Transcript of the Testimony of

Dr. Bernard Kueper

November 22, 2022

AUGUST J. LEVERT, JR. FAMILY LLC, ET AL. v. BP AMERICA PRODUCTION COMPANY

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18TH JUDICIAL DISTRICT COURT
PARISH OF ST. MARY
STATE OF LOUISIANA

NO: 78953 DIVISION "A"

AUGUST J. LEVERT, JR. FAMILY LLC, ET AL.
VERSUS
BP AMERICA PRODUCTION COMPANY
* * * * * * * * * * * * * * * * * *

VIDEOTAPED DEPOSITION OF
DR. BERNARD KUEPER
TAKEN VIA VIDEOCONFERENCE
ON TUESDAY, NOVEMBER 22, 2022, AT 9:00 A.M.

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APPEARANCES:

REPRESENTING PLAINTIFFS:
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I N D E X

E X H I B I T I N D E X

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S T I P U L A T I O N

IT IS STIPULATED AND AGREED by and among counsel for the parties hereto that the deposition of the aforementioned witness may be taken for all purposes permitted within the Louisiana Code of Civil Procedure, in accordance with law, pursuant to notice;

That the formalities of reading, signing, sealing, certification and filing are specifically NOT waived;

That all objections, save objections as to the form of the question and responsiveness of the answer, are reserved until such time as this deposition, or any part hereof, is used or sought to be used in evidence.

* * * * * * * * *

ANNA COKER COATES, RPR, CCR, Certified Court Reporter in and for the State of Louisiana, officiated in administering the oath to the witness.

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THE VIDEOGRAPHER: This is the videotaped deposition of Bernard Kueper. This deposition is being held via Zoom on November 22nd, 2022, at the time indicated on the video screen, which is 9:02 a.m.

Would counsel please introduce themselves.

MR. HUDDELL: Kevin Huddell and John Arnold on behalf of the Plaintiffs.

MR. TROUTMAN: John Troutman, Jamie Rhymes, Court VanTassell, and Denice Redd-Robinette on behalf of BP America Production Company.

(WHEREUPON,

DR. BERNARD KUEPER,

AFTER HAVING BEEN FIRST DULY SWORN BY THE ABOVE-MENTIONED COURT REPORTER, DID TESTIFY AS FOLLOWS)

EXAMINATION BY MR. HUDDELL:

Q. Good morning, Dr. Kueper. How are you today?

A. I'm well. And yourself?

Q. Doing fine.

Could you please state your full name for the record?

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A. Yes. Bernard Kueper, K-U-E-P, as in Paul, E-R.

Q. Where do you reside?

A. I live in Kingston Ontario, Canada.

Q. Where are you physically today?

A. In my home office in Kingston.

Q. Okay. How are you currently employed?

A. I'm a professor emeritus at Queen's University here in Kingston. And I also have a consulting company, B. Kueper & Associates, Limited.

Q. What is your role with respect to that company?

A. I own the company --

Q. Do you have any --

A. -- consulting practice.

Q. Do you have any co-owners of the company?

A. No.

MR. HUDDELL: Bill, I'd like to pull up his résumé, which is Tab 9. We'll mark this as Exhibit 1.

(EXHIBIT 1 IDENTIFIED)

EXAMINATION BY MR. HUDDELL:

Q. Dr. Kueper, does this appear to be your

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most recent résumé?

A. It does, yes.

Q. Okay. Within this résumé, do you have a listing of cases in which you've testified?

A. I'm trying to remember if that's part of this document; my résumé, that is. If it is, it will be either page 2 or the last page. I do remember going through and making sure my list of cases was up to date, and provided that to Liskow. So if you go to the very end of the document -- oh, let's see -- be about page 43 or something. I don't know. If it's not there, it's a separate submission. I remember we sent those in to, I think, to Mr. Troutman.

Q. Okay. Let me see if we have that.

MR. TROUTMAN: Kevin, it is a separate submission.

MR. HUDDELL: Oh, okay.

MR. TROUTMAN: It's entitled "List of cases in which Dr. Kueper has testified as an expert at trial or deposition in the last four years."

MR. HUDDELL: Oh, so you were trying to obscure it.

MR. TROUTMAN: Right.

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MR. HUDDELL: We'll try to grab that at a break.

MR. TROUTMAN: Kevin, try Bates Label 139 of Dr. Kueper's production.

MR. HUDDELL: Okay. We'll grab that.

Also, we were trying to find invoices. Were you able to find that?

MR. TROUTMAN: Yes. We'll be circulating those shortly. We're getting those Bates labeled right now.

MR. HUDDELL: Okay, great.

EXAMINATION BY MR. HUDDELL:

Q. When were you first involved in this case; when were you first asked to be involved in this case that we're here for today?

A. I would have to check, but I believe it's on the order of five, six months ago. But I need to verify that if that's super important.

Q. What were you asked to do?

A. To take a look at the data and provide an appendix to HET's report, my opinions regarding viable remediation methods for the site, for the Levert property.

MR. HUDDELL: Okay. I'd like to mark as Exhibit 2 your Appendix L, which I think is

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Tab 7.
(EXHIBIT 2 IDENTIFIED)
EXAMINATION BY MR. HUDDELL:
Q. Does this appear to be a copy of your report for this case?
A. If you scroll down to the next page, please. I just see the cover page, HET appendix cover page.
Yes, there it is. Yes. That's got our signatures on it, sure.
Q. Okay. Now, this is also signed by Dr. West. Who is he?
A. Dr. West is employed by B. Kueper & Associates. He and I have worked together for, I want to say, about 12 years now. So he's an employee.
Q. Okay. Are there any opinions in this report that I should talk to Dr. West about instead of you?
A. I don't think so. He prepared it.
Q. Okay. What did he assist you with?
A. Well, Dr. West takes a look, initial look, at the data. He and I talk about it. And sometimes he does initial draft of paragraphs and documents, and then I edit and review. So we work

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closely together on these types of things.
Q. Were you involved in the Iberville Parish School Board case?
A. No.
MR. HUDDELL: Okay. Let's go to PDF page 3, Bill, of the report.
EXAMINATION BY MR. HUDDELL:
Q. And in particular, in the middle of the second paragraph, you write, "Laboratory measured vertical hydraulic conductivities in clay ranged from 4.0 times 10 to the negative 8 centimeters per second to 1.4 times 10 to the negative 7 centimeters per second at the IPSB property." And you reference HET 2016, correct?
A. Correct.
Q. Do you know how those conductivities were calculated?
A. I believe they were measured in the lab. So HET went up there, and they took some soil core. And then they preserved the core, and then they would send it to -- we've got the lab report. I don't know if it was Cooley or who it was, but there was a lab that they used. So they're intact samples, and those are measured by a lab.
Q. Okay. And so based on that, I believe,

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you then write, geometric mean horizontal -- no, okay. So that's vertical hydraulic conductivity.
The next sentence is, "Geometric mean horizontal hydraulic conductivities were derived from slug tests in monitoring wells screened across predominantly silty layers on the IPSB property, and ranged from 4.6 times 10 to the negative 5 centimeters per second to 1.4 times 10 to the negative 4 centimeters per second."
Is that right?
A. That's correct.
Q. Okay. And so how are those values calculated?
A. Those are calculated based on slug tests, as mentioned in this sentence. So a slug test is where you either add water or remove water from a monitoring well, and then you allow the water level inside the well to recover with time. And that rate of recovery can be used to calculate the hydraulic conductivity of the geologic materials that are screened across that -- or that are across the screen of that monitoring well.
Q. The slug test that ICON performed, were those performed on the IPSB property or on the Levert property?

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A. The IPSB property.
Q. Okay. And so when you look at the vertical hydraulic conductivity versus the horizontal conductivity, does that tell you anything about the groundwater flow?
A. Well, first of all, the vertical hydraulic conductivities that we talked about in the previous sentence, those were from clay samples. So I would expect those numbers to be lower than the slug test values, because the slug test values were done in monitoring wells screened across predominantly silty layers. So they're a couple of magnitude -- two orders of magnitude higher, which is completely expected.
Overall, these two sets of numbers, the clay and the silt hydraulic conductivities, tell me that this is a low hydraulic conductivity geologic setting, which is completely consistent with the boring logs; in other words, silts and clays don't have a lot of conductivity, and that tells me that the groundwater is not going to flow very fast through those materials.
Q. So you write, "Groundwater elevation contour maps prepared by ICON and HET indicate that the direction of the shallow groundwater flow

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is variable with a horizontal component of hydraulic gradient of approximately .005 or less."
Is that right?
A. That's correct.
Q. That gradient, that's a unitless measurement; is that right?
A. Correct.
Q. Okay. Then you write, "The shallow groundwater velocity at the site is estimated to be approximately 2.4 feet per year or less," correct?
A. Yes.
Q. And how did you come up with that value of 2.4 feet per year?
A. That is what's known as Darcy's law, the well-established empirical relationship within the groundwater profession. And Darcy's law utilizes hydraulic conductivity as an input parameter, and it also utilizes the hydraulic gradient of 0.005 as the -- an input parameter. Pardon me.
Q. Okay. Is that a directionless measurement, the 2.4 feet per year?
A. No. You would use those hydraulic conductivity values from the slug test, and then you'd say, okay, my hydraulic gradient is

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unitless, but it does have direction. So you would say the 005 was in that direction, in that direction, as well, and that's the direction that you get the 2.4 feet per year from. This calculation is an overall typical value for this geologic environment.
Q. Okay. So what is the direction of the 2.4 feet per year?
A. It would be whatever the direction of the gradient is. And that you get from the groundwater elevation contour maps that are mentioned at the beginning of the previous sentence.
Q. Well, and as you said in the previous sentence, that direction is variable, correct?
A. Correct. Yes.
Q. Okay. So it sometimes is going to be flowing one direction, and sometimes another direction, right?
A. I thought you -- okay. What you just touched on is that the direction might vary in time. I thought we were talking about direction spatially. So on one part of the site it may be flowing in that direction, another part of the site a different direction. But you're right, it

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can also vary in time, as well as spatially.
Q. Okay. So for some months of the year, it could be traveling west at that 2.4 feet per year rate. But then some other months of the year, it might start traveling east 2.4 feet per year?
A. Well, that's hypothetical, right, the way you asked that question. We have to go look at the groundwater elevation maps to make this a site-specific conversation, if you want.
Q. Well, just conceptually, when you say that the flow is variable, you're talking about the direction of the flow, right?
A. Correct. Yes, that's right.
Q. All right. So it can be going one direction at a certain rate, and then it can -- or at the rate that you suggested, and then it could go the opposite direction at the same rate; is that right?
A. Well, again, I'm not sure about the word "opposite," but it can go -- the groundwater overall could be flowing in a particular direction on a portion of the site. And on a different portion of the site, the groundwater may be flowing a different direction. In other words,

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when I say that it's variable, I didn't mean it moves that way one day, and then it moves the opposite way the next day. That's not the intent of that sentence.
Q. Well, seasonally, based on, for example, the flood or drop conditions of the Atchafalaya Basin, correct?
A. Well, like I said, the groundwater flow direction at a particular location can vary -- the direction of it can vary in time. At the same -- I don't want to say the word "time" again, but I will. At the same time, you know, for a given point in time, given day of the year, month, season, at two different locations on the site, you could have different flow directions, groundwater flow directions.
Q. Okay. Is it important to any of your opinions in this case the direction of the groundwater flow?
A. As a hydrogeologist, direction of groundwater flow is usually important, yes. My main opinion, as you know, in this appendix is suitability of monitored natural attenuation as a strategy for this site. And that does not -- the use of MNA is not dependent on groundwater flow

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direction.
Q. Okay. The use of MNA is not dependent; is that what you said?
A. That's what I said, yes, that's right.
Q. Is not dependent on groundwater flow direction?
A. MNA can work in any direction, that's right.
Q. I'm trying to remember from physics. Is velocity, is the term "velocity," is that -- what is it; vector, is that a vectorless term, or does it require direction?
A. It's a vector, yes.
Q. Okay. So it requires direction, right?
A. That's right.
Q. Okay.
A. It doesn't require direction; it is in a certain direction.
Q. Okay. And in this case, you've determined that the direction is variable, correct?
A. It can be, yes.
Q. Well, at this particular site, it is variable or it's not, right?
MR. TROUTMAN: Object to form.

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THE WITNESS: Are you referring to the Levert site or the IPSB site?
EXAMINATION BY MR. HUDDELL:
Q. Well, let's start with the Levert site.
A. Okay. We don't have water level data for the Levert site.
Q. Okay. So does that mean we don't know the velocity of the groundwater at the Levert site?
A. I think it's pretty -- very reasonable to assume that the velocities are going to be much the same at Levert as IPSB. I mean, those sites are right next to each other. The geology is very, very similar. I'd be shocked if there was a difference in groundwater flow conditions on Levert compared to IPSB.
Q. Okay. So you're assuming that -- and you explained why, but you're assuming that the velocity on the Levert site will be the same as the velocity on the IPSB site, correct?
A. Yes. Very similar, if not the same.
Q. Okay. So then what is the direction of flow on the IPSB site?
A. Well, it varies, like we've been talking about.

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Q. Okay. So it is variable on the IPSB site, the groundwater flow direction, correct?
A. Correct.
Q. Okay. So you said the use of MNA is not dependent on the groundwater flow direction. Is it a factor in some way with respect to the propriety of using MNA?
A. What do you mean by "propriety of using MNA?" If I could just --
Q. Does the groundwater flow direction have any -- let me restate that.
Is the groundwater flow direction a factor in determining whether MNA is an appropriate methodology?
MR. TROUTMAN: Object to form.
THE WITNESS: Not for Levert site, no. I say that because groundwater is moving extremely slowly and really not going anywhere, so to speak. I can say that.
MR. HUDDELL: Bill, can we pull up Tab 4. Tab 4 is the figures for -- it's Appendix B. These are your figures. And I wanted to go to figure 16 -- I'm sorry, figure 17, which is on PDF page 18.
THE WITNESS: I've got it open on my

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screen. It's identical to what you're showing.
MR. HUDDELL: Okay. I can't remember what exhibit we're on. Is this Exhibit 4?
THE VIDEOGRAPHER: I'm at 3.
MR. HUDDELL: So Exhibit 3 will be the Appendix B figures.
(EXHIBIT 3 IDENTIFIED)
EXAMINATION BY MR. HUDDELL:
Q. Is this one of the things you would have looked at in coming up with any of your opinions in this case?
A. Definitely looked at it.
Q. You looked at it, all right.
A. I'm thinking -- pardon me for interrupting. It's a figure like this where we would have gotten the hydraulic gradient from, which then leads to a groundwater velocity.
Q. Okay. And so this is, I guess, a snapshot in time, right, October 13, 2015; is that right?
A. Yes. I had to look at the date.
Q. So what's this show us with respect to groundwater velocity and hydraulic gradient?
A. Okay. So the hydraulic gradient, you

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would take the difference in the magnitude of these contours, divide by the distance between the contours, gets you the hydraulic gradient.
Q. Okay. So based on this potentiometric map and the hydraulic gradient, you -- what would you say is the groundwater velocity?
A. Well, we took the gradient, based on a map like this, multiplied it by hydraulic conductivity. And then you also have to divide all that, that product, by the porosity to get your velocity. That, in its entirety, is Darcy's law. So without a hydraulic gradient map, you'd have to estimate -- sorry, without a groundwater elevation map, you would have to estimate the hydraulic gradient. But here we have measured values.
Q. Okay. Your report says that the shallow groundwater velocity at the site is estimated to be approximately 2.4 feet per year or less, right?
A. Correct.
Q. If we looked at the -- what would you say is the direction, since velocity requires a direction component, what's the direction of the groundwater flow at this site?
MR. TROUTMAN: Object to form.

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THE WITNESS: You're asking about the Levert site, I take it?
EXAMINATION BY MR. HUDDELL:
Q. Well, let's start with the Levert site.
A. Okay. It would be to the west.
Q. Okay. And there's also, I guess -- what if we -- is it also to the south, if we moved -- if we looked at the groundwater in the northern most part of that gradient on the Levert property, we would have -- and we were right on the property boundary, it would be to the south; is that right?
A. If we're on the western property boundary of the Levert site in the northern part, it would be to the south, that's right. Then as you work your way more eastward, the flow becomes completely west, and then you can see a mirror of that on the IPSB property.
Q. Okay. So then on the IPSB property, the predominant flow direction is to the east probably?
A. Yes, I would say east. And as you go north on that property, as you can see, it's more of a southeast component to it.
Q. Okay. So the direction component of the groundwater velocity is different from the Levert

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property to the IPSB property; is that fair?
A. Based on this date, yes.
Q. Okay. Would you expect that the groundwater between monitoring wells MW4 and MW5 would actually not be moving at 2.4 feet per year; that it would be moving slower than the further, you know, east or west of those locations?
A. I have to go back and check that. I mean, we have values of hydraulic head at both 4 and 5. You could calculate a gradient based on those two posted numbers. I don't know what it would be. Again, the 2.4 feet per year velocity is a typical value for these sites.
Q. But in between MW4 and MW5, it seems like the water is probably going to be pretty much standing still, right?
A. There would be a very small component of flow. I would expect it to be pretty weak, though, based on this date.
Q. Right. Is there anything other than groundwater flow that would impact -- not impact. Let me restate that.
Is there anything other than groundwater flow -- okay, let me try one more time.
Is there anything other than groundwater

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velocity that would affect whether the chemical constituents found in the groundwater are migrating one direction or the other?
MR. TROUTMAN: Object to form.
THE WITNESS: Did you start that with "other than the velocity;" was that your question?
EXAMINATION BY MR. HUDDELL:
Q. Yes. Is there something other than the velocity of the groundwater itself that would factor into the potential for contaminants to move in the groundwater?
MR. TROUTMAN: Object to form.
THE WITNESS: In general, constituents in groundwater will move in the direction of the groundwater velocity. And depending on what the constituent is, there can be processes other than velocity that dictate how quickly it moves.
EXAMINATION BY MR. HUDDELL:
Q. Okay. So for example, chlorides, if we were finding chlorides at 12,000 milligrams per liter at MW4, with this sort of potentiometric regime, would you expect there to be movement of chlorides to the east and west?

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MR. TROUTMAN: Object to the form.
THE WITNESS: So are you saying that if there's chloride at MW4, you're asking me on October 13th, 2015, on that particular day, were they moving south?
Yes. There would also be other components of flow, but, in general, there's a southerly component of flow there.
EXAMINATION BY MR. HUDDELL:
Q. Okay. What are the other components of flow?
A. You're asking about October 13th, 2015?
Q. Yes.
A. Well, predominantly to the south, based on these data. If you want to talk about, you know, the overall chloride impacts in that general area, then you can see that there are other directions, as well. But just specifically between 4 and 5, looking at those water levels, one is minus .24 feet, one is minus .28 feet elevation, you see that there's a driving force to the south on that date.
Q. A very slight driving force to the south?
A. Whatever that grading works out to be.

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I don't have it memorized, you know.
Q. Okay. So if the groundwater is not moving at all, you're still going to have dispersion of chlorides, right?
A. Diffusion.
Q. Diffusion?
A. Yes.
Q. I get those very confused. So what is dispersion, and what's diffusion?
A. Okay. Dispersion is a mixing mechanism -- mechanical dispersion -- let's start there -- is a mixing mechanism that occurs whenever advection occurs. So if the groundwater moves, there's going to be pore-scale velocity variations. And that's called mechanic dispersion. It leads to dilution.
Diffusion is in response to a concentration gradient. Diffusion will occur whether there's a velocity or not. The velocity can be zero, you'll still have diffusion occurring. And then mathematically, mechanical dispersion plus diffusion, we call that hydrodynamic dispersion. So diffusion is actually a subcomponent of dispersion.
Q. Diffusion is a subcomponent of

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dispersion?
A. That's how -- that's right. That's how we quantify it in hydrogeology. That's correct.
They're separate processes in a way, because dispersion, most people think of the mechanical part. And then diffusion is this other thing, but you lump them together mathematically when you deal with anything quantitatively.
Q. You lump them together into what category?
A. The hydrodynamic dispersion coefficient.
Q. Did you calculate the hydrodynamic dispersion coefficient at the IPSB property or the Levert property?
A. I did not.
Q. Okay. How would you go about calculating that?
A. Well, I think the important thing here is that this is, I would say, a diffusion-dominated environment. As we've been talking, groundwater velocity is slow. So I think diffusion into the clays is a very dominant process acting on the chlorides at this site.
Q. So at this site, diffusion is the dominant -- what did you say?

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A. Mechanism controlling the fate of chlorides; mechanism.
There would be portions, you know, there might be a silt lands here or there where advection is more important. But overall, this is a very slow-moving groundwater regime with a lot of diffusion going on.
Q. Okay. That other word you were using, did you say "advection?"
A. Yes. Okay, pardon me. I shouldn't have introduced a new term without defining it. So advection, think of that as the same as groundwater velocity. In other words, the groundwater moves. Whatever is dissolved in the groundwater moves, also. That's advection, that water rate at the velocity.
Q. Okay. So with respect to diffusion, since it's the dominant mechanism, how much movement of chlorides would you expect along this property boundary, the western part boundary of the Levert property between MW4 and MW5?
A. You're asking about October 13th, 2015?
Q. Yes.
A. I haven't calculated that. It will be slow.

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Q. Okay. It would be faster than the groundwater velocity, though?
A. I haven't done that calculation.
Q. Okay. So do we know how far chlorides at MW4 would travel to the east in sort of, you know, feet per year, like you did with groundwater velocity?
A. On this particular date, they're moving from MW4, if you want to pinpoint that as the starting point, these data indicate that they'd be moving to the south by advection and in all directions by diffusion.
Q. Okay. And the diffusion in all directions, how fast is that?
A. I didn't calculate that.
Q. Is that something that can be calculated?
A. You could estimate it. I'm not sure we need to do that here. I don't need to do that to support my opinions, put it that way.
Q. Okay. Well, what I'm getting at is, if we found chlorides at MW4, let's say at about 12,000 milligrams per liter, we could expect that those chlorides are going to be moving to the east onto the Levert property at some rate based on

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diffusion being the primary mechanism controlling the fate of chlorides here, right?
MR. TROUTMAN: Object to form.
THE WITNESS: Given the figure that we're looking at, there would be diffusive movement -- well, not based on this figure, but there will be diffusive movement of chloride in all directions. And, of course, as that chlorides move, you know, the concentrations are reduced. Diffusion as a dispersion is an attenuation mechanism.
EXAMINATION BY MR. HUDDELL:
Q. So again, assuming that we had about 12,000 milligrams per liter of chlorides at MW4, how long would it take for those chlorides to drop down to 250 milligrams per liter?
A. Due to natural attenuation processes, like dispersion and diffusion, it would be on the order of decades.
Q. Okay. Is that a calculation you've made in this case?
A. I did not do that.
Q. Are you capable of doing that calculation?
A. I don't think we -- I could do it, but I

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don't think we need it. I mean, one thing we know for sure is that concentrations are going to continue to decline in groundwater, because our sources have been removed, right. It's no longer operating and also pit closure going on. Excuse me. So concentrations will continuously decline. And given it's a diffusion-dominated environment, yes, it will be on the order of decades.
Q. Okay. Well, what would you need to do that calculation?
A. Well, again, I don't think we need it. But if I had to do it, I would need a diffusion coefficient, which you can calculate.
Q. Okay. You'd need a diffusion coefficient to calculate, okay. What else would you need?
A. You'd need your starting concentration, which in your question was 12,000. But again, I always come back to, you know, you don't need to do that for this site.
Q. Okay. Starting concentration, and then what else would you need?
A. That would be basically it.
Q. Okay. So what would we need to determine the diffusion coefficient?

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A. Well, you'd want literature, and you would estimate the diffusion coefficient given the molecular weight of chloride and a couple other things that are easy to look up for chloride.
Q. Anything else you would need?
A. For the diffusion coefficient, you'd need the tortuosity of the porous medium. But again, that can be estimated.
Q. What was that word, the what of the --
A. Tortuosity.
Q. How do you spell that?
A. T-O-R-T-U-O-S-I-T-Y.
Q. Is that a site-specific parameter?
A. You can estimate it given knowledge of the geology. So, you know, for clays and silts, you can make an estimate as to what it is.
Q. Okay. Anything else we would need to determine diffusion coefficient?
A. No.
Q. Do you have any opinions as to the source of the chlorides that have been found in limited admission area 1?
A. They would have come from the IPSB property, that pit that's since has been closed over there.

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Q. What mechanism brought the chlorides from the IPSB property to the Levert property and limited admission area 1?
A. It would have been advection; in other words, the velocity, which back when those pits were operating, would have been much higher than it is here in October 2015.
Q. Can you explain what you're referring to about using the pits, how that affects the movement of chlorides?
A. Sure. Yes. The pits have fluids going into them, and that creates a hydraulic mound, which increases the hydraulic gradient and pushes the chlorides faster than they're moving today.
Q. Do you know when the large pit on the IPSB property was no longer used?
MR. TROUTMAN: Object to form.
THE WITNESS: The pit on the IPSB property that I think we're talking about, I remember reading that. I think it's in the HET report, may be in the ICON report, as well. I don't want to speculate when it was no longer operating. I remember reading the numbers the other day, but I don't want to speculate.

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MR. HUDDELL: Can we go to figure 8 of Exhibit 3, Bill.
THE WITNESS: That's the 1987 aerial photo; is that right?
MR. HUDDELL: Yes.
THE VIDEOGRAPHER: Kevin, what PDF number is that?
MR. HUDDELL: Tab 4. It's PDF page 9.
EXAMINATION BY MR. HUDDELL:
Q. All right. Do you see this, Dr. Kueper?
A. I see -- let me just flip back to the Zoom meeting, make sure. Just a little better focused on my screen.
Q. Sure.
A. Yes, same one up.
Q. Okay. So I think what you're referring to as this pit feature on the left side of the '87 aerial photo; is that right?
A. Yes. I was just on my screen. Did you point to it? I can't see a pointer.
Q. No, I didn't point to it.
A. Oh, okay.
Q. Let's see.
THE VIDEOGRAPHER: Is this it, Kevin?
MR. HUDDELL: Sure. Do you see where it

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says "LT-1" there, Bill? And then there's a pit just to the, I guess, northwest of that.
EXAMINATION BY MR. HUDDELL:
Q. So anyway, there what he's outlined in black, is that the pit you're referring to that had the hydraulic head?
A. That's my understanding, yes.
Q. Okay. All right. So back when that pit was in use, you had additional mechanisms that would have forced the chlorides to move to the Levert property; is that right?
A. You would have had that hydraulic loading that I was talking about; in other words, it would be a stronger hydraulic gradient to the east than what we have today.
Q. Okay. And do you know how long then it would have taken for the chlorides to move onto the Levert property back when that pit was operating?
A. I didn't do that calculation.
Q. What would you need to do that calculation?
A. You'd need to know the fluid level in the pit, and you'd have to know the density of the chloride solution, the brine that's leaking out of

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the pit.
Q. Do you know the chloride content of the produced water that was put into that pit?
A. I do not. I did not look that up. I'm not even sure it's available. Probably is somewhere, but I don't recall reading that, no.
Q. Do you know generally what the chloride content is of produced water?
A. Well, it's in the many tens of thousands of milligrams per liter.
Q. So if we're finding chlorides of 12,400 milligrams per liter at LT-1, are you able -- does that help you figure out how long it would have been before those chlorides got there?
MR. TROUTMAN: Object to form.
THE WITNESS: Just knowing the concentration of chlorides at LT-1 does not tell me how long it took for them to get there. But that number is a lot lower than typical produced water, chloride content.
EXAMINATION BY MR. HUDDELL:
Q. Okay. Let's talk about monitored natural attenuation.
THE WITNESS: Kevin, it's been an hour. Could we take a short bio break now, since

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you're switching topics now?
MR. HUDDELL: Sure, absolutely. 10 minutes?
THE VIDEOGRAPHER: We're going off the record, it's 9:58 a.m.
(RECESS 9:58-10:12 A.M.)
THE VIDEOGRAPHER: Back on the record, it's 10:12 a.m.
EXAMINATION BY MR. HUDDELL:
Q. All right. Dr. Kueper, can you tell us what monitored natural attenuation is, or MNA?
A. Sure. Monitored natural attenuation, we'll call it MNA as you suggest, is a remediation strategy whereby natural processes attenuate; in other words, lower the concentrations of constituents over time.
Q. Okay. So what documents or what literature are you relying on to support your opinions with respect to MNA?
A. The two primary ones -- I'm just flipping on my other screen here to my appendix, and it's EPA 1999 document, I believe. Where is that? We would have produced it. Just give me a second here.
Yes. U.S. EPA April 1999, Use of Monitored

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Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, OSWER Directive 9200.4-17P, as in Peter.
Then RECAP also discusses -- RECAP 2003 document discusses MNA, as well. And there are other MNA documents out there, as accepted remedy at certain sites. Been around for quite a while.
Q. Okay. Did you follow RECAP -- did you look at RECAP before you wrote your opinions in this case?
A. Yes.
MR. HUDDELL: Okay. So, Bill, let's pull up Tab 13, which is the RECAP document. We'll mark that as Exhibit 4.
(EXHIBIT 4 IDENTIFIED)
EXAMINATION BY MR. HUDDELL:
Q. All right. So this is the Louisiana RECAP document. My understanding is it discusses monitored natural attenuation in Section 2.16; is that right?
A. That sounds familiar.
MR. HUDDELL: Okay. And, Bill, that is at PDF page 79.
EXAMINATION BY MR. HUDDELL:
Q. Okay. And so for this case, one of our

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primary constituents is chlorides, correct?
A. Correct.
Q. And so with respect to chlorides, your use of monitored natural attenuation would be simply to put in monitoring wells and look at the chlorides, right?
A. Well, for chloride, you would put in monitoring wells, as proposed in the HET plan, and monitor them and look at the data and move forward.
Q. All right. How long would you monitor the chlorides?
A. Well, HET has proposed one year with quarterly sampling in that year. And HET makes the argument in their report that there's no adverse risk at this site. So you start with one year, and then LDNR can decide maybe they want another year. I don't know. Maybe they want a few more years. Maybe they'll decrease the frequency. You start with one year quarterly and see where you're at with the data.
Q. Well, in your experience, monitored natural attenuation requires at least three years of monitoring, right?
A. I've written that for other cases, yes,

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other sites, other reports. I think what -- you know, a lot of these sites are somewhat similar in Louisiana in that you get this very low permeability, you know, upper geology. And for this particular site, given the low hydraulic conductivity, the low groundwater velocity that we talked about before the break -- and lack of receptors, which is really key.
Now, I'm not a risk assessor, but I read the HET report. And where you have a situation like this with no receptors being impacted and not expected to be in the future, you start with quarterly per year and see where you're at. That's for LDNR to decide.
Q. All right. So under RECAP, it says that MNA should be evaluated and compared to other remedial processes to determine which is the most appropriate process for a site, right?
A. I see that on my version here, that sentence, yes. It, meaning MNA, yes.
Q. Yes. As with any remedial process, monitored natural attenuation should be selected only where it can meet all other remedial goals for this site and where it can obtain those goals in an appropriate timeframe, correct?

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A. I see that sentence, yes.
Q. All right. Do you agree with that?
MR. TROUTMAN: Object to form.
THE WITNESS: I think that MNA is appropriate for this site. Remember, this is RECAP. And where it can obtain those goals in an appropriate timeframe, yes, I agree with that, sure.
EXAMINATION BY MR. HUDDELL:
Q. Okay. So this is Department of Environmental Quality, in their RECAP document, saying that it should be selected -- MNA should be selected only where it can meet all of the remedial goals for the site and where it can obtain those goals in an appropriate timeframe, right?
A. I see that, yes.
Q. Okay. Do you strongly agree with that?
MR. TROUTMAN: Object to form.
THE WITNESS: I agree with that sentence, let's put it that way.
EXAMINATION BY MR. HUDDELL:
Q. Okay. But you don't strongly agree with it?
MR. TROUTMAN: Object to form.

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THE WITNESS: I can't comment on your definition of strongly versus mine, but I don't object to that sentence. Does that help?
EXAMINATION BY MR. HUDDELL:
Q. Okay. You don't object to it?
A. Right.
Q. So what are the remedial goals for the groundwater at the site?
A. Well, if you look at the HET report, they calculated a dilution attenuation factor. That value, I think it was 440. And multiply that by the secondary -- EPA secondary drinking water standard for chloride was 250 milligrams per liter, which I think is also the -- leave it at that. Then you multiply those two numbers together, and you get 110,000. So HET is proposing 110,000 milligrams per liter as the acceptable concentration of chloride in groundwater. And we -- not we. But the site does not exceed 110,000 milligrams per liter.
Q. Okay.
A. Now --
Q. Go ahead. I'm sorry.
A. Yes. I mean, if you want to -- the

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other way -- not the other way -- yes, the other way I think of it is, MNA, would it get you to whatever your clean-up goal is, whether it's how you want to calculate it or whatever the number is. I don't see pump and treat being appreciably faster, if at all, than MNA. And that was a key thing in my thinking. I read the ICON plan. And given that this is a diffusion-dominated environment, I just don't see a lot of difference between pump and treat and MNA in terms of the timescale to get to whatever number you're trying to get down to.
Q. Well, Dr. Kueper, what remedial goal did you have in mind when you recommended MNA?
A. Well, like I just said, whatever number DNR decides on, you know, pump and treat and MNA are going to be about the same timescale to get there. I looked at 124 milligrams per liter, which is the ICON background number. I looked at 250 milligrams per liter. And then like we just talked about, there's the HET point that with a DAF applied, you don't exceed the goal at all right now for chloride in groundwater.
Q. That was 110,000 milligrams per liter?
A. I think so. Let me get my calculator

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here.
Yes, that's right, 110,000.
Q. Okay. So you looked at 124 milligrams per liter. You looked at 250 milligrams per liter, and you looked at 110 milligrams per liter?
A. 110,000 milligrams per liter.
Q. Right. And what do you mean you looked at them; what analysis did you do?
A. Well, like I said, I read, you know, where those three numbers come from. And it's clear to me that MNA is going to ultimately, it will get you there. The site is not above the 110,000 currently; therefore, won't be in the future, because the entire chloride distribution is in declining condition, declining concentration condition going forward in time. So whether you want to get to 124 or 250, MNA is going to be on the same order timescale as pump and treat, because it's a diffusion-dominated environment. You got back diffusion that's going to occur.
Q. What's back diffusion?
A. Okay. So these chlorides were introduced to the groundwater system. And when concentrations were, you know, high in the silts -- and high is a term, you know, it's

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qualitative -- but basically higher in the silts than the surrounding clays, you get diffusion into the clay. That's called forward diffusion. And then with time -- and it's already occurring now, in my opinion -- concentrations of chloride in the silts are going down because of dispersion and diffusion and because the pits are no longer operating.

So what happens when the chloride concentrations in the silts end up lower than in the adjacent clays, now that the concentration gradient is reversed, you now get diffusion out of the clay back into the silt. And that will be the ultimate time-limiting factor at this site. And that back diffusion is going to dictate the timescale for both MNA and for pump and treat. That's really the point there, is both those approaches are subject to this back diffusion process. Therefore, pump and treat is not appreciably faster, if at all, than MNA.

Q. You did not calculate time it would take for MNA to reach 250 milligrams per liter, did you?

A. No, I did not.

Q. You could have done that, right?

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A. Possibly. I didn't feel the need to. I'd have to think that through. But again, it's a back diffusion-dominated environment. Concentrations are declining now. So pump and treat is going to be subject to this back diffusion limitation, as will MNA. So therefore, there's not, you know, a big difference in those two technologies. So I selected MNA, in my opinion.

Q. You didn't determine the time it would take to reach 124 milligrams per liter with MNA, correct?

A. I didn't feel a need to determine that time. I did not do that. And again, I come back to what I said in the previous answer: I don't see a difference, an appreciable difference, in the time for MNA and pump and treat to reach a specified concentration in groundwater.

Q. You don't see an appreciable difference, but you didn't actually calculate that difference, correct?

MR. TROUTMAN: Object to form.

THE WITNESS: That's correct. I did not calculate it -- sorry, John, did you say something?

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MR. TROUTMAN: No. I just said, object to form. You can answer the question if you can.

THE WITNESS: All right. Thank you. I didn't feel the need -- repeat the question, please.

EXAMINATION BY MR. HUDDELL:

Q. You don't see an appreciable difference in timeframe between MNA and pump and treat; yet, you did not calculate the timeframe under MNA, correct?

A. I did not calculate the timeframe because I didn't need to. Diffusion affects both pump and treat and MNA. I know, you know, based on my experience and many years working with diffusion, forward diffusion, back diffusion, things like that, that it is a dominant process going forward at this site. There's no need to do a calculation to know that ultimately MNA will get you wherever you want to be in terms of a concentration. And that's going to be the same with pump and treat. It's going to be a back diffusion-limited process. I don't need to do calculations to make that statement.

Q. The next sentence on page 69 says, "An

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appropriate timeframe is one that is reasonable compared to that offered by other remedial methods. To ensure that the timeframe estimates are comparable, the assumptions used in each treatment proposal evaluated are to be consistent."

Do you see that?

A. I do, yes.

Q. All right. And here, though, again, you didn't do a timeframe estimate for MNA, correct?

A. The sentence doesn't tell you to do that. It just says, the assumption should be consistent. And I'm concluding that back diffusion is going to affect pump and treat as it will MNA. Therefore, there's no appreciable difference in timescales.

Q. Unless otherwise approved by the Department, the criteria presented in Sections 2.16.1 --

MR. TROUTMAN: Can you scroll down?

MR. HUDDELL: I'm sorry, what?

MR. TROUTMAN: Can we scroll down?

MR. HUDDELL: Oh. Bill, can you put both pages?

THE WITNESS: I've got my version open

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on my other screen.
EXAMINATION BY MR. HUDDELL:
Q. Okay. So "Unless otherwise approved by the Department, the criteria presented in Sections 2.16.1, .2 and .3 should be followed for monitored natural attenuation plans submitted to the Department," right?
A. I see that, yes.
Q. 2.16.1, Evidence to Support Monitored Natural Attenuation says, "Monitored natural attenuation of constituents of concern impacting soil and/or groundwater may be allowed as a remedial alternative when it has been demonstrated to the Department that the constituent of concern under site-specific conditions will naturally attenuate to the appropriate RECAP standard without causing adverse impacts."
Is that right?
A. That's what that says, yes.
Q. "Department requirements for a monitored natural attenuation program shall include adequate evidence to support a determination that:" And then it lists five things, right?
A. Correct.
Q. Number 1 is that, "All sources of

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constituents of concern have been controlled and NAPL has been removed/controlled to the extent of technical practicability," right?
A. I see that.
Q. Number 2, "The plume has reached declining conditions and the area of constituent concentrations above screening standard is not expanding."
Is that right?
A. I see that, yes.
Q. So what have we done to show that the plume has reached declining conditions?
A. Well, produced water has relatively high concentrations of chloride. And the highest number, I think you mentioned it, was 12,400 or something on that order in a particular monitoring well. Those numbers are going to keep going down. Those concentrations is what I mean by numbers. Because going back to point 1 above, the sources have been controlled; in other words, the pits have been closed or are going to be closed. And even more important, they just haven't been used for a long time.
So your sources are gone. And now you've got this chloride plume, which is going down, down,

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down, down in concentration and will continue to do so going forward in time. And that gets us to point 2, which is reach declining conditions. It has to have, because there's no more brine feeding the system.
Q. Now, you don't know whether the area of constituent concentrations is expanding or declining at the Levert property, right?
MR. TROUTMAN: Object to form.
THE WITNESS: The chloride distribution at the Levert property, I'd be shocked if it was expanding at any appreciable rate. Are there a couple molecules moving? Maybe. But you got to remember, the sources have been removed. So the whole plume is in a declining condition; in other words, concentrations are going down in time. And that's why you monitor, as part of monitored natural attenuation. You can actually measure those concentrations as a function of time to verify that.
EXAMINATION BY MR. HUDDELL:
Q. Okay. So you haven't verified it yet, right?
You suspect it based on the source having

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been removed, but you've not yet verified constituent concentrations are declining, correct?
MR. TROUTMAN: Object to form.
THE WITNESS: I am using my experience in 32 years of research in this area to give an opinion that the concentrations are declining in time, because, like I said, the source has been removed. No more loading to the ponds or the lagoons -- pardon me, the pits. Three different sites in my head. So yes, it's in my opinion we're in a declining condition right now.
EXAMINATION BY MR. HUDDELL:
Q. Okay. But we have no data to support that yet; that's something that would have come after you did some amount of monitoring, right?
MR. TROUTMAN: Object to form.
THE WITNESS: Well, it's my opinion that the chloride concentrations are going down in time. If LDNR would like some monitoring data to support that, then that's fine, they can ask for that.
EXAMINATION BY MR. HUDDELL:
Q. Okay. Do you have a recommended timeframe for the monitoring that would occur

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during -- for your MNA?
A. Well, I agree with the four quarters for one year, and then let's see where we are. At the same time having said that, LDNR may not require any monitoring. So I think we have to see what LDNR are going to say. But starting quarterly for one year, I think that's the right place to start. And if LDNR recommends going further out in time, then I'm fine with that.
Q. Is there -- well, if 110,000 milligrams per liter is chosen as a remedial goal, you wouldn't need the monitored natural attenuation at all, would you?
A. That's correct.
Q. Okay. So Number 3, "Constituents are susceptible to natural degradation processes," right?
A. I see that, yes.
Q. Okay. Would you agree that chlorides are not susceptible to natural degradation processes?
A. Chlorides are not susceptible to degradation. I don't know -- if 3 means is the constituents susceptible to concentrations going down, yes, chloride concentrations will go down

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because of dispersion and diffusion. But there are no biodegradation, for example, processes or hydrolysis processes acting on chloride.
Q. So if we had organics, for example, we would expect there to be some natural degradation process, right?
A. Depending on the organic. Some require aerobic environment; some require an anaerobic environment. So you can't just say blanket that all organics degrade. But all will under a certain geochemical regime, yes.
Q. Okay. But we know that chlorides are not susceptible to natural degradation processes, correct?
A. Right. Degradation does not imply concentration reduction. In other words, chloride does not get destroyed; it just goes down in concentration.
Q. Okay. Number 4, "Constituent concentrations reaching human or ecological receptors do not result in unacceptable risks."
That's not really something that you looked at; it's something that other members of HET did, right?
A. Yes. HET or, I think, Helen is at ERM,

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but I did not do any risk evaluations.
Q. Okay. And then Number 5, "Conditions are favorable for degradation and/or natural attenuation of the constituent of concern." And then it says, "This shall include documentation of the constituents' degradability and/or attenuation capacity and identification and discussion of site-specific characteristics which support natural attenuation."
Is that right?
A. I see that.
Q. One of the problems that you mentioned, I guess, was that the chlorides can become bound in the silts and then recontaminate the groundwater; is that what you were saying?
MR. TROUTMAN: Object to form.
THE WITNESS: I didn't characterize it as a problem.
EXAMINATION BY MR. HUDDELL:
Q. Okay.
A. It's a process that's occurring out there. And it also is a natural attenuation process, because it does bind up the chloride and prevents it from reaching potential receptors.
Q. Okay. But as far as conditions being

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favorable for attenuation, one unfavorable condition is that this, I guess, reabsorption into the silts; is that right?
MR. TROUTMAN: Object to form.
THE WITNESS: Well, we talked about diffusions into the clays from the silts and then back from the clays into the silts. And that's a natural attenuation mechanism. It's like a big sponge out there not allowing the chloride to move.
MR. HUDDELL: Let me share my screen for a second, Bill.
So we'll mark as Exhibit 5, these are your invoices.
(EXHIBIT 5 IDENTIFIED)
EXAMINATION BY MR. HUDDELL:
Q. I'll just go through them quickly. August 31st, 2022, this is your invoice for August. Is it -- do you recall that you were retained in August for this case?
A. I am not sure when I got my retention letter, but if this is my first invoice, then that's consistent with what I said at the beginning of this deposition, which is on the order of maybe six months when I was first

contacted.
Q. Okay. And we got one for October, one for September. And I think that's it. All right.
MR. HUDDELL: Can we take a two-minute break? I think I might be just about done.
MR. TROUTMAN: Sounds good.
THE VIDEOGRAPHER: We're going off the record. It's 10:42 a.m.
(RECESS 10:42-10:52 A.M.)
THE VIDEOGRAPHER: We're back on the record. It is 10:52 a.m.
EXAMINATION BY MR. HUDDELL:
Q. Dr. Kueper, with MNA, do you continue to monitor until the remedial goal is met?
A. I think it depends on the particular site. For some sites, you might do that. For this site, I don't -- well, you'll have to defer to DNR on that. The answer is, not necessarily.
Q. So according to HET, the remedial goals for the groundwater have already been met. The site conditions are below the remedial goals that HET has identified for the groundwater; do you agree with that?
A. That's how I understand their report, yes, using RECAP, that's right.

Q. And so if that is the case, you would agree that MNA is not even necessary, correct?
A. Under that particular scenario, yes.
Q. Okay. And so unless DNR comes up with a different remedial goal for the groundwater, your recommendation is that no MNA is necessary, correct?
MR. TROUTMAN: Object to form.
THE WITNESS: Can you read back the question, please?
EXAMINATION BY MR. HUDDELL:
Q. Sure. Unless the DNR were to come up with a more stringent remedial goal than what HET has already developed for the groundwater, your recommendation would be that no MNA is required, correct?
MR. TROUTMAN: Object to form.
THE WITNESS: I think that if the 110,000 is adopted, then there's no MNA required for groundwater.
MR. HUDDELL: All right. That's all the questions I have.
MR. TROUTMAN: Thank you, Kevin. No questions here.
THE VIDEOGRAPHER: This concludes the

deposition of Bernard Kueper. We're going off the record. It is 10:55 a.m.
(DEPOSITION CONCLUDED AT 10:55 A.M.)

CORRECTION SHEET

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WITNESS: DR. BERNARD KUEPER
TAKEN ON: NOVEMBER 22, 2022
BY: ANNA COATES, RPR, CCR

WITNESS' CERTIFICATE

I, DR. BERNARD KUEPER, read or have had the foregoing testimony read to me and hereby certify that it is a true and correct transcription of my testimony, with the exception of any attached corrections or changes.

_____ _____
DATE SIGNED DR. BERNARD KUEPER

INITIAL ONE:

_____ Signed with corrections as noted.

_____ Signed with no corrections.

DATE TAKEN: NOVEMBER 22, 2022

REPORTER'S PAGE

I, ANNA COATES, Certified Court Reporter, in and for the State of Louisiana, the officer, as defined in Rule 28 of the Federal Rules of Civil Procedure and/or Article 1434(B) of the Louisiana Code of Civil Procedure, before whom this sworn testimony was taken, do hereby state on the record;

That due to the interaction in the spontaneous discourse of this proceeding, dashes (--) have been used to indicate pauses, changes in thought, and/or talkovers; that same is the proper method for the court reporter's transcription of a proceeding, and that dashes (--) do not indicate that words or phrases have been left out of this transcript; also, that any words and/or names which could not be verified through reference material have been denoted with the phrase "(spelled phonetically)."

_____
ANNA COATES, CCR, RPR
LOUISIANA CCR NO. 97018

REPORTER'S CERTIFICATE

This certification is valid only for a transcript accompanied by my original signature and original seal on this page.

I, ANNA C. COATES, CCR, RPR, do hereby certify that DR. BERNARD KUEPER, to whom the oath was administered, after having been duly sworn by me upon authority of R.S. 37:2554, did testify as herein above set forth in the foregoing 63 pages; that this testimony was reported by me in the stenotype reporting method, was prepared and transcribed by me and is a true and correct transcript to the best of my ability; that the transcript has been prepared in compliance with transcript format guidelines required by rules of the board; that I have acted in compliance with the prohibition on contractual relationships, as defined by Louisiana Code of Civil Procedure Article 1434 and in rules and advisory opinions of the board; that I am not related to counsel or the parties hereto, nor am I otherwise interested in the outcome of this matter.

_____ _____
DATE ANNA COATES, CCR, RPR
LOUISIANA CCR NO. 97018