me the best environmental assurances that I can. That's what I want

to do. And so I think that's where we are here.

Q. I'd like to turn your attention, under the Design and Construction standards, to Section J, which is the multi-well fluid management pits, which is Section J(1). One of the questions that came up is whether the design standards --

A. Hang on.

Q. I'm sorry. I'll let you get there.

A. I'm slow. I'm sorry.

Okay.

Q. One of the questions that came up is whether the design standards of the multi-well fluid management pit really contemplates a double-liner requirement. In your experience, does a liner system require that design standard?

A. No. And I don't think -- you know, I think that was, you know, perhaps a misinterpretation from earlier testimony.

So with a multi-well fluid management pit and the leak-detection system that you have here, you can have a double liner. You're not precluded from that. And a design engineer that is putting one of these together may decide that that's what he wants to have, but the proposed rule would also allow if you wanted to have a compacted clay base or something else

to serve as that secondary liner. So it doesn't mean that you have to have, you know, a double -- a double liner, in that sense.

Q. But you do have to have a fairly impermeable underneath stratum to catch the -- for the leak detection system to the work, correct?

A. I wouldn't say -- it doesn't have to be some impermeable bathtub, but you want something that is, you know -- that's -- that's going to give you that idea and be relatively impermeable; that's going to serve as a good base and a good, you know, secondary liner or equivalent.

Q. Does a leak in the liner and also having a leak, if you did have a geomembrane, actually necessarily result in a significant release from that system?

A. No. And, you know -- and it -- it's interesting to me. It's like, you know, when you -- when you -- when you start thinking about stuff -- and I think about stuff a lot, but -- but -- you know, you have to -- you have to put things into perspective. So if I had even a double -- a double-liner system and I got a leak in the upper liner, and I snuck underneath and I cut a hole in the bottom liner, you've got to keep in mind that even if it's a double liner or if it's

clay -- you know, they're compacting these things; they're building them to a pretty good standard. So if you're seeing a major release, the leak-detection system is going to show it. If you're seeing a very minor release -- just because you may have a leak in both doesn't mean that you're not going to see it.

So if you have a double liner, you're going to have to have that fluid go across that leak, and then it's going to have to be able to escape.

And I've seen tons and tons and tons of situations where you had a minor leak, you know, during, say, an operational perspective -- and keeping in mind this is really, generally, a temporary situation. But -- but you don't typically see stuff going, you know, in some major perspective. And if it is a major leak, you're going to -- you're going to notice in the leak-detection system; you're going to see your fluid dropping. And if you get this minor leak, you know, whatever we want to talk about, you know, even if it's the perspective of passing through the liner itself, it's temporary. I have time to be able to come in after, do a minor -- do my testing, just like I have here, and I address it.

Q. And then the last question I have for you here is -- there was a concern, I think perhaps expressed by

Mr. Jantz, that we could build a multi-well fluid management pit in the bottom of an arroyo, and, I think, allow everything to wash out. Do the design standards allow that?

A. You know -- you know, keep in mind that -- that we can come up with any number of -- of -- of -- of theories of what you can or can't do, but -- but -- but we have setbacks; we have a process where you've got to do design setbacks, submit to the state for approval. It is beyond my imagination to think that you're going to have a multi-well fluid management pit in an arroyo. And, furthermore, you know, as -- as -- as we look at kind of where we want to have these and how we're using them, that's just not going to work to our advantage.

Now, you know, when you -- when you -- when you look at those, you know, one of -- one of the concerns that you have in here is, you may have, you know -- you know, multiple, you know, arroyos out there that -- that some may be minor or -- you know, I mean, how small do you want to go to where you have a concern? So you may be looking at, really, the situation, what's out there, where you want to put stuff. And -- and, generally, you know -- you know, when you think about, well, you have maybe more flexibility on a multi-well fluid management pit, but a lot of times you don't,

because, you know, you've got to deal with the normal setbacks, but then you have to be out there looking at things like arroyos and other things to be able to say, Okay, I've got to put it right here or something. Those are the kind of constraints that I have. And you don't want it washing out.

Q. And then, in addition, if you look at the top of page 20 on Attachment A, you're going to see paragraph ten. Doesn't that provide for run-on controls?

A. Yes, it does.

Q. And so as a practical matter, would not the run-on control requirement of paragraph J(10) really preclude location of an arroyo or other feature that would have a significant waterflow?

A. That would -- yeah. That would -- and again, I don't want to say that there's, you know -- I think in the context of what we're talking about, yes, but -- but keep in mind -- I mean, you could have, you know -- I don't know how we all determine or think of -- of -- of arroyos, just in general what they could be, but, I mean, you could have some very small arroyos that really are meaningless, where -- where run-on or erosion -- erosion sediment control are not really an issue. So -- so -- so in my -- in my opinion, what we have here

addresses the issues of concern while also giving you the ability to properly locate.

Q. If we move, then, on to Condition K, which is burial trenches for closure, is it your understanding that any substantive change is intended by the wording changes in K, paragraphs one and two?

A. Could you repeat?

Q. Is it your understanding whether there is any substantive change to the requirements of the existing Pit Rule intended by the wording change as seen in paragraphs K(1) and (2)?

A. No.

Q. If we come to paragraph four, there is a striking of the requirement that liner material be resistant to ultraviolet light, and this is for burial trenches. Why is that appropriate?

A. It's just in -- in this one, it's just not necessary. I mean, this is going to be buried.

Q. And if it's buried, is it exposed to ultraviolet light?

A. No. It's going to have at least four feet of cover on it.

Q. If we move to paragraphs nine and ten, there is a deletion of the provisions for a geomembrane cover. Why is it important to delete the geomembrane cover?

What is that doing, and what are the issues?

A. You know, I understand academically the idea of the geomembrane cover, and if I'm, you know -- you know, trying to, you know, contain radioactive -- nuclear waste or something like that, I want to have as many barriers of protection as I can. But when we really look at pits and if you've explored pits that have been closed, you know, in New Mexico, across the country, you know, in my opinion, you're better off not having a geomembrane cover.

So what this allows is, by not having that, you know, some of your -- your lighter volatiles, like benzene, that may -- you know, may be in there but that are probably already gone, are going to escape. But you're also going to be taking advantage of not trapping fluids or anything below that cover that are -- that are going to be positively impacted by -- you know, by the climate that we're in. So, one, it's unnecessary, and, two, I think you're really better off, environmentally speaking, without it.

Q. And then it's been noted that in the bottom of paragraph eight, there is an error in what the industry had proposed, in that it still refers to "the installation of the geomembrane cover." And should that really come out if we're proposing to remove the

geomembrane cover?

A. Yes.

Q. So the "prior to the installation of the geomembrane cover" should probably come out as well?

A. (No response.)

Q. Now, sometimes if I take off the cover, but I leave a liner on the bottom, is there a concern that there's going to be precipitation that will be coming down and actually turn my pit into a giant bathtub?

A. You know, in my experience, in a whole bunch of places, including areas that get a lot more rain than New Mexico, I've never seen that. I also believe, based on what we're doing here and what happens in the water cycle, that that's -- it's really not a possibility. It just doesn't happen.

Q. So it's your opinion that removal of the geomembrane cover in this case is not going to increase the water buildup right along that lower membrane?

A. Correct.

Q. And so you do not believe that the elimination of the geomembrane cover will change the migration pattern of salts that might be in the pit in terms of whether they are going to go further down towards the groundwater?

A. Correct.

Q. We then proceed to Section 12, which is the Operational Requirements. There's been a little bit of discussion about the repair and replacement requirements in paragraphs four and five. Is it possible to repair a pit liner's integrity if it's had a puncture, if it's above the water level, for example?

A. If it's above the water level, yes.

Q. And is that repair going to be functionally as good as the liner was prior to the repair?

A. Yes, if it's done properly.

Q. If you come to the next section, which is Section 8, I believe that Commissioner Bloom asked a couple of questions about the oil absorbent boom. What's the impact of the oil absorbent boom exposed to the environment for a period of time?

A. Can I address the booms just in general, if that's acceptable?

When we think of -- when we think of booms, we tend to think that these are, you know, kind of a complicated thing, and typically they're not. I mean, a lot of times, it's some absorbent material and netting and that. And when we think of even shortages of them or not being able to get them, even with, you know, the BP oil spill -- you know, the types of booms that they were looking at in the Gulf and having a shortage of

those versus what we might use here is a couple of different things. And we actually used some booms within that time frame and didn't have any trouble getting them.

But when you -- when you you start looking at the management of booms, having them out there on an ongoing basis, what I see is a typically -- they typically don't get handled that well. They're generally exposed to sunlight, you know, so they're not -- you know, they're not necessarily made to some, you know, high-tech engineering standard that's whatever.

And, you know, we've done a couple of these. I know one -- one -- one site that we worked on in Elk Basin, of northern Wyoming, right on the Wyoming-Montana border; we had booms that had been out there that we had maintained, and we had an issue to need them. We threw them out, and they, essentially, disintegrated.

You know, so -- so when you -- when you look at the handling and all that, in my experience, it's better not to be -- not to be having them where they're just out, exposed, getting dirty and all that. And, furthermore, when you -- when you make the decision of whether or not to use a boom, you know, keep in mind,

if I have a small, you know, spill, which I think, you know, maybe some oil's getting on a pit, I've got a little bit of time. I've got enough time to call a vacuum truck that's going to be there in a few hours to suck that out and that can go -- that can be managed in a normal method.

If I try to absorb that small amount of fluid with a boom, one is, my boom has to actually, you know, work. And I may throw it out there. I've been hauling it around from 15 other wells, and now it's dirty and whatever, and it's not really being effective. So now I've got it all kind of oily. I still haven't gotten everything up, and maybe -- you know, maybe it is keeping, you know, whatever oil I have in the pit contained within a small amount of pit that it was probably going to be contained in anyway. Now I have to dispose of that. So how do I do that?

Well, now I'm going to have to send it somewhere. They're probably going to want me to incinerate it. It's going to cost me a bunch of money unnecessarily. When, in fact, in a matter of hours, I could have had a vacuum truck out there just to manage it.

Now, I will say that I've been in instances -- and I referred to this just recently on two

blowouts that I've handled in the last year, and we used booms. And in both cases and in states that are big states that certainly, you know, don't have, you know, let's say, the oil and gas infrastructure that New Mexico has, and we were able to have booms on site within two or three hours, so -- you know.

And -- and -- and -- and in the event that you have -- and you think about this from a -- from a safety, from an environmental. So let's -- let's say that I've got some boom out there, you know, and, you know, kind of the thought process is that I'm going to -- I'm going to be able to contain, you know, some leak or some discharge or something from -- from the well or whatever we have. If it's a -- if it's a significant -- like if it's a -- we have a well blowout, you know, and now I've got, you know, all sorts of fluid; that boom isn't going to be enough, you know. And so I'm going to -- I'm going to -- I'm going to make calls to order the stuff I need.

But, furthermore, by the amount of time that -- even before -- let's say that it's, you know, four hours, maybe, before I can even, you know -- that it's some large amount of time before I'm going to be able to get a boom and that kind of equipment out there, I'm probably going to take other methods to do some

earthen work that's going to preclude -- you know, if I've got an ongoing -- you know, a well has blown out; there's stuff, you know, I'm going to -- I'm going to build trenches or, you know, whatever I have to contain that, if there's a nearby river or whatever that is from either the well or from a pit or whatever it is.

So having the -- this on-site thing might kind of give us a little bit of, you know, feeling of security, but it's really -- it really is a false sense of security. And, furthermore, I'd almost say that it's -- you know, by requiring that, you're probably going to have equipment that's not going to, you know, be able to do what you're hoping it could do.

Q. Moving on to Section B(1), there's a proposal to allow petroleum hydrocarbon fluids to go into a temporary pit. Does that cause you any concern?

A. No.

Q. Again, when we discuss Table 1 and Table 2, can you talk about the rationale for why that does not cause you concern?

A. Yes, sir.

Q. If you move on to B(2), there's been some discussion about "under normal operating circumstances." Why is it important in your view as a former regulator to clarify the "under normal operating circumstances"?

A. You know, if you -- if you -- and I understood, you know, one of the -- one of the prior notes was about, you know, if you take a kick or something. But I think it's -- you know, really, you've got to think it's kind of broader than that. And, you know, you have -- you have freeboard for a purpose. You know, if you have a pit regulatory program, you want to have freeboard.

And when you start thinking about why, you know -- well, if you get a big rainstorm, you know, you want to be able to have sufficient freeboard to do that.

If -- if you -- you know, you may even say -- like we used to kick, but when you think of where you can have a kick, you know, sometimes you can have a freshwater kick. You can -- you can be -- or a -- or a nonhydrocarbon-bearing zone kick. You may be able to go in some -- you know, at some depth and have a zone that -- that -- that's artesian, I guess if you think of it that way, but maybe is higher pressure than you thought, that might give you a bunch of returns back, and it's going to take you a little bit to get that under control or whatever.

So it could be a hydrocarbon zone that you have to close off. It could be a rainstorm. It could be, you know, any number of things. And really the idea is, that's why you have that that. So if you -- if you

have one of those situations, you don't want to -- you don't want to show up and say, you know, Well, we just got six inches of rain, and you don't have your -- and maybe you had a vacuum truck or something on the way, but technically you're in compliance for having the freeboard that -- for the purpose that you had it.

So under normal operating circumstances, you maintain that freeboard, and it's kind of your emergency protection. I look at it as a -- as a barrier of protection, a level of -- a layer of protection. So you want to make sure that you're not dinging people for things that are really the whole purpose of it.

Q. If we move to D(3), which addresses below-grade tanks, on page 24 of Attachment A, in your opinion, is the substitution for the integrity demonstration a better approach for inspection and maintenance of these below-grade tanks?

A. Yes, I believe it is.

Q. And is it feasible, in perception, to repair a below-grade tank should it generate a leak, as opposed to necessarily take it out and replace it?

A. I mean, it kind of depends. But, you know, what I've seen in my experience is, the majority of what you see and the kind of things that you can repair -- you can do certain repairs on there. I mean, I've come

up to some of these tanks, and you get bullet holes, or you've got maybe a piece of equipment backing in and you accidentally or inadvertently puncture a hole into it. And really a lot of those repairs are, you know, benign repairs. They're just a normal operating thing that you should be able to do, and the repair would be more than adequate and not compromising to the ongoing operation of the tank.

Q. And if we move, then, on to paragraph F, which deals with the multi-well fluid management pits, do you believe that the provisions that are written here are going to be protective of public health and to groundwater and freshwater?

A. I do. And I will note that this confused me initially, because in the title, it says "well fluid management pits," and it should be multi-well fluid management pits. But, yes, I believe this is protective.

Q. And then in paragraph three, right now there is this absolute requirement to maintain at least two feet of freeboard for the pit. Is that really just like it is for a temporary pit, just sort of under normal operating circumstances?

A. Correct. So this was, to me, I think, an oversight in putting these together. It needs to be

similar to the temporary pit.

Q. And how likely do you believe it would be that there would be an environmentally significant release without the leak-detection system determining that or identifying that occurring, under one of these multi-well fluid management pits? In other words, how likely is there to be a release from the primary system of the multi-well fluid management pit that the release would not be detected by the leak-detection system?

A. If I can -- if I can maybe kind of clarify that in steps. I would say that for any significant leak, you would detect it 100 percent of the time. And I would say, under no situation would you not.

Under a minor leak, I would say that you would detect that 100 percent of the time.

If you had -- I mean, if you had -- if you think about it, almost like, you know -- there could be -- there could be a leak that was so minor that it didn't really, you know, aggregate enough water for flow, but it's technically, you know, a leak. You probably would not detect that.

So if we look at the -- at the steps of what I see as significant versus an insignificant leak, I think any significant leak you would detect.

Q. And would an insignificant leak be a threat to

public health or to the groundwater?

A. No.

MR. HISER: Madam Chair, I'm going to switch now to closure, and that's going to be sort of a whole different line of inquiry. So if you were looking at a break, this would be a good point.

CHAIRPERSON BAILEY: Perfect timing. Let's take a break for ten minutes.

(Break taken, 10:26 a.m. to 10:40 a.m.)

CHAIRPERSON BAILEY: We'll go back on the record.

MR. HISER: Thank you, Madam Chair.

Q. (BY MR. HISER) Mr. Arthur, we are now going to turn our attention to Section 19.15.17.13, which addresses closure, and this is found at page 26 of Attachment A.

Now, Mr. Arthur, is it your understanding that the industry revisions preserve the fundamental division of closure into two parts, one of which is closure by removal, and the second of which is closure in place?

A. Yes.

Q. And the closure by removal is now also consolidated in Section A of this draft of the proposed revisions, and closure in place is now in Section B?

A. Correct.

Q. Are there any real changes to closure by removal other than the substitution of Table 1 of the previous narrative standards that were in the rule?

A. That's certainly the primary change.

Q. And the other addition is the addition of multi-well fluid management pits, which are solely and only in the closure-by-removal aspect; is that correct?

A. Correct.

Q. And the only other change that's been proposed is that if the multi-well fluid management pit leak-detection system has never detected a leak, they're not required to do sampling beneath the pit; is that correct?

A. Correct.

Q. And in your understanding of how the leak-detection system works, is that protective of the public health and groundwater?

A. Yes.

Q. When we turn, then, to paragraph B, this is for waste that would be buried in place, and the only materials that can be buried in place are those from a temporary pit or a trench; is that correct? For example, if you're taking drying pad material and putting them in a temporary pit.

A. (No response.)

Q. I'm sorry. I confused you.

A burial place is for a temporary pit; is that correct?

A. Correct.

Q. And then the materials from drying pads and tanks associated with closed-loop systems; is that correct? That's the second part of the instruction of the Section B?

A. Correct.

Q. And the major change here is that a number of numeric standards that were in the previous rule have been moved to Table 2; is that correct?

A. Correct.

Q. And in the interest of full disclosure, the levels that are found in Table 1 and Table 2 are different from the levels that were found in the previous narrative discussions?

A. Correct.

Q. What I'd like to do, with the Commission's permission, then, is to go ahead and flip forward to page 41, which is Table 1 and Table 2, because this is really the crux, I think, of the changes that the industry has changed as part of this revision.

Mr. Arthur, as you look at Table 1, what is

being done here in Table 1?

A. The general -- the general format for Table 1 is really setting it up on what I would define as kind of recognizing a risk basis, where we're looking at those risks based on a depth to unconfined groundwater. So we've separated or categorized what we're doing based on either less than 50 feet, 50 to 100 feet, or greater than 100 feet. And we're looking at that based on four particular constituents and then -- and then looking at particular levels for each four of those constituents under these three different categories.

And if we look at kind of how the constituents are, based on the limits that we specify, I think it's first important to recognize that as we look at BTEX and benzene, those constituents typically volatilize and move through pores to the atmosphere when present, you know, at, say, less than ten milligrams per kilogram. So if we look at those particular ones, we've kept a consistent limit for those two constituents throughout each of the different depth categories.

If we focus on the other two, chloride and TPH, what we've really done is -- looking at chloride being something that is really kind of our identifier, it can be mobile. What we've said is, under -- if less than 50 feet, we've set a limit of 5,000 milligrams per

kilogram. And then at 50 to 100 feet -- so we're further away from that aquifer. We've doubled that limit and then doubled it again, if we're more than 100 feet. So we're recognizing on really an environmental risk basis what those can be.

What we've done on TPH and really looking at its tendencies, we've started at less than 50 feet, at being 100 milligrams per kilogram. In recognizing its tendencies, we've multiplied that times ten, in the next category, to 1,000 milligrams per kilogram, and then times five, in over 100 feet, to 5,000 milligrams per kilogram.

Q. Now, Mr. Arthur, you've talked about the impact, in large part, to groundwater, and you've talked about the possible volumination of benzene and BTEX fractions [sic]. Why weren't you concerned about the direct exposure to these constituents? Is it because there's always a cover over them?

A. Yeah. Keep in mind, as we -- as we close this -- because this is -- this is for closure. So we've removed, in Table 1, the contents. We're sampling the soil below, and as we do our closure, we're putting four feet of soil on top of this. So from a -- from a -- from a content per contact perspective, it's really a nonissue. I think one of our prior experts testified

similar to that.

Q. The four-foot of closure is if we're doing a burial in place, but it may just be a foot for whatever background soil it is, if it's a below-grade tank or a multi-well fluid management pit; is that correct?

A. Correct.

Q. And those actual setbacks are set forth in Section F of the proposal; is that correct?

A. Yes.

Q. Why, in your viewpoint, do you believe that these levels that are set forth here, the 5,000 to 20,000 milligrams per kilogram of chloride, and 100 to 5,000 milligrams per kilogram of total petroleum hydrocarbons -- hydrocarbons minus GRO plus DRO -- are appropriate?

A. One is, you know -- I think it's -- I don't know -- maybe unrealistic to -- to be able to sit there and think of: Can I test for every conceivable thing that's going to be in place, versus recognizing what it is we're dealing with?

And as we've heard, I think, in prior testimony, and also based on my experience, is, Table 1 captures the primary constituents that are going to give you an idea if there is a problem. Chlorides are really the first thing that you typically see and that you've

seen in every case that I've been involved in, and is a very good indicator. So we've got, I think, a good range of constituents here to be able to look at.

As we look at, you know, their protectiveness and appropriateness for the different categories, you know, I look -- look at my experience, the research I've done and believe, in each of these cases, that they provide really probably -- honestly, an overly conservative basis.

Q. So at one level, if we were to look and not find these four constituents in an area, would you be reasonably comfortable that no release has occurred?

A. Yes.

Q. And given the depths to groundwater that are here, even if a release had occurred and these constituents were found at this level, are you reasonably comfortable or have a high degree of certainty that we would not find these constituents at levels of concern to the groundwater where people might use that water in the future?

A. You mean -- you're saying if we sampled these and found these?

Q. If we were to sample these constituents, found them less than these concentrations, these depths to groundwater, would you be highly certain that you would

not subsequently find them at levels of concern in the groundwater?

A. Yes, sir.

Q. And would that also be true for other constituents in the pits if these constituents were found at these levels?

A. Yes.

Q. If we move, then, and look to Table 2, what is the difference of Table 2 and Table 1?

A. Well, first, I guess, and most obviously, is, Table 2 is set up for a really different circumstance, where the pit materials are left in place, and recognizing that as we've come up with a similar kind of basis to Table 1, but for a different circumstance. So because one is removal and the other is left in place, two tables were felt necessary. And this one addresses using, really, a similar approach on categorizing things by distance to unconfined groundwater, and the details -- the depths are slightly different, and the limits and methods are slightly different.

But within this, if -- if I -- if we look at both BTEX and benzene being essentially similar, if we look at the TPH being similar, the one bigger change that you're going to see, or difference, is that we're now using a different method by which to assess

chloride.

And if we look at the reasoning, I think it's mostly common sense. If we look at the SPLP method, it's really designed to determine the mobility of both organic and inorganic compounds, and that's kind of intrinsic of the method.

And so as someone, you know, like me, who is looking at trying to evaluate these pits, I want the most appropriate method. And so we changed the method in this one not necessarily to make numbers look bigger or smaller, but really to have the appropriate data in place to evaluate.

Q. Is that because the milligram per liter here is looking more at leaching capability --

A. That's correct.

Q. -- as opposed to just milligrams per kilogram --

A. Correct.

Q. So is it your testimony that if we have, for example, chloride at 2,500 milligrams per liter at 25- to 50-foot and at 5,000 milligrams per liter over 50-foot, that we would not expect to see chloride in the groundwater at a reasonably foreseeable place of use in excess of 250 milligrams per liter or the water-quality standards of New Mexico?

A. Absolutely not. So if we -- you know, in reality, I think that, you know, Table 2 is awfully conservative, because the one thing that, you know, you look at in here is, we have greater than 50 feet. So at some distances, even -- even this sampling is questionable as far as necessity.

But if we look at having these compared to the water-quality standards, you would -- you would not expect, you know, closure of pits like this to exceed the state's water-quality standard.

Q. Now, in the existing Pit Rule 17 for burial trenches only, there is an additional requirement that for -- that the industry needs to sample all of the 3103 constituent lists and show that they stay below certain levels. Is it necessary or appropriate to look at that constituent going to be protecting the groundwater at a reasonably foreseeable place of future use?

A. Honestly, I have no clue as to what the scientific basis or need for that is, and have thought long and hard about it and see no -- no technical need or driver or regulatory purpose of doing that that.

Q. So it's your opinion that in order to protect the groundwater, we don't actually need that list of 3103 constituents to the testing regimen?

A. It's not even applicable.

Q. When you say it's not applicable, I mean, the water-quality standards certainly apply in the groundwater --

A. Yes, but not for where you would sample -- not where that would be proposed to the place of point of sampling.

Q. So it's not appropriate to try to apply those standards up in the pit waste --

A. Exactly.

Q. -- because that deals -- that applies down here in the groundwater?

A. Where it may potentially be used, yeah.

Q. So it's your testimony today that if we were to adopt criteria level -- criterions of levels and depths that we see at Tables 1 and 2, that we would be protective of public health?

A. Yes.

Q. And of freshwater?

A. Yes.

Q. And of the environment?

A. Yes.

Q. Now, in the siting criteria, we talked a little bit about the importance of response time. Is response time a critical element in the post-closure phases that we are talking about here with Table 2, or is that more

of an issue during the operational phrase, when we have liquids in the pit for the multi-well fluid management pit?

A. Well, I think, clearly, to me, and based on my experience and in my opinion, the issue is during operations, you know. Then we've got -- we've got a head. You know, we've got issues to be concerned about.

In post-closure, you know, I, for the life of me -- I mean, based on everything that we're doing in a closure process, this stuff isn't going anywhere. So the response time related to that is -- is not -- not an issue of concern.

Q. And in the many, many pits that you said that you've worked with -- and I believe you said your experience was with 6,000 pits, not all of which you've probably looked at the depth -- have you ever seen a substantial amount of chloride that has gone up or down in that pit, from the pit, and if so, how far?

A. Well, keep in mind, some of the pits that I have experience with were filtration pits. You know, that was what they were proposed as. So the answer to your question is, yes, in general. But to clarify, for the types of pits that we're talking about right here, I have not.

Q. You have not seen any migration, or you've only

seen the migration to a limited extent?

A. Well, I guess my statement, to clarify, would be significant, in my opinion.

Q. Significant migration.

And now you mentioned an infiltration pit. That's not a term that many of us here are going to be familiar with. Explain a little bit to the Commission what an infiltration pit is.

A. Well, the first infiltration pits that I did were for Walt Disney World, and they had infiltration pits in Florida to allow -- slow-rate filtration pits. It was designed to access treated effluent and allow it to percolate in the ground.

But moreover, in -- in -- in oil and gas and water management, I've dealt with pits where the idea of the pit is to allow water to actually migrate downward. In some of the very, very early days, you know, around the turn of the last century, in the early 1900s, in many oil and gas-producing states, you had disposal pits, to where -- you know, there was one that we were working on, had been working on for some time, in the Wichita, Kansas facility where maybe over a period of 20 or 30 years operators disposed of their brine into a pit that just filtrated --

Q. And the purpose of that was actually to --

A. Yeah.

Q. -- move the water out of the pit and downward?

A. Right.

Q. And that's not at all related to the types of pits we're talking about?

A. Absolutely not.

Q. If we return, then, to slide -- I think it's going to be Exhibit 14-21 of the presentation. If we go back to that original dichotomy that you drew between operational closure and post-closure phases, in your opinion, have we addressed the various release pathways [sic] that are going to be potentially present through the proposed rule -- or the existing rule even with the proposed revisions?

A. Well, if we look at the various possibilities, you know, we look at, you know, spills and overland releases, you know, the siting and design requirements, operational requirements, freeboard repair seem to address those concerns and provide for a quick response.

Direct contact from -- if we look at this from a, you know, public health or a safety perspective, they appear to be addressed. Punctures and leaks in the liner, you know, we addressed those through a variety of means. So I'm confident that -- that, you know, based on the various criteria we've looked at, the rules are

certainly more than adequate.

Q. What about in the post-closure phase?

A. If we look at post-closure, again, in my opinion, the couple of things that we look at -- you know, if we look at, first, kind of erosion and exposure issues, you know, we've got, you know, siting to prevent location high-risk areas, you know, so we're not going to, you know, put it right next -- that's kind of why we have setbacks. We've got a cover in the case of all of them. We've got contouring, which is another, really, I mean, one of the more important aspects of all of this so that we -- you know, that we can contour, revegetate so that we don't have some significant erosion later on. I'd say that if there is an issue that I've seen that, you know, has, you know, caused me concern is areas where that wasn't done, and you can get highly erodible soils. And I can walk up to the site, and I can see the pit at surface. So that's an important aspect of the rules.

Bleaching aspects, from the minimum distances for buffering, the limits, in both Tables 1 and 2, and contouring to minimize hydraulic head and so forth, so I think really we've -- the proposed rules, I think, do address things, I think, you know, more appropriately than the existing rules, and the proposed

rules address the things that you would be concerned about from a public health and environmental safety perspective.

Q. And how would New Mexico's rules stack up against other major producing states even with the industry revisions included in them?

A. Well, one of the things we tried to do as part of this is -- I wanted to look at exactly that. So if you -- if you -- if you look just very generally at the oil and gas-producing states, you know, there's -- you know, there's about 33 states that -- that -- that really do this. And if we look at the -- if you remember, kind of, you know, what I talked about earlier in going through is that we looked at kind of the components of the proposed Rule 17 and how that -- how that compares to other states. We see that states that have -- permits are required to construct or use, about 19 other states have that that. Liners required for at least some pits, 23 states. Requires some sort of minimum freeboard, 16 states. Setbacks from surface water, only 10 states. Pits are prohibited in the water table, 12 states. Regulate the duration of use, 16 states. So if we look at that, I think, you know, these stack up pretty well.

Q. All right. Did you look at any states in even

greater detail?

A. Yeah. What I tried to do is, I chose really kind of six states that I, you know, felt had, you know, a good bit of production and would be a good comparison, at least in my opinion.

But New Mexico's liner requirements are more stringent than four of the six states that I chose in this comparative analysis. New Mexico's freeboard requirements meet or exceed all other of the six states. New Mexico has more detailed setback requirements than all the other six states, and New Mexico has more stringent requirements for setback from the groundwater than five of the other six states.

Q. And that would be even with the revisions that are proposed in the industry proposal; is that correct?

A. Yes.

Q. And so if you were to summarize, do you believe that the Commission can conclude that the proposed revisions to the rule are going to be protective of public health and freshwater and the environment?

A. Yes.

Q. How do you reach that conclusion?

A. Well, if we kind of look through, you know, my analysis, you know, the history of temporary pits with incidents which could impact groundwater is pretty

small, you know, 0.0125 percent of the pits that have been in the state. You know, from a -- from a risk perspective on environmental rules, that's -- that's pretty darn good.

The current proposed Rule 17 uses siting, design, construction, operation, closure, reclamation requirements that I think do a good job of ensuring public health and the environment.

Q. And even with the revisions to proposed Rule 17, does that have impact on New Mexico's leading position in how they regulate the impacts of pits, or does that leave us still as one of the leading states?

A. I would say that with the proposed rules -- the proposed Rule 17 is more detailed and stringent than regulation rules in most of the other states managing oil and gas production and especially with high levels of current oil and gas development.

The Commission, I think, can and should conclude that the proposed Rule 17 is protective of public health and the environment.

You know, I'm just one guy, but, you know, I've looked at a lot of pits. I've been on a lot of different sides of the table. I have experience with the various details of this from both a regulatory perspective and trying to help implement these, and

these seem like a very good take at rules that I think meet what the state is trying to accomplish.

Q. If you turn back to the NMOGA exhibit book and flip to Exhibit 15, there is a document called "Expert Report on Proposed Revisions to the Pit Rule." Did you prepare this report?

A. Yes, sir, I did.

Q. Does it summarize the testimony that you gave to the Commission today?

A. Mostly. We got a little bit beyond what's in my expert report with the testimony, but, yes, in general, it does.

MR. HISER: Madam Chair, I would move that NMOGA Exhibit Number 14, which are the slides that you saw; NMOGA Exhibit 14A, which is the drawing of the multi-well fluid management pit; and NMOGA 15, which is the report of Mr. Arthur be admitted.

CHAIRPERSON BAILEY: Any objections?

MS. CALMAN: No objection.

MR. JANTZ: No objection.

MS. FOSTER: No objection.

MS. GERHOLT: No objection.

CHAIRPERSON BAILEY: Then they are admitted.

(NMOGA Exhibit Numbers 14, 14A and 15 were

offered and admitted into evidence.)

MR. HISER: And I've completed my direct. I'll turn it over to you.

CHAIRPERSON BAILEY: Ms. Foster, do you have any questions of this witness?

MS. FOSTER: Madam Chair, no, I do not. Thank you.

CHAIRPERSON BAILEY: Mr. Jantz, do you have questions?

MR. JANTZ: Yeah, I do have questions.

CROSS-EXAMINATION

BY MR. JANTZ:

Q. Good morning, Mr. Arthur.

A. Good morning.

Q. Let's just start off at the beginning with the --

A. On the presentation?

Q. On the presentation, yeah.

Looking at your overview of the pits -- historic pits, could you explain to me the process you used to evaluate the historic pits statistics that you present here? Step one, what did you do?

A. We estimated the number of pits that have been constructed in the state. We looked at past testimony conducted by the OCD of the 4- to 500 pits. We

attempted to then research those and evaluate, really, available information to come up with the statistics that we had, including review of individual data on the -- you know, the subject smaller number of pits that had alleged issues.

Q. Okay. So the number of pits that have been constructed is an estimation, right?

A. Yes, 80- to 100,000.

Q. And that's based on -- what do you base that estimation on?

A. We've seen that -- we've seen that number used, but also looking at the number of wells that have been in the state and so forth. So it's in that -- it's in that range.

Q. So is it based on historical data of wells drilled?

A. Yes.

Q. And that information was available from public records? Is that what --

A. Yeah.

Q. And you said you reviewed testimony from the OCD. What testimony did you review?

A. I reviewed the presentations and stuff from the last hearing.

Q. So the Pit Rule hearing in 2007, 2008?

A. Yeah.
Q. You reviewed testimony from the OCD?
A. Uh-huh.
Q. Did you also review Dr. Stephens' testimony from --
A. I reviewed his slides.
Q. You did review his slides. You didn't review the testimony?
A. No, I didn't go through and review whatever -- written testimony.
Q. So in your review of OCD's testimony from 2007, 2008, do you recall the percentage of reporting that operators do in terms of leaks and tears in liners?
A. No.
Q. Would you be surprised if I told you that Mr. Michael Bratcher, the field supervisor in Artesia, estimated that 80 percent of the time those breaches aren't reported?
A. That would surprise me, and it sounds like what you're suggesting is an estimate, too, but --
Q. It was based on his experience.
So let's just assume, for the sake of argument, that that's true, and it was sworn testimony in the Pit Rule hearing, which you say you reviewed. Is it possible that this information that you have

doesn't -- is a very -- is underreporting the number of groundwater impacts to -- to groundwater for pits?

A. I would be surprised if it's very far off of that.

Q. But it's possible?

A. Could you be more specific?

Q. Is it possible, assuming for the sake of argument, that 80 percent of the time these things aren't reported by operators, that this data set that you used represents an underreporting of --

A. So my reporting is on potential instances where there's alleged groundwater contamination.

Q. Right.

A. You're trying to provide something that, to me, sounds very different; so any time there is a leak or tear. So I can have a tear in something that is above the waterline or that doesn't result in a groundwater issue, and to me those are two different things. So I'm not sure where you're going.

Q. Well, the tears that were noted by Mr. Bratcher did result in some impact to soils underneath the pits. So I'm sorry --

MR. HISER: I think that I would object to that.

MR. JANTZ: I can read the testimony. And

Mr. Arthur said that he reviewed --

A. I didn't review everybody's testimony. I reviewed presentations, I think is what I told you. So I haven't read the whole testimony from the last multi-week Pit Rule hearings. Sorry.

Q. (BY MR. JANTZ) Let me rephrase. Assuming that 80 percent of the time operators do not report tear -- liner breaches that result in impacts to the soil underneath the pit, is it possible then, making that assumption, that this could represent an under-reporting -- that the data set you used could represent an underreporting to the impacts of pit contents on groundwater?

A. Well, what I -- how I can respond to that, really, is going to be based on my experience in a number of different states, including New Mexico, but certainly all around the country. I have seen many instances of pits becoming compromised. I would say that, in general, those compromises are very minor and not something that is going to be jumping to the conclusion that if I have a tear or a leak in a pit that goes unreported is automatically a cause of groundwater contamination. I think that is a massive jump on your part, and it's not something that I agree with. And I think that my numbers that I have here, even recognizing

with what you're saying, are probably not going to vary significantly.

Q. Did you run a statistical analysis on this data set?

A. Could you be more specific?

Q. Did you -- well, let me ask this: Does the data set that you used conform to generally accepted scientific standards for a reasonable -- for a legitimate data set upon which to base conclusions?

A. Is there a -- is there a reference that -- that -- that you're having, or are you asking, is this, in my professional opinion and experience, acceptable? I'm confused of what you're really asking.

Q. Okay. I'm trying to --

A. Is there an ASTM standard or something? Is that what you're looking for, or what?

Q. I'm trying to find -- I'm trying to find out if there is some objective standard upon which to base -- to compare the data set that you're using, to determine whether it is a valid data set.

A. I would say -- one is, I can only answer based on my experience.

Q. Okay.

A. And in my experience, the analysis that we did is not like analysis that I've been involved in and that

I've seen done in other rulemaking endeavors both at the state, federal and local level.

Q. So in your experience, there's no objective statistical analysis or other type of criteria upon which to compare this data set with what might be a scientifically or statistically acceptable data set?

For example, sample size, that's generally --

MR. HISER: Madam Chair, perhaps it would be helpful if Counsel could clarify if he's trying to do the Student's t-test to compare whether two sets of data are the same, or what exactly he's trying to compare, because there are many ways you can use statistics.

MR. JANTZ: Sure.

Q. (BY MR. JANTZ) For example, with respect to groundwater samples pursuant to RCRA. EPA has certain standards that are required to be met, and you have to designate the data as normal, lognormal, averages. Is there a similar process for evaluating data such as this, or did you just take a look at the records, do a simple arithmetic -- did simple arithmetic and present your conclusions?

A. You know, I've done a little work in the RCRA and Superfund programs, and I've seen statistical analysis done by accounting agencies. And I think

there's probably many standards of how statistics are done, can be done, may be done, and, in general, when you see some of these standards and bases, they're based on a program where you're dealing with many similarities.

And what I'm trying to do in this case is use a method that has the data that I saw as available, the actual data and results from this data from estimating the number of wells and more recent events. So as opposed to looking at this as some, you know, documented statistical analysis approved by the FDA or whoever, what I tried to do was use the data that was available, my best engineering judgment, my experience and my understanding of the area to come up with -- with data to be able to present in a fashion that I thought was most applicable to the rulemaking process.

Q. Okay. Let me ask you this: When you looked at this data set, did you look at the depth to groundwater for each site where contamination was found?

A. I looked at the summary reports, and so I think that had the depth to groundwater, yes.

Q. So I imagine -- can you give me a range, to your recollection, of the depth to groundwater?

A. I don't remember, but what I can tell you is that in all the cases that I reviewed here, all occurred

during the operational phase. All were tears in the liner. And I don't believe that in any of the cases it -- I just -- I can't, off the top of my head, recall, but I don't remember the depth to groundwater being real significant. You know, I can't remember those numbers off the top of my head.

Q. So what do you mean by distant?

A. Not hundreds of feet.

Q. Okay. But it could be closer than hundreds of feet?

A. Yeah.

Q. Did the data set you reviewed have information about the size of the pits in terms of volume?

A. I don't recall.

Q. What about the age of the pit?

A. I believe it had that, but I don't remember that data. It's been a couple of days since I looked at the specific details on all that.

Q. Sure. Did the data set you looked at mention the type of liner?

A. Yes. They all had some liner. So this was -- in all of these cases -- this was really before Rule 17. So in those cases, what I looked at was that under the existing rule or the proposed rule, that, you know, the proposed rule would be more protective of the incidents

that I saw.

Q. Did it talk about what thickness of liner it was?

A. I recall some liners. I believe that I saw 12 mil thickness on some of them, but I can't remember specifically. I was looking more at, you know, how they were put together.

Q. The data set you looked at, the reports you looked at, did they mention how the violations -- or how the contamination was discovered?

A. I don't recall.

Q. So you don't remember if it was self-reported?

A. I don't remember that, no.

Q. The estimation of the number of pits, the 80- to 100,000 that you estimated here, are those the same kind of pits that are -- that you evaluated in the data set?

A. Would be all pits.

Q. Huh?

A. All pits.

Q. They're all pits.

And they're the exact same kind?

A. All pits. That's what I'm estimating. So that would be the historic pits. There's been temporary pits, permanent pits, et cetera.

Q. Uh-huh. So it's a one-to-one comparison, is what you're saying? You evaluated all pits, temporary permanent, whatever. That's the same kind of pits as the 100,000 in the estimate, right?

A. (No response.)

Q. Let me rephrase that that. Are there different kinds of pits that have been used historically that are used now?

A. You know, I'm thinking about both of your questions, sir. And in oil and gas development over the years, I think that, in general, the pits were similar. I mean, not to say that they were all permanent or, you know, all temporary or anything like that. There's that -- I mean in that universe of pits used for oil and gas development. So in that light, similar.

And when I think about -- when you say, Are all pits the same? You know, I mean, I'm trying to think of what other sorts of things the oil and gas industry might have used a pit for 50, 100 years ago. And I think even if I explore back to those times, it would have been for relatively similar purposes, although I'd say that you might even have had some of those pits, in many of the early days -- one of the things that's interesting in New Mexico's history is, they used to produce oil and put them in pits. And

they -- you know, so some of the early -- when they were looking for workers from the East, they'd send postcards out of these pools of oil, and some of the Easterners thought that how you explored for oil was by going around searching for pits.

So certainly there could be -- there could be instances where you could have pits that probably, I would say, are more environmentally endangering than what we're talking about here, which I think leads to my overall conclusion that having relatively a small number of groundwater impacts or alleged groundwater impacts makes me feel positive about that.

I'll also state that if -- if, you know, many -- in my experience, where you see pits that have a leak or a tear or maybe an overflow or, 100 years ago, an intentional overflow, but -- but for the most part, you know, if you had an ongoing issue of groundwater contamination, I think that in most cases you would see it, you know. Even if something went unreported, you know, there would have been an impact, and we don't necessarily see that.

So, you know, I think that the state would have -- if there were, you know, out of the 80- to 100,000, 50,000 or maybe 80,000 that caused groundwater contamination, you know, I'm going to guess we would be

doing pit hearings well in advance of 2008 or 2012, or even from the Rule 50, because there would have been a mass outcry from people of groundwater contamination, and we haven't seen that.

And honestly -- I mean, I'm not making this up -- is that in most of the pits that I've seen, even historic pits -- and I've seen pits that in infiltration pits that certainly caused real problems, but most of the pits that I've seen, even unlined pits, you know, the migration from those has really not -- you know, I mean, not been that significant.

Q. So what's --

A. So I'm confident with these numbers.

Q. So what's the point, then, of the -- what's the point of NMOGA's proposed revisions to the Pit Rule, then? If what we have is protected -- I mean, I don't want to put words in your mouth, but what we have is protected.

A. Well, first, thank you for not wanting to put words in my mouth.

Q. (Laughter.)

A. I think you've done a little bit of that here the last couple of days.

But from my perspective, when I look at the existing rules compared to the proposed rules -- okay?

And I'll give you my professional opinion. One, I think the proposed rules address some things from a clarification perspective. They address some things to incorporate a risk-based infrastructure, which I think is important. They address and allow the issue of multi-well fluid management pits. They, I think, improve some things from an environmental perspective.

I really think not having a geomembrane cover over the pits when we're burying those is a good idea and actually better.

You know, so it does a number of things that improve them, I think, makes them more easily regulatable, which, I think, to me, is important, more implementable by industry. And I can't tell you how -- how important that is. When you're, you know -- if I'm a regulator, I do not want to make a rule that is harder than hell to implement, because what's going to happen is, people are not going to be able to do it. So I want to do something that's clear, that's concise, that makes sense, that's not -- you know, that's not making requirements that costs industry money; it costs them time; it costs the state time, and it costs the taxpayer money that is not providing an environmental benefit.

So I think that the proposed rules really meet on a number of different levels to improve the

rule. And I think, in part, one of the ways that it's --

(Cell phone ringing.)

THE WITNESS: Okay. I apologize. I thought I got this turned off.

A. But -- but it also bases on a little bit of experience in trying to implement those rules, on both sides, for the last couple of years. So I think that there is a need for the proposed rules, and the proposed rules, I truly believe, are an improvement.

Q. (BY MR. JANTZ) But that wasn't my question. My question was --

A. I thought it was.

Q. -- in your professional opinion, are the current pit rules protective of freshwater?

A. Yes.

Q. Public health?

A. Yes.

Q. Livestock?

A. Yeah.

Q. And the reasons for the change -- the proposed change, if I understand, in your professional opinion, are: Cheaper to implement?

A. Well, you're all about cost on everything, and I don't think -- that's not -- that's not really my --

the main focus of what I'm even seeing here nor is it what I said.

Q. But that's a consideration; is it not? And you did mention, if I heard you correctly, that they are cheaper to implement; is that not true?

A. I haven't done or tried to do an economic analysis or assessment of this. What I've tried to do is to look at the implementability of it, the adequacy of it, you know, those sorts of functions as opposed to, you know, the burden from a -- from a time and those perspectives. So I would say that overall, the proposed rules are probably cheaper to implement for the companies and the state and more easily to regulate managed compliance, which is a positive thing, I believe.

Q. Sure. And if that's the case, given the success rate with even unregulated unlined pits, why don't we just go back to that? That would be much easier to regulate, wouldn't it?

A. You know, over the formation of our country and the implementation of oil and gas development, energy development, really, of any type, there is -- there has been a much more growing need to have, I'd say, more highly regulated, more accountable regulatory infrastructure on everything we do.

And I think that from a societal perspective, that in 2012 -- or 2008 is that -- is that rolling back -- irregardless [sic] of risk and not showing regulation, even if the regulation maybe is -- is -- is overly conservative most of the time, it serves to address the minority of the time.

We have speed limits, you know. Well, you're probably not going to speed. I'm probably not going to speed, but the Commissioner, you know, might have a lead foot. So we're going to put in a speed limit to make sure that we're all on the same path.

So how I see it is that -- is that, you know, even though we've seen the statistics that we've had, it's important for us to have a good implementable infrastructure so that we can demonstrate that we have a regulated industry, that the regulatory infrastructure from which they work is good and that can be regulated. So it's, I think, a lot of accountability and a number of different things.

So I would not agree that we should roll back to no rules or whatever. But what I will say is that if you look at from what I've seen from a number of other states, New Mexico is much more stringent in exhibiting Rule 17, and even the proposed Rule 17, than many other states. So there are a number of things

aren't necessarily implemented in other states that are [sic]. And that's not across the board. But, in general, if you look at the whole, these are pretty -- pretty good rules that I think are protective.

Q. And you come at that from risk-based perspective; is that right?

A. From an experience perspective. I guess risk, too.

Q. Have you done a rigorous risk analysis on that? When I see risk analyses, I'm used to seeing, well, there is 1 in 1,000 chance of something bad happening, or 1 in 100,000 chance of something bad happening, but I haven't seen that yet in this hearing. Have you done that?

A. So are you talking a human-health risk assessment?

Q. Yeah.

A. So I think, you know, when you look at -- and I understand your lack of knowledge and not a risk assessor, but when you look at -- when you look at risk assessment -- and I've seen a number of those done both while I was at the EPA and in my consulting career. When you look at, you know, kind of the risk-exposure limit, you have a pathway. You have -- you know, you've got something that's -- you're doing a RCRA closure, so

you're going to put a housing development on a former, you know, smelting company.

You know, the Wyoming Oil and Gas Conservation Commission's office is on a former Superfund site. So they did risk assessments there. They're going to have an office building there. You have people that are going to be driving around here. And what they decided is, they looked at the use of that, and turned it into a golf course and so forth to be able to have a basis from a risk assessment.

In looking at what we're doing here, we looked at Dr. Thomas' testimony on risk. He handled that. I think he did that well. I didn't do a human-health risk assessment. When you start looking at the surface, we looked at lot of the components of that, but we didn't try to come down with a particular number. It would be awfully low.

Q. Are there -- and forgive me, because you're right; I don't do risk assessment. I'm just a lawyer --

A. Sorry.

Q. -- so I rely on what guys like you tell me.

Are there risk assessments done for nonhuman-health type things? Like, what's the risk of impacted groundwater from this particular source of contamination -- or potential source of contamination?

A. You can -- I mean, if you use the term "risk assessment" broadly, you can do risk probability analysis.

Q. And did you do that here?

A. I think that what -- you know, depending on how you want to define a risk assessment or risk probability analysis in broad terms -- and I didn't try to call it that, but I think that, you know, some of the statistical analysis that we did, you know, just, you know, looking at data that exists, could probably be determined, in a broad sense, a risk assessment.

Q. And can you explain the statistical analysis that you did?

A. So I'll use the last one, for instance, you know, about looking at the number of wells that were drilled, that those would have had pits, that 95 percent of them would have had temporary pits, and that there were six alleged cases of -- or six cases of alleged groundwater contamination to that. So you could do a real basic probability analysis or -- or -- or -- or any -- just an analysis. I don't know that you have to call it a risk analysis or a probability analysis or anything like that. It's just, that's the data that is there.

Q. And based on your -- based on this estimate of

80- to 100,000 wells, are all the pits tested for release?

A. All the 80- to 100,000 pits?

Q. Right.

A. Probably not. I'm sure not.

Q. Okay. Let's move on to the -- some of the siting requirements.

CHAIRPERSON BAILEY: Why don't we have one more question, and then we'll stop and ask for public comment?

MR. JANTZ: Well, since I'm going into the siting requirements, this is a whole line of questioning.

CHAIRPERSON BAILEY: Maybe we should break right now.

Any people who signed up for public comment today? We have no one?

All right. Then why don't we take a lunch break and be back here at five to 1:00?

(Lunch recess, 11:40 a.m. to 12:58 p.m.)

CHAIRPERSON BAILEY: We are back on the record for cross-examination of Mr. Daniel Arthur.

I believe, Mr. Jantz, you were in your cross-examination.

MR. JANTZ: Right.

Q. (BY MR. JANTZ) One other question I forgot to ask you about the data set that you looked at regarding historical pits. Is that the same data set that OCD used back in 2007, 2008?

A. Yes.

Q. You didn't add any information to that, any data points, anything like that?

A. It depends on what part of the analysis you're talking about. So we did the -- I did the additional analysis of the 2005, 2007. We looked at the 500 to see what we could find from that, that was alleged groundwater. So we didn't add any new data points, I guess.

Q. Okay. And that was my question. Thank you.

So I want to go to the siting requirements and ask you a couple of questions about that. Now, you testified that the siting requirements of the setbacks, as well as the distances to groundwater, were protective, in your estimation; is that right?

A. Yes.

Q. And in terms of, for example, the distance to groundwater, both confined and unconfined, was that based on any modeling that you did, contaminant transport --

A. First, there aren't distances to confined

groundwater.

Q. Okay.

A. So I'm trying to not let you put words in my mouth, here, again.

But on the -- on the separation from unconfined aquifers, we did not do -- I did not perform any sort of fate and contaminant transport modeling as part of this.

Q. Okay.

A. I reviewed the modeling that was done before.

Q. And which models were those?

A. The stuff that Daniel B. Stephens did.

And I also -- really, probably the thing that I -- beyond the modeling, you could just about make -- you know, do whatever you want to in a lot of situations. But I looked at my experience over the years to look to see if those, I felt, were reasonable, and I thought they were.

Q. And in your experience, has that involved modeling any of these things in other circumstances, fate and contaminant transport -- contaminant fate and transport?

A. Are you asking if I've ever done fate and contaminant transport models?

Q. For a particular pit, anything consistent with

that.

A. What kind of pit?

Q. A temporary pit, permanent pit, multi-well fluid management pit, any or all of those.

A. Yes.

Q. And how many times?

A. How many models or models off of how many pits and runs on an individual pit?

Q. How many pits have you modeled?

A. That I have personally modeled, or managed the modeling and -- and -- and modeled?

Q. Personally modeled, we'll say.

A. Pardon?

Q. Personally modeled.

A. Less than 30. On an individual pit, I've also done some, you know, more regional models and that, that would have encompassed larger numbers, but on an individual pit basis, less than 30.

Q. With regard to the confined groundwater, isn't it the case that confined groundwater -- well, let me back up.

It's my understanding that your testimony was that that really only refers to artesian water, artesian sources; is that right?

A. In the -- in the definition of the proposed

rule --

Q. Yes.

A. -- it would be, you know, confined from below and above and have -- I can't remember the exact -- the exact wording. Until that one penetrated, the groundwater would rise, which would be suggestive of artesian properties; not necessarily artesian to the surface, but --

Q. Uh-huh. Okay. So if a -- if there were confining layers above a groundwater source, above which a pit rule -- or a pit were located, and there wasn't pressure, would that be unconfined groundwater, or would that be considered groundwater under this rule, in your opinion?

A. It would depend on if it met the definition.

Q. So if there were no pressure, that's unconfined, because the definition --

A. I don't know what you mean by no pressure. The definition doesn't say pressure, so you're kind of changing the definition of what I'm looking at here. So if you want to look at the definition, it says what it is.

Q. Yeah. Let's look at the definition.

A. I think confined groundwater means what the definition says.

Q. The water is under pressure. So if the water isn't under pressure but is confined, but does have a confining layer above it --

A. Okay. Yeah, I'm incorrect. So, yes, you're right. Yeah. "Under pressure so that when penetrated by a well, the groundwater will rise."

Q. Is it possible to have confined groundwater as it meets the definition here if there are faults or fissures within a confining layer?

A. Faults or fissures?

Q. So suppose -- assume you have a groundwater source, and there is a confining layer below, a confining layer above. Okay? And it's under pressure. It meets the definition of confined groundwater as it is in the proposed regulations. Would that be confined groundwater, as I've described it, under this definition? A confining layer above, a confining layer below, under pressure.

A. Yes.

Q. Okay. Now, assume, then, that there are faults or fissures, and/or fissures, in the uppermost confining layer. Would that necessarily mean that there was -- would it depressurize, necessarily, the groundwater?

A. Well, we're getting real hypothetical here, but let's just say, for practical purposes, that there was a

fault or something there that had been there. I'm assuming, since you're using geological references, that it would have been there from a geologic time perspective, but yet we have confinement above and below, and if penetrated, it would pass fluid above and not downward into that aquifer. So it would meet those conditions. So either the fault or fissure would be sealed, or there would be flow out of the aquifer and enough pressure so as not to allow fluid to flow into it.

Q. Okay. So it could be a faulted or fissured uppermost confining layer and still meet this definition, hypothetically? And you have been qualified as an expert, so you are allowed to --

A. I think that's just what I said.

Q. Okay. I was -- I was just making sure I understood it properly. That's all.

A. But still, it's in the basis of what I'm saying. So you could have a sealed fault, where there is no movement, or an open fault, although I will say that it, technically, would meet that definition. But if that was the case, my guess is, it would not be under pressure and -- I mean, I'm trying to think of a circumstance where that hypothetical situation would exist, and I'm not sure there is one. But academically,

yeah.

Q. Sure.

And generally, how does one determine faults and fissures in a particular area? So assume you have a pit. There's a groundwater source underneath, confining layers above and below. How did you go about figuring out whether that confining layer is really a confining layer?

A. I'm really -- honestly, I'm kind of confused about the line of questioning, and I don't mean to be smart, you know, about this. But, you know, you're -- you're -- you have a confined aquifer, and now you're saying, Well, if there was something where it wasn't confined, would it still be a confined aquifer? So I don't quite understand it.

So if you had a fault or some sort of something there that would have been there in geologic time to allow that pressure to dissipate, it probably wouldn't -- I mean, it wouldn't be in existence.

So a lot of the map -- geological mapping has that. There are generally people that have drilled water wells that have some ideas of what that shallow geology is. And we're not talking about faults and fissures at 15,000 feet. We're talking at 50 feet or something like that, and, generally, you can see that

sometimes at the surface, or the USGS has seen that, or -- you know.

So I'm not sure -- I don't understand where you're going or how -- I'm trying to answer in what I think is -- is -- is a sound manner, but you're asking me to almost like tell you that -- that it's -- I don't understand. I'm having trouble understanding how to answer this question.

Q. I'm not looking for a particular answer. All I'm looking for is your professional opinion. And where I'm going with it is, you know, irrelevant to the purpose. I would just like an answer to the question.

You have an aquifer underneath a given pit. Generally, how does one figure out whether that aquifer has confining layers or not?

A. Typically, there's a lot of published data, you know, in the shallow geology that it's going to have some of that information for you. I mean, if it's going to be a confined aquifer, it may be mapped. It may have some name from drillers. There are a number of different sources that geologists or hydrogeologists would look for in that. And that's just partly what you would go through -- that process that you would go through in siting a pit to see if you could find that information.

Q. And do those -- do those reports -- you mentioned USGS. Do they often -- are they often accurate on an acre-by-acre scale?

A. It depends on the area. And it may be -- you know, sometimes you may be looking at a number of reports and doing field geology and so on and so forth. It's not just, Well, I trust in this, you know, one publication that has one well in 100,000 square miles, in making that determination. I think that any professional is going to do a much better job than that to try and identify it.

Q. So assume you're that professional. Walk me through what you would go through to figure out whether a particular area under a pit was confined or unconfined, absent doing a pump test to determine the pressure.

A. Well, you could find it out without doing a pump test, but I would probably start out, you know, looking at publications for the area or region, whether from the USGS or the state geologist or other information. We commonly would look at water-well drilling records. We've, in the past, talked to drillers. And where that information isn't available and there are residences in the region, we may and have talked to that. That's another thing that you wind up,

in essence, doing a little bit anyway here, because you have setbacks to the water wells. I may do field geology, if necessary. And I don't have a good feel for that, but I would go through those processes until I had a pretty good comfort level.

Q. In terms of the USGS maps, which is a part of the significant watercourse definition, 7.5 in the quadrangle map, what sort of scale does that equate to in terms of one inch equals two miles? That's sort of the way I'm used to dealing with it.

A. I don't remember that off the top of my head. I've looked at a number of those maps. It's been awhile since I've looked at one. I mean, in more recent times, I've got staff that I'll have doing that, and I just can't remember off the top of my head the actual scale.

Q. Do you remember, in looking at those maps, whether those maps identify ephemeral streams on them?

A. I don't recall if they do.

Q. Are you aware of whether the State Land Office -- New Mexico State Land Office has identified ephemeral streams, for example, in Lea County?

A. I'm not sure. I haven't asked them.

Q. If you'll give me just a second here.

A. No problem.

Q. Okay. Thank you.

In terms of the siting requirements, you testified, if I remember correctly, that the multi-well fluid management pits would never be sited in an arroyo; they'd never be located in an arroyo.

A. Well, what -- what I think I said is that, you know -- you know, when I look at this, you're certainly not going to do -- you're not going to site a pit -- and there are rules -- run-on rules here that you have to account for. But if you -- you know, if you start looking at arroyos, I mean, you know, we're talking about a creek bed that could have flow in it. So there may be, you know -- you know, certainly a broad spectrum of arroyos. So I would not say never, but any -- certainly any significant one, no.

Q. Okay. So the rules don't prevent --

A. Oh, I think they do. I think, you know, with the run-on requirements and siting and design standards -- that's what I'm saying. Maybe not any. You know, I mean, if you have, you know, some -- some small arroyo that's really not going to be a run-on requirement or a run-on problem, I'm not sure that would necessarily be an issue, but -- but for the most part, I think the run-on rule is going to address anything of significance.

Q. Okay. But my question was: The rules don't

prohibit a multi-well fluid management pit for being sited in an arroyo?

MR. HISER: He's asked and answered that already.

A. I think they do.

MR. JANTZ: Well, he actually didn't answer my question.

A. I did. I think I did.

Q. (BY MR. JANTZ) Could you point me to where, in the regulations, that's prohibited?

A. Okay. On the run-on rule. So if you're in an arroyo --

Q. Could you point me to that rule, so I know where to look?

A. There you go. Number -- number 10, at the top of page 20.

Q. But that's not a siting requirement. That's a design and construction specification.

A. You know, in designing pits like this -- and I understand where you're coming from. Okay? I do. But sometimes design requirements impact how you site things. So you have -- you may have siting limitations that are trying to address, you know, kind of, let's say, high-priority environmental areas, but you may have other design requirements that might also limit on where

and how you're going to design a pit.

Q. Going to these multi-well fluid management pits --

A. Yes, sir.

Q. -- I'm a little confused about what exactly goes into these pits, because Commissioner Bloom referred to this article from the Artesia paper and that it refers to two pits in the fracking operation that they talk about, I guess, in Texas, one for a fracking flowback and one for reusing water for fracking. Is that a typical setup, and is that -- well, let me ask you: Is that a typical setup?

A. Could you repeat the question?

Q. Sure. The article refers to, in this fracking operation, two pits, one for fracking flowback fluids and one for reusing water used in the fracking process. Is this a typical setup, in your experience?

A. I didn't -- I didn't read the article. Does it say for reusing or recycling, or could you read the article, please?

Q. Sure. And actually, I'll give you this copy.

A. Okay. Great.

MR. JANTZ: If I may approach?

CHAIRPERSON BAILEY: Yes.

Q. (BY MR. JANTZ) And it's on the first page,

Mr. Arthur, third column, second full paragraph.

A. (Reading.)

What I would say is that, you know -- and typical to me is a -- is a -- is a challenge more, and I've been asked, you know: What's the average depth of an oil and gas well? And it's another one of those kind of catchy questions.

But what I can tell you that I've seen is overall -- and this has, I would say, evolved, to some extent. Depending -- and some of this is kind of location dependent. So if you can have a -- a single pit from which you can -- that you could, you know -- and you're hoping to blend and recycle -- you may have a pit that you're putting both produced water back into, as well as freshwater, you know, or maybe -- you know, in the case we had earlier, you may be taking fresher produced water from a coalbed methane play, maybe groundwater or surface water and produced water, and blending it.

But depending on where you are, you may not have one of those sorts of pits available. So what I've seen is flowback during that process; is produced water going into tanks. And for the most part -- well, I will say, I've seen pits, also, that have been used for staging flowback water when -- and oftentimes those may

be smaller than a larger one, where you're trying to centralize water for re-use, maybe by a treatment system. It may be by a disposal-well facility.

So as far as the norm or typical, I don't know about that. I've seen several different configurations.

Q. So in the definition in the proposed regulations, would both of these types of pits be multi-well fluid management pits or only one kind of these pits?

A. I think it -- I think it would -- I think it would depend. So let's say you had a pit that was at a single well pad, and you were -- you were producing -- producing -- or flowing back your produced water into that pit, and you were going to be using that water and maybe blend it for another well on the pad. I would say that would be -- you know, that would be included in there.

If this was just like a, you know -- and I'm trying to think of a situation where you're going to just have flowback from a single well that's not re-used, and my guess is that -- I guess I'm having a hard time with that definition, because even the ones that I've seen in Texas is, they may stage to have produced water for multiple wells come in. They may

blend there, but they may also have another pit where they may have mostly freshwater, where they're -- where they're staging mostly freshwater and then blending produced water into that to get it to a level. So then they'll use that and maybe fill more freshwater and then blend.

So you could have, you know, multiple -- I guess, in your terminology, multiple kinds of multi-well fluid management pits that are all really kind of the same, in my mind.

Q. This article also mentions, in the second column, that these multi-well pits in Texas are lined with 30 to 60 mil liner. That's thicker than 20 mil; is that right?

A. Yes. You are sharp. That's --

Q. Well, I appreciate you acknowledging that (laughter). I get the affirmations when I can.

A. Anytime.

And they are thicker.

I would -- I would just note on here that, you know, we've been involved heavily in the Eagle Ford play with water. It looks to me like part of this article was written by someone who builds pits, and, you know -- so I -- I take this as a little one-sided, but I've seen, you know, different companies having

different specifications with the type of thickness of liners that they use. But what I'll say is, thicker doesn't necessarily always mean better. Really, the best thing is to have a good design and a good operation of the pit itself.

Q. One more question -- or one more series of questions, I guess.

A. Excellent (laughter).

Q. We've got plenty of time.

A. Yeah. Me, too.

Q. On the multi-well fluid management pits, you mentioned the fluids that go in there, the fracking fluids, because I guess Mr. Lane testified that they're primarily used for frack jobs.

A. I separate the two. So what I would say is, fracking fluids, or hydraulic fracturing fluids, are the fluids used in the fracking process, and this is not those.

Q. Don't some of those come back in the flowback?

A. You flow -- well, flowback is a process. So during the flowback process, you produce water from the well that has utilized -- that's fracked the formation. It's a little more complicated than that, but you can get some of the additives and so forth that you put in back in the flowback process.

Q. Okay. So you're going to get some --
A. Yeah.
Q. -- frack fluid in the flowback?
A. Well, no. I said some of the chemical additives. I wouldn't say that that's frack fluid back. I look at it differently, but it's a technicality.
Q. Okay. The guar gum that you mentioned, what is that? One of those chemical additives?
A. I mean, you could get probably a little bit back of most any of the additives you put in there, maybe, except for the hydrochloric acid.
Q. So any of the other chemical additives that go into fracking fluid could come back in flowback -- flowback water?
A. To some degree.
Q. And does that includes the breakers?
A. Yes. But, I mean, generally what you see, from what you put in to what you get out, is a very small fraction of that.
Q. What is that fraction?
A. It depends on the well, on the formation and all that, and sometimes you don't -- a lot of times you don't see any of the chemicals that you put in.
Q. Can you give me a percentage range based on your experience?

A. On -- on -- I would say from -- if you looked at it on an individual chemical, zero to five percent.

Q. And, presumably, in your experience, you've done the chemical analysis on these flowback fluid -- the fluids that come from flowbacks to --

A. I've been involved in and produced water analysis following hydraulic fracturing in many states around the country, yes.

Q. You talked about the setbacks -- going back to the siting requirements, you talked about the setbacks from -- the setbacks for pits being adequate to allow an operator to catch a leak, if there were one, a breach of some sort, if there were one. Be able to catch that breach before it contaminated surface or groundwater. Is that a fair characterization of your testimony?

A. Yes.

Q. Is that statement based on any studies that you've reviewed on response time?

A. I would say that that's based on my experience.

Q. In terms of the burial in place and trench burial, you talked about the need or lack of need for a geomembrane cover. Did I hear you correctly that water infiltration is impossible -- water infiltrating into the pit contents without the geomembrane is impossible as long as you have that four-foot earthen cover?

A. Could you repeat that?

Q. Sure. Is it impossible for water, precipitation, flooding, what have you, to reach pit contents, to infiltrate through the four-foot barrier, the earthen barrier, that the pit rules would require?

A. Not impossible, but not likely.

Q. Not likely.

And that's based on what data?

A. My general experience.

Q. Is it also based on your review of Dr. Stephens' model?

A. I would say that would go into my experience. I've looked at his model -- at his presentation of his model.

Q. And you agree with his methods and conclusions?

A. No.

Q. You don't agree with his methods and conclusions?

A. I think his -- I think his were overzealous, that he was overestimating what you would see through the model. And you see that, I think, a lot of times in models.

Q. So you don't agree with his assumptions. Is that what you're saying?

A. I'm trying to be careful here to tell you what

I think as opposed to what you're telling me.

Q. Well, if you don't -- don't let me tell you anything. You don't listen to me.

A. Well, I'm trying -- but you're asking the question as did I beat my wife, you know.

So what I would say is that, you know, Dr. Stephens, I think, is a smart guy, and I think he did his best to make his best reasonable assumptions as you could on a complicated issue. But yet what I -- what I see from -- from a pretty broad experience at looking at pits, at looking at pits that have been closed is that a lot of models are based on, you know, this perfect-world situation that never happens. And what I've seen from my experience is that that doesn't typically match the model.

So you can -- you can run a model, and you're going to make these assumptions that you're going to have all these particular factors that are going to happen and you model it. But what really happens is that, you know, you go through droughts or this or that, you know, and what the model says doesn't necessarily happen.

And, in general, what you wind up seeing in a lot of these pits -- and if you look at digging them up, you see, you know, a dry bentonite clay that isn't

an issue.

Q. So again, my question is, though: Do you disagree with his assumptions?

A. I don't know how to answer the question.

Q. Well, let's just take a specific assumption about infiltration rates.

A. I don't remember what his infiltration rates were. What I'm telling you is that I looked at the model. I saw his assumptions. I looked at the results, and determined, within that, that was a good try to model, but really probably wasn't a very accurate representation of what happens in real life.

MR. JANTZ: You know what, I think that's all I have for this witness.

CHAIRPERSON BAILEY: Ms. Gerholt?

MS. GERHOLT: I have no questions for this witness.

CHAIRPERSON BAILEY: Mr. Dangler?

MR. DANGLER: Thank you, Madam Chair. I do have more questions.

CROSS-EXAMINATION

BY MR. DANGLER:

Q. Good afternoon, Mr. Arthur. Is that correct?

A. Yes, sir.

Q. Great.

A. Good afternoon.
Q. I did warn you that I was going to start out with a compliment, so --
A. Yes, you did.
Q. -- we'll just get that out of the way. You sound very knowledgeable and very reasonable, like the kind of person I like to have sitting at my kitchen table.
A. Thank you.
Q. And I want to try to honor that with you.
I do want you to understand -- from a couple of your comments, I want to make sure we're on the same page here.
Have you testified before?
A. Ever or here?
Q. Let's say starting with a court, an actual district court. Have you testified in a district court?
A. Yes.
Q. So when you complain about, on cross-examination, somebody putting words in your mouth, you do realize that is the essence of cross-examination?
A. Thank you.
Q. I'm just saying.
A. Okay.
Q. I, myself, have been unprotected

cross-examined, and it's a hideous experience. But I think you've got some wonderful gentlemen here protecting you. And, certainly, if you want to explain yourself, we want you to do it, and you've had an opportunity on direct.

A. Thank you.

Q. That's how it works, right, because you've testified before?

A. Uh-huh.

Q. Okay. Because I don't want you accusing me of saying, Did I beat my wife? I want to just clear that right off the bat.

A. Excellent.

Q. Great. Okay. Now we're set on that.

I tried to limit the number of points that I've got here, but let me just start with something you were just addressing, because this will help us get it out of the way and maybe orient some of my concern.

A. Okay.

Q. Now, I heard you say that that top cover, the geothermal [sic] --

And if I'm misspeaking, please correct me, because I do not know this field as well as you do.

The geothermal [sic] cover on top --

A. The geomembrane.

Q. -- geomembrane -- thank you -- the four-foot layer of dirt that protects it is what re-assures you that the water is not going to percolate through and create a problem from above. Is that a fair --

A. I think it's a little more complicated than that.

Q. Okay.

A. But, you know, one of the things that I liked about not having another geomembrane is that by not having that, you know, I get to -- I get to take advantage of any, you know, liquids being able to dissipate to the surface and not attempting to accumulate or being limited from that by a geomembrane.

Q. And I thought that was completely interesting, but I do want to understand. If there is a problem coming down from above, you're not concerned about it because of that four-foot layer. Am I right in understanding that?

A. By some cover, and it doesn't even have to be four feet. But by having a cover and vegetation that's going to be utilized in the water and that zone, all of those things together.

Q. That sounds great, but I also heard you testify -- and you volunteered this. You said it was something that concerned you, that sometimes the

gradients left behind are so poor that, I think you testified, you can just see into the contents of a pit.

A. Well, what I was referring to is erosion.

Q. Correct.

A. So when you -- when you close a pit, you need to have -- you need to have a cover. You need to contour it. You need to have vegetation so that you're doing that in such a manner that you're preventing erosion. And the areas where that has concerned me is where that hasn't been addressed, and the soil erodes.

Q. So in your experience, you have come across a pit where there has been an erosion problem --

A. Yes.

Q. -- and you've seen the contents?

A. And I would say, in the cases that I have seen that, there was not a -- the company that closed the pit did not -- did not take care in placing a cover, in contouring or revegetating. They really didn't do an appropriate reclamation of the surface.

Q. And I appreciate that concern. My problem, if I have a problem -- and I really don't know if I do, because I really haven't considered your testimony about the geothermal cover. And it's interesting to me, but I've got to say, I don't have a dog in this fight.

A. Uh-huh.

Q. But my problem is, when your reassurance, on the one hand, is a cover, and on the other hand, sometimes there isn't a cover, then I'm confused about your risk analysis overall.

A. So -- so what -- if you look at this from my perspective -- and that's all I can give you.

Q. That's right.

A. The important thing here to me is looking at the proposed rule holistically. I'm a big holistic analysis sort of guy.

Q. Right.

A. And what the rule does include is putting a cover, recontouring, revegetating so as to avoid that. And I think that those things, I guess, give me comfort that the -- the situations where I've seen this be a problem shouldn't occur.

Furthermore, it also goes into the points -- if you look at, you know, not only the closure situations, but you also have, you know, for instance, the run-on rule that we just went into. So now I can have some security in my mind that, in this case, we're not putting this in a -- you know, someplace that's going to be flooded. So, you know, we're doing -- we're doing the steps holistically so that hopefully that shouldn't happen.

And keep in mind -- you know, this was the arguments we used to get into when I was at EPA, that I've seen in several states, is that regulation -- you can't make a regulation that will never allow anything to happen. You can't say, Okay, we're going -- we're going to have a speed limit, and from now on, no one will speed, you know. But what you try to do in regulation is, do something to the best of your ability, so you're using multiple different things to give you comfort that you're being protective of public health and the environment. And these regulations do that. They don't just say, Do this one thing. They include multiple different factors. And from my perspective, that's a positive thing.

Q. Yes, that is a positive thing. And still, when things that should not occur sometimes do occur, then your risk analysis would have to shift to take account of that. Isn't that fair to say? There are a lot of things that should not occur but, in fact, do occur, and you have to take that into consideration, as well as take that into consideration of design?

A. Well, that's when you have --

Q. You have a fair question -- just answer that one by itself. Is that a fair thing to say?

A. Repeat the question, please.

Q. Okay. Is it fair to say that when there are things that should not occur but actually do occur, that we should take those into consideration?

A. Into consideration how?

Q. As we're designing our risk-assessment models of any particular part of a rule. Because as I understand --

A. I'm not sure I agree with you.

Q. Okay.

MR. HISER: Madam Chairman, if the attorney would give the witness the courtesy of being able to respond before he continues on.

CHAIRPERSON BAILEY: I'm sure you will give him enough time to answer.

MR. DANGLER: I sure hope I do. Thank you, Madam Chair.

Q. (BY MR. DANGLER) If you say it should occur, that there is four feet on top, but, in fact, sometimes there is not four feet on top, could you say that sometimes what should occur does not occur?

A. You're looking at it --

Q. I'm only using your experience.

CHAIRPERSON BAILEY: Mr. Dangler, please give him enough time to answer.

MR. DANGLER: Thank you.

THE WITNESS: Can I ask you a question? Is it okay for me to give him my -- my opinion on what I -- what I think he's asking? I'm not -- I'm not sure how to specifically --

CHAIRPERSON BAILEY: I think you need to ask your attorney.

MR. HISER: I think if you don't understand the question, you should ask Mr. Dangler to say what your issue is and rephrase the question for you.

A. I'm -- I'm -- if I can explain kind of how I feel, and maybe that'll answer your question, if that's acceptable to you.

Q. (BY MR. DANGLER) That's not exactly acceptable to me, but let's break it down as tightly as we can.

A. Okay.

Q. So when you're having an opinion about something, anything --

A. Uh-huh.

Q. -- you have assumptions that go into that opinion. Is that fair to say?

A. Yes. Yes.

Q. And an assumption might be that because part of the rule calls for four feet of soil on top, there should be four feet on top; is that correct? The rule calls for it?

A. I don't -- I don't look at it that way, so I really kind of say no.

Q. Okay. You don't think that means there should be four feet on top, if the rule says so?

A. I think, technically speaking, that you're going to try to put four feet as close as possible, but, you know, if you had four feet mostly over it and you had 3.99 feet in one little spot, does that mean that you're -- that you're not complying? I don't think that's -- you know, technically speaking, if we're getting into exact numbers, you know, it -- that's why I'm having a hard time with that.

Q. Okay. I'm trying not to make this technical. And to help us with this example, we can say --

A. And I want to --

Q. -- four feet, a little less, a little more, but substantial compliance with four feet. That's a working assumption.

A. Yes.

Q. Okay. If you know, from your own experience, that occasionally there have been pits where that has all eroded down to nothing and you could see what's in the pit, what you have testified to, would that now challenge that assumption that you have made that there is four feet on top?

A. If there's not four feet at closure, there was supposed to be four feet -- are you talking immediately upon closure or 50 years from now, or what --

Q. Well, I'm not sure when that occasion might happen, but what I'm wondering is, if, within that change, you're thinking about the risk model.

A. No, because in most regulatory programs, there's an enforcement arm, just like a police officer that gives you a ticket if you break the speed limit. So when those cases -- and there are certainly cases when things happen that don't [sic], and there's an enforcement program, and people come -- you know, they address the compliance.

Q. Okay. Do you know much about the enforcement programs in New Mexico?

A. A little bit.

Q. Do you think they're adequately staffed?

MR. HISER: I'm going to object. He may not have a basis for giving that. He didn't testify about enforcement.

CHAIRPERSON BAILEY: I'll sustain that.

Q. (BY MR. DANGLER) You used some terms that -- you talked about sustainable practice.

A. Yes, sir.

Q. And I don't think you used the term "best

practice," but I think you talked about continuous improvement, in your direct.

A. Uh-huh.

Q. Do you remember using those terms?

A. (No response.)

Q. Are you familiar with this National Petroleum Council study, Prudent Development (indicating)?

A. Yes.

Q. And they recommend that, don't they? They recommend continuous improvement?

A. Uh-huh.

Q. And they also recommend something called "State Review of Oil & Natural Gas Environmental Regulations," STRONGER. You're familiar with that organization --

A. Uh-huh.

Q. -- that comes in and looks at practices and sees what's good?

And you're also familiar that they recommend councils of quality assurance for various regions? They kind of think that's a good practice.

A. Say that again, to have --

Q. One of their recommendations is that, you know, you have local councils that would look at the regs in different locations.

A. Okay.

Q. Does that make sense to you?
A. Uh-huh.
Q. Councils of quality is usually what they're called.
A. (Indicating.)
Q. You've had experience in a number of different places, correct, not just here, not just New Mexico?
A. Correct.
Q. Have you had any experience in the Bakken of North Dakota?
A. Yes.
Q. So you're aware of the big snowmelt they had last spring that overwhelmed a bunch of pits?
A. Uh-huh.
Q. That was not -- that was not an anticipated event, was it?
A. No. I think -- I don't think it was an anticipated event.
Q. In fact, local guys said they were real surprised at the level of snowmelt, that it was much higher than normal. And there were about 50 pits that flooded, and there was some millions of dollars of fines levied against a bunch of companies.
A. Uh-huh.
Q. When we're talking about New Mexico and

New Mexico's groundwater and New Mexico's situation, how comfortable are you with our situation in New Mexico, our water situation?

A. I'm not exactly sure what you're asking.

Q. Well, let's start with: How many years have you practiced in New Mexico?

A. I probably did my first project here in about 1990.

Q. And you haven't been here exclusively since 1990?

A. No.

Q. Because you go to different places?

A. Right.

Q. There was a line of inquiry about the government maps. Excuse me for not having my GPS [sic] language right, but I think you knew -- USGS maps. And I think you had testified on direct that it was easy to mark, because the USGS maps already showed it, correct?

A. For the blue lines, yeah.

Q. Yeah, for the blue lines.

And since you've referenced that, I thought that that might be a good idea. I think the question about -- I'm not going to ask you, again, the precise question about the ephemeral streams, but there is a marking for intermittent streams on that map; it's

dotted, broken.

A. Uh-huh.

Q. So if your theory was that you wanted to distinguish something that could be easily read by an administrator and operated on, wouldn't it also be easy to include the intermittent streams in the siting criteria?

A. Typically -- I mean, just from what I've done, those are usually things you'd like to go out and look at, but certainly that could be helpful in the process of identifying those.

Q. And I want to take a couple of things off the table, because I think you -- on the last cross, I think you would like to not be there, and I want to make sure that I'm not missing something. I think I understood you to say that you're not the economist here.

A. No.

Q. Okay. So you don't have any information about the economics of all these things that you testified about?

A. I've not done an economic analysis of that, right.

Q. So it's fair if I don't ask you any questions about that. Is that fair?

A. Great.

Q. I have another kind of big- -- big-term question. Maybe we'll eliminate some other questions. And I think you were asked this, so it's definitely been asked and answered; but I do want to make sure I understood it. And that is, are you relying on new information since the last Pit Rule was done?

A. On developing my opinions or --

Q. Well, I'm sure you've had four more years of life experience to add to your opinion. I'm not talking about that. Excluding that, is there any study that you want to reference? Is there anything, in the last four years, that is important that I have missed?

A. You know, it's hard for me to answer that because I wasn't involved in the last Pit Rule. But I looked at, you know, some of the presentations. I looked at the data, myself. We looked at some of the data that had -- you know, like the number of wells that have been drilled and so forth and that estimate. So I'm not sure if you would count that as new data or not, but certainly looked at this relative to -- you know, from my perspective today, not from that time period.

I would say that one other thing that would be of further significance relative to that is that I did have the opportunity to talk to industry who had been working under the existing Pit Rule, and asking

them questions about their experience with it, that I thought was valuable.

Q. Okay. But in terms of a systematic study or you looked at all the pits that have been done in the last two years --

A. No.

Q. -- that's not information that --

A. No.

Q. One of the -- one of the recommendations of the Prudent Development study that you're somewhat familiar with is a discussion of prescriptive rules versus flexibility, which, I think, has come up several times during our hearings, and they recommend some sort of balance between the two. Why would they recommend a balance between prescriptive rules and flexibility, if you know?

A. You know, that's a discussion that I think has been going on with regulatory agencies and industry for a long time. And I think that, you know, the discussion from the MPC study and what I've seen in other rulemaking or NEPA analysis-type things is trying to find a balance so that you could -- so that as industry and regulators, you could have some thresholds, but recognizing that it's tough to build a very specific regulation that is going to account for every possible

situation or thing that can happen.

Q. Right.

A. And so having some flexibility within that is generally a positive thing, but there -- there is a balance.

Q. And you've said you've thought about stuff, and I really mean for this to be a little bit of a thoughtful colloquy.

A. And I'm happy to do that.

Q. I'm really not trying to trap you on this, because I've been trying to figure this out myself, and it's fascinating to me.

Do you think there is sometimes a prescriptive rule just to make it easier for a regulator to just drive on by and see what you've got, whatever you've got, or don't have whatever you've got? Do you follow my question? If everything is a creative, innovative solution to whatever the problem is, then it might be harder to monitor?

A. You know, I can --

Q. I'm just asking.

A. And again, I can kind of testify to this from my -- the bulk of my experience. I've seen things go both ways, to where you can have a regulatory program -- and one of the first ones that I was real exposed to was

the underground injection control program. And in that program, if you look at how it's structured, it's a risk-based and a performance-based program. So based on higher degrees of risk, more protection, but you have performance measures that you adhere to, and that in different pieces of the program, you can still have things like a mechanical integrity test or a pressure test that has a particular, more prescriptive readout. You know, you have to have -- you have to bill [sic] it; you know, have a pressure that's going to hold at a certain level for this type.

So some of that -- I mean, there's similarities in what we have here, from Tables 1 and 2, from the liners, from -- you know, from -- from some of that, while trying to provide some flexibility.

I've seen other programs that -- that -- you know, where -- where due to whatever situation, they've been, perhaps, I think, overly prescriptive, and those can have their -- you know, their problems. But I'd say that in my experience what I saw is that typically as a regulator -- and I was guilty of this, too, is that you generally start out wanting to have something that has a pass/fail. You know, I need to be able to know that it passes or it fails. And then generally, through that process of getting to know the

answer, you wind up going, Oh, well, it's really not that easy. I'd be failing stuff that should pass and passing stuff that should fail.

And -- and -- and for that reason, that's why -- you know, that's why regulatory agencies aren't staffed by, you know, accountants or something like that. That's why we have, you know, geologists here and engineers and different environmental scientists and biologists, to be able to provide that stuff, and even field people that have experience and know-how and can have that ability.

So if we made them prescriptive enough that you could just do that, you know, I think, you know -- I don't think that would be good, or trying to simplify it or just make it easy.

Q. Right. And I'm not suggesting that we always make it easy, but my suggestion to you is, sometimes there might be a prescriptive rule just because it might be easier to monitor, just because it might be easier to see, just check on it.

A. I mean, hypothetically, I guess you could -- you certainly could have a rule that you did that way.

Q. One of the interesting things in your direct is that you were asked about the boom requirement that's been eliminated. And I'm doing it an injustice to call

it the boom requirement, because I think -- I don't know if you heard all the testimony, or should I catch you up?

A. I've been here.

Q. Okay. So you know the testimony about the boom. That rule is currently written -- that one little section does allow for alternatives to the boom, correct? Its main requirement is that something's on site?

A. It does, but when you're requiring something on site, you're typically -- what that leaves you with, in the way that it's written, is a boom.

Q. Right. And that may be the shortcut that the industry chooses, but let me ask you this: If you did have a boom on site and you had a spill, and you didn't want to use the boom, you could still call the truck and have them come suck the oil off; there's nothing in the rules that stops you?

A. No.

Q. Okay. So the rule is just about having something on site and maybe just to make everybody feel a little more comfortable that you even suggest it. And it may not be the most effective way of handling that problem. Is that fair to say?

A. Yes.

Q. But it is something to monitor, to see if you've got one there or not, and doesn't do any harm. It may not be necessary. I'm going away from that.

A. I'm really not a believer in having needless requirements, and -- and -- and this one -- it just seems like it's a requirement that serves no purpose.

Q. I understand that is your opinion, but does it do any harm?

A. Honestly, I think it could, and I think it could by -- by -- there could be really two views at the false sense of the security that I gave you. So, one, it could be a false sense of security to the public or a regulatory agency, but it could also be a false sense of security to an oil and gas operator. They'll say, We have a boom, so we don't need to worry about that. And then we use the boom, and then it's not adequate, or it's really not what we need, as opposed to, if you do have an issue or a need, immediately getting the right equipment there to handle it.

Q. Now, you've been qualified as an expert geologist -- I mean, hydrologist, correct?

A. Uh-huh.

Q. So you're a scientist?

A. Uh-huh.

Q. And I, myself, did very poorly in science, so I

have to ask you some questions about science, because I want to make sure I understand it. I didn't get it in the fifth grade.

A. Oh, come on.

Q. No, I didn't; I promise you.

My understanding of science is, you state something, a hypothesis, and then you go about proving it. Is that fair?

A. I'd say that's one thing you can do in science.

Q. The way it was always taught to me is that, you know, you state something; you try it out a few times; do it to see if it's true or not. And constantly science changes. Is that fair to say?

A. Not necessarily.

MR. HISER: I'm going to object on the grounds of relevance, unless Mr. Dangler would like to tip his hand as to where we're going.

MR. DANGLER: Absolutely. I'd be happy to tip my hand, Madam Chair.

CHAIRPERSON BAILEY: Please do.

Q. (BY MR. DANGLER) I'm just wondering, if all your testimony is based on your own experience, where the science part comes in; backing it up with the testing and the experiments and all of that.

A. Well, I'm surely not suggesting that my

experience is not science-based, but through my experience, my experience has involved research work that we've done with the Department of Energy and the state agencies on impoundments and some of the issues we've done here. We've done studies on pits. We've done, you know, closure reports that have gone to agencies. We've done internal audits. We've done all sorts of -- I mean, a number of different things that certainly have included technical and scientific analysis, through my experience, including -- as you probably know, I was one of the task managers on the MPC study you're referring to.

Q. Right. And I'm not questioning your experience at all or your right to have probably very relevant opinions. I'm just wondering that we haven't seen any of these studies or any of this science. That's all my confusion is. And I was offering you yet another opportunity to tell us if you've got anything that we could review, because that's what peer-review stuff is.

A. Well, one of them is the study you're referring to, because I helped author a portion of that document. And, you know -- I mean, you know, experience comes in a number of different ways, Counselor, through studies, reports, documents, field experience. So do I have scientific analysis of this? No. I've used my

experience to come to those conclusions, and it's not without basis.

Q. I want to go back to this idea of cumulative impacts and things, because that's a concern I've got about the rules, in general. And I first want to make sure I did hear you on direct, because I know we had a question originally about the hydrocarbons going into the pits, and then I think Counsel said he was going to cover it more when he got into the charts and the maps. And I'm afraid I didn't ever really catch up to what your answer was about the hydrocarbons. Please enlighten me, like, why the hydrocarbons going into the pits didn't appreciably change the risk.

A. If we have -- are we talking about, you know, the hydrocarbon drilling muds, I assume is what you're --

Q. What I'm referring to is, there is a rule change, if I'm correct, if I can get that citation.

A. And I think that's relative to the drilling muds, so you can have oil-based drilling muds versus freshwater-based drilling muds. And regardless of whether or not we're dealing with water-based or oil-based muds, the general, you know, characteristics of those muds, I think, are still very good and don't give me any additional pause from a risk perspective or

a perspective of concern on my part.

Q. Okay. And just for your reference -- but I think you already know exactly what I'm already talking about -- I'm talking about the bottom of page 22, top of page 23 of Attachment A. It presently requires the operator to use a tank made of steel or other material.

A. This is under -- under -- on page -- B(1)?

Q. Top of page 23. Yeah. It would be B(1), and it's the carry-over on the top of page 23 where the change is made.

A. Okay. So they're removing any -- any visible layer of oil from the surface of the drilling of the pit.

Q. Right. And they're still going to remove the visible layer of oil, but they're no longer as concerned about making sure we have a steel tank for hydrocarbons, as I read this, unless I'm reading this wrong.

A. Right, for drilling fluids.

Q. So that would allow hydrocarbons to go into one of these pits?

A. Like an oil-based drilling mud.

Q. Yeah. And that would, presumably, create a different mixture in the pit?

MR. HISER: Asked and answered.

CHAIRPERSON BAILEY: He's just getting

clarification.

MR. DANGLER: Yeah, I am. Thank you, Madam Chair.

Q. (BY MR. DANGLER) That would create a different mix in the drilling pit?

A. The characteristics, though, you know, with the mud -- I mean, you know, whether it's fresh- or oil-based mud, they do the same thing. So, again, it doesn't give me any additional concern.

Q. So now we're adding new things, maybe. Not of great concern, but new things, and we're extending the life of the pit, correct? It can be kept open longer now under the rule changes?

A. Uh-huh. Uh-huh.

Q. And we're also shortening the distances to water -- various water bodies to the pit. Is that fair to say?

A. We're utilizing a risk-based approach, yes.

Q. I like the risk-based approach. I agree with you. That's the kind of thing that is modeling off of that study, like that. But now you've got three different risk factors changing all at once. Do you see why I'm saying that?

A. No.

Q. Okay. Well, one risk factor would be, you're

introducing different fluids into the pit. You may find that not to be a significant risk factor, as I understand your testimony.

A. A significant difference?

Q. You may not find that to be a significant risk factor.

A. Or difference.

Q. Or difference.

A. (Indicating.)

Q. But it is a change?

A. From the industry revisions -- it is a change from the existing rules, yes, sir.

Q. And it's a change from existing rules that the pit's going to be open longer, which has --

A. Yeah.

Q. -- a possible increase for the chance for something going wrong?

MR. HISER: I'm going to object to the factual predicate for that, because I don't think it's correct.

Q. (BY MR. DANGLER) Well, let's break that one down.

MR. HISER: Thank you.

Q. (BY MR. DANGLER) That would help us.

Is time a factor in the durability of a

pit?

A. Could you be more specific?

Q. Sure. Do things like pit liners degrade over a long period of time, just to start with that question?

A. So are we talking tens and hundreds of years?

Q. Let's talk 50 years. Do they degrade over 50 years?

A. It depends.

Q. As a general proposition, would you say that things tend to degrade over time, with the exception of plutonium?

A. Well, that's such a generality. I don't know if I agree in general. I mean, I can have cement on a well at a certain level that the temperature doesn't change, and it may go on for hundreds of years, and it will never change or degrade. I can have a pit material that is buried, you know, for 500 years, and, likely, its degradation is going to be maybe minimal. If it's in the sunlight, sitting out, you know, they're going to have life expectancies. So it really depends on the situation, sir.

Q. Okay.

THE WITNESS: Hey, Eric, I hate to be a pain in the butt, but I need to use the restroom.

CHAIRPERSON BAILEY: Why don't we take a

ten-minute break?

(Break taken, 2:16 p.m. to 2:33 p.m.)

CHAIRPERSON BAILEY: Mr. Dangler, you were in the process of cross-examination.

MR. DANGLER: Thank you, Madam Chair.

Q. (BY MR. DANGLER) I want to talk about benzene a little bit with you. Under the current rule, I believe the parts per million is .2, and the suggested change is up to ten parts per million. Is that an accurate statement?

A. Uh-huh.

Q. That appears to me to be a 5,000 percent increase in the amount of benzene allowed to be in the pit. Without requesting any science or some other study, just on a practical, kind of, common-sense, human-condition kind of question: Why would such a dramatic increase in a known carcinogen be a good idea?

A. Because at the levels that we propose, they are -- they remain protective of public health and the environment.

Q. Do you agree that even 100 parts per million would be protective of the environment?

A. In the reference of what we have in Tables 1 and 2?

Q. (Indicating.)

A. I particularly tried looking at the -- at the levels that were stated at ten, and I believe those levels to be safe. So, hypothetically, going into other infinite hypothetical characterizations is a little -- is going to take a little more thought than just off the top here, but I think what we have here is appropriate.

Q. And the follow-up question is: Is there any science, other than your experience and your opinion about this, that you're relying on?

A. I think Mr. -- Dr. Stephens testified a little bit about benzene in his last stuff, but I think that it's pretty evident, in all likelihood, when we get to closing pits, that benzene is going to volatilize or -- volatilize into the atmosphere and really not be an issue to begin with. So --

Q. And speaking of that testimony -- and I think you had a comment on direct that you thought the risks versus a hazard was good testimony. As I understood what Dr. Thomas was saying, the BBs and the ping-pong balls, the bentonite clay sinks and creates a seal. Do you agree with that?

A. I have a hard time putting it into the perspective of ping-pong balls and BBs, but very much I agree with the tendencies of bentonite clay and so forth. That would certainly add to the protectiveness,

the fact that that's there, yes.

Q. And would you agree -- and by his own description -- that would tend to be at the bottom of the pit, that it would settle?

A. I don't think he said exactly that. If you look at what he said about ping-pong balls and BBs, is that you're going to get some overall coverage. And if you -- if you -- have you ever seen, you know, like where they've, you know, maybe excavated a portion of a pit, looking at it on the side? And if you've been in the field looking at that, what you generally see, I would say, almost without exception, maybe without exception, is that you wind up seeing that bentonite clay throughout the -- the entire column of that buried pit. So, you know -- I mean -- so -- so, really, you know, the way he described, although I wouldn't, I'd say the ping-pong balls and BBs was a good description.

Q. Okay. You are anticipating my next question, which is kind of going to be the sides of the pit. Do you think the same strength of protection is happening on the sides, or do you think it tends to be more up above?

A. I think if you go to Ben's testimony on ping-pong balls and BBs, maybe it's more relevant than I thought. His example was kind of an all-encompassing

thing, which I tried to describe. So I don't -- I don't really differentiate side, top, bottom. It's going to be throughout.

Q. But you would concede that there could be leaks to the side of the pit, not just to the bottom of the pit?

A. We're talking a closed pit or an active pit, or what kind of --

Q. I'm thinking more of an active pit. I'm thinking of the possibilities of leaks not just to the bottom but out to the sides.

A. Okay. So Ben's testimony, when he was talking about that, was relative to pits under closure circumstances, and what you're talking about now is active pits. So we're talking a couple different things here.

Q. That's fair to say.

A. So if we look at an active, operating pit, I would say that probably what you're going to see the most likely of some sort of tear in a liner, for instance, is probably going to be on the side, either above the fluid level or below, and the regs address those two things. You may have, you know, no bentonite mud in there. You may just have water, I suppose, or something. But if you did have that, yeah -- yes, you

could have a leak on the side, as well as you could on the bottom.

Q. In the other cross, you were asked a lot of questions about your sample size and what you did, you know. And as I understood your testimony on cross and on direct -- and I want to again make sure that I understand your testimony right. In terms of spills and doing your first-level analysis of the risk of pits leaking and stuff that you did, I understood you looked at OCD records?

A. Yes.

Q. Is that fair to say?

You didn't review any files of the New Mexico Environment Department, Groundwater Bureau?

A. No.

Q. So you didn't happen to run across a chloride spill that they've been dealing with?

A. Is this the one you referenced earlier?

Q. It is. The one that's west of Hobbs.

A. Yeah. I don't think that's related to a pit, though, is it?

Q. Well, the report indicates that it's caused by historical oil and gas activity. But I'm just wondering if knowing about that would change your opinion a little bit about the overall safety?

A. No.

Q. Does knowing that there might be other information out there cause you to want to go look at it?

A. You know, I'm an engineer and a scientist, and I'm curious by nature; so there's never a point in my professional career where I'm not wanting to go out and look at stuff. It never ends.

Q. That's great, and we can end on agreement. Thank you very much.

A. Thank you.

CHAIRPERSON BAILEY: Dr. Neeper, do you have questions of this witness?

DR. NEEPER: Yes, I have questions. Thank you.

CROSS-EXAMINATION

BY DR. NEEPER:

Q. And good afternoon.

A. Good afternoon.

Q. I will attempt, if I can, first, to clarify the extensive discussions we've had on statistics, and I won't be fishing in this. Your slides, and as I understood from your discussion, that you had found ground -- groundwater contamination had been found associated with six pits that had been made since --

2005 to 2007, and this information came in, I think, by about 2011; is that correct?

A. Yeah. We identified six from that two-year period.

Q. Yeah. They were created during that two-year period?

A. Uh-huh.

Q. And you concluded from that that this was a 99.89 percent success. I believe that's the terms you used.

A. Uh-huh. Yes.

Q. But does not success imply reaching a goal of some kind, success in terms of something achieved?

A. Dr. Neeper, to be honest with you, the term "success" has been the most difficult word in our language that I've attempted to define in my lifetime.

Q. I'll be glad to pass the question and try to come at this thing from a different route, if you prefer.

A. Okay. That would be appreciated.

Q. Our problem is that the Commission must make decisions based on the record of the hearing, and we don't want to leave false impressions of statistical arguments. Would it be statistically equivalent to say these pits are failing at the rate of about one per

year; in about six years, you have about six failures?

A. I'm not sure that you could -- I certainly did not draw that conclusion.

Q. But is that not the exact result of the arithmetic? If you have a six-year period and six pits fail, are they not failing at an average rate of about one pit per year?

A. Keep in mind -- well, this is 2005 to 2007 and six incidents, so going to an average per year is a stretch that I wouldn't like to make, technically. You can look at when they occurred but also recognizing the situations of what those occurrences were. So they were some liners and so forth. So when you say these pits, the pits prior to the existing Rule 17, we identified over that two-year period, the results that I presented to you.

Q. From these data, can we infer anything about the future movement of contaminants out of those pits and toward either the surface or the groundwater?

A. So you're asking me -- well, can you clarify?

Q. Yes. You used the term "99.89 percent success." Does this mean that in the future, no more than 89.99 [sic] percent of those pits will disperse contaminants, will -- let me restate that. That 89.99 [sic] percent of those pits will retain their

contaminants in such a way that they could never reach groundwater; can that conclusion be drawn from this study?

A. You know, I've -- I've -- I've looked at numbers and statistics a lot, and trying to draw conclusions from statistics is a dangerous thing to consider.

Q. Yes.

A. So what -- what you should utilize, statistics or figures, is as facts in a -- in a much broader analysis.

So you can look at incidents from, you know, the life span of oil and gas activity over a particular period, over that period, and look at how things changed during that period, and even looking at the incidents, maybe, that you had during that period and what has changed since then. And you can -- you can make some estimates. You could draw your own conclusions, your own theory of how you think, based on what you have here, what's changed, what you believe will happen in the future. Can you -- can you say that with absolute confidence, that it will be that number, or it could be higher or it could be lower?

So I'm not -- I'm not here to suggest that because of that, it means that you're only going to have

this or something else. In my opinion, I think, with the changes of the existing rule and the proposed rule, that you're going to have less incidents.

Q. But as a technical statistical piece of data, it does not allow us to project what would be a contamination rate into the future; is that correct?

A. Well, for what purpose? I mean, you could project anything with data. There's no -- there's no projection police. I mean, so certainly you can project. It's the confidence of the accuracy of that projection that has concern. To me, you wouldn't simply project to get a number without looking at that data and doing that in an informed manner.

Q. In terms of contaminants that may be left behind in pits, the proposed rule considers chlorides and light hydrocarbons. If I understand you correctly, you have said that the chloride moves fastest, and that is the reason for using it as a prime indicator for the thing you would measure.

A. In the context of this analysis --

Q. In the context of a burial.

A. -- and what we know about with this and how the closure is done and what I would expect to see occur, based on my experience with a lot of pits is -- and pits that have had issues and that have not, chlorides are --

are -- are -- are really always the first thing that you see.

Q. Yes. I would agree they are a leading indicator, so that is not a question between us.

Now, my question is: If we are burying these materials and we see a chloride content given by -- let's say we are close to exceeding the rule, does that not imply that we should look for other contaminants, if the chloride is, as expressed by Dr. Thomas, less biologically harmful? Isn't it serving as an indicator that we should look at the other contaminants?

A. You said if it's close to a threshold? I'm confused.

Q. The burial standard is expressed, let us say, in terms of chlorides.

A. Yeah. Okay. I understand.

Q. And you're familiar with that?

A. Yeah.

Q. If we found high chlorides, let's say, approaching the limit of the burial standard --

A. Based on that distance to unconfined?

Q. Yes. Whatever is given as the standard.

A. Okay.

Q. Is that not an indication that something has

brought contaminants to this point, and we, therefore, should look for the more harmful contaminants that might be there?

MR. HISER: I'm going to object, Madam Chair, because it's not clear what Dr. Neeper is talking about. Since he's referring to the burial table, is it the stuff in the pit or the stuff in the environment? If he could clarify that.

THE WITNESS: I think I know what he's asking.

MR. HISER: Okay.

A. You know, I've been looking forward to this communication, because I'm getting deposed by a nonattorney.

But what I'll tell you -- and -- and -- and please believe that I mean this honestly, based on my experience -- is that what I really tried to look at were those levels in Tables 1 and 2, and I believe that based on those levels, with those separation distances from unconfined water, was that those were really overly conservative. So they already -- they already included, say, that depth of conservatism that you're -- you know, say if you're approaching that, I felt and still feel and fully believe to the bottom of my heart that those meet that, and that if you were getting close to those,

that there would not be a necessity to be looking for other things.

And I also say I feel confident in the things that we've identified in the table are sufficient and adequate for us to assess what we're doing in the closure process.

Q. (BY DR. NEEPER) Understood.

A. Okay?

Q. I will rephrase that to be sure we understand. I do believe I understand.

You're saying, if chloride meets the standard, whatever else is there is not likely to be harmful?

A. (No response.)

Q. You can say, no, that's not what you meant, but that's what I understood. You feel comfortable.

A. I'm not -- you know, you went into that different thing with "harmful," you know, so I'm trying to figure out what --

Q. Erase the word "harmful." You would feel comfortable with whatever else might have accompanied the chloride?

A. I would feel comfortable -- I would not see the need to do additional analysis.

Q. Right.

A. Okay?

Q. Agreed. Thanks.

If I understand you today, in your testimony, you had suggested that only one liner would really be needed in a multi-well pit?

A. So -- and I realize this may be a little confusing, but what I consider, and I think is considered in the rule, as -- it could be a secondary liner. It could be, for instance, a clay-based liner. So what I'm saying is, it doesn't necessarily have to be, you know, a liner in the sense of what we're talking about.

Q. All right. I will clarify that, and you tell me if I'm right.

A. (Laughter.)

Q. What you meant to infer is, one might have one polymer liner, but the secondary liner would not necessarily have to be a polymer layer. It could be a clay or something else that could enable you to have a leak-detection system?

A. Yes.

Q. If one detects a leak, does the rule require any particular action?

A. Can we refer to the rule?

Q. You certainly may refer to the rule.

MR. HISER: In the interest of speed, it's page 22, Operational Requirements for pits.

A. I would say that in -- in -- in -- in evaluating the rule overall, when we looked at tears and so forth in liners, that I looked at that as -- as doing this. But what I can see, it has in here about inspections and so forth, but what I don't see in this is an action requirement if a leak was detected.

Q. So would it be reasonable for a citizen, then, to presume that in terms of the rule, an operator who has detected a leak in his pit may proceed to operate as though nothing has changed? He has to report it, I believe, but in terms of operation, he continues to operate?

MR. FELDEWERT: Madam Chair, in the interest of saving time -- and I know this is in the middle of Dr. Neeper's cross-examination. I'm sure he doesn't mean to misrepresent the rules, but if you look on page 22 of the rule, paragraph -- Section 17.12, which are the general specifications and operational requirements for all pits, multi-well fluid management pits, there are provisions in there, Dr. Neeper, that require an action be taken if there is a problem detected.

CHAIRPERSON BAILEY: Thank you.

Q. (BY DR. NEEPER) I will move forward, then, and presume that the operator must do something.

I have a very small point I want to clarify. I understand, informally, people are in agreement. Throughout the rule, it says "used spring," when referring to a spring, or setbacks. Would it be acceptable to you, or to NMOGA, if we simply used the word -- if the rule employed the words "any spring," rather than "used spring"?

MR. HISER: Madam Chair, NMOGA has not proposed any change on the existing rule on that. Therefore, I don't know that our witness is prepared to address it.

CHAIRPERSON BAILEY: I'll have to agree with that. The language of the current rule has not been changed concerning springs.

Please continue.

DR. NEEPER: Thank you.

Q. (BY DR. NEEPER) You had described how it might be difficult to maintain netting and that one rule fitting too many circumstances just creates difficulties for operators, one rule fitting all sizes. Would it be more appropriate to require netting based on, let us say, a chemical standard of the water and the amount of oil on the surface; those being the real dangers to the

wildlife?

A. First, I didn't exactly say what you said that I said.

Q. All right.

A. But I'll take a stab at it, in light of trying to be expeditious and helpful and get to your point.

Netting and so forth can be an issue. It can be as much of a problem with birds as not having netting. And I think that how you look at a rule and kind of make a rule on whether you're going to require netting or not -- you know, right now, you have a permitting process. You have -- the state is going to have to look at that, and you don't have, at the agency, a staff of accountants. I mean, you have professionals, and they have a rule that gives them flexibility. And I believe 100 percent that through that process, that the right decision will be made for the set of circumstances, and I believe that that's the most appropriate way to handle it.

Q. The current rule does not provide a restriction on the slope of the liner or the berm that holds the liner, as I understand the discussion; is that correct? Or, I can clarify it. Does not require a specific numerical value --

A. The proposed rule?

Q. The proposed rule.

A. Correct.

Q. The rule says that some account must be taken of repose. It just says some words about repose. Presumably, then, is it correct that a liner could be installed on a berm at its angle of repose?

A. If that was deemed appropriate by the engineer who designed the pit, yes.

Q. And, in fact, if an angle of repose were vertical even, that would be permissible and allowed; is that correct?

A. Depending on the situation you're in and the soils, the rock, yes. And I've seen ends of berms that were -- were vertical and worked very well.

Q. If you had a slow but continuous leak in a pit, let's say a pit containing either low- or high-chloride fluids --

A. During the operational phase?

Q. -- during the operational phase, would that leak cause an exceedance of soil standards that must be met before the pit can be closed in place, or buried?

A. It seems to me that you're kind of mixing things up. So let's say that we had a leak, and depending on where you were with the separation -- you may have exceeded that -- you wouldn't be allowed -- you

met the criteria of the limit to do that closure. Is that what you're asking?

Q. I'll try a specific example to help. Suppose I am drilling with 15,000 milligrams per kilogram -- or liter of chloride, a high -- a low-chloride water fluid, but at the top of the limit. And suppose I have a continuos leak that drizzles down through this oil, at some point, to the pit. If that liner were then pulled up, would that spot in the soil likely exceed the closure standards for burial of that soil?

A. I don't know.

Q. You have mentioned, I believe, that you prefer not to have a plastic or a film cover on top of a burial unit because that would allow better escape, you said, I believe, of moistures or liquids toward the ground surface. Did I understand correctly?

A. I think that's what would work best in -- in keeping that dry, allowing any moisture to dissipate and so forth, yeah.

Q. If we picture the ground in some areas having enough rainfall that there is some infiltration and if you had an open-lined burial unit, why would the burial unit not accumulate at about the same rate as the infiltration through the rest of the soil?

A. Can you rephrase -- clarify exactly what

you're --

Q. I can try using some of your words, in a sense. An open burial unit was sort of like a bathtub --

A. I didn't say bathtub. He (indicating) said bathtub.

Q. Somebody used the word "bathtub." I'm trying to picture -- I've cupped my hands (demonstrating).

A. What I would -- what I would -- what I would hope to see and likely see and have seen is that when you have -- especially when you get into areas like New Mexico or eastern -- you know, a lot of the Rocky states that are somewhat arid, and even vegetation, those plants help in pulling out moisture. You get -- I mean, you get infiltration. That's part of the reason why you have an unconfined aquifer. But we're not making this pit a -- you know, as you're wanting to think it, a bathtub for accumulation.

And even if there was some accumulation -- you know, could there be temporary accumulation? Maybe a little. But what you're going to see and just where this pit is located -- it's in an unsaturated zone -- that water is not going to -- it's just not going to stay there. I have not seen that happen. I've not gone into a pit and gone, Wow, there's a bathtub here, just never, ever.

Q. But if we have a trench burial, would we have something that looked like a bathtub? It has an open top, and it has a membrane down the sides and into the bottom.

A. But you're still closing that up, even that, kind of like a burrito or whatever.

Q. Yes. You have -- you have the required four-foot dirt on top --

A. Well, you're closing that liner, and you're not keeping a big bathtub.

Q. Oh. Is that liner closure --

A. Yes.

Q. -- required by the rule?

A. That's just how -- that's how you do it when you do it. I mean, you don't just leave the -- you know, you fold everything. You dewater; you fold every -- you solidify.

Q. All right. You're telling me that is the practice whether or not it's required by rule?

A. I just don't believe that the state would even approve a closure if you didn't. That, to me, would be an improper closure.

Q. Well, if I were the operator and I did that improper closure, and the state tried to make me fix it, I would refer to the rule. So I'm trying to say: Why,

if I were an operator, would I have to fix it?

A. I guess I believe the rule encompasses that. I mean, that's just how you --

Q. All right. Can you compare the 15,000-milligrams-of-chloride standard for low-chloride waters with something people are more familiar with so that there is an easier basis for knowing what this means? You had said, I believe, seawater was something like 30,000 total dissolved solids. How would the chloride limit, for example, compare with seawater?

A. You asked me about a comparison, and I think what's important is to think that, in practical terms, we can be dealing with -- with fluids that may be -- that are, one, produced from different -- from different areas, from different production horizons, okay, where we may get water.

If you look at, you know, northwestern New Mexico, where they're producing, you know, coalbed methane, you may get a little bit of water that's in the 8- to 12,000 milligrams per liter TDS, most of which is chlorides. All right? We may be working in other areas that -- where our produced water may be, you know, 50, 100, 150, whatever, milligrams per liter TDS.

And really what you're looking at is trying to kind of manage these types of waters, you know,

appropriately. So if you have some that really is generally a lower-chloride water versus waters that may be much higher in chloride, that's really the distinguishment and the comparison.

Q. All right. I will ask another question in the same vein, and you may also find it not answerable in terms of how you see things.

Could you express any of the chloride burial standards in terms of how much -- suppose it were salt. How much salt would have been there in the original wastes before dilution for burial? They are normally diluted with a factor of three to the soil. But how salty would the original wastes have been?

A. I don't have those -- those -- I can't answer that question. I don't have those off the top of my head.

Q. Is there any common practice, ordinary practice in the oil field that's going to generate solid waste in the pit that would exceed that standard? Let's say for the 20,000 milligram standard.

MR. HISER: I'm going to object on the basis that the rules prohibit us disposing of solid waste in the pit. If Dr. Neeper means cuttings, that's not solid waste as we use that term in the Commission.

CHAIRPERSON BAILEY: Would you please

change the language?

DR. NEEPER: I'll rephrase the question.

CHAIRPERSON BAILEY: Yes.

Q. (BY DR. NEEPER) Would any routine and ordinary operation in the oil field be likely to generate pit contents -- solid pit contents that would exceed the 20,000 milligrams per kilogram limit?

A. It's certainly possible.

Q. That is possible?

A. (Indicating.)

Q. All right. Can you relate the SPLP number for chloride back to what might be the equivalent in a solid waste milligram per kilogram so that we could understand the SPLP in terms of what's required for soil?

MR. HISER: I'll renew my objection about --

CHAIRPERSON BAILEY: If you could use a different term.

A. I think I know what you're getting at here.

Q. (BY DR. NEEPER) I would like to know what is the equivalence between the SPLP standard and what might have been, let us say, the salt content in the original cuttings and muds in the pit that could have generated something that reached that standard? What would have been the milligrams per kilograms in the original

content?

A. So in reiterating what I said earlier, what I'm used to looking at in this is that SPLP method, because I think it's most appropriate. If you tried to -- you know, the way you do that -- there's delusion factors and that, so those numbers would be higher, but I don't see the relevancy. And to do that, I'm going to be doing a bunch of math, and I don't want to do that on the stand in my head.

Q. No, I understand not wanting to do it on the stand.

But if we specify the soil conditions in milligrams per kilogram and we specify closure criteria in milligrams per liter of a leach test but for the same contaminant, chloride.

A. But one where I'm removing the contents and one where I'm not.

Q. I have to think about that. Excuse me for a minute.

A. So Table 1 is where we're actually -- we're removing the pit contents, and Table 2 is where we're leaving the pit contents in place.

So in Table 1 -- you know, so we're removing those from there, and -- and the method and the milligrams per kilogram appeared most appropriate.

In Table 2, where we're leaving the pit contents in place and we're concerned about mobility and leaching and those sorts of things, having the SPLP test seemed most appropriate to me from just a technical method. Whether they are equivalent to the -- or the salts, it really -- it doesn't seem relevant.

Q. In your assessment that it is acceptable to leave these concentrations in the ground, have you looked for significant migration of chloride below pits in New Mexico?

A. Yes.

Q. Did you do this by drilling under the pit or trenching a pit, or how did you do it?

A. I would say in every case that we've done that in New Mexico and other states, typically, it's always been trenching. That seems to be the most -- for me, the most effective way to be able to look at it and see it.

I have done things where we've evaluated and tried to assess contaminants in an area to see if a pit had been causing that, where we had drilled outside of the pit, where we didn't trench.

Q. And did you find migration beneath the pits?

A. It depends on -- I've looked at a lot of pits, Dr. Neeper, and the majority of the time where we have a

pit that is not -- was not supposed to -- wasn't an infiltration pit or something --

Q. Yes, I'm speaking of temporary --

A. These kinds of pits. You know, have I seen cases in the many that I've looked at where there was movement downward? Yes. And most of those, where they were more than a few inches, were historic pits, that don't have a lot of the closure requirements that you have today.

Q. The different closure requirement you would have today if you were leaving a pit in place, then, would be a required now dilution of the soil with the pit material and form?

A. What is exactly specified in these regs.

Q. As specified in the regs. And you would also have the four-foot cover. Is it the dilution factor that would be different or the four-foot cover; do you think?

A. Have you seen how they closed pits 50 years ago?

Q. Yes.

A. So in those times, a lot of times you didn't necessarily remove liquids. I mean, you didn't necessarily solidify. You didn't necessarily mix. I mean, there were a lot of practices that were done in,

you know, historic times that are simply not done today.

So the cases that I've looked at where I've really seen problems were, for the most part, in those older pits, or where there was somebody that put a pit in without a liner, that was just completely not following the rules, and they paid the price through -- through enforcement actions.

But when the process is done properly -- and I would even say, Dr. Neeper, that -- that -- and I tried to allude to this earlier, is that when you look at kind of the -- if you have the right pieces in place, this, kind of, holistic way of doing it -- so you're siting; you're having setbacks; you're doing design; you're accounting for the things that -- you know, the "gotchas" in your design. You're going through operating to where, if you have a problem, you fix it. You're inspecting. Maybe it's a multi-well. You have a leak-detection system. You're closing. Is that -- is that you could -- you could do probably a not really perfect job at closing these pits and still not have a problem, because we're looking at, you know, kind of, multiple layers of protection. And that's -- and that's really not -- you know, that's kind of common in the environmental arena.

You know, in RCRA circles, the IUC program,

you try to do things where you plan for a number of different situations. And that's what we've done here, and that's why I think that -- that that overall approach -- why you just don't see the problems that you might imagine you would see.

Q. I can understand that as someone operating a pit without a liner, you might get saturated flow. Other than the that, is the transport necessarily different beneath the pit now from what it would have been historically after closure in some previous pit? Isn't it simply whatever transport is going to go on in the ground? It really doesn't know how the pit --

A. Well, I think that you see less problems now because of all those things. But I think you're right in that, you know, today you had bentonite muds and so forth, and a lot of pits even 50 years ago may have been -- may have been -- had some of the same types of fluids in them and so forth. So when you look at -- if you look specifically at transport, for instance, some of the -- I mean, you know, the soils, maybe, are the same soils as they are now, but even within that, that's why -- even then -- you know, even if you look at that historical perspective, from what I've seen, you still don't see massive -- even when all the liquids are not pulled out, you don't see massive, you know, BP oil

spill problems with pits.

Q. Do you see migration of the chloride beneath the pit?

A. You can.

Q. You can.

A. In some of the historic cases, yeah. I've seen that in pits that I've investigated.

Q. So there isn't anything inherently that stops the migration of chloride? For instance, the fact that you have bentonite in the pit material does not necessarily inhibit migration of chloride out of the pit?

A. So you're mixing a number of these things, I think. So if we talk -- are we talking pits now? Maybe it's better that we stick to one thing. Are we talking pits that would be covered under these rules, or --

Q. I'm not talking about anything that is not under these rules. I'm not talking about infiltration galleries.

A. So these pits, under these rules, with what's in there and what I've seen under, kind of, new era, modern pits that are closed like this, I've not seen a downward movement more than a few inches.

Q. In how much time after closure of the pit?

A. Some of these have been 20 years.

Q. Thank you.

I'll try one more time on this, and then get off the topic. In your written document, you say: Dilution of the wastes with three-to-one soil is sufficient to prevent elevated chlorides. Now, I will agree that reduces the chloride concentration by a factor of three. Does that imply a greater safety somewhere for the environment or something else we're trying to protect?

A. Yes.

Q. You gave the statement that the natural chloride bulge is evidence of a low infiltration rate. And I presume in this you mean from Nevada, in the state of Nevada?

A. What I meant -- and I meant that specific to New Mexico -- was the fact that you see -- and really in multiple western states -- is that you'll see a chloride bulge. And what happens is, it kind of demonstrates to me that you can get salts that move, and they don't just always keep moving. Because of the environment we're in -- we're in somewhat of an arid environment, and stuff doesn't necessarily keep moving down. It doesn't keep pushing. It's not a head. It doesn't go anywhere. It may move up and down a little bit, but it doesn't go anywhere. It just doesn't go seek -- you know, there's

not a magic, you know, lead that's pushing it to the groundwater.

Q. And that circulation, where you have a natural chloride bulge, which is what I presume you mean, nature has caused it. Would you then say it reaches an equilibrium situation, where -- if it's going up and down, it's going at the same rate. So anything you test, you get about the same result year after year?

A. Well, I can tell you that I'm not a chloride bulge expert, and that's not really part of my, you know, the overall testimony here. But from what I've seen is that they generally tend to stay in about the same spot.

Q. Yes.

If there is a dynamic of water moving back and forth, it's such that, on the average, you get an equilibrium situation, and it doesn't move very much?

MR. HISER: Is there a question, or is that a statement?

DR. NEEPER: Yes, there is a definite question, and I just asked whether that is a equilibrium situation, because that is crucial, or will be.

A. (No response.)

Q. (BY DR. NEEPER) Are you aware of the annual temperature cycle in the soil and how that can drive

water in one way or another in the near surface? Near surface being four feet or so, or the annual temperature cycle.

MR. HISER: He's going beyond the scope of direct. He didn't testify about that.

CHAIRPERSON BAILEY: He's asking if he has any knowledge of the cycle. He didn't ask if he had testified.

DR. NEEPER: I'll give a reason for asking that question. I do not wish to pursue the question if this has not been the man's interest.

A. That's not something that I've looked at. I know you're going to have another expert that's a soil scientist that may be better to discuss that particular question with, I would guess.

Q. (BY DR. NEEPER) All right. You're saying another witness will discuss that, if it's to be discussed.

I have a final question, then. There has been a lot of discussion on this term of a "risk-based rule." It's obvious that some of the questioners are missing something. Has there been a study done that has shown that the rates of transport, whatever they are going to be out of what is proposed to be buried in pits, cannot reach a place where they would have adverse

impact? That is if I understand the definition of risk.

A. So I'll give you this in kind of a two-part answer. My basis is really based on my experience. So I didn't do a model. I think what you're going to hear later from another witness is modeling that was done that I think addresses that question. But what I can tell you from -- I didn't attempt to model that. I looked at that from an experience basis.

Q. Very good. No further questions.

CHAIRPERSON BAILEY: Commissioner Bloom, do you have questions?

COMMISSIONER BLOOM: Thank you.

CROSS-EXAMINATION

BY COMMISSIONER BLOOM:

Q. All right. Mr. Arthur, how would you feel if I dropped my questions about low-chloride fluids and confined and unconfined waters that we've talked about already?

A. Okay.

Q. All right. We've talked about those. Those questions were answered.

A. It's getting late in the day (laughter).

Q. It's been kind of heady, so how about I start with an anecdote that leads to some of what we talked about, a story that ends with me laying on the floor

with a screwdriver in my hand? Would you like that?

A. Excellent.

Q. Okay. Let me start by thanking NMOGA for, I think, going back at the end of the night and looking at some of the questions that we've had throughout the day and bringing them up in the following day's term. That's been helpful. So I want to talk about a few of those things. And this is where my anecdote comes in.

I bought a house about a year ago. Three months ago, my kitchen faucet goes out, and water's leaking out of the sides. So I decide to replace it, and I'm going to replace it with one of those fancy ones with the pull-out hose that retracts automatically. I know how that retraction thing works, so I tried to install it. You know how it works?

There's a little weight under there, and you have to attach the weight yourself on the -- on the hose, because the manufacturer's not going to do it, because there might be different distances. Okay?

A. Okay.

Q. And so I'm lying under the sink, and I'm tightening down that weight on there with a Phillips head screwdriver. And I'm doing it to excess, because I do things to excess. So I'm tightening it, and it slips, and that screwdriver flies into my hand, gets

stuck in my thumb. I scream like a four-year old.

Eventually, I extract myself from under the sink, and I go to look for my first aid kit. And I don't have any Bactine in there. I have some of that triple D ointment. You're not supposed to put that on puncture wounds. So I don't have anything to really clean it out, and I didn't have any hydrogen peroxide either. And the Band-Aids didn't really fit there too well.

So I kind of changed my day around. I decided to go to Walmart early to buy the groceries, stock up on things, and I buy some Bactine and I buy some Band-Aids.

And I'm asking myself: What's the take-away from this? Is it: Keep a stocked first aid kit in the house; or is it: Throw away the first aid kit and just get stuff when I need it? That's what I think the take-away is.

A. Oh, I understand where you're going.

Q. Where am I going?

A. The boom.

Q. The boom, yeah.

So you're out in Montana, and you needed some booms, right? And you threw a couple of them down, and they didn't work. What is your conclusion today?

A. One is -- is -- is just on the issue of the booms and the conclusion. And I fully understand the story, and I appreciate the humor a lot. That was hopefully lightening the day.

But again, you know, from the take-away -- and, you know, like I said, in the last two years, I've worked two blowouts, too, which you don't want to happen. But I guess you learn different things in life in just what you see, and oftentimes -- you know, and this is from when I was a regulator, when -- you know, at different parts of my life. I've seen good intentions that don't necessarily always work.

And, you know, as much as I respect the Band-Aids and all that, what -- what you tend to have happen in this is, you're looking for different kinds of solutions and what you're going to use those for.

And I've had -- I've had experience with a boom up there that -- actually in Wyoming -- didn't work; essentially disintegrated when they put it out there, because it wasn't cared for and wasn't used. And ultimately what we did is, we called a vacuum truck that was out there in about two hours, and we wound up being much more effective at what we did.

So I think that, you know, in what I've seen is -- even in the companies that I've worked for,

in helping them, you know, assess a post-blowout, is that they didn't come to the conclusion then to say, We need -- we need to have booms on site. What they ultimately did is, they came to the conclusion that, you know, even though everything that we needed wasn't, you know, sitting right there, we were able to get it pretty rapid, in an area where you don't just have stuff everywhere.

You know, the guys that had the stuff certainly wanted to make money and were there, and they're available, and the oil industry works 24 hours a day, which, if you're working in it, can drive you really crazy, because you wind up being out somewhere at 2:00 in the morning.

And maybe there are situations where -- where you want to have a boom or some device, if you're in some likely sensitive area that you want to be prepared for, but, for the most part, in my experience, I just haven't seen the need for it. And you may disagree, and that's okay. You guys are -- you know, it's your Board, not mine. But in my opinion, having that stuff there is just -- it's unnecessary, and I think it can provide a couple false senses of security.

Q. But in that case, you could have made the call to the vacuum truck, right? You wanted these things,

but they didn't work?

A. Well, the thing with the booms is that they went to the booms first, because it was the guys in the field, and that was just -- that was what they were supposed to do. Subsequent to that, they changed the procedure; quit having booms, and those guys had a different procedure.

And that's how a lot of the -- and when you look at how the operations work in the field, you have an engineer or a regulatory supervisor, probably one of the guys in here. They may write up procedures like, Okay, here's our emergency response stuff that we're going to have; here's how we're going to handle it. And if the guy in the field says, Okay, take boom from garage; throw on water, you know, then that's what they're going to do. Versus, if you have this, depending on this, call somebody and get instructions; call back vacuum truck, or whatever is necessary.

Q. Sensitive areas. I believe you talked to siting a bit, and are we reducing the distance between some of these sites from 300 to 100 feet?

A. Yes.

Q. Would that be a case where you want to have a boom?

A. I -- I -- I -- I still think -- even in those

cases and, for that matter, any of the cases that we have in here, I don't think that there's a generic case where we would have or want to have, necessarily, a boom.

I can tell you, if I was, you know, in some super-high, you know, sensitive area that -- you know, I mean, we've done wells right on the banks of a lake, you know. We had that stuff in place; I mean, put in place, the hay bales and all that. And you do that sometimes with soil and erosion, sedimentation, plants, where you may have some of that stuff there to give you that protection, as well as how you're siting.

So even if you're within that much of a wetland -- you know, and -- and I would say -- part of my experience is, even from wetlands -- and part of the work that I'm doing is in East Texas; and you have a lot of wetlands in there right there on the Louisiana border, and there is a lot of oil and gas development that's there. And we use a 100-foot setback. And in that particular area, I've handled maybe 20 spills that have occurred, and in every case, that 100-foot setback was more than adequate for us to respond and address the issue.

Q. Going back to one other issue, another concern I have, with the slope of the side of the pits. And

your comments were helpful from the viewpoint of regulators, and thank you.

A. You're welcome.

Q. People and critters are my concern now.

A. Okay.

Q. How steep could the side of the pit be?

A. You have pits in the United States where you may have -- you may have one end of a pit that could be a vertical slope.

Q. Could all four sides be vertical, like a swimming pool-type effect? I was worried about people falling in, or animals.

A. You could have that. And keep in mind -- you know, I would say it would be unusual where I've seen a pit that has four -- you know, four vertical sides. Just because, how would you construct it? I mean, how would -- that would be difficult. I've seen that in Russia.

But I think that even in there, we would have, you know, other access issues, like fencing, that would -- that would help to keep out people, and any -- really any critters of -- well, I'm -- you know, I guess a deer could jump a fence, you know. But if they got in a fence, even with a slope, depending on, you know -- I mean, any pit could be an endangerment from that

perspective.

Q. I don't want to belabor that anymore.

I appreciate your time and experience having been at EPA and having been a regulator, so I want to come back to the multi-well fluid management pits.

As someone that's being asked to change regulations, or create new regulations in this case, perhaps you can sympathize with my concern about the size and volume of these -- of these pits. Is there any limit on their size currently in the proposed --

A. Not in the proposed rules.

The only thing I'd offer in that is that as you start looking at the utilization of those -- of those multi-well fluid management pits, there isn't a size limit. But I think that what you'll find and what I've seen just in different areas is, they're kind of purpose limited, you know.

So, you know, like the example I had is that, you know, you're using -- you're using, you know, that pit for a particular area. And, generally, it's not -- it's not reasonable, you know, to use this pit on wells way -- you know, that are far away. So what you do is, you wind up closing that one and maybe building another one.

You know, so you're not likely to just go, Well, we're just going to make it bigger and bigger, and all of a sudden, it's the size of Pittsburgh.

Q. You've probably seen we have a lot of acquisitions and --

A. Yeah.

Q. -- mergers in New Mexico, and you've seen bigger and bigger units being built.

A. Yes. I've done a lot of environmental work on exactly that.

Q. So we could essentially have -- I could imagine a pit that has 100 acre-feet of water in it, and it's serving multiple frack jobs at once that cross a sizable extension of land. And I guess my questions are: One, could we end up regulating something the size of a small dam, and, you know, the regulations for that? I don't know if these are questions that you would have to do some research on. Or are we going to get so big that we're talking about something that goes beyond a pit?

A. I would say -- just from a basic management perspective and what I have seen is that I have seen freshwater ponds that have been built that have been sizable, where -- where -- I'll give you an example.

Chesapeake Energy -- this was a few years ago -- built a major pond, with a dam, and they had to

go through all sorts of permitting with the state engineer and all that, because they did do that with the idea of -- in that case, they did it so that they could kind of work like an aquifer storage and recovery well. So what the intent was was to take water out of the river during the rainy season, capture it in this giant impoundment so that they wouldn't have to -- they could minimize the water take out of the life cycle during the nonrainy period.

So you can have some of those, but that's not typically what you would see in a pit that you're using to -- you know, for supplying water, in recycling and so forth. In those cases, really like kind of the case that I put up here, I think, is what is more the norm. And they're kind of limited on kind of how far they can do [sic].

So even with acquisitions -- so, you know, if somebody comes and buys in additional acreage or whatever --

Q. We need the rate based on all possibilities, not just what might be a norm, correct?

A. Sure. I mean, but --

Q. My next question is going to be about -- about age. And drawing on your experience as a regulator, are questions about minor performance at two years,

five years and ten years, for a multi-well fluid management pit, of interest to a regulator?

A. I think everything is of interest to -- I'm having a hard time thinking of a case where it wouldn't be of interest. What I can say is that the liner material, the siting and design specifications that are in your rule -- and that is really -- you know, that I've seen in other -- it's specific to multi-well fluid management pits and are pretty good -- I shouldn't say pretty good. Are generally well engineered, that can have the ability to have a safe and effective life span that could go multiple years.

COMMISSIONER BLOOM: Could we pull up slide 4-3 -- I'm sorry -- 14.3, please, 14-3?

Q. (BY COMMISSIONER BLOOM) Mr. Arthur, you were looking at this earlier. You said that New Mexico has a good safety record. Is that a fair assessment of what you were saying?

A. I didn't say a good safety record, but what I thought is, based on -- and, you know, just summarizing this slide, is that looking at this relative to groundwater, the results that you see are pretty good.

Q. Have we had any contamination to groundwater with this new Pit Rule that you're aware of?

A. Not that I'm aware of.

Q. When we were in slide 4-25 -- I'm sorry -- 14-25, you said that -- it was after we were talking about some comparisons -- that New Mexico is a leader in dealing with pits.

MR. HISER: That was -- technically, Counsel said that, not the witness.

COMMISSIONER BLOOM: Okay.

Q. (BY COMMISSIONER BLOOM) Would you agree with that?

A. I believe that. I think even right now -- I think that probably everybody in the country is looking at what you guys are doing with this Pit Rule right now, and I think you know that.

Q. So you're asking us to make changes. Why would we make changes to this?

A. Well, I'm not an operator, and I'm not sure that that's not, you know, maybe more appropriate to them. But in reference to my opinion, which I think you're asking, is that -- is that I think that from the existing rule to the proposed rule, the proposed rule addresses some things that I think that are -- that are probably less than ideal, in my opinion, from a regulatory perspective. There's clarifications and -- and a -- I guess a number of points that I would say that would be suggestive of that. I like what we've

done in Tables 1 and 2. I like the identification and recognition of, say, low-chloride fluids.

Even if you -- f you don't -- you know, if you looked at that not compared to something else, but compared to the water you're dealing with and the relative risks of not doing a one-size-fits-all sort of thing -- but recognizing that, I think that adding the multi-well fluid management pits to that, I think, will ultimately be a very -- a very positive thing that has a lot of environmental benefits; probably more benefits than has been brought up at the hearing.

So overall, when I look at why change, I think it's -- it's an improvement. It makes the rule, I think, more straightforward, understandable to implement, which, from my regulatory side, means that I'm going to get better compliance.

Q. So we're allowed to make a change, and we have economic, scientific and environmental data that would help us know if there are wastes of resources, correct, or if we're not protecting correlative rights, which is part of what we do here, or the impact on the environment -- impact on the environment, correct?

A. Uh-huh.

Q. Seem fair?

So I want to talk about setbacks. And I

don't know --

COMMISSIONER BLOOM: Ma'am, could you pull up the slide from presentation number three? I think it was pretty helpful.

MS. TUPLER: From Exhibit Number 3?

COMMISSIONER BLOOM: Yes.

THE WITNESS: I think it's a different presentation.

COMMISSIONER BLOOM: 3-6.

MS. TUPLER: Which page are you looking for?

COMMISSIONER BLOOM: 3-6, slide number six.

Q. (BY COMMISSIONER BLOOM) Mr. Arthur, you're our hydrologic expert here today?

A. Yes, sir.

Q. So how do we -- so the current rule is a setback for 50 feet and -- and horizontal of 50 feet, and then the setback for near a watercourse is 200 feet and 300 feet, 500 feet for a water well, and 500 feet for a wetland. And we're going to change some of those. We're going to change depth to 25 feet, watercourse, to 100, water well to 100, and wetland to 100. What data have we seen that shows that that's a conclusion that would be acceptable, provides for safety?

A. What I -- what I looked at and -- and -- and --

and part of what I based my -- my assessment of this -- I didn't -- I didn't come up with the numbers. I evaluated the numbers and made -- and drew an opinion from that, but -- but I would say that it's not without -- without data. So I've been in multiple hearings with Pit Rule development; have testified before, for instance, with Tom Richmond and Montana Oil and Gas, and have looked at Pit Rule.

Other things with setbacks that we've seen is like the state of Ohio. Rick Simmers there led an effort looking at their setbacks from different things and tried to come up with a basis for that.

I also recently worked with the Delaware River Basin Commission on how they came up with their setbacks, working with the U.S. Army Corps of Engineers and the National Park Service on setbacks within that.

And -- and I would say, I've also done supporting work with the New York DEC's Supplemental Draft Generic Environmental Impact Statement, where we have discussed and evaluated setbacks. And -- and within -- that, and as well as experience in responding to spills. So part of what I do as a consultant and did back in my EPA days and so forth was emergency response.

And setbacks is a challenging thing, because there's not -- there's not a -- an actual way to

come up with a right or wrong solution, you know. So you can start studying setbacks in a number of different perspectives, and what you find is, there's not an equation. There's not, you know, something that says, Here it needs to be 100 feet, because, you know, exactly this.

What it generally is is based off of operating, regulatory and resource management experience. So even in many of like -- I've done a few oil and gas Environmental Impact Statements for the Bureau of Land Management. It's been a lot of the same thing.

So they come up with those sorts of things, and I think there are a lot of reference documents that you could probably have in the record as a reference that suggests that, beyond just what other states are doing in regulation that might be able to help you.

Q. So 500 feet used to be what we were told was a safe distance from a water well. Now we're at 100 feet.

A. For low chloride, yeah.

Q. What I would like to have is an understanding of how quickly a plume could move through -- move through soil.

In a previous life, I worked on military-base issues, and one of the things we had in

Albuquerque, an issue we still have, is the fuel plume out at Kirtland Airforce Base. Eight million gallons of fuel spilled. It went down 500 feet in, say, 50, 60 years, and then it went a mile horizontally. You know, it probably had quite a head on it.

But how do I know that a plume isn't going to move 100 feet in 20 or 30 years?

A. So I'll give you a similar reference and a distinguishment, if that's okay.

I'm a petroleum engineer, but I've had one experience in being able to build a dam, and that's been -- that was at Elmendorf Air Force Base in Alaska. And they had a gas -- a JP-4 fueling area called Four-Million Gallon Hill, and it was on a big hill. So they actually had four one-million underground storage tanks, and then they built soil [sic] above that.

One of the things I learned with the Air Force and working at multiple Air Force bases on environmental projects around the country is that in the Air Force, jet fuel tends to get treated like water. Historically, that's -- that's what you saw. And in this case, I saw -- I noticed jet fuel leaking out the side of this hill, going in a creek, while people were wondering why there was a sheen on the sound. So we built a dam, collected that, and it's still a problem

today like that.

Now, we're not necessarily dealing with JP-4, and it's not an air force base. But what you see when you look at the type of setbacks that we're at, keep in mind -- and from my testimony, and hopefully you'll put some -- some -- at least a little bit of credence on the experience I've had in working with a lot of regulatory agencies, a lot of companies on pits, is that really the primary time when you're going to have some sort of incident is during the operational phase.

Most of the time when you're looking at setbacks to, let's say, a wetland or a watercourse is going to be overland flow. So certainly we had an event, you know, that occurred in the Bakken of massive snowmelt and, you know, flooded Lake Sakakawea. There was water everywhere. The entire western portion of the state was flooded. We can have those anomalies. That happens sometimes, you know. Sometimes a hurricane hits New Orleans and takes out the whole city.

Typically, that's not what we design -- we don't plan for worst case. So even when we do an Environmental Impact Statement, you don't guess the worst possible case, what could happen, and design for that.

So if we look at those things, the two issues that we had on a watercourse or a wetland, you're looking at mostly overland flow. So we've got a couple of things that happened to us in those particular cases. One, if we get overland flow, what we're probably going to see -- and what I've seen in really every case that I've been in is that we're going to see infiltration as that water moves. We're going to see pooling. And the likelihood of that moving even 100 feet is going to be slight.

Furthermore, as that -- let's say that that did reach a wetland or a watercourse, whether it was 100 feet, 300 feet, 500 feet -- you know, in the low-chloride opportunity -- or the low-chloride situation, the chances of that -- of that being a significant impact may be even less.

And if we look at the case of the Bakken -- and I can tell you that this was the instance of one of the blowouts that we looked at. They got 20 inches of rain in one day. And what we had in that case and what you had even in some of the situations in the Bakken is that you had fluid, that that fluid -- you know, let's say our flow-chloride fluid was 15,000 milligrams per liter of chloride. But by the time you have this massive event, there's so much dilution that even in the

case of the ATGAS blowout, when we got very far off the pad, we could not even measure the -- the -- a difference in the floodwater that was leaving the area that we knew was impacted by flowback versus areas that were unaffected by the well.

So as we look at the possibilities of an overflow, you know, in a dry situation or even that massive, you know, Bakken flooding thing that sounds bad, but really -- you know, people got fined, and they deserved to be; that was the rules. But when you look at the environmental impact of that, it was pretty benign.

If we look at the other ones, where we look at a residence or a water well, you know, now we're primarily looking at a situation where, again, you know -- and if we even look at the history here in New Mexico, I can tell you, based on my experience, it's pretty identical. I mean, it's the same sort of industry. Things happen during that operational phase. I have witnessed -- a guy -- this was actually in the Bakken area -- got fired. He picked up a drill bit and threw it in the pit. It hit the side of the pit, created a big rip, you know, went down to the bottom, and, you know, it was an unfortunate thing, you know. But what I would say is, in an immediate response, they

called a vacuum truck out there; emptied that; pulled things back; addressed the situation like you would expect; notified the state and addressed that.

So even in these situations, you know, I think you're really not giving up much.

And although -- in this case, I like the idea that we're having low chloride versus other, which is really, you know, a high-chloride solution. You're giving yourself a little bit more buffer. But I think either of those are safe.

I think the 500 feet -- you know, when you start looking at -- and this was an issue we came up with at the Delaware River Basin Commission. When they started out, they wondered, well, maybe we should have 1,000-foot, you know, setbacks and everything. And what we wind up doing and what we've done -- we've done this, gosh, I think four or five times -- is what we call buffer analysis, where when you start looking at where you're going to be able to put things, if you start, you know, pulling out all the setbacks, you wind up, perhaps unknowingly, impacting how wells can be drilled and what resources perhaps can be accessed.

You know, we heard --I heard, I think, on the first day, someone saying that, you know, you could -- hey, they're drilling wells five miles,

horizontals, now. Well, I think that -- you know, if you had a five-mile horizontal well, I can tell you, the only purpose of that well is to hold production, because in trying to complete that well, to get it to produce and to clean it out at the end of five miles is impossible.

The longest horizontal in unconventional resources that I've seen that has been really producible has been 12,000 feet, about two miles, and they still estimate that only about half of the horizontal is producing. So it's tough to do that.

So what winds up happening is, you wind up, perhaps unknowingly, limiting and actually maybe unknowingly make resources unavailable.

Q. So you addressed the horizontal flows there?

A. I tried to address both, I think.

Q. Twenty-five feet to groundwater. I mean, is there -- if a liner is punctured, do we have any understanding of if a plume could move 25 feet? Is there data out there to support that it won't?

A. You know, in the -- so what we're really talking about, I think, is in a catastrophic event, correct? So if we had a catastrophic event -- because that's what we're saying. Twenty-five feet, right?

Q. Yeah. Okay.

A. So catastrophic event: The guy throws the drill bit in there. All right? And now, for the 25 feet thing to be an issue, I'm going to see -- I'm going to physically see the fluid in that pit escaping. So I'm going to have a volume of that pit. I'm going to know that. I'm going to know what's happening. And through that, what you're really looking at is buying time.

So now, in the 25 feet of the low-chloride solution, I've now had a catastrophic event. I know about it, and I have the ability to immediately take action.

So that's part of the reason why I believe, especially in the low-chloride situation -- and I really honestly think that you could do 25 feet on either of them, but I recognize there is still a perception, you know, of higher chlorides, that maybe you have a greater potential impact if something did happen. But nonetheless, I think in that, if you look at that, that it's really -- what your concern is, on that catastrophic event, that the 25 feet is much more than adequate.

Q. That's helpful. Thank you.

Just a couple more quick things -- hopefully quick.

What is the cost of the setbacks? Is waste -- do we have waste because there is this setback? Are we wasting resources? Is there oil or gas we're not able to access because of these setbacks?

A. I have not done -- as I noted before, I've done a lot of buffer analyses. I didn't do a buffer analysis related to these regulations, but what I can tell you is that many times, handling setbacks is a very delicate situation that you have to do, because the setbacks that you have can limit resource access and could mean that you're going to have unrecoverable resources because of that.

And I'm not saying that -- you know, I didn't -- I didn't look at this, so I don't -- you know, I haven't done the modeling here to be able to answer that particular question. But what I can tell you, in every other situation where I have, is, that's been an issue, and that's led to a lot of negotiation on, you know, how do we make the setbacks effective so that we're confident that they're enough, but they're not too much? Because, you know, you don't want to -- I mean, you want to be able to do your job whether you're the State Land Office, or, you know, the OCD or whatever, or even a water basin commission or the BLM. It's a balance. And certainly that can happen.

Q. Two things on just a portion of your presentation where you were talking about comparisons with other states.

A. Uh-huh.

Q. How are comparisons helpful?

A. You know, for me -- I have a son that plays baseball, and he's a catcher. And Monday, because of the perfect timing of the hearing, I missed him at a major league draft showcase. And what they did is, they run the players through, and they have them run a 60-yard dash; and they have them -- he's a catcher, so they have him throw to second, and they have him hit. And what they do is, they put those numbers out, and then they compare, and you kind of see where you are. And I think that's -- you know, that's the same sort of situation that you have here.

And I think that -- I know when I was -- when I was at EPA -- I've also -- some of my clients are state agencies, so we consulted. Two states, for instance, Artie Bingwell [phonetic] in Arkansas and Tom Richmond in Montana, they use us. We're kind of a technical expert for them. So we may come in when they're doing rulemaking or permitting or whatever, and they'll ask us to assess something.

But comparisons, you know, as you do that,

you typically -- you know, you don't -- you want to -- generally, you don't want to be somebody who is way out of line with something. We're going to have 5,000-feet setbacks, you know. Because, you know, you don't want to be an undue burden, all those sorts of things. So the comparisons just really kind of help you know, okay, How are we in here? Maybe this is more important to us -- like, even like when you look at, you know, my slide 23, where I kind of said, How many other states are doing these sorts of things? It's not necessarily a win -- a contest that you want to be the top in every one. You know, the whole reason that states say, Hey, states need to be able to regulate oil and gas activities, or whatever it is, as opposed to the federal government, is that they want to have a program that is fit for them.

So in those different things and the setbacks and the comparisons, looking at those in other states can help you assess that. So what we try to do is look at the states overall, and then we compare it to a smaller subset of states, to be able to say, Okay, that's all of them. But what if -- you know, what if you even just looked at the ones that we felt had a lot of similarities to New Mexico, as opposed to saying, Well, you guys were just way out of line, or, Everybody

else was ahead of you. I mean, you fared pretty well in even that sort of analysis.

So I don't know exactly what you do with it other than use it in your decision-making process in deciding what to do with a rule, and if, you know, you think that helps you --

Q. We compare ourselves with, say, five states that we can see as being -- having lax standards, perhaps, or we might come out looking like we were a very tightly regulated state?

A. I agree.

Q. Or perhaps that we compare ourselves with six countries in the world that had the most restrictive standards, we'd come out looking like we had a pretty good show here in New Mexico, right?

A. You can make that stuff do whatever you want. And I didn't try to do that. I tried to --

Q. I believe what we're aiming for, then, is to maybe look at other states to see what they're doing to help us get towards a goal of adequately regulating industry in our state.

A. Right. And also, I think, it's different -- maybe different areas, because Pennsylvania, they have a lot more rainfall. There may be some parts of their regulations that they want to have more stringent than

you do in New Mexico, and vice versa.

Q. And lastly, you had percentages, looked at percentages, and we saw a success rate -- call it a success rate of 99.98 percent. Doesn't -- I guess the failures, do they -- you have to look at their magnitude, right, to understand if that's a success, right?

A. Well, where there was alleged -- where there was alleged groundwater. Okay. So you could -- you know, I think if you said, Where has there ever been a tear in a liner? So let's say -- and, you know, I've seen this done in a number of ways. You can make statistics, you know, do what you want. But if you said, Okay, I'm going to -- maybe there's been 50,000 incidents where there was a tear in the liner above the -- above the fluid. Even though it was fixed and not an incident, do you count that, you know?

So what we tried to do in this -- and maybe you want to look at statistics beyond even what I presented, but to look at them with a purpose.

So in this case, you know, my portion of the testimony is kind of as a hydrologist and so forth, so really kind of the main thing I was looking at was water. So to me, and even looking at past information provided by the OCD, the stuff that's available, you

know, I focused on those particular things. So that's not to say that that's any event or whatever and so forth.

Q. Let me pivot for a minute. What I'm asking is: What is the potential cost of a failure? And let's look at the Gulf, for example. There are 3,500-some wells in the Gulf, right? If they have one bad accident, what can it cost? You might have -- there are 3,000 wells, and you have one failure. That's a 99.97 percent success rate. One failure can be big, and it would cost you, right? Let's look at the cost of these failures.

A. You know, two months ago, I gave a presentation on the risk of hydraulic fracturing to a government organization in New Zealand. The majority of their production is offshore. And they have a new shale play there, and they've got a little bit of onshore development. And one of the things that I did as part of that was discuss the difference between onshore and offshore development and the difference in risks.

So the BP incident was a massive incident. It got our entire nation's attention, and it provided a situation, because of the depth and all that and because it's offshore, that you can't respond to, in many ways.

What I saw now -- in two instances, I've been the environmental guy on site for, let's say,

equivalent blowouts. And the difference that we have when we're on site in these equally catastrophic events is that we have a number of different things available to us. We have berms. We have roads. We have all these other things. So when you look, it's like, well -- maybe that -- you know, if you had just that one -- you know, you had 100,000 wells. If you had one of them, it could be this really bad thing, so you don't even want to have one.

Well, in here, you know, what you really look at is, you know, what are the really potential -- worst case, what could happen? And what I saw in the ATGAS blowout, which the representative from the state of Pennsylvania, in one of their -- one of the news reports that they gave, said that this was the worst environmental catastrophe in Pennsylvania's history of oil and gas wells. And you think: That's where the Colonel Drake well was, you know. And we've had a 22-inch rainfall. We lost about 500 barrels of fluid from the well. There was a river within, oh, probably 3- or 400 feet. It happened at 2:00 in the morning, you know. This wasn't a pit, but, you know, 20 inches of rain, you know, all this -- these massive things.

What we found out, from looking at the results of that, is that the company acted pretty quick

in building berms below the pad. They even had -- because of the -- because of the berms at the pad, they accumulated a lot of water, and a portion of the pad actually fell and washed out. But what you saw -- even with that is that we saw no -- no impacts in the waterway. The area of impacted soil was really rather low, because you had -- you had sheet flow, so you had some that was maybe within 50 feet. It filled up a cato [sic] watering pond that was just below the pad.

And ultimately, the biggest impacts that I saw from that particular situation is, we had dead crawfish from the pond, and in the area of release, at the surface, we had a lot of dead worms. So things moved so fast and there was so much dilution, you really didn't see what you might think would be this catastrophic environmental impact.

Q. That's all. Thank you, Mr. Arthur.

A. You're welcome.

CHAIRPERSON BAILEY: Mr. Balch.

CROSS-EXAMINATION

BY COMMISSIONER BALCH:

Q. Good afternoon.

A. Good afternoon.

Q. For the record, I try my hardest not to speak.

There's been a lot of discussion about

material that's left on site, so I was a little bit curious, because we have a impact panel in the EPA and also in the oil field. You might be able to address some design standards. I know that oil and gas waste is treated differently than a lot of other waste strains.

For example, the EPA says that CO2 is a toxic substance. And part of my other work involves a large CO2 sequestration project, and we have to assure the Department of Energy that the CO2 that we're sequestering will be in place at that site with a 95 percent compost for 1,000 years. That's a design standard for the CO2 sequestration project.

Now, similarly, we can take the waste off site, perhaps to a municipal landfill. Those sites are also going to close someday, and they're designed to some standard. Would that -- would you be able to talk a little bit about those sorts of design standards and how they may be applicable to the design of waste left on site?

A. I guess there are a couple of different things. And first you mention, you know, the CO2, and I've done a good bit of CO2 work. We're actually doing work for the Department of Energy in doing the environmental analysis for several of their CO2 projects, one, I believe, that you're involved in, as part of NEPA, for

DOE. But that sort of containment is not dissimilar to other things that have been done.

So, for instance, in Land Ban Program for a hazardous waste injection unit, they do model to show that things are going to remain in place for 10,000 years. And the first thing that I learned when I was in college for modeling is that you never model for longer than you have data. And then I got to EPA, and I'm trying to build a model, but I have, you know, a few years of data, and I'm modeling out 10,000 years. And I thought, you know, don't tell my professors, you know.

So -- so I think as -- as -- as -- as you -- as you make those predictions, and -- and ultimate faith [sic], there's a little bit of, you know -- you know -- you know, judgment that you have to make.

I remember when we were doing the land ban modeling and figuring out what -- you know, what to do and how to do that, our direction from the EPA administrator was, you know, I want solid regulations; you know, I don't want you to develop something that's unattainable. And so what we tried to do, even for the 10,000-year modeling, was come up with some things that were -- that took into account long-term things, density, dependency and all that kind of stuff, but that

was not unachievable given our natural environment.

If we look at that in relation to even, you know, landfills or pits -- you know, I've done -- I've done landfill work in California, on the North Slope. I had the -- I had the pleasure of doing an arctic landfill in -- in -- in Western Siberia, under a USAID contract that actually got used to take -- to take oil and gas waste, as well as other waste.

So there are certainly some of the same things that you may -- that you may want to consider in doing, you know, maybe an oil and gas landfill or a municipal landfill or a -- or a hazardous waste-type of landfill that you might think of in relation to this, but in my -- in my view, I -- I -- I really take a very rigid stand that landfills are very different than what we're talking about with pits. And that kind of comes from just my experience with a lot of landfills.

And part of my job early on in my early EPA days is, they make the young guys go out in the field and go inspect stuff, so you get to go inspect landfills and weed shade [sic] and, you know, all sorts of different things, and a lot of times that wasn't very fun. But when we look at those compared to this and -- and --

and -- and when I've done things like go back and

evaluate pits and so forth, it's been very different. So when you look at the contents, you think, you know, okay, I've got maybe issues with chlorides or other things. But we have, you know, these other things where maybe you have liners or you don't have liners and cases where you either do or don't, but the base of the pit has generally been -- has been prepped and compacted and maybe has clay in it, maybe it doesn't, but at least it's been compacted. And we have all these other things going for us.

And then -- and then we tend to -- we want to -- you know, we want to dewater. We solidify stuff. You know, we've done some of the pits where we've actually, you know, put mixed cement, you know. But that's one of the things we do in Pennsylvania. We actually mix pit contents with cement. So there's a number of things you can do, whether it's soil or other things to attempt to solidify to work with the bentonite clay.

And -- and, you know -- and the -- the bentonite is a -- is a really -- you know, I've had mud lab, as a petroleum engineer, and have looked at how the industry uses that even in -- in their bases during the drilling process. They use bentonite to stop flow. So I think that's, you know -- and it actually does. So

you filtrate out. And bentonite is these platelets, you know, and it's a -- you know, all clays are not mixed the same, but why they use bentonite mud, why they don't say, Well, we'll just use some clays -- they use bentonite clay because of its properties.

So within that and when you look at these pits -- and then if you -- if you -- if you look how we're doing that, different things we're doing from design and slopeage and maybe temporary nature, and then if you've had the opportunity to investigate pits -- and many of the ones that I have is where -- where we've looked at -- maybe there's a complaint or a contamination issue or something. You know, we go back in, and we're investigating a pit.

And what you generally see is this layer of what just looks like clay. It's typically pretty dry, and, you know, it's not something that you're going to look at and go, Wow, that stuff is threatening the groundwater. It looks like the soil. And you don't necessarily see that at a landfill -- or all landfills.

And I will say that in the Wilson Basin, we've permitted some -- some landfills that take drilling waste -- and the ones that -- the ones we worked with, they do -- they actually do land farming. So they take a lot of the waste, land farm it, and

then -- and then take that waste in there. But they've located it on the Bearpaw Shale, the one that -- the one that we did there. So you've got 600 feet of shale between you and anything, you know.

So it depends so much on where you are and so forth, but I think that pits are different than landfills. They don't act the same. They don't -- you know, you don't have leak-collection systems. You don't have things that you're worried about. I mean, there are a bunch of people collecting methane off of -- off of landfills. I mean, there's -- one of our clients does that as a business. It's a different -- a different situation.

Q. Let me ask a follow-up question, if you don't mind.

A. I don't know if I'm helping or getting to your question.

Q. One of the responsibilities we have as commissioners is to get the information on the record that we think we need, even if it's not part of your direct testimony.

A. Uh-huh.

Q. Okay?

A. I understand.

Q. So my follow-up question is: A lot of

discussion, a lot of cross-examination was focused on how far can you estimate, in 50 years or 100 years or 500 years or 1,000 years -- I think even a million years was brought up the other day -- as to time periods you might be looking at for transporting the material from the waste pit to some other location.

From your experience, what sort of time scale, really, should we be looking at to minimize the hazard or to reduce the risk to a reasonable point?

A. You know -- and this is simply my opinion based on my experience, and I've seen models. You're going to get some model testimony, but I'm -- models have value. You should look at models. You should consider models. But from what I've seen is that -- is that -- and this is, I'd say, for a variety of different kinds of pits, but I would say, modern day pits, what you wind up seeing -- if you were to trench out, you may see, you know, a little bit of impacted soil that could be up maybe an inch -- let's say zero to five or six or seven inches that moves up. And I think, you know, in probably -- I don't think I'm out of line even with prior testimony, that you can get some osmotic pressure and maybe a little bit of movements of salt.

Furthermore, from what I've seen is -- and I'm not -- you know, I haven't been around a million

years to look at that. But in modern pits, you see things that move just a couple of inches or a few inches, generally.

Now, I can tell you that on older pits, I've seen movement that -- where -- where, you know, things weren't done as we do today, with blending, with fluid removal, where you might have seen movement of five or ten feet, that I've seen that has -- has -- has -- from pits that have been 30, 50, 80 years old. But what you don't see -- and this is the problem I have with a lot of the models and the assumptions that you make, is that a lot of people make what I believe is the wrong assumptions. They can say, Well, okay, that pit's 5 years old or 20 years old, and you had six inches of movement, so in a million years, it's going to be, you know, way more than six inches. But the problem with that is that, you know, at the time when we see that -- I mean, I'm seeing pits that aren't -- you know, it's not like some -- some gooey blob, you know. And what I'm looking at and what I've seen in my experience is that you could look at this pit -- and, really, I would say that most of what you see there occurs very close to either, you know, during operation, very near to the closure time, and then what you see is, you don't see a lot more movement. And the mistake that gets made, I

think, is that you want to see that, and then you say, Well, that occurred in a year or two years or ten years or so; over some big time frame, it's going to be a whole lot more. And that's just, I believe, a wrong assumption.

Q. So when you're using the standards set forth in the modified rule -- the proposals to modify the rule, essentially, you're asserting that those materials will, more or less, be in place for -- until some large geologic activity moves it around?

A. You know, stuff -- stuff happens. I mean, you know, Yellowstone National Park didn't used to be a volcano. But that's -- I'd say that's accurate with what my opinion is.

Q. I'll switch gears just a little bit here. There's been a lot of discussion about the scale of multi-well fluid management pits in comparison to a normal temporary pit. I think the examples that have been presented to us so far have been fluid management pits that were two, three, maybe four times larger than what's allowed by the current temporary Pit Rule in New Mexico.

Is there some scale at which you start to increase your risk as you increase the size of those volumes? Is there someplace where you would start to

become uncomfortable having that 100 feet away from a watercourse?

A. Really, I would say that my comfort zone is not necessarily the size but more the design. So I think the other Commissioner had made a good point. You know, if you start getting into these things where you've got a 60-foot dam, I mean, to me, that's -- and I've seen impoundments in Wyoming that did that, and those -- those give me concern. And the ones that I saw in this was in some of the coalbed methane development, where they're unlined, and maybe they're even doing a relatively freshwater. But when you get, you know -- when you into bigger things, you've got to make sure that you're going to the State Engineer's Office. The type of engineering and stuff that you're going to have is going to be different. I'm not sure that you guys want to be responsible for permitting a 60-foot dam.

But if I look at it from the perspective of size and really based on -- on -- I mean, I've seen hundreds of multi-well fluid management pits. You don't see them like that. Typically, they look more like a pit, and typically they're not -- they don't just -- you don't see them getting, you know, bigger and bigger and bigger and giant. They're pretty good size. I mean, you may want to have, you know, the sizes that

we've referenced here, but when I start thinking, you know, of 100 acre-feet, you know, just bigger and gianter [sic] and all that, it doesn't make sense to me.

I'm not sure -- I guess my opinion is that the size is not necessarily an issue to me. I think the size will take care of itself with industry. I think that, you know, certainly if the Commission wanted to set, you know, a size limit, you could. I just don't -- I don't personally feel that it's necessary, and it doesn't -- it doesn't -- based on what I know and a familiarity with these, I don't see an added risk.

Q. So if you think of these pits in comparison to a city, maybe an urban sprawl, where you get -- where you take the same height and then you go out, versus taking the same area and going deeper, you're more concerned if the pits were to become taller or deeper than if they were to become more laterally extensive?

A. Yes. I mean -- and I'm thinking-- you know, when I make that statement, I'm kind of thinking to the extreme. You know, when you get beyond -- when you've got pit walls that get beyond a certain height, you need -- you know, when we do that, I want a dam engineer, somebody who has done that. And although I may be, you know, a registered professional engineer and, you know, worldwide from SPE, SPEC, but, you

know, I don't -- you know, the dam I designed, that I mentioned to him (indicating), was four feet tall. I was good with that. But, you know, if I'm doing something that is, I mean, a big-time thing, that really brings into a whole different engineering, hydraul- -- I mean, there are just so many other things that you start worrying about, as well as safety. And then you start thinking, okay, if I lose 100, you know -- if I lose, you know, whatever, a lake, you know, what can happen there? Is it going to flood the town, you know?

Q. Would it be reasonable to ask for, rather than size limitations, design limitations?

A. I think that that's kind of intrinsic in that, because I think if you got above a certain size, you're going to be required to go to the State Engineer's Office, and I think that -- it would just surprise me if anybody -- one, if they did have to do that, they would have to go through that process. But I just cannot imagine or foresee someone actually trying to go do that. So I think you already have that -- those kind of precautions in place. I just don't -- it's not my -- that's not my expertise, so those are the kinds of things that make me nervous, because I'm not an expert in that.

Q. Sure. I understand that.

The water-detection systems, they've been talked about being put into place, but not -- I don't personally have any understanding of how those function and their reliability. Would you feel comfortable, within your expertise, discussing what a typical water-detection system might be comprised of and then how reliable it might be?

A. So this is the leak-detection system we're talking about?

Q. Right, leak detection.

A. So we may have -- you know, through these -- these -- you know, this kind of double liner, recognizing the secondary liner could be, you know, clay soil or something. And what you'll have is, you'll have, you know, a pipe with holes and a base, so they can collect water so that if there is a leak or something, you're going to be able to see the water -- you know, water from the leak-detection system.

I think that as far as we look at reliability, I can't imagine a situation where it wouldn't be reliable, just how, you know, you place where you're detecting, kind of. The low end of the pit, that's where water's going to go. You know, that's just real basic stuff. So I see those as pretty dependable.

I think that, you know -- you know, if -- I think you could see, you know, leaks where you need to take action versus leaks to where you have some, you know -- you know, it looks like maybe we're getting just a little bit of water that you know you're going to have to address when you close the pit, you know. So if you do detect a leak, you're taking samples and addressing things that way.

And in that, you know, the thing where you're looking at an environmental threat is not when you have a few drops, you know, over this, but when you're accumulating some sort of water that's telling you, Hey, something's not right. And through these systems, you'll see that, and then you have the ability to take action. And I think that's, you know -- that's a good, I think -- a working, good, you know, reliable solution.

Q. Low maintenance at some point?

A. Uh-huh. Sometimes easy is better, you know.

Q. Right.

I imagine it's in your report, in Exhibit 14 or 15, but you mentioned the six other states that you compared New Mexico regulations to.

A. Uh-huh.

Q. For the record, can you just list those states?

A. Let me go to the report. I looked at a number of different states. We looked at New Mexico, Colorado, Wyoming, Texas, Pennsylvania, Ohio and Montana. And really, if you look at the different states around, you know -- I felt that those were comparable states. They're states that have -- have either a good deal of activity. They have unconventional plays. They have a good regulatory process. They're not -- they don't seem to be the slackers or the over-the-top guys. I mean, they just seem to -- and, personally, I know -- I have -- I have just a lot of experience in all of those states. So the data from a comparison perspective meant a lot to me, and I thought it was appropriate for this. So that's why.

Q. Thank you.

Mr. Jantz asked you directly or -- I'm sorry -- in cross-examination about how many pits you have personally modeled. You said the number was somewhere under 30. How many additional pits to that number would you say you've been involved in or directed the modeling of?

A. For modeling? And if I -- if I include some of this -- this is -- this is going to sound like a big number, but I want to preface this with, some of the modeling we've done has been regional modeling, where

you're looking at kind of a cumulative impact sort of -- sort of thing, and some of that includes modeling that we did in -- like in the Powder River Basin, the coalbed, that included hundreds of pits. And I'd say that probably the -- you know, the -- probably the closest I'm going to tell you is hundreds. But if I look at individual modeling that we've [sic] done, less than -- less than 100.

Q. So 30, personally; 100, directly with your company; and perhaps 1,000 over all?

A. Maybe more than that. I'm not --

Q. We've had a lot of discussion, also, centered around confined versus unconfined aquifers. One question that I had was: Assuming you were able to even identify a confined versus an unconfined aquifer, which is pretty hard in places in New Mexico -- water data can be very sparse.

A. Uh-huh.

Q. But if you had a confined aquifer and it was somehow breached, over time, that would become -- I'm sorry. If you had a confined aquifer and it became breached, over time, that would transition into an unconfined aquifer?

A. It could be -- in relation to what we're talking about here, it may not be a confined aquifer.

It could still be, essentially, an artesian aquifer or something like that. Okay?

Q. But if you open up the seal, basically, it would eventually not be a -- not fit the definition that's in the modified rule of a confined aquifer --

A. For that area, maybe?

Q. -- that's under pressure, essentially?

A. I mean, you could have localized confined aquifers regionally. I mean --

Q. I think everybody else has asked my other questions, and I think we're down to just a couple of people, so I will let you --

A. Good questions. Thanks.

CROSS-EXAMINATION

BY CHAIRPERSON BAILEY:

Q. Given that OCD is charged by the legislature in Statute 70-2-12.3 against contamination -- to prevent against contamination of freshwater supplies designated by the State Engineer and given that the State Engineer has designated freshwater supplies to be anything with less than 10,000 milligrams of TDS, why should this Commission make the distinction between confined and unconfined when we're charged with protection of all freshwater?

A. The basic reasoning in the -- in the

distinction is not necessarily to protect one and not to protect the other. For confined aquifer, you know, we have -- you know, by its definition, that's included herein, is one that is confined both above and below by -- I believe it says -- well, it says "within soil or rock below or above the land surface." But, generally, seeing a confined aquifer, the reason it's confined and may have -- be pressurized is because those barriers are impermeable, or relatively so.

So the fact of what we're looking at here and why we've distinguished them doesn't necessarily, in my opinion, say that we're not protecting one and we are the other. What we're doing is recognizing the distinction and that, from this rule, the confined aquifers are intrinsically protected.

Q. You mentioned the Kansas lined filtration pit.

A. Yeah. The early-1900 thing?

Q. Yes. So you used the term "brine." How is that defined contrasted with seawater?

A. Well, the development -- I mean, one of the other things that I've seen over time and in looking at definitions throughout the country is, one, within many states, there are inconsistencies on the definition of freshwater, brackish water, brine, saline water, and certainly throughout the country.

But in the example of Kansas and the particular infiltration pit that we looked at with the Kansas Corporation Commission, the produced water, at the time of that production, I believe, was in the order of 100- to 150,000-milliliters per liter chlorides. Typically, from --

Q. Let me stop you there.

A. Okay.

Q. What is the commonly used concentration of chlorides that would qualify a fluid to be called brine?

A. It varies, but what typically -- how I think of that is -- in relation to even, you know, brackish or saline is that typically you can look at freshwater being something like up to, say, 4,000 to 6,000 milligrams per liter chlorides. Brackish water may be deemed that, up to 10- to 15,000, and above that, typically, I look at that as saline or brine.

In some areas of the country and even some of the unconventional plays, you get produced water that is relatively fresh. The term "brine" winds up being used, almost, you know, in an oil-field term, a brine disposal well, but may be disposing of relatively freshwater. So I think it's almost analogy to produce water in many ways.

Q. Page 9 -- maybe it wasn't page 9.

Diesel-based fluids with chlorides. Chlorides appears to be the only determinate of the siting requirements, whether or not it's freshwater fluid or hydrocarbon-based drilling fluid. Is that a correct interpretation?

A. So, yeah, low chloride versus other. So if we were looking at -- at -- at something that wasn't a low-chloride solution, it could fit into that other. And I believe that that's why NMOGA chose not to say high-chloride solution, because it could be -- or high-chloride fluid was because it could be an oil-based mud. So that would be treated within a nonlow-chloride solution from a siting and so forth.

Q. Several times you mentioned the context of the netting --

A. Uh-huh.

Q. -- that netting might be really necessary for those pits where oily waste is stored. That immediately throws up a flag. What kind of pits are we storing oily waste in?

A. If you have -- you know, that's -- I guess, just what you see -- you know, if you had an oil-based drilling mud and you were using that in the pit, you'd probably want to have that netted. So I guess that would be my reference. But I suppose my reference, when

I mentioned that, I was thinking to something beyond just the pit rules here, as a general statement. I mean, in some states, you can have waste pits that might be -- might even be oily waste from multiple wells -- but I don't believe you allow that in New Mexico -- and those are always netted.

Q. I needed that clarification.

A. Sorry.

Q. Exhibit 14-22, where you stress the use of vegetation to minimize erosion and exposure from something and to prevent leaching as much as possible. I'll make no secret; I'm a real advocate of revegetation. Everybody here knows that already from previous hearings (laughter).

A. I am, too.

Q. And so I am very glad to see that you are stressing that we need to have the rooting zone of vegetation over these areas free enough of contaminants that we will be able to grow something in these locations.

A. Uh-huh.

Q. And can you confirm that for me?

A. I'm not sure if that's a yes-or-no answer, but I think it is, so, yes. And I believe that's how it's structured so that you would have that. And I think

that -- I agree with you, that that is an important piece of this to avoid erosion. If you probably -- if you feel as you do, that's a key thing and part of that. So I think how these are set up, it accounts for that. I think we'll have a soil scientist, I think, that will probably -- you know, has better expertise than me on the specific subject of revegetation. But I've done an awful lot of that, and if you've got to bring water out there, whatever you've got to do to get things revegetated, it needs to happen.

Q. I look forward to Dr. Buchanan's testimony.

But your portion would be what we need to do to prevent the upward migration --

A. Uh-huh.

Q. -- of any salts --

A. Uh-huh.

Q. -- into the rooting zone?

A. Uh-huh. And I think that the proposed rules addresses that, so you can have vegetation and not be negatively impacted by a closed pit.

CHAIRPERSON BAILEY: That concludes the cross-examination.

Would you like to redirect on the questions that were asked?

MR. HISER: I only have one question,

mostly for clarification.

REDIRECT EXAMINATION

BY MR. HISER:

Q. There was a question from Dr. Neeper about folding of the pit liner, and that was in the Pit Rule. Would you look at page 21, the top of the page. That requirement is there. Do you see that? This would be Attachment A, Exhibit 1, paragraph K(8).

A. Yeah. Yes.

Q. And that's the folding that you referred to?

A. Yes.

MR. HISER: That concludes my redirect, Madam Chair.

CHAIRPERSON BAILEY: Commission, Counsel needs to make a statement.

MR. SMITH: The Commission has taken steps today in order to place notice properly of the continuance of this hearing -- possible continuance of this hearing to -- I think it was June 20th. It may not be inferred from the Commission doing that that the Commission takes the position or acquiesces to the position that that notice is legally required. It is simply being done in an abundance of caution, because it was either submit the notice today or not be able to. So it is merely a matter of covering the Commission's

bases.

CHAIRPERSON BAILEY: Mr. Arthur, you are excused as a witness now, officially.

THE WITNESS: Thank you.

CHAIRPERSON BAILEY: Rulemaking requires that we set aside time for public comment. We allow five minutes per person who signed up. Teresa has a timer to alert everyone to the five minutes. Statements may be made either as sworn or unsworn comments. We do have one person who has signed up: Robb Hirsch.

MR. HIRSCH: Yes. Robb Hirsch.

CHAIRPERSON BAILEY: Can you state your full -- do you want to make a sworn or unsworn statement?

MR. HIRSCH: Sworn is fine.

CHAIRPERSON BAILEY: If you would like to come up and have the court reporter swear you in, and you are subject to cross-examination as a sworn witness.

ROBB HIRSCH,

after having been first duly sworn under oath, testified as follows:

CHAIRPERSON BAILEY: Would you please state your name and place of residence?

MR. HIRSCH: And you prefer me to stand?

CHAIRPERSON BAILEY: Well, you can sit.

MR. HIRSCH: That would be great.

(The court reporter requested a spelling of Mr. Hirsch's name.)

MR. HIRSCH: R-O-B-B, and it's H-I-R-S-C-H.

And I'm sorry, what was your question? You asked me to state my name?

CHAIRPERSON BAILEY: Yes, and place of residence.

MR. HIRSCH: I live in New Mexico, and I appreciate the chance to have public comment.

I represent -- well, I'm a father, first of all, with three kids, I think most importantly in this matter, and then a citizen of New Mexico and someone who works in the wind and solar energy business. But I volunteer my time with and I'm the executive director of and founder of the Climate Change Leadership Institute, which is a New Mexico-based nonprofit, dedicated to clean energy, conservation and climate stewardship.

And let me just quickly say, on the solar and wind energy work, it has nothing to do with my comment here. I think it was suggested that I had some vested interest, and that's entirely not true. In fact, wind and solar energy can complement with natural gas and needs to on transmission lines and with projects to be effective in this day and age. But also, the wind

and solar projects I work with, which happen to have leases which co-exist with natural gas, are for renewable portfolio standard requirements of states.

So, in any event, I just wanted to speak, though, clearly on the behalf of the Climate Change Leadership Institute, and we're collaborating with the Students for a Sustainable Future, along with many citizens from around the state who have enlisted in a joint project calling for cleaner oil and gas development.

And I just wanted to say that it feels like, from this hearing and in general, a false argument to say that the public has to go along with this kind of amendment in order to enable the all-important economic development of oil and gas drilling. And I think that's false, because we can develop oil and gas, and we can do it in a more clean, responsible and cost-effective manner. And I think it's also false to suggest, from the industry, that the industry will vacate New Mexico -- I've heard these suggestions -- if these kinds of rules, like the Pit Rule, are in place as it stands. And I think that's proven to be untrue.

And you look at the case of Colorado, for example, where you have a very real, responsible public disclosure of chemicals used in fracking, where the

industry had warned if those kinds of things were there, they would vacate, and the industry is thriving and doing really well in Colorado.

And the industry has done well and will continue to do well in New Mexico with a sound and effective pit rule, as it currently stands. I think contrasting with Colorado on the matter of the public disclosure of chemicals, New Mexico's disclosure rule for chemicals is very weak and very concerning, and I think it was a public relations effort to actually have that rule enacted in New Mexico, which doesn't call on the industry to do anything really than they have to do already for federal requirements for what they have to disclose. So comparing it to Colorado, I think New Mexico looks, I think, embarrassing, actually, and we should not have passed that.

Anyhow, to continue, I think that it should be clear that the Climate Change Leadership Institute and my comments are not trying to stop oil and gas drilling nor am I trying or are we trying to stop fracking. Quite the contrary, actually. We believe that there should be more responsible and more sustainable and cleaner oil and gas development. And sustainable development is really the key.

And I think that this Pit Rule, as it

stands, is a great example of sustainable development, and it's something we should be proud of.

And I only have one minute, so most of these comments I won't be making, but maybe I can come back another day.

I mean, my question is -- if this is -- it seems like this is going to happen. It seems like the OCD should be objective and nonpartisan, but, unfortunately, I think each administration in power appoints the commissioners, and I think that it's, unfortunately, been in a partisan way. And I think the Commission is likely to go along with this request to amend and/or majorly gut the Pit Rule, and I think that's unfortunate. And I think we should establish an independent commission and an OCD that is objective on the basis of science and on the basis of economic analysis and not on the basis of subjective administration kinds of bents.

And so I think we should very seriously, as a public, and think about if we have kids, that it's important to preserve the Pit Rule to properly contain the waste from oil and gas operations.

And I thank you for your time and consideration.

CHAIRPERSON BAILEY: Are there any

questions of this witness?

MR. FELDEWERT: No.

MS. FOSTER: No.

CHAIRPERSON BAILEY: No questions.

Thank you for your comments.

We will continue this.

(Discussion off the record.)

CHAIRPERSON: That looks like the order. These consolidated cases will be continued until tomorrow morning at 9:00 a.m.

(The hearing recessed, 5:05 p.m.)

STATE OF NEW MEXICO

COUNTY OF BERNALILLO

CERTIFICATE OF COURT REPORTER

I, MARY C. HANKINS, New Mexico Certified Court Reporter No. 20, and Registered Professional Reporter, do hereby certify that I reported the foregoing proceedings in stenographic shorthand and that the foregoing pages are a true and correct transcript of those proceedings that were reduced to printed form by me to the best of my ability.

I FURTHER CERTIFY that the Reporter's Record of the proceedings truly and accurately reflects the exhibits, if any, offered by the respective parties.

I FURTHER CERTIFY that I am neither employed by nor related to any of the parties or attorneys in this case and that I have no interest in the final disposition of this case.

Mary C. Hankins

MARY C. HANKINS, CCR, RPR
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