Exhibit 3

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW JERSEY
CIVIL ACTION NO. 15-6468 (FLW)(LHG)

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, et al., Plaintiffs	:	DAUBERT HEARING
v.	:	JANUARY 9, 2019
AMERADA HESS CORPORATION, et al., Defendants	:	VOLUME 1

CLARKSON S. FISHER UNITED STATES COURTHOUSE
402 EAST STATE STREET, TRENTON, NJ 08608

B E F O R E: THE HONORABLE FREDA L. WOLFSON, USDJ

A P P E A R A N C E S:

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-and-
COHN LIFLAND PEARLMAN HERRMANN & KNOPF, LLP
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STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BY: GWEN FARLEY, DEPUTY ATTORNEY GENERAL
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BERGER MONTAGUE
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On behalf of the Plaintiffs

(Continued.)

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ARCHER & GREINER, PC
BY: CARLOS M. BOLLAR, ESQUIRE
On behalf of Defendants ExxonMobil Corporation and ExxonMobil Oil Corporation

GOODWIN PROCTER, LLP
BY: MARK E. TULLY, ESQUIRE
On behalf of Defendants Gulf Oil Limited Partnership and Cumberland Farms, Inc.

C E R T I F I C A T E

PURSUANT TO TITLE 28, U.S.C., SECTION 753, THE FOLLOWING TRANSCRIPT IS CERTIFIED TO BE AN ACCURATE TRANSCRIPTION OF MY STENOGRAPHIC NOTES IN THE ABOVE-ENTITLED MATTER.

S/Vincent Russoniello
VINCENT RUSSONIELLO, CCR
OFFICIAL U.S. COURT REPORTER

M O R N I N G S E S S I O N

(In open court.)

THE DEPUTY CLERK: All rise.

THE COURT: Thank you.

Everyone may be seated. I'll have the appearances of counsel who will be doing the questioning this morning.

MR. MILLER: Good morning, your Honor.

I'm Duane Miller on behalf of the State of New Jersey.

THE COURT: Okay.

MR. KAUFMANN: Leonard Z. Kaufman of Cohn, Lifland, Herrmann & Knopf, Saddle Brook, New Jersey, on behalf of plaintiff.

MS. FARLEY: Gwen Farley, Deputy Attorney General, State of New Jersey.

MR. WREN: Tyler Wren, Berger Montague, on behalf of the State of New Jersey.

MR. LENDER: Good morning, your Honor.

David Lender from the law firm of Weil, Gotshal & Manges for ExxonMobil.

MR. BOLLAR: Good morning, your Honor.

Carlos Bollar from Archer & Greiner on behalf of ExxonMobil.

MR. TULLY: Good morning, your Honor.

Mark Tully from Goodwin Procter for Cumberland Farms and Gulf Oil Limited Partnership.

THE COURT: Thank you.

Everyone else who is here has signed in. So we have documentation of your appearance here today. I only wanted the appearances of those who will actually be participating in the hearing.

My understanding is that essentially the questioning is going to be done by Exxon and perhaps some by Cumberland Farms, and a number of sites are not going to be inquired about by other parties, so that the hearing is going to be truncated really from how many days we thought we would have. Correct?

MR. MILLER: Correct.

THE COURT: Off the record.

(Brief discussion off-the-record discussion.)

THE COURT: All set?

MR. MILLER: Yes, your Honor.

THE COURT: Present your witness, please.

MR. MILLER: Anthony Brown.

(Continued on the next page.)

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ANTHONY BROWN, called as a witness on behalf of the plaintiff, having been first duly sworn, testified as follows:

THE COURT: You may proceed.

MR. MILLER: Good morning, your Honor.

We premarked the witness' 2013 and 2017 reports as Exhibits 1 and 2 for the record for identification.

THE COURT: All right.

MR. MILLER: And then Exhibits 3, 4 and 5 are Power Points.

I have a courtesy copy for the Court.

THE COURT: I'll take that. It appears that it's generally been excerpts that have been provided in the briefing. So do you have a full report to give me as well so I don't have to dig through various excerpts? I was hoping you were bringing that today.

MR. MILLER: Yes, your Honor. As you can see by the thickness of the binder, it is a full report, I believe.

THE COURT: You don't have to send it up to me. But then I would appreciate, if you are going to be referring to a particular page, that you're either going to put it on the screen or give me that page so

I don't have to hunt through which exhibit it was to find it.

MR. MILLER: Yes, your Honor. I don't anticipate personally using the reports. I'm marking them for the record.

I assume counsel may question the witness about the reports, so I thought it would be convenient.

THE COURT: That's fine. I'm assuming if they are going to go to a particular page as well, they will be able to put it up for me.

MR. MILLER: Yes.

THE COURT: Okay.

DIRECT EXAMINATION

BY MR. MILLER:

Q. Good morning, Mr. Brown.

What is your profession?

A. Good morning. I am a hydrologist.

Q. Could you briefly explain what that science entails.

A. Certainly, yes. Hydrology is the scientific study of water as it appears on the surface and below the surface of the earth.

Q. Could you briefly describe for us your

educational background, particularly in that field.
A. Yes.
I have an undergraduate degree from Kings College, London, United Kingdom, in geography, with primarily a focus on hydrology, geomorphology, and soil science.
In addition, I have a postgraduate diploma in civil engineering from Imperial College, London, and a Masters of Science Degree in engineering hydrology from Imperial College, London.
Q. Since we're not necessarily familiar with English universities, could you give us some indication of its stature, please?
A. Certainly, yes. Imperial would be the premier science and engineering university within the U.K.. I'm sure Imperial would argue it's within the world. But I think Cal Tec and MIT are probably the other two comparable institutions within the United States.
Q. Do you actually exchange students with those universities?
A. Yes. The majority of research collaboration of Imperial is actually with MIT.
Q. Now, in the past have you held positions with environmental engineering firms?
A. Yes. I finished my graduate work in 1988, and

since then I have been working as a groundwater consultant.

Q. Were you with the Worley Parsons firm?

A. Yes. I actually started my own company in 1992 which eventually became called Komex. We sold that company to Worley Parsons, who is a very large global oil and gas consulting firm.

Q. What was your position with Worley Parsons?

A. I ran their global infrastructure and environment business sector, which is about 3,500 employees worldwide. And I also handled mergers and acquisitions and strategic developments for the Americas.

Q. Now, have you spent part of your career dealing with the subject of MTBE?

A. Yes. I have spent a considerable amount of time, starting in the early 1990s right up to the current time, I have been working almost consistently on projects that involve MTBE contamination.

Q. Have you been consulted or provided advice to governmental agencies concerning MTBE?

A. Yes. I have government clients, particularly various states that have filed claims related to MTBE contamination of groundwater resources, as well as county and municipal clients who, again, having to

deal with MTBE contamination of water supplies.

THE COURT: Let me interrupt.

Mr. Miller, all of this background, if this is going to his qualifications, there is no objection to his qualifications it's my understanding from having read the Daubert papers.

MR. TULLY: That's correct, your Honor.

THE COURT: I have all that material. I find him qualified. If you want to proffer the areas he is in, I know there is no objection, let's just do it, and we can go on to the substance of the testimony.

MR. MILLER: That's fine, your Honor.

BY MR. MILLER:

Q. Mr. Brown, in what areas are you acting as an expert witness in this case?

A. I'm providing expert witness testimony in the areas of groundwater hydrology and groundwater restoration.

MR. MILLER: We would offer him as an expert in those fields, your Honor.

THE COURT: My understanding is that there is no objection to his qualification in those areas. Is that correct?

MR. LENDER: Not referring to the Daubert motions. We didn't move on that basis.

THE COURT: Exactly.

MR. TULLY: Correct, your Honor.

THE COURT: All right. He will be accepted as the expert in those areas, and we'll get to the actual opinions.

BY MR. MILLER:

Q. Mr. Brown, I want to go briefly over your experience.

Have you worked with oil companies dealing with contamination?

A. Yes, I have. I have worked for a variety of oil companies during the course of my career. I would say the majority of work was for originally Mobil Oil Corporation, now ExxonMobil.

Q. In doing that work, have you dealt with contamination from gasoline at service stations?

A. Yes, I have. I've implemented actually investigation and remediation programs at over 100 service station sites and numerous field terminals, pipeline releases and refineries.

Q. The technique or method that you used to investigate and proposed programs to clean up those sites, is that also something that you did for this case?

A. Yes. The methodologies I would use in

evaluating those sites would be identical to those that I used in this matter.

Q. In terms of the methodologies that we're going to discuss this morning that you employed in this case, are they generally accepted?

A. Yes. These are the methodologies that any consultant or even any expert would use when evaluating any contaminated site including those contaminated with MTBE and other gasoline constituents.

Q. Now, if we could turn to the slides. We're going to cover something extremely briefly. This is a matter that relates to qualifications. So could we go to the next slide.

It mentions that you went to the White House to advise them on MTBE? Is that correct?

A. It is, yes. Under the Clinton administration I was invited to present at the White House.

Q. Could we have the next slide, please.

We're going to be using some terms and one of them is the "vadose zone." Can you explain what that is briefly, please?

A. Certainly, yes. If we refer to the figure here, we can see this brown line is the ground surface, and there is a tree growing here. And initially when one

moves through the subsurface, there is an area of the subsurface where the pore spaces -- that is the voids between the soil grains or the facies in the rock are not completely saturated with water, and that's referred to as either the "unsaturated zone" or the "vadose zone". And then eventually we move to a point where the pore spaces as can be seen here are completely saturated with water, and that's what we call the "groundwater zone" or it's referred to as an "aquifer."

Q. Is there a transition zone between the two?

A. Yes. There is a small transition zone called the "capillary fringe," which is saturated with water but it's under negative pressure.

Q. And in terms of the terminology we're going to be using today, we're going to be focusing on both the "vadose zone" and the "saturated zone." Is that correct?

A. To a degree, yes. However, the majority of the discussion today I would assume would be related to the groundwater.

Q. Now, the settings in New Jersey that relate to cases that we're going to discuss this morning, what geological settings are we talking about?

A. Perhaps if we go to the next slide, this slide

depicts some of the typical geologic materials we would see in the State of New Jersey. There are basically two types of geologic materials:

The first I'll refer to as "unconsolidated sediments," and these are comprised of sands, gravels silts, and clays. So they are not cemented into any form of rock. They are just like a loose sand you might see at the beach. These are depicted here as these yellow areas on the slide being the sands, and in this case a till which is a glacial deposit of more finer grained material.

The other type of geologic material we see here in New Jersey is competent bedrock, solid rock. Here, while some bedrock has what's referred to as primary porosity, that is some pore space, the majority of the bedrock contains water in fractures.

These are cracks in the rock that are usually vertical, subvertical, or horizontal, and the water enters these fractures rather than moving through interconnected pores. So the water is much more variable in its location within the fractured rock.

Q. And you can actually develop a well in the type of fractured rock we have here in New Jersey. Is that correct?

A. That's correct. There are many large municipal

water supply wells in fact that are completed into bedrock aquifers. Because of the interconnection of the pores in unconsolidated sediments, any well will essentially draw water from throughout the entire area of the sediments; whereas in fractured rock it will only draw water from the fractures that well connects with.

So if we have a well, say, this one on the right, it only connects to one fracture. Therefore, its yield will be quite low; whereas, the well here just to the left of it intersects many water bearing fractures. Therefore, it will have much higher water yields when it's pumped.

Q. If we compared the two types of deposits in the subsurface, the fractured rock versus the unconsolidated materials, which of the two is more complex to understand when you are dealing with contamination?

A. Certainly the fractured rock is much more complex because one has to understand the orientation, the density of the fractures, as well as the general groundwater conditions.

Q. And does that affect your ability to predict where MTBE may be present in the subsurface, that is when it enters fractured rock environments?

A. Yes, it does. Perhaps an example: In my career I worked on a major gasoline spill from a pipeline; consulting work I was performing for Shell in Kankakee, Illinois, where they had a release from the pipeline. The groundwater flow direction suggested the plume would go in one direction. However, the fractures were oriented about 45 degrees to the groundwater flow. Therefore, the plume had actually moved 45 degrees and contaminated wells that no one had expected would be contaminated.

Q. So understanding fracture orientation is part of the information you need to have and consider it to predict the movement of MTBE in the subsurface. Is that correct?

A. Where one can identify that, that is very valuable. It's very difficult to do actually in urban areas just because any surface expression of those fractures is no longer evident.

Q. If we could turn to the next slide, please?

We're not going to go through each of these bullets. But basically you were retained in 2012 to work on this case and to evaluate each of the original 19 sites. Is that correct?

A. Yes, that is correct.

Q. Today you are prepared to discuss a subset of

those, a total of four, but two you will be testifying on this morning. Correct?

A. That's my understanding, yes.

Q. Could you explain what your assignment was briefly, please, in this case?

A. Yes.

We would review information pertinent to the trial sites, and based upon that review of both regional and site-specific information, at certain trial sites we identified some real critical data gaps. Therefore, we implemented field investigations. And for all of the sites where there was off-site groundwater contamination, we evaluated what would be feasible and technical technologies to restore the groundwater to a pre-discharge condition.

Q. You used the term "we." Could you explain?

A. I apologize. I have my own consulting firm. It's a small firm of about 12 staff. So some of the work would be performed by staff under my direction.

Q. Okay. In terms of your evaluation of the data, what were you trying to get, what type of information?

A. As I indicated, there would be two types of data sets: The first would be regional information that would allow us to develop essentially what we refer to as a site setting. So regional hydrogeology, regional

groundwater flow conditions.

Q. Is regional information useful in making predictions at a specific site?

A. Very useful, yes.

Q. Could you briefly explain it.

A. Certainly, yes.

For example, groundwater, essentially, in general, moves from what are referred to as areas of recharge -- that's where there is water recharging the aquifer -- to areas of discharge, and those discharge locations are usually large water wells that are pumping or a surface water body that's being supplied with groundwater. That relationship between areas of recharge and areas of discharge will often drive the flow from one to the other.

So it's important to understand that on a regional basis. So where are the wells that will essentially drive a lot of the groundwater flow.

Q. How does someone in your field determine the direction of groundwater flow and why is it important to do that?

A. So there are essentially two ways to evaluate groundwater flow.

The first would be an inferred flow based upon that recharge/discharge relationship. So if we know

we have large water supply wells, it's pretty clear that the flow around those wells -- it could be many miles -- would be towards those wells.

Now, we also could use actual site data where we have installed monitoring wells. These are wells that are not wells to produce groundwater but just monitor the groundwater. We can actually measure the water levels in those wells, and from those measurements we can determine the groundwater surface and gradient, so we know based on those measurements, just as if you were measuring the elevation on a hill, where is the down-gradient direction.

So we can use both site data and inferred regional information to determine the direction of groundwater flow.

Q. So basically groundwater is flowing downhill?

A. Essentially, yes, in simple terms. It's related to other factors, but, generally, topography is one of the key factors in evaluating groundwater flow.

Q. So if you measure the groundwater level in a well here, and it's higher than a point here, what inference do you draw based on the science that you are part of?

A. One of the key elements of hydrology is that groundwater will always move from a condition of high

hydraulic head, high elevation, to a condition of low hydraulic head. That's a lower elevation. So as you say it flows downhill.

Q. You used the term "head." What does that mean?

A. "Head" is just the reference to, in this case, evaluation within an unconfined aquifer versus elevation plus pressure within a confined aquifer.

Q. And then if we go to the other setting, which is the fractured rock, do you use the same approach to determine the direction of flow or is it more complex?

A. As I indicated earlier, it's a little more complicated because one can first measure the actual groundwater flow direction based on elevations. The groundwater can only flow within the fractures. So the fractures may have an orientation that is slightly different than the overall groundwater flow field.

I'll give an example. If you are standing at the top of the hill, and you want to drive down the hill, the most direct way is straight down the hill. However, if the road zigzags all the way down the hill, as might be a fracture network, you have to follow the road.

Q. Okay. You mentioned that a well can draw water from several miles away. How does that work? Could you explain that briefly?

A. Certainly, yes.

When a groundwater well starts to pump water, it essentially lowers the groundwater, the elevation in the vicinity of the pumping well, and it creates what's referred to as a cone of depression. So essentially as it withdraws water from the aquifer, it creates a cone around the well. That is the area around the well is being depleted of water because it is being pumped; and as the pumping continues, that cone gets deeper and gets very, very wide because it's drawing water from a very large area.

Q. In effect, it creates its own depression in the water surface?

A. That is correct, yes.

Q. And that depression causes the water to move toward the well?

A. That is absolutely correct, yes.

Q. Now, in this case, in addition to evaluating the setting and the sites, you were asked to evaluate feasible and practical technologies to restore the groundwater to a pre-discharge condition. I want to start with, what is a "pre-discharge condition"?

A. A pre-discharge condition would be the state of the groundwater prior to the release of the pollutants.

Q. So in this case we are talking about MTBE. Is that naturally present in groundwater?
A. No, it is not.
Q. Is it primarily associated, based on your expertise and experience, with gasoline stations and similar sources of gasoline releases?
A. Yes. MTBE was most predominantly used as an oxygenate in reformulated gasoline.
Q. What is "reformulated gasoline"?
A. Essentially, it's gasoline that had its basic formula adjusted by the addition of an oxygenate, and the most common oxygenates are either ether oxygenates, MTBE being far the most common, or alcohol-based oxygenates, most notably ethanol.

Now, originally, those compounds were added to enhance the octane value of the fuel, make it burn more efficiently. And then in response to Clean Air Act amendments, it was required to add an oxygenate to gasoline in certain areas of the country.

Now, those areas coincided with most of the population and most of the refineries. So oxygenated, reformulated gasoline in response to the Clean Air Act amendments was widely used throughout the United States.
Q. Roughly what percentage of the gasoline was MTBE

and this reformulated gasoline you described?
A. It varied depending on the grade of the gasoline, between 11 and 15 percent by volume.
Q. Was that the single largest constituent in gasoline during the period of time that MTBE was in gas?
A. Yes, by far.
Q. Are there other industries unrelated to gasoline that are known to be sources of MTBE releases?
A. The only other ones would be the chemical plants where they are actually making the MTBE. Other than that, the uses are very, very minor. And I never identified a contamination source other than a gasoline release when it comes to MTBE contamination of groundwater.
Q. Okay. Now, did you come up with and evaluate the feasibility of technologies to restore groundwater for this case?
A. Yes, I did.
Q. Did you do it for the two sites we are going to discuss this morning?
A. Yes. We prepared actually an initial feasibility evaluation that addressed all of the sites, and evaluated eight different technologies that could be used to restore the groundwater. And then we

considered that on a site-specific basis, so for each of the sites based on the conditions at that site, which would be the most appropriate technology to use to restore the groundwater to a pre-discharge condition at that particular site.

Q. Did you consider whether those technologies were practical?

A. Yes. Essentially, the guidelines for doing a feasibility analysis, evaluate the feasibility based on three criteria: effectiveness, implementability, and cost. Essentially, effectiveness and implementability together determine whether the technology is practical.

Q. We're going to go into that more specifically in a minute. If we can go to the next slide, please.

This describes briefly your overall approach in doing the work in this case and other matters. Is that correct?

A. Correct, yes. It describes essentially the fact that the methodology that I used in this particular matter is identical to the methodologies that I have used in many other projects. In fact, just about every contaminant project that I work on, I use the same procedures.

Q. Is that true for when you were working on

gasoline station sites for the oil industry, that you used the same procedures?

A. Yes, it would be the identical procedures.

Q. And the experts for the defendants that prepared reports in this case, you reviewed them?

A. I did, yes.

Q. Did they use the same procedures that you did?

A. Yes. Essentially, these are the procedures that are used by all consultants when evaluating a contaminated site.

Q. Do you currently have clients in the oil industry?

A. Yes, I do.

Q. And when you are evaluating conditions to consider a remediation restoration, here you've got sites that you evaluated. Approximately how many have you done this type of analysis for?

A. So I have actually used the methodology as part of the implementation of the actual investigation and remediation programs at over 150 contaminated sites, of which about 100 would be gasoline release sites, and the others would be other types of contaminants.

I've also used the methodologies to evaluate conditions at over 500 contaminated sites, of which 300 or more would be gasoline release sites. This

would be where I was working for a party that was not the responsible party for contamination but had been impacted by the contamination. For example, a state agency, a county government, or a municipal government.

Q. Okay. Let's go to the next slide, please.

Further discussion of the overall approach that you took in this case.

Did the experts for the defense arrive at the same conclusions you did if they used the same methodology?

A. In some cases, some of the conclusions are similar if not identical. I would say many of the cases they used the same methodology but they reached a different conclusion based upon their analysis.

Q. Now, in terms of implementing an investigation, did you do some investigative work in this case?

A. Yes. We did two types of investigative work. The first would be the review and analysis of existing information. The second would be actual field investigations where we went to a site and drilled monitoring wells and collected samples in some other way.

Q. Did you believe before you rendered your expert reports in 2013 and 2017 that you had the information

you needed to form your opinions?

A. Yes, I did.

Q. Now, let's go to the methodology itself.

The first item you list out of four is understanding the site setting and identifying receptors or potential receptors. In this context, what is a "receptor"?

A. So a receptor in this context could be one of three things.

The first could be the groundwater itself, and that it has been impacted by the pollution, so it is a receptor.

The second might be a water supply well, which could be a domestic well for a single residence or a large municipal well that is either impacted or threatened by that contamination.

The third would be perhaps a surface water body, such as a stream or a lake or a wetland where groundwater recharges that surface water body, and there is a risk that the contamination could move with the groundwater and contaminate that surface water body.

Q. The next step in the process is to evaluate contaminants of concern. In this case, there are two contaminants of concern. Is that correct?

A. There are two particular contaminants we are concerned about. The first we mentioned is MTBE, methyl tertiary butyl ether, and the second is tertiary butyl alcohol, or TBA.

Q. Is TBA also an oxygenate for gasoline?

A. It had been used either directly as an oxygenate, but it is also present as essentially an impurity within MTBE, and it also is a degradation product of MTBE.

Q. Is that also a chemical that the government has some concern about and regulates it just as it does MTBE?

A. That is correct.

Q. Now, did you consider the applicable regulations in New Jersey that applied to those two chemicals in evaluating evidence in this case?

A. I did, yes.

Q. Why would it be important to understand the level the government is concerned about on a regulatory basis in doing your work?

A. There are two considerations.

The first is the government essentially establishes risk-based levels; that is, some concentration that they believe there is an acceptable risk for consuming or being exposed to that particular

chemical below a certain concentration, and that is referred to on the national level as a maximum contaminant level or an MCL.

Q. Do MCLs apply, for example, to public drinking water?

A. That is correct. So for a public drink water supply, a purveyor of that drinking water must comply with the standards that are imposed either by the federal or state government; and usually most water utilities, if they reach 50 percent of that standard have to implement some kind of mitigation, either treatment or take the well offline, or some other process to ensure they don't deliver that water in those concentrations to their customers.

Now, if I could go back to the first question. I had not quite finished.

Q. Sorry. Go ahead.

A. So the MCLs are a risk-base standard essentially. That is, they understand that exposure even below the MCL poses some risk, but they believe it to be an acceptable risk.

The other standard is the point at which there is no perceived public health risk, and that's referred to at the federal level as a maximum contaminant level goal, or an MCLG.

Now, in addition to those levels, many states have what they refer to as a "nondegradation standard," or, in the case of New Jersey, a "pre-discharge standard." That is, essentially, the State does not allow degradation of one of the State's resources to any degree. Therefore, restoration is the cleanup of a particular resource, in this case, groundwater, to a pre-discharge condition.

Q. And for a chemical like MTBE or TBA, is it your understanding then in New Jersey, that level is basically the level at which you can detect it in a chemical laboratory?

A. Yes. So by clear inference, the level should be zero because it's not a naturally occurring compound, but one is limited by the detection limit that a laboratory has. How low can it detect the compound? And that's called the "practical quantitation limit" or PQL.

Q. When you prepared your reports in this case, you proposed programs in some sites where the groundwater would be cleaned up. Correct?

A. Correct, yes.

Q. And in setting a cleanup program or planning it, is it important to understand what the goal is in terms of the concentration, what it should be?

A. It's very important. That's essentially your target, your end point.

Q. And in this case, when we talk about remediation versus restoration, what are we talking about?

A. Essentially, remediation is the cleanup of a resource, in this case, groundwater to those risk-based standards. Whereas, restoration is the cleanup to the pre-discharge condition.

Q. You indicate in your third step that you followed in your methodology is to prepare a detailed summary of site-specific information, and you list four items that are part of that. Correct?

A. Yes. These are four of the typical elements that we implement as part of our review of site-specific information.

Q. Obviously, one of the things you want to do is understand the contamination that is present at a site, you list that, and then you talk about contaminant, fate, and transport. Are those technical terms in your field?

A. Yes. As you mentioned, the first step is just based upon the existing data. Where is the contamination? What is the magnitude? What are the concentrations? Where was it potentially released from?

The second element, the bullet there, is: Where might it go?

So what is the fate and transport? Because of MTBE's particular properties, it essentially goes where the groundwater goes.

Q. We'll cover that in a minute.

You also indicate another thing you do is identify deficiencies in existing work and data gaps. Why is that important?

A. Well, one needs to identify particular data gaps that might limit your ability to complete the evaluation. Those would be critical data gaps. And at some of the sites we did identify those and actually implemented field programs.

In others there would be data gaps that would not limit your ability to reach opinions and develop restoration programs, but still need to be completed at some point in the future or addressed.

Q. And as part of your work, did you also consider and in some cases recommend additional investigation?

A. Yes. In some cases we actually implemented investigation. But in all of the remaining sites, we did actually recommend future additional investigation does need to be performed.

Q. Did you have as one of your resources of

information reports from consultants retained by oil companies who had a release site and had done their own investigation?

A. Yes. I would say that was the majority of information reviewed as part of our site-specific analysis.

Q. Apart from that, what other types of information would you get that would help you review and summarize site-specific information?

A. There may be in fact some records of actual release events at a station. There may be records of underground storage tank removal programs or gasoline piping replacement programs at each station. These may not be contained within the consultant reports but they would be available for a particular site.

Q. Did you attempt to get all of that type of information to the extent it was available?

A. We did, yes.

Q. Let's turn to Step 1. This is the regional information.

Is this basically a listing of the types of information that you use and consider in understanding the regional setting?

A. It is. This is some of the typical information that one tries to identify and review. As we

mentioned, just the location and topography, the geologic and groundwater conditions, the surface water hydrology conditions; are there streams nearby that could be receptors, for example? Are there water supply wells, information on receptors, such as domestic and municipal supply wells? What's the local land use? So, for example, are there residences that sit on top of the contaminant plume that might be exposed to vapors coming from that plume?

Basically, that forms essentially an understanding of the region for the setting for a particular site.

Q. Let's go to the next slide.

Are there properties of MTBE that are important to understand in making predictions about how it will behave in the environment?

A. Yes. Gasoline containing MTBE or the MTBE within that gasoline has certain chemical properties that make it behave quite differently than gasoline that doesn't contain an oxygenate when it comes to a release into the environment and its impact to groundwater.

Q. So one of the things that can happen when a chemical is released is it can dissolve into groundwater. Correct?

A. Yes. Often you hear the old adage, oil and water don't mix. Unfortunately, they do. Some of the constituents within oil that dissolve into the water and particular MTBE is highly soluble in water. So you can have a transfer of the MTBE from the gasoline that was released into the groundwater, so it dissolves into that water.

Q. Is MTBE so soluble that you can literally find it present in levels as high as millions of parts per billion?

A. Yes, that is absolutely true.

Q. Did that actually occur at some of the sites that we are talking about?

A. It does. Some of the sites we had concentrations in the millions of parts per billion in groundwater.

Q. Now, one of the things that can happen with a chemical when it enters the soil is that it can stick to the soil. Correct?

A. Yes. Particularly, there are certain gasoline constituents that are essential bound to the soil particles. They absorb onto the organic carbon within the soil. So therefore their movement is retarded by that absorption.

Q. In other words, they don't move very far?

A. Correct. Particularly longer chain hydrocarbons -- I should point out, gasoline contains numerous constituents.

Q. More than?

A. On the order of 100, say, depending on the gasoline. But the majority of them are either long chain hydrocarbons or branched chain hydrocarbons.

MR. MILLER: I don't want to do a deep drive into chemistry today, your Honor. I'm going to avoid that.

A. (Continuing.) Crude oil contains hundreds of compounds. In each they vary in the number of carbon atoms in each compound, the number of hydrogen atoms, and how those atoms are structured. Hydrocarbons that have a large number of carbons, they absorb very readily to the soil material. So, therefore, they don't move very far at all.

Q. How does MTBE compare to those?

A. Well, compared to those, first, it's highly soluble, as we discussed, and, secondarily, it hardly absorbs to the soil particles at all. So, essentially, it moves through the subsurface with the groundwater and it's unretarded. That is, its movement is not restricted by natural processes as much as the gas of the gasoline constituents.

Q. Does it almost move at the same speed as the groundwater itself?
A. Pretty much, yes.
Q. Another characteristic that you list is that it doesn't volatilize from the groundwater. Why is that important?
A. So once a compound is dissolved into the groundwater, there is still the potential the compound could volatilize from the water. That's controlled by a chemical term called "the Henry's constant." And MTBE, once it's in the groundwater does not want to partition; that is, it doesn't want to volatilize from the groundwater. Whereas other constituents will partition from groundwater into the overlying vapor. Particularly, a concern here would be, say, chlorinated solvents, like dry cleaning solvents.
Q. Is MTBE persistent when it's dissolved into the groundwater?
A. Yes. Once it is in groundwater, its biodegradation rate; that is, how quickly it would be broken down by natural microbes. It's much lower than many of the other gasoline constituents.
One of the things that became apparent in the early-to-mid 1990s is that one of the other constituents of concern in gasoline is benzene, but it

was realized in studies in the early 1990s. Benzene actually biodegrades reasonably well. Therefore, there aren't many very large plumes of benzene. Whereas, because of its lack of biodegradation and its other properties, there is a much larger number of significant MTBE plumes from gasoline releases.

Q. Given the characteristics that we've discussed about MTBE, what does that tell us about how it will behave in the subsurface?

A. So as we discussed, the MTBE will dissolve into the groundwater. It will move with that groundwater pretty much at the rate of groundwater movement. It will be very poorly retarded, if at all. It will persist for a long time because its biodegradation rate is low.

So because of that generally MTBE plumes, when one compares it to other gasoline constituents, will be longer and larger, migrate much further and deeper, because as it moves away, it moves down also and persists longer.

Q. When we talk about persistence and persisting longer, could you give us some scale that we're talking about? Are we talking about years, decades, what?

A. Well, depending upon site-specific conditions,

it's at least decades. In some cases, it may run to more than a century.

Q. Let's turn to the next slide, please.

In setting your targets to be achieved, did you consider the groundwater quality standards that apply here in New Jersey?

A. Yes, I did.

Q. And could you explain what they are for MTBE and TBA, please.

A. As I mentioned earlier, there are essentially two types of standard. The first is the standard that applies to restoration, and that is the pre-discharge condition. That is, MTBE should not be there at all, but when limited by how low the labs can detect the compound, and that is what we referred to earlier as the PQL, the practical quantitation limit. So for MTBE and TBA, it's 1 part per billion for MTBE, and 2 parts per billion for TBA.

Q. And in developing a remediation program, is that your target, the PQL?

A. That is correct, yes.

Q. And then in terms of the drinking water standard here in New Jersey.

A. So the other standard we discussed was at a federal level, we have what are called MCLs.

Now, in New Jersey we also have standards that they refer to as "groundwater quality standards." Those are 70 parts per billion for MTBE, and 100 parts per billion for TBA.

Q. Now, in doing a typical gasoline cleanup, where the responsible party is trying to clean up for the site, which of those two goals are typically used?

A. So for a remediation program that's being implemented by the responsible party, they are usually targeting the groundwater quality standards, that is, the higher concentrations.

Q. 70 for MTBE?

A. That is correct.

Q. And in this case did you take a look at getting the contamination down to restoration levels?

A. Yes. My goal was to evaluate technologies or a combination of technologies that would eventually restore the groundwater to that pre-discharge condition, that is a target of the PQL.

Q. Let's turn to the third step. This is basically a list of the types of information that you gathered. Is that correct?

A. It's actually, one could describe it as, a series of substeps. So when one is evaluating the site-specific data, these are the steps one goes

through in completing that evaluation.

Q. So your attempt is to gather all of the appropriate site-specific documents. Is that correct?

A. Yes. That's the first step is pulling together the pertinent documents and data.

Q. Why is the site history and site investigation and remediation history also important for you?

A. It's important to know what is being done at the site both in terms of its general operational history where that information is available, as well as the history of investigation and remediation programs that may have been implemented at that site.

So we see from the first investigation after the current time, what has the responsible party been doing at the particular site.

Q. I'm going to move on to the next one without going through each of those items in detail.

I think, in general, at least, they have been conceptually discussed.

The next is a site conceptual model. Is that a tool that is used in your field, and why and how is it used?

A. Yes. This is a term that's used within the consulting industry when evaluating groundwater contaminant conditions. It essentially tries to

create a picture of the current conditions with respect to contamination and the projected conditions based upon the fate and transport of the contamination.

THE COURT: I don't have page 14 in my handout. I go from 13 to 15. Do you want to hand me up a 14.

(Pause.)

Q. You have some terms there that are not self-evident to me at least.

What is LNAPL listed as one of the sources that you evaluate?

A. "LNAPL" is an acronym that stands for "Light Non-Aqueous Phase Liquid."

Q. And as applied to gasoline, what does that mean?

A. That is essentially pure gasoline as it's present in the subsurface.

Q. Can you actually have a situation where you can measure gasoline in a monitoring well, gasoline itself?

A. Yes. In fact, at some of the sites that are the subject of this matter, there are actually monitoring wells that have been installed where the pure gasoline in the subsurface could be measured in the wells. There was so much gasoline it was accumulating in the

wells.

Q. Why would that happen?

A. Essentially, the release had been large enough that not all of the constituents could either absorb to the soil particles or dissolve into groundwater. So, therefore, there was still pure gasoline present in the subsurface.

Q. I take it, that's an indication of a larger release?

A. Yes. That would be an indication of a very significant release.

Q. Could you actually measure LNAPL or this pure gasoline in feet in a monitoring well at some of the sites?

A. Yes. At some of the sites it's accumulated in multiples of feet, and I've worked on sites where there have been over 10 feet of gasoline accumulated in wells.

THE COURT: Are you speaking generally or particularly as to any of the sites here?

THE WITNESS: In certain sites there was gasoline observed in wells, and it was measured in feet. But I was saying a site that I have worked on, not in this matter, I've actually seen gasoline of over 10 feet in a well.

BY MR. MILLER:

Q. What happens to that gasoline over time that's floating on top of the groundwater?

A. Essentially, two things happen.

First, obviously, the gasoline is spreading out on top of the groundwater surface. So it's often depicted as sort of a pancake, or the syrup on top of a pancake might be a better analogy. It's a little more complicated than that because it's mixing in a multiphase environment. So it's part gasoline and part water.

The second thing is the gasoline, as it's in contact with the water, the constituents in the gasoline are dissolving into the water.

Q. So, eventually, would the LNAPL be expected to disappear if you cut off the continuous release of gasoline at a site?

A. Yes. If, say, for example, it had come from a leaking tank, if the leak had been stopped and the tank replaced, now we have a finite volume of gasoline within the subsurface, and eventually that gasoline or the MTBE in that gasoline all of it would eventually dissolve into groundwater.

Now, that may take many, many, many years if not decades. Therefore, many of the sites, including

some of those that are the subject of this litigation, the responsible party implements programs to try and recover that LNAPL, that pure gasoline.

MR. MILLER: Your Honor, I don't mind being interrupted with questions at all if you have any.

THE COURT: Even if you did, I would. Take that as it is.

MR. MILLER: Those guys over there sometimes interrupt me, too.

Q. So if we have gasoline released from an underground storage tank, how deep in the subsurface is the tank?

A. Generally, the bottom of the tank at most of the gasoline sites, underground storage tanks, gas stations, I would say vary from about 12 to 15 feet below ground surface.

Q. In some of the settings here in New Jersey you've investigated and will testify about this morning, how deep is the groundwater?

A. In some cases the groundwater is at a similar depth. So the tank is often literally sitting in groundwater. So when a release occurs, it goes straight into the groundwater.

Q. Now, in the conceptual model, the next factor that you evaluate is the "pathway." What do you mean

by that?

A. Essentially, we're evaluating where the contamination will move. So in this case we are looking at particularly groundwater transport. So we know where it's being released. We have an understanding where it's present. Where will it move to? What is the pathway it uses to migrate.

Q. And the receptors you've discussed earlier, that would include wells, bodies of water, et cetera. Correct?

A. That's correct. So we want to know where they are, what are they used for, how might they be exposed, and what treatment might be required if they are exposed.

Q. Can a person in your field predict where the gasoline is flowing away from the site, if it's reached the subsurface?

A. Yes. That's one of the things we try to do as part of that site conception model in evaluating the fate and transport of the contaminant. So we look at the contaminant's properties and in this case the hydrogeologic conditions, and the groundwater flow, and, say, based on that, where would we anticipate the contamination would move to?

Q. In this case, did you literally evaluate a site,

predict where the gasoline was going, and install a monitoring well to determine if it had reached a location away from the station it was in the direction you predicted the MTBE would move?

A. Actually, yes. As part of this matter, we did that at several sites. But more recently we did it at one particular site where I had evaluated where I believe the contamination had migrated to, and we installed monitoring wells in that location and identified very high concentrations of MTBE.

Q. Was that the first time anyone had identified contamination in the area you just described?

A. It is, yes. The responsible party had not conducted an investigation in that area.

Q. So you were able to accurately predict where it was going. Is that correct?

A. Correct.

MR. LENDER: Your Honor, it would be helpful to know which site we are talking about.

THE COURT: I was going to ask that myself.

Q. Mr. Brown, you have a question. It didn't come from me.

A. The sites we're discussing today or the subject of today's hearing, that site would be the Getty West Windsor site.

THE COURT: Which actually is not being discussed today.

MR. MILLER: Correct.

THE COURT: We understand the work that you did. So your responses should be limited to the sites that are the subject of the inquiry today, the Livingston site, and the other site, the Cumberland Farms is involved in, Bakers Waldwick.

So the question you just answered with regard to installing with monitoring wells and determining MTBE had flowed there, and it was not been discovered by the responsible party, the site you identified is not the Livingston or the Bakers Waldwick site. Correct?

THE WITNESS: That is correct. The site we were just discussing was the Getty West Windsor site.

THE COURT: So we'll put that aside.

MR. MILLER: Yes, your Honor.

BY MR. MILLER:

Q. Could we go to the next slide, please.

We talked a lot about contamination in groundwater. The technical term is "plume." Most people are familiar with it. Could you use this illustration to explain how groundwater plumes move and how you can predict their movement?

A. Certainly, yes.

Here we have a depiction from the published literature that shows a typical MTBE plume, and MTBE in the words of Monty Python would that beautiful plumage, and the plume essentially would migrate from the gasoline release area at the service station in the groundwater in the direction of groundwater flow and would eventually in this case reach a surface water body which is a stream.

They have also depicted some wells, but these are actually remediation wells. One could also imagine if there was a drinking water well in a similar location, that well would also be impacted.

Q. You can also use wells to intercept and remove contamination from the subsurface. Correct?

A. That's correct. In this case, the depiction shows what they are referring to as oxygen injection wells where they are injecting oxygen to promote the degradation and oxidation of the plume. This could also be a capture well where one was pumping the water to capture the MTBE plume. That's done in the process called pump and treat.

Q. In this case, you show that the water table has a slope that's toward the stream. Correct?

A. That's correct. You may recall I mentioned

earlier in the course of this testimony how, in general, groundwater moves towards points of discharge. In this case, the point of discharge is a stream. Now, the point of discharge could also be a water supply well that had that cone or depression we talked about. So the water moves from the release towards the point of discharge.

Q. What does the term "water table" refer to? I don't think we've used that before.

A. You may recall, we talked about measuring the head, the evaluation of the groundwater in monitoring wells, and then we contour that surface just as if we were contouring a hill, and essentially that surface is referred to as a water table. So below the water table, in this case, the sediments are saturated completely with water. That's the groundwater zone. Above that is the vadose zone.

Q. If the slope is steeper, how does that affect the groundwater flow or movement?

A. So if the slope of the water table of the general groundwater surface is steeper than the velocity of the groundwater, movement is increased.

Q. Are there actually mathematical formulas used in your field, taking advantage of the information about the slope of the groundwater, that enables you to

predict the speed of groundwater throw?
A. Yes. One can use an equation that was developed by a gentleman called Darcy. Henri Darcy, he was a French engineer. He was the city engineer for the city of Dijon in the 19th Century, and he developed a mathematical formula to calculate the flow of groundwater, and from that formula you can calculate the velocity of the groundwater.
Q. That formula has been used for more than 100 years by people in your field?
A. It is. It's probably the most widely used formula in the groundwater profession.
Q. Let's go to the next slide.
This is a more complicated setting. Correct?
A. Yes. The previous slide showed a gasoline release and an MTBE plume within unconsolidated sediments, so in this case a sand aquifer. This slide shows a gasoline release into fractured bedrock.
Q. There are various red lines shown. Is that intended to represent -- if you look at the top there is an underground storage tank abbreviated UST, and there appears to be a fluid or something in red piling up. What are we talking about there?
A. This is the underground tank. The gas station had a leak. The gasoline is leaking from the

underground storage tank. It's collecting in the bottom of the tank pit, and it' entering a fracture intercepted by the tank pit, and the gasoline is penetrating into that fracture and then moving into interconnected fractures.

We can see in this case, rather than really a broad pancake or syrup of MTBE on top of a pancake in an unconsolidated sediment, here we have linear features of gasoline within the fracture network.

Q. If we look at the left portion of the diagram, there is something that appears to be similar to a well that has red in it. Could you explain, please.

A. Certainly, yes. So this picture is showing three wells completed in close proximity. One of the wells has red in it, which is an accumulation of gasoline. This well has gasoline because it intercepts a fracture that contains gasoline, whereas the other well right next to it completed at a very similar depth does not intercept the gasoline containing fracture; therefore, it only contains groundwater and no gasoline. So we can see it's a very complex distribution of the gasoline within the fractures as compared to the distribution in unconsolidated sediments.

Q. Apart from the graphic, in the real world could

you literally have wells close together in a fractured rock environment where one is contaminated and the other one appears to be clean?

A. Yes. I actually have worked on projects where wells within a few feet, in fact, had one well with an accumulation of multiple feet of gasoline and the well right next to it has no gasoline whatsoever.

Q. Can that same complexity make it more difficult to clean up MTBE that has entered into a fractured rock environment, when compared to the other environment we were discussing, which is the unconsolidated materials laid down over time by streams and rivers and that kind of thing?

A. Yes. Clearly, because of its distribution and where it is located, it is much more difficult to remediate and restore this aquifer zone.

Say, for example, in unconsolidated aquifers, one might evaluate the use of an in-situ technology. That is a technology that cleans up the contamination in place. We had on that previous slide an in-situ approach using oxygen, somehow introducing oxygen to the subsurface. The issue with in-situ technologies is, how do you get the oxygen to the contamination?

In an unconsolidated aquifer that is still quite complicated, but in a fractured rock aquifer

that is extremely difficult to do.

Q. In other words, you can drill two wells that are designed to intercept and clean up MTBE next to each other and only one of them might turn out to be able to be used for that purpose because only one of them might intercept the MTBE?

A. That is correct. Even in unconsolidated settlements that can actually occur. I had worked on a project with Mobil where we had two wells within ten feet. One had tens of thousands of parts per billion, and the other had just a few hundred. So even in unconsolidated settlements, the distribution of the contamination is completion, but in fractured rock settings it's extremely complex.

Q. Can you have a situation where the well is contaminated today in fractured rock, and you come back two years later and it's not present, and you come back later than that and it is?

A. That can occur. That's not as common because those fractures are interconnected.

Let's say you implemented a product recovery program at that well, you actually somehow went in and sucked the pure gasoline out, and after a period of time you realize, Oh, we cleaned up that gasoline, the well doesn't contain gasoline now, you might come back

a few months later and the gasoline has reaccumulated. It's just taking time to move through the fractures and reaccumulate in the well.

Q. Does that have implications about your recommendations at MTBE sites in this case?

A. That's one of the key factors we would consider in determining what would be an appropriate site-specific restoration program.

Q. Let's go to the next slide, please.

These are steps to achieve a restoration program, which you explained earlier, is getting down to 1 part per billion for MTBE or below so that it can no longer be detected. Correct?

A. That is correct. That is the first subset within the restoration. What is your goal?

Q. In this case, how does that apply?

A. So with respect to the stations that are the subject of this matter, one would evaluate technologies that would allow you to restore the aquifer to that standard or a combination of technologies.

Q. In evaluating the feasibility of restoration approaches, does the setting matter?

A. It does, yes. So one has to consider site-specific conditions because one technology may

work at one site but not at another. In some cases, we have technologies that are more widely applicable such as pump and treat, which could be applied to many if not all of the sites.

Q. So basically it's not a one size fits all approach. Is that correct?

A. That's correct. And even if the technology is applicable to multiple sites, how it's supplied is different and specific for each site. So the number of recovery wells, the pumping rate, how it will be treated, those are all site-specific conditions even if the same technology is applied.

Q. And you used that site-specific analysis in your recommendations in this case for restoration?

A. Yes, we did.

Q. Now, you indicate that in selecting the technology at an individual site, it matters whether or not the contamination in point number 4 is in the vadose zone or soil versus the groundwater on an off-site and drinking water. Why is that?

A. When one is considering where the contamination is, the technology or the approach one takes to remediation or restoration will vary. Therefore, cleaning up the vadose zone -- that is the area above groundwater, it would be a different technology than

if we were cleaning up groundwater.

Now, if we're cleaning up on-site groundwater as compared to off-site groundwater, again, it might be a different technology. If we were cleaning up an impacted drinking water well, the technology might be somewhat similar, but now we're dealing with a different type of groundwater condition where we might have a well with very high flow conditions.

Q. The last step is estimating the cost. We are not going to be spending any time on that today, I believe. I don't think that's really the focus of the motion. So let's go to the next slide, please.

You indicated eight technologies were evaluated, and you list them on this slide. What is "monitored natural attenuation"? I think "no action" is self-explanatory.

A. So "monitored natural attenuation" is an approach that is taken to address groundwater contamination. So once a chemical is in the groundwater, there are processes that occur that can retard that contamination's movement and also processes that can in fact slowly degrade or address the contamination. Those processes collectively are referred to as "natural attenuation."

Now, to evaluate whether that's going on, you

have to actually monitor the conditions.
Q. What does it mean to "monitor"?
A. One has to actually measure the groundwater in monitoring wells and take samples from those wells, have them analyzed to evaluate whether the natural attenuation processes are in fact restoring the groundwater in a reasonable period of time.
Q. So I take it monitored natural attenuation would be different than relying on natural attenuation without monitoring?
A. Well, it's hard to rely if you are not monitoring it. You do not know if it's happening. You have to monitor it to know if it's happening or not.
Q. Is it important to do the monitoring?
A. Yes, it's very important. One needs to know whether the natural attenuation processes are in fact sufficient to address the contamination and restore the aquifer.
Q. Are there sites in this case where you recommended monitored natural attenuation at some point in the process?
A. Yes. I believe, actually, at all of the sites. We recommended at some point as part of the restoration program we would move to a monitored

natural attenuation approach.
Q. Was that at the beginning of the process or toward the end or what?
A. It's essentially toward the end. So one would implement some other form of restoration to reduce contaminant concentrations to a point at which you believe monitored natural contamination could address the residual lower contaminations.
Q. And typically at these sites, where was that point where you thought you could transition from what I'm going to call active remediation or cleanup to monitored natural attenuation?
A. We indicated that we felt the appropriate point would be once one reached the groundwater quality standard -- that is, 70 parts per billion for MTBE, one could transition from active remediation or active restoration to monitored natural attenuation.
Q. Why did you select that level?
A. Based upon the work I've done at hundreds of sites, we often find there is a concentration of which active remediation would be no quicker addressing the low concentrations than just letting natural attenuation. So one doesn't know exactly what that level might be, but we often find it's some multiple of the restoration goal. And in looking at the

information for many of the sites, we felt an appropriate number would be a groundwater quality standard.

Q. The third technology you have evaluated was "enhanced biodegradation." We talked earlier about injecting oxygen. Is that an example?

A. Yes. That's the most common approach taken to enhance biodegradation.

Q. Why would injecting oxygen enhance biodegradation?

A. Biodegradation in the subsurface occurs in two types of ways.

One is aerobic; that is, degradation by bacteria that like oxygen rich environments; and anaerobic, which is a degradation by the microorganisms that prefer low oxygen environments.

Q. Which of the two tends to be faster in degrading?

A. So with respect to MTBE, one would prefer to see aerobic conditions. Now, for certain other constituents, you are actually better off with anaerobic conditions. So, for example, many of the chlorinated solvents that are released to the environment or the bacteria that degrade them prefer anaerobic conditions.

Q. So literally by injecting oxygen you could make in an oxygenated environment that wouldn't exist in nature that enhances the biodegradation of MTBE. Correct?

A. That's correct, yes. That's the intent behind many of those oxygen injection programs.

Q. Now, "soil vapor extraction," it applies to the vadose zone or unsaturated area because you are calling it soil?

A. Yes. This is a technology that's used to treat contamination in the vadose zone. That's above groundwater, floating on top of the groundwater, or also slightly mixed with that capillary fringe. Here we are relying on the natural volatility of the contaminant to partition into the vapor; that is, it moves from the gasoline and becomes a vapor within the pore space, and you essentially suck it out.

Q. Is that effective if the contamination is in the soil zone?

A. If it's in the soil and the contaminant is volatile in its pure phase, and the soil is relatively permeable, soil vapor extraction is extremely well.

Q. Basically, is the goal to remove massive contaminant from the subsurface?

A. Yes. Essentially, the contamination that's

still present in the soil or present as LNAPL, is what's referred to as a secondary source. It sits there and continues to contaminate groundwater. Therefore, the technology like soil vapor extraction is used to reduce that secondary source.

Q. Another technology you considered was in-situ air sparging. Could you describe that for us, please.

A. In-situ air sparging is a process by which air or, in some cases, oxygen are injected below the groundwater table. They accomplish two things.

First, they can create a more aerobic environment, and the second, the physical injection of the air can partition or strip some of the dissolved constituents from the groundwater and move them into the vapor phase in the vadose zone where they can then be withdrawn by soil vapor extraction.

Q. What is "multiphase's extraction," briefly?

A. So this is essentially combining soil vapor extraction with the extraction of LNAPL, if it's accumulating in wells, and the extraction of very high concentrations of MTBE that are dissolved in the groundwater at the site itself.

So it's widely used at the release site to not only get rid of contamination within the vadose zone, but also recover LNAPL and the very high

concentrations of MTBE in the groundwater.
Q. So multiphase literally captures vapor and water?
A. It's capturing in many cases vapor, pure gasoline, and water.
Q. What is "in-situ chemical oxidation"?
A. In this case, this technology not only injects oxygen to enhance aerobic conditions, but you inject an actual chemical at very high dosages to promote the physical oxidation of the contaminant. That is, a chemical reaction will occur that eventually breaks the contaminant down ultimately to carbon dioxide and water.
Q. So it's a chemical attacks chemical process?
A. Essentially, yes. You are injecting some oxidative compound, like hydrogen peroxide or fenton reagent to promote a physical reaction in the subsurface.
Q. The last technology listed is "pump and treat"?
A. Yes. So pump and treat, we mentioned that earlier, this is where one puts in a pumping well that's specifically designed to intercept the plume, or it could be multiple wells that are pumped at a defined pumping rate to capture the contamination. You essentially pump it to pull in the contamination;

and then once it's pumped from the well, you treat it with some type of above-ground technology.

MR. MILLER: Your Honor, I'm about to shift to the two sites.

THE COURT: Off the record.

(Off-the-record discussion.)

BY MR. MILLER:

Q. Let's turn to the Exxon Livingston site first, please. That's Plaintiff's Exhibit 4. We've marked the PowerPoint into three sections, 3, 4, and 5.

This is a description of some basic details about the Exxon Livingston site which is in a township in New Jersey. Correct?

A. That's correct.

On this figure to the left we could see an insert map which shows the State of New Jersey, and the yellow star would be the approximate location of this particular site.

Q. It's been a gas station since 1934, but MTBE wasn't a gasoline in 1934. Is that your understanding?

A. That's my understanding, yes.

Q. Back here on the East Coast, when was MTBE introduced in the gasoline, approximately?

A. It varies, depending on location and oil

company, but I have seen examples where MTBE was added to gasoline in the late 1970s. It was not added as an oxygenate. It was simply added as an octane enhancement to improve the combustion of the gasoline. So it was added at much lower percentages.

Q. So if you add oxygen to gasoline, it literally raised the octane level that we are familiar with at the pump?

A. That's correct. It allows the gasoline to burn more efficiently.

Q. In that particular case, Exxon Livingston, have they installed approximately 40 monitoring wells?

A. That is correct, yes.

Q. And those monitoring wells are used to gather measurements of various chemicals, including MTBE?

A. Yes. They have a chemistry data set that extends over 15 years. So they have been sampling the wells for over 15 years, and having those samples analyzed for gasoline constituents including MTBE.

Q. Did you evaluate the 15 years of chemistry data particularly as it applies to MTBE?

A. Yes, we did.

Q. And in terms of the extent of the documents you had on file, what is the size of the file, please?

A. With respect to this particular site, we

reviewed over 11,000 documents.

Q. Let's go to the next slide, please.

There are some dots shown over an aerial photograph of the area. What do the dots represent?

A. So this figure is actually taken directly from my expert report. This is the service station in the area where we see the majority of the dots. This is the Exxon Livingston site. This is Livingston Avenue at Mount Pleasant, the main intersection here, and the dots -- most of them are approximate to the site or just to the west of the site, but there are also dots that extend about a third of a mile to the west of the site. These are monitoring wells that have been installed by ExxonMobil.

Q. And is a public drinking water supply well also depicted?

A. Yes. There are actually two supply wells depicted on here. This is Livingston Supply Well 11, which is about a third of a mile to the west of the Exxon Livingston site, and there is also a commercial well for a liquor store that's to the southwest of the ExxonMobil site.

Q. Are we talking about an unconsolidated deposit environment, a fractured bedrock environment, or what?

A. So for this particular site we have a thin

veneer of unconsolidated sentiments, not so thin, 30 feet or so; and below that we have bedrock. So we are addressing contamination both within unconsolidated sediments and in the bedrock itself.

Q. So if we take the public drinking water supply well, Livingston 11, is that actually completed in drawing water from bedrock?

A. If I move down a few slides. We go to this slide here.

Q. Is this kind of a map of the subsurface?

A. Yes. First, let's look at this figure here, which is the map we just looked at, and it has two red lines on it. These lines depict where we are going to show cross-sections. These are vertical slices of the subsurface, and the cross-sections depict the geographic conditions that were mapped in the drilling of the wells. So we're going to look at cross-section A prime that runs across the Exxon Livingston site to the northwest, and then to the public water supply well, Livingston Well No. 11.

Q. Where did you get the data to do the cross-sections from?

A. The data is collected by the consultants who drill and install the monitoring wells or the drilling company that installed the public supply well. When a

consultant is retained, in this case for the majority of the wells, by ExxonMobil, when they drill the bore hole, that's the physical hole they drill into the subsurface within which they will install a well, they take samples of soil and rock they encounter, and they describe that on what's called a boring rock. And, as my family says, yes, your job is pretty boring.

Q. So let's look at the cross-section that's along that line you have shown us that goes all the way to Well 11.

A. Yes. It's difficult to read the particulars on this. This is taken from my expert report. This area here is the Exxon Livingston site. We've marked the site. The cross-section runs from just east of the site all the way to Public Water Supply 11. It shows the type of geology that was detected when the monitoring wells were drilled as depicted by the consultants working for ExxonMobil.

Q. I see Zone A, as an example, the shallowest of the labeled zones toward the bottom of the figure that we have, and it extends all the way from the ExxonMobil site to the well. Correct?

A. That is correct. So when they investigated the site, ExxonMobil's consultants first identified the unconsolidated sediments that ranged from about 20 to

50 feet thick, depending on where you are; and at that point they entered the bedrock, and they classified the different layers of the bedrock, which is referred to as strata, those different layers, and they labeled them by A, B, C and D descending with depth beneath the ExxonMobil station. So the shallowest bedrock zone they referred to as Zone A, and then it went B, C and D. So these are the different bedrock layers.

So the consultants evaluating the bedrock felt there were differences within the samples that allowed them to basically develop this layered model for the bedrock.

Q. Do you agree with them in the way they defined those zones?

A. Yes. They have done a reasonably good job of characterizing the bedrock.

Q. Okay.

A. Now, as they advance more wells to the west of the station, they realized, because of the natural dip, that is, the slope of the bedrock layers, there was actually a bedrock zone above A, and they just referred to that as Zone Z.

Q. Why would the bedrock dip in this way? Is there a brief way to understand that?

A. Without getting into a complex geologic

discussion, over time, historically, the layers may have been deposited flat horizontally, and then over time, because of the natural forces in the subsurface over millions of years, the layers can become bent or tipped; they can also become faulted and offset. So that's referred to as the dip. That's the slope of those layers that has changed over time, and the slope that is now present.

This slide, slide 3 of the set shows the regional geologic conditions. So here we have the natural geologic conditions regionally in the area of Livingston, and we can see that same dip that occurs to the west within the geologic strata.

Q. If we go back to your cross-section, did MTBE make its way from the Exxon station all the way to City Well 11 to the city of Livingston?

A. Yes, it did.

Q. It was detected in the well more than once?

A. Yes. There was a period of time MTBE was detected in the well, but in the recent sampling over the last few years no MTBE has been detected in Supply Well 11.

Q. Did you, in evaluating this site, evaluate whether there was some other MTBE source in the area besides the Exxon station in Livingston at 38 East

Mount Pleasant Avenue?

A. Yes. We actually looked at data for two other service stations within this area. One I remember was a Texaco station. I can't remember the branding of the second station. But we evaluated the contaminant and groundwater conditions at those two stations to determine whether they might have contributed to the MTBE detected at Livingston Supply Well 11.

Q. Did you also evaluate the nearest receptors or wells in doing your analysis for this site?

A. Yes, we did. Obviously, we discussed Water Supply Well 11. There are also a series of other water supply wells proximate to the Exxon Livingston site.

This figure, again, is taken from the expert report. The yellow star here is the Exxon Livingston site. Then we have Public Water Supply Well 11. We have other water supply wells that are proximate. The one of real concern is Water Supply Well 11. But we also identified a commercial well at the Bottle Stop Liquor Store.

Q. What is the distance between the Exxon Livingston site that released MTBE in gasoline and Well 11?

A. We indicated here on this slide it's 1700 feet.

So about a third of a mile.
Q. Did you also compile a site chronology?
A. We did, yes. We reviewed all of the documentation for this site and prepared a brief chronology both in text format, which ran many, many pages, of all of the actions that occurred at this site, particularly the investigation and remediation actions, and then we also prepared a bar graph to show those actions over time.
Q. Did Exxon actively remediate the site?
A. Yes, they did.
Q. Did they do that in general before or after they learned that MTBE was in City Well 11?
A. The majority of the remedial actions that have been implemented occurred after the discovery of MTBE in Water Supply Well 11.
Q. If you do remediation back at the site after it's been detected in a well a mile away, does that help over time?
A. Yes, it will. You are removing the source of the contamination, the secondary source we talked about. So one is limiting the amount of contamination that could ultimately over time impact groundwater.
Q. You mentioned the MTBE detections in City Well 11 went away over time. What do you attribute that

to?

A. I think the key factor would be the complexity of the hydrogeology. Well 11 pumps water from fractured bedrock. So there may be a period of time there was some contamination, a defined fracture that was intercepted by that well. But over time that MTBE was no longer present in that fracture and hasn't been seen since then.

Q. Does that rule out the possibility that over time some other fracture may contribute MTBE to the well?

A. No, it does not. The continued migration of the plume could ultimately impact the well at a subsequent time.

Q. Now, did you make recommendations concerning this site?

A. Yes, I did.

Q. In understanding your recommendations, the first thing we need to discuss is groundwater flow?

A. Yes. You may recall part of the standard methodology I use and other consultants use in evaluating these contaminated release sites, we do a site-specific analysis, and one of the steps is to evaluate the hydrogeology and groundwater flow conditions. How deep is the groundwater? Which

layers, which strata is the groundwater present in? And which direction does the groundwater flow within those layers?

Q. At this site, the direction of groundwater flow literally changes depending on what area in the subsurface you are talking about. Is that correct?

A. That is correct, yes.

Q. Can you explain that, please?

A. Certainly, yes.

So ExxonMobil, as part of their investigation program, has installed wells at various depths. They are installed in different layers, different strata. Some of the wells go into the unconsolidated sediments; others are screened within defined bedrock layers. And in quite a few locations, they have installed multiple wells at a single location. These are often referred to as cluster wells. So you have multiple wells, and they are completed at different depths. That allows us then to monitor the water level in those wells that's specific to an individual layer and determining the groundwater flow direction in that layer.

Q. So what are the directions of the flow in the subsurface that vary?

A. Certainly, yes.

So based on the data that has been collected by ExxonMobil in the monitoring wells that they have installed, within the unconsolidated sediments the predominant groundwater flow direction is to the southwest. Now, one has to understand, there is always some variation. Groundwater flow changes with time to some degree.

Q. Does it change by season, for example?

A. By season. It can change in response to well pumping. But, In general, for the unconsolidated zone, the flow is to the southwest.

Q. Okay.

A. Now, when we look at the conditions within the bedrock, the wells that are completed in Zone B, that is the second bedrock layer beneath the Exxon station, the flow direction is also predominantly to the southwest. We know, for example, that's the direction towards the commercial water supply well that was impacted.

Q. Well 11?

A. No, the commercial well I'm talking about to the southwest.

Now, if we look at wells that are completed in Zone C, the layer below that, the water levels in that zone indicate a flow direction actually to the

northwest or west-northwest. So it's almost 90 degrees off from the flow direction in the layer above.

Q. And if we go to the northwest, we encounter City Well 11?

A. Correct. That's the direction which we would find City Well 11.

Q. Could we go back to the map where you show the location of the commercial well, please.

A. Yes. So this is the Exxon Livingston site. This is the commercial well southwest of the site. And this is the municipal water supply well to the west-northwest of the site.

Q. Does City Well 11 intercept the C zone where movement is to the northwest?

A. Yes. It actually intercepts all of the zones that have been characterized as part of the investigation by ExxonMobil.

So bedrock Zone Z, A, B, C, and D because they all dip to the west, but the public water supply well is very deep, so it intercepts all of the different bedrock zones that have been characterized by ExxonMobil.

Q. Can we turn to your slide 9 in this subset concerning the site where you characterize the

contamination.

Historically, what was the maximum contamination of MTBE found at the Exxon Livingston site?

A. So the next step after we've evaluated groundwater flow conditions is, What are the contaminant conditions? So where is it? What's the extent? What's the magnitude?

When we summarize some of the magnitude information in this particular slide, where we have the three particular contaminants of concern, MTBE, TBA, and benzene, the first detected concentrations -- that is, when they first sampled wells at the site, what was the concentration? And the maximum concentrations detected over the entire 15-year record, which is now almost 17 years, and then the maximum in the most recent sample we had at the end of 2016, that was documented in my 2017 expert report.

So the maximum MTBE detected in a monitoring well related to the ExxonMobil site was 234,000 parts per billion, and this was in a sample taken from Monitoring Well 1, which is at the Exxon station taken in July of 2003.

Q. Is it located in the station somewhat near the underground storage tanks?

A. Relatively close, yes. This is close to where the release occurred.

Q. Today's most recent concentration that you give from your 2017 report is 74 parts per billion and change?

A. Correct. The most recent sampling in December of 2016, the highest MTBE detected in any of the samples collected by ExxonMobil was 74.3 parts per billion.

Q. And what do you attribute that decline to?

A. It's attributed to the active remediation that ExxonMobil has been implementing for many years at this site.

Q. Does the remediation at the site -- I realize you said it produces concentrations further away over time. But does it actually address the contamination that has already left the site directly?

A. It does not address the contamination that has migrated away from the site some distance. Obviously, what it does, it cuts off the source. So now we have a finite concentration and massive contamination off-site.

Q. And if you don't clean up the source, what happens instead?

A. Instead you got continued loading of the

contaminant into the groundwater and continued migration of those higher concentrations off-site. That's the importance of doing on-site source remediation.

Q. Now, did you make recommendations in your report of 2013 that Exxon actually made a comparable change to what they have done in the past as a result of your recommendations?

A. Yes.

MR. LENDER: Objection, your Honor. Foundation, because it was his recommendations. We would like to get a foundation for that.

THE COURT: I'm not sure of your objection.

MR. LENDER: Just the foundation. Whatever ExxonMobil did was because of his expert report. I would like a little foundation that was assumed in the question.

THE COURT: I understand.

MR. MILLER: I can try and lay that foundation, your Honor.

BY MR. MILLER:

Q. When you prepared your report in 2013, did you make some recommendations concerning additional activities that should occur at the site?

A. Yes, I did. In particular, I recommended that

the high levels of contaminant that were detected immediately west of the site, they were off-site, but immediately to the west, those should be remediated also. And, in addition, I also recommended an that additional investigation more distant from the site be conducted. Those are just two of the recommendations I made.

Q. And did Exxon do something after you made those recommendations in the areas you've just described?

A. Yes. Between the production of my expert report in 2013 and my evaluation of data in 2017 for this site, ExxonMobil had expanded their remediation program to pump contaminated groundwater from the west of the station, and they pumped that water to their on-site treatment system. So they had expanded remediation to the area immediately west of the station.

Q. Let's take that a step at a time. You take contaminated groundwater. It has MTBE in it. You said you treat it. What do you physically do to remove the MTBE?

A. So the technology that's most used and used in this case is one passes that contamination or the contaminated water through vessels that contain granular activated carbons. So this is a media that

absorbs contamination. It's usually made from either ground up coconut shells or bituminous coal that's been ground up.

Q. So if we looked at a filter for a fish tank, it would be similar to those granules if it was bituminous?

A. Yes. Often people have filters in their own home that you can actually attach to the tap. They contain a granular activated carbon. So they absorb organic chemicals.

Q. So that filter can be used to literally remove MTBE to what level? We start out with contaminated groundwater. We have to go through the treatment. What do you have?

A. Essentially, the system is operated so it's non-detect below the PQL.

Q. Did ExxonMobil use a treatment process at the station to clean up contaminated groundwater?

A. Yes. They used that process.

Q. Did they also use it in the western area off-site that you described recommending they install treatment in?

A. Yes. They used the existing treatment system they had on site and they just ran plumbing to off-site wells just to the west, installed pumps in

those wells, and pumped that contaminated groundwater to their on-site system.

Q. Do you agree that action on their part of installing treatment in the western area was appropriate and necessary?

A. Yes. It was consistent with the recommendations I made in my 2013 report.

Q. Now, you mentioned that in addition to recommending treatment in the western area in 2013, you recommended some off-site investigation. What was your goal in recommending that off-site investigation?

A. So in 2013 we had quite limited off-site data related to the release at the ExxonMobil station, that is, more distant beyond, say, Livingston Avenue, and, therefore, I had recommended the investigation of some depth discreet monitoring wells; that is, you complete the bore holes and install monitoring wells that are screened within specific layers.

Q. Why would you want them in specific layers?

A. Because one wants to know specifically where is the contamination in the subsurface, in which particular layers, and also one could then calculate where is it moving in those individual layers.

Q. Did Exxon do anything after 2013 in your report to conduct investigation in that area that you

described?
A. Yes. They did advance some very deep bore holes and completed sampling points at specific depths, within specific layers at those locations.
Q. And is that part of what you recommended?
A. Yes. That was somewhat consistent with what I recommended in 2013. I actually recommended more locations, but they had advanced some of those locations by 2017.
Q. And did that investigation have something to do with the distance from the service station to City Well 11, Livingston Well 11?
A. Well, the investigation was in that general direction and was more off-site towards the water supply well.
Q. And prior to the time that you recommended it, had Exxon placed any monitoring wells in the distance between the station once we get away from a station itself and City Well 11?
A. Well, historically, they had installed monitoring wells just to the west, as far as Livingston Avenue.
Q. A distance of how far about?
A. Maybe 350, 400 feet.
Q. So we have another almost a thousand feet to go

before we get to City Well 11?
A. Correct.
Q. And did you recommend that monitoring wells be put over that distance?
A. That is where I focused the additional investigation that I recommended for this site.
Q. And did the contamination of MTBE in City Well 11 have something to do with that recommendation?
A. Yes. Obviously, we understood that well had been contaminated at some point in the past. Therefore, we felt it was highly likely that there was going to be some contamination within the bedrock to the west of Livingston Avenue.
Q. When those monitoring wells were drilled, did they determine that MTBE was in that additional distance between the furthest point of on-and-off-site monitoring associated with the Livingston station and the well, so when they drilled in the area you recommended, did they find MTBE?
A. They did find MTBE at certain locations and at specific depth intervals.
Q. And how were you able to predict what direction and what depth they should test and then find MTBE at that location?
A. Well, one evaluated first the groundwater flow

conditions, so which direction was groundwater flowing in, particularly, in the deeper bedrock, and where had historically MTBE been detected.

We knew there were several detections at Water Supply 11. We also knew there had been detections of MTBE right up to Livingston Avenue, just south and north of Mount Pleasant. So generally we knew from the distribution of the existing contamination and the groundwater flow direction that it was highly likely that contamination would be present west of Livingston Avenue.

Q. Is is your opinion that the Exxon Livingston station is the likely source of MTBE if it was detected in City Well 11?

A. Yes.

Q. And at the time you made your initial recommendations in 2013, had Exxon acknowledged that they were the source of contamination in City Well 11?

A. Not that I'm aware of.

Q. I want to turn to your key opinions. There are quite a list of them.

Did you develop this set of posed questions for each of the sites and answered them based on the data for individual sites?

A. Yes. I developed a set of 21 specific questions

that I would address for each individual site. So my answer to those questions would essentially be then from this list of opinions. So these questions were posed for every single site I evaluated, and the answers vary between sites based upon the site-specific information, and the answers were the opinions.

Q. For example, in question 6, you answered "no" because in your opinion no release from a different site commingled with the Exxon release?

A. I could not conclude that it was more likely than not that such a commingling of contamination had occurred. Therefore, my opinion is that, no, such commingling had not occurred.

Q. And in 2013, did you form the opinion the Exxon Livingston site was not only a threat, if we look at question 20, to the deep aquifer but also to potential receptors, namely, wells?

A. Yes, I did.

Q. In your opinion, did the additional investigation done after 2013 that you've described in this courtroom between the station and the well confirm that opinion?

A. Yes, it did.

Q. In other words, we now know that the release at

the Exxon station in your opinion is not just a threat to that well, it is the source of the MTBE in that well. Is that correct?

A. The source of the contamination that had been previously detected in that well.

Q. Now, in essence, samples were taken along the line between the station and the well, and MTBE was found when they drilled a well at an appropriate depth along that distance. Is that correct?

A. That is correct.

Q. How does that support or reject your opinion that it is the source?

A. We now know, based upon the additional investigation that ExxonMobil has been performing, that MTBE contamination is present in discrete bedrock zones to the west of Livingston Avenue, and that contamination is contiguous with the contamination on the east side of Livingston Avenue; that is, there is now contamination present between the ExxonMobil station almost all the way to the Public Water Supply Well 11.

Q. Okay. Let's turn to the feasibility study that you did for this site.

We previously talked about each of the technologies. You've abbreviated them under the

heading "Approach" in this table?
A. Correct, yes. We have not included the "No Action." We just included the seven other approaches.
Q. Some of the technologies are listed as low, some are medium, and some are high. What does "high" referred to?
A. So you may recall, as part of the feasibility evaluation, we evaluated the eight technologies under three criteria.

"Effectiveness" -- that is, would they be effective at addressing the contamination and lowering the risks to the environment and public health?

The second being their "implementability." Can you implement them? That is both technical implementation, can you physically do it, and administrative implementation? Would you be allowed to do it?

The third element would be a relative term of "costs." Are the costs low, medium, or high? Both in terms of capital, what you have to spend to put the system in in the first place, and then long-term operating cost.

THE COURT: So the OMM is your operating?

THE WITNESS: Operation and maintenance.

Q. And the capital cost is the cost of installing

the treatment system or technology. Correct?
A. It's installing the pumping wells, the plumbing, the infrastructure for the treatment plant, the treatment plant itself, the design and permitting of all of that. So it's all of those up-front costs that occur in a short period of time.
Q. So all of the technologies had a medium operating maintenance cost, except for pump and treatment which is rated as high, so it would be more expensive?
A. No. Actually, the way the evaluation is conducted, if the technology has low effectiveness and low implementability, then we don't consider the cost because, clearly, it's not going to be effective and it's not going to be implemented; therefore, the cost is irrelevant. So the little dash there means we don't have to evaluate the cost. So we only evaporate costs for technologies that are rated medium or high in terms of their effectiveness and implementability.
Q. Now, had Exxon already implemented some of the technologies listed, for example, soil vapor extraction at the site?
A. Yes. For the vadose zone, they had implemented a remediation system onsite that utilized soil vapor extraction.

Q. Did it work?
A. Yes. It has worked quite well.
Q. To explain, why did you list it as low in effectiveness?
A. Because here we are looking at its effectiveness to address the groundwater contamination, and SVE is not really applicable to groundwater. SVE which is the acronym for soil vapor extraction is not really applicable for groundwater. It's used to treat contamination above the groundwater.
Q. So the technologies that you believe, based on your site-specific information are likely to be effective, are listed as monitored natural attenuation off-site as opposed to on-site. Correct?
A. Correct.
Q. And pump and treat?
A. That is correct. And the pump and treat would be both for on-site contamination and the near-site. That is the area just to the west where high concentrations have been detected.
Q. Did Exxon also use the pump and treat technology with respect to the site?
A. Yes, they did. They implemented initially an on-site pump and treat program; and after 2013, they expanded it to include pump and treat just to the west

of the site.

Q. So does it appear in terms of Exxon's actions they formed a similar opinion on the technology which should be used and where it should be used?

A. Yes. The actions that Exxon has taken at this site are consistent with my recommendations.

THE COURT: Let me understand. You said they did pump and treat on or near the site just west of the site, and your recommendation is just west of the site. So are you suggesting there is anything else that needs to be done with regard to pump and treat or has that been completed?

THE WITNESS: With respect to this particular site, the current pump and treat system is the only active remediation or active restoration program that is required at this site. The remaining parts of the contamination could be addressed through monitored natural attenuation.

THE COURT: So your opinion is pump and treat is no longer an issue for restoration?

THE WITNESS: That is correct because ExxonMobil is already doing that.

THE COURT: So the only issue for this site is, as you see it, the monitoring wells?

THE WITNESS: There are actually two issues.

One is the ongoing monitoring of the wells to demonstrate that natural attenuation is controlling the contamination and reducing the concentrations into the future.

The second thing is there is still required some off-site investigation required.

THE COURT: I wanted to know what we are limiting ourselves to as to what still needs to be done in your opinion.

Maybe this is a good time to break. Let's be back at around 1:10, please.

THE DEPUTY CLERK: All right.

(The luncheon recess is taken.)

(Continued on the next page.)

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A F T E R N O O N S E S S I O N

(In open court.)

THE DEPUTY CLERK: All rise.

THE COURT: Thank you.

You may continue.

ANTHONY BROWN, resumed.

DIRECT-EXAMINATION (continued)

BY MR. MILLER:

Q. Good afternoon.

A. Good afternoon.

Q. Mr. Brown, is the process of cleaning up contaminated groundwater on-site and to the west, those two extraction wells pumping to the centralized treatment system, is that completed or is it ongoing?

A. As of the time of the preparation of my updated expert report in 2017, it was still ongoing.

Q. And did you in your 2017 report take into account that Exxon had done some of the work that you had proposed so as to eliminate those items from your estimate?

A. Yes. When you consider what I had recommended in 2013, ExxonMobil had actually done some of that

work between 2013 and 2017. Therefore, I updated my recommendations in 2017 just to reflect what I felt was outstanding.

Q. Okay. I want to go to where we are today. So I want you to skip forward to site restoration.

This is a summary of your recommendations in your report. Is that correct?

A. On the 2017 report, yes.

Q. You recommend six monitoring well clusters. You previously described a cluster well is where you have multiple completions basically in the same hole?

A. Actually, no. A cluster well are monitoring wells completed in different holes very close to each other, within a few feet of each other.

Q. Hence, the name "cluster"?

A. Correct.

Q. And the reason you have several of them is so that you can do depth discrete sampling?

A. That is correct. You may recall, we have consolidated zones, and within the bedrock, we have Zones Z, A, B, C, D, and then clearly even zones below that. So we had recommended that the wells be screened in those individual zones.

Q. And what did the six monitoring well clusters have to do with your site restoration plan?

A. Essentially, they would allow us first to have greater understanding of the distribution of the contamination within the aquifer to the west of the Exxon site, and then those wells can be used to perform the ongoing monitoring needed to demonstrate natural attenuation was sufficient to ultimately allow the restoration of groundwater to a pre-discharge condition.

Q. So the monitored part of natural attenuation, your proposal is six well clusters?

A. Actually, the monitoring would be done on all of the wells. This means we believe there were still six locations where additional data was needed.

THE COURT: And how many wells was that going to include?

THE WITNESS: To date, there are 40 monitoring wells at the site, and then we are proposing six clusters.

THE COURT: When you say "clusters," how many in a cluster?

THE WITNESS: It varies. In some there's only two, and in other there are five. I can't remember the exact number, but it's probably on the order of about 20 more monitoring points.

THE COURT: Is there any issue with the

location of them and who owns the property?

THE WITNESS: We don't believe so. We tried to position them either on property where wells have already been installed or on properties where we believe you should be able to get access.

BY MR. MILLER:

Q. The recommendation for six monitoring well clusters is specifically tailored to this site and MTBE concentration factors?

A. Correct. Those are specific to the conditions at this particular site.

Q. Is that particular set of recommendations contained in your 2017 report?

A. It is, yes.

Q. And was an earlier version with additional recommendations in your 2013 report?

A. There was in my 2013 report. There were additional recommendations within that report.

Q. And you've downsized them to fit the current situation?

A. Correct. ExxonMobil had performed certain actions subsequent to 2013 that required me to reduce the scope of the recommendations for this site in 2017.

Q. Next slide, please.

This is your list of site restoration products of a part of 2017 expert report?

A. That is correct, yes.

Q. There is only one item that has an asterisk, "well-head treatment system design permitting," 59 thousand and change, and the asterisk at the bottom says, "claim withdrawn."

MR. MILLER: Your Honor, to clarify, we've notified counsel in writing that we are not making that claim in view of the current situation. The rest of it describes the additional work that needs to be done for --

THE COURT: That should be crossed out and that amount deducted. Right?

MR. MILLER: Correct.

THE COURT: Thank you.

THE WITNESS: I should clarify. There is also a contingency that would be deducted as well. So the total that would be deducted is the 59,000 for that line item and another 10,000 of contingency.

THE COURT: But you have $247,410 on contingency. You are only taking a small amount out of that?

THE WITNESS: 10,000, which would be the contingency related to the well-head treatment.

THE COURT: Tell me what "contingency" means.

THE WITNESS: So obviously when performing a investigation and restoration program, when one develops an initial cost, there is always some degree of uncertainty what the ultimate cost might be, and in fact I think it's probably pretty normal in our business to find that the ultimate cost is often more than one initially estimates.

Sort of when you get a contractor to do some work on your house, the chances of him coming under that bid are pretty slim. So, generally, we find that the costs are greater because of uncertainties. So the contingency addresses those uncertainties.

THE COURT: How did you determine what the contingency is? A certain percentage?

THE WITNESS: Correct. For this site it's 15 percent, and it's based upon contingency factors that are documented by USEPA for when one is preparing such costs.

THE COURT: Okay

BY MR. MILLER:

Q. Did you also use the standard methodology for coming up with the costs?

A. Yes, we did.

Q. Could you briefly describe it.

A. Certainly. So what we did is we developed essentially a very large menu of likely items that would have to be done at any particular service station, and I believe they were on the order of 70 different items on the menu from installation of the monitoring well in bedrock to 50 feet might be one line item. It could be the installation of a granular activated carbon treatment system.

So there were various line items that when one looks specifically at the site you would pick from the menu, and the line item costs were based on either fixed hard numbered bids that we received from local contractors, estimated costs from publications. There are a series of publication put out that document typical construction costs. And then also for professional services, our own estimate, as to what those would be.

THE COURT: Could you just explain -- because, obviously, if I added every one of these line items, it's more than your bottom line. So what am I actually adding?

THE WITNESS: So you are actually adding the total capital cost --

THE COURT: Take out the cost of the monitoring wells on top.

THE WITNESS: So the monitoring wells and the wellhead capital --

THE COURT: That was all part of the total capital.

THE WITNESS: -- would have come into total capital.

THE COURT: Got it.

THE WITNESS: Because the wellheads come out, the total capital amount would be the 860,000. Then you are adding that to the NPV monitoring, the 730,000. That's based on the annual monitoring cost and --

THE COURT: It's the 159,449 is per year and you multiply that by five.

THE WITNESS: Five, and you adjust it for net present value.

THE COURT: Okay. I've got it.

THE WITNESS: And that comes to 730,000. And then you have a contingency on top of those two numbers, which is 15 percent of the total. So you are adding it up. In this case now one item has been removed -- 860, 730, and 247.

THE COURT: I have it. Thank you.

BY MR. MILLER:

Q. Why did you recommend monitored natural

attenuation for five years versus some other period of time, please?

A. Well, we actually performed an analysis of how long the contamination would persist from 70 parts per billion to 1 part per billion based upon certain degradation factors; and based on the various scenarios we run, it was somewhere from five to 70 years. Therefore, we took the most conservative, that is, the lowest number of years in developing our costs, even though it could run much longer than that.

Q. Okay. There is some discussion in the papers about FLUTe wells versus cluster wells. What is a FLUTe well?

A. So a FLUTe well is a fairly innovative new approach to completing multi-level monitoring points.

So you may recall, what we are recommending is multiple wells close to each other in a cluster. There are a variety of approaches that can be used to draw a single hole, and complete a much more complicated completion that has multiple sample ports.

So essentially you only have one hole, it's a bigger hole, but then you have a much more complicated completion. FLUTe well is one of those types of approaches. The other one we often see commonly is called a Westbay system.

Q. What is the concern, if any, with either the Westbay or FLUTe systems, if you could briefly explain that?

A. Generally, the concern when one is completing a single bore hole with multiple sample ports is that you can get a cross contamination between the ports because essentially your seal between the ports is quite small. Therefore, that seal can become pump compromised. So there is greater concern about how valid the results would be from a multi port versus a cluster well where you know the well is completed just in just one zone.

THE COURT: Are FLUTe wells accepted?

THE WITNESS: Yes, they are. Westbays are too. They have been around longer. With the history I know of, there have been a lot of problems with Westbays, and I had clients that drilled them out and had to replace them.

THE COURT: I'm not sure I got a differentiation between Westbays and FLUTe wells.

THE WITNESS: They are actually just two different methodologies to complete a multiple sample ports in a single bore hole.

BY MR. MILLER:

Q. If, for purposes of understanding this FLUTe

well concept, you have shallow contamination at a particular layer, and you have a desire or need to sample lower than that, what would happen if the single bore hole was used and the system failed for any reason, to maintain separation for each of the layers where they are taking samples?

A. Obviously, the concern then is you get cross contamination between the layers. So your sample is no longer as valid because it doesn't represent a single zone.

Now, the way the wells are intended to be installed, the hope is that that doesn't occur. Unfortunately, with the history I know of the Westbay system, it had occurred quite a bit of time in these multiple completions.

Q. Could you literally introduce how it contaminated groundwater that is shallow into a deeper zone?

A. You could. That would mean you would be installing one of these wells in an area where there is very high shallow contamination, which generally that's not where they are installed. They are usually installed more distant from the release.

So you would usually be in monitoring levels that are in tens or hundreds of parts per billion, not

the tens of thousands.

THE COURT: So that's not a real concern.

THE WITNESS: Particularly for this site, that would not be a concern.

These wells, the FLUTe wells that have been installed, are out in the more distant location where one would not expect to see very high levels in shallow zones.

Q. Are FLUTe wells relatively new?

A. The gentleman that developed them developed them some time ago. But I would say they have only been used more widely in recent years. In fact, this is the first case I'm aware of where FLUTe wells were used. I'm sure they've been used elsewhere, but it's the first one that I have come across.

Q. Did the FLUTe wells have a track record that tells us how reliable they are?

A. I couldn't say. I have not evaluated the technology in its wide-spread use.

Q. Okay. Why did you recommend cluster wells instead of FLUTe wells?

A. Cluster wells provide a more rigorous sampling process. Because you are drilling an individual bore hole for each sample interval, you know you have eliminated the risk of cross contamination if you

complete the well perfectly, which would be a normal well completion process.

In addition, many of the existing locations that have been drilled by ExxonMobil were already cluster wells. They had already been using that approach to investigate the contamination at the site up until the more recent period when they had used some FLUTe wells.

THE COURT: What is the difference in cost between a FLUTe well and a cluster well?

THE WITNESS: I don't know the exact number. I would anticipate because it's a single bore hole or be it a larger bore hole, the FLUTe wells would be less expensive.

THE COURT: You don't know if it's demonstrably less or what the cost actually is?

THE WITNESS: I don't. We reviewed the expert reports for ExxonMobil's experts and we couldn't identify any cost they presented as to the cost of the FLUTe wells.

THE COURT: So essentially your opinion today is based on what you think is the best course to take, and it's not looking at a cost comparison because you don't really know what the cost differential would be?

THE WITNESS: I think that's a reasonable

summation, yes.

THE COURT: Is FLUTe a brand name?

THE WITNESS: I think it may even be trademarked.

THE COURT: Thank you.

BY MR. MILLER:

Q. Now, the defendants in their papers claim that your recommendation for five years of monitored natural attenuation was arbitrary and duplicative. Do you have a response?

MR. TULLY: Your Honor, I'm just curious, no part of this defendant's motion is seeking to exclude this expert on his cost calculations. I'm just not sure this is a productive use of our time.

MR. MILLER: I'll stop, with the Court's permission.

THE COURT: Okay. Go ahead.

BY MR. MILLER:

Q. I want to move to the Bakers Gulf service station site.

MR. MILLER: Which is Plaintiff's Exhibit 5 in the PowerPoint, your Honor.

Q. This is a station located on the Franklin Turnpike in Waldwick, New Jersey, and you reviewed the history of the site and you summarized it here. Is

that correct?

A. Correct, yes.

In this slide we show on the left just the vicinity of the site, and the yellow star in the middle is the location of the service station. The insert map is the State of New Jersey, and we can see this site is in the northeast corner of the state, and then we summarize its location and the history as an operating gasoline station.

MR. TULLY: Your Honor, before we go further, if we can get some clarification, a number of slides referred to, and, therefore, I'm expecting the testimony the witness will be attempting to give relate to information that was not considered as part of the August 2017 supplemental report, and that's the basis of our motion.

I just wanted to get some guidance because it would be inappropriate to now supplement essentially his expert report by testifying as to data that he did not review.

THE COURT: That he did not review. You mean didn't review at the time of his 2017 report.

MR. TULLY: Some of which was not even sought after the 2017 report, and plaintiffs concede in their briefing that information that was provided as to many

of these well locations, it was provided in 2013, and it is not referenced in any fashion in the 2017 report.

And now in these slides, if you look at the back of the deck, apparently the testimony will be as to that data, starting at slide 17 -- your Honor, this is what we pointed out in our reply.

The witness also submitted an affidavit in support of the opposition to the Daubert motion that made some of these same points. And as we argued in our reply, I think quite correctly, you just can't do that. He's now essentially supplementing his 2017 report with information that he apparently didn't even have when he finalized that report.

That's the essence of our motion, your Honor. So this examination and cross-examination will take a very different tact if he's either allowed to supplement his report, which I contend he should not be, or if he is.

THE COURT: Mr. Miller.

MR. MILLER: Your Honor, I use a PowerPoint as a guide, and you will see that I adjust my questions to the situation and don't necessarily go over every point in the PowerPoint just as I had not yet. When we get to that area, I can explain what we are doing

and why we are doing it the way we are. I thought it was important to put it in context --

THE COURT: The underlying question being raised is, Are there now attempts to give opinions about matters for which there was evidence prior to the submission of his report, which he did not include in his original report but is now opining on.

MR. MILLER: His opinions have not changed one iota at all. In fact, this data that they are talking about is in my judgment trivial compared to the total amount of data that was used and the total number of documents that were used. I think we need to put it in that context, and it will assist the Court in deciding whether or not their point has any real relationship to his opinions.

THE COURT: I'm going to allow some testimony on it. We'll put it in context when he cross-examines --

MR. TULLY: I was going to suggest, if we take it conditionally --

THE COURT: That's fine. I think that's the way to go.

MR. MILLER: I have no objection to taking it conditionally.

THE COURT: All right. Please continue.

BY MR. MILLER:

Q. Can we go to the next slide which discusses the site location.

There are about 40 monitoring wells associated with this site. Correct?

A. There are 40 monitoring wells that either have been installed by the parties responsible for the release at the Gulf station or installed by other parties but monitor the contamination associated with the release at the Gulf station.

Q. We'll get to the other parties in a little bit.

Basically, those 40 monitoring wells associated with the station, you have chemical monitoring data for MTBE and TBA for how many years?

A. For 19 years.

Q. Do you regard that as a sufficient data set in which to base opinions?

A. Yes. For this site there is a reasonable chemistry data set, yes.

Q. Did you consider all 19 years of data in doing your analysis?

A. I did, yes.

Q. Up through 2017, the time of your last report. Correct?

A. Correct.

Q. All right. And then in terms of the amount of documentation you used for this site, it's over 8,000 documents. Correct?

A. That is correct.

Q. Let's go to the next slide.

It discusses the regional hydrogeology. Can you explain the setting to us, please, from a hydrogeological perspective .

A. Certainly, yes. And I will try to keep it as simple and understandable for a layman as possible.

Essentially, the site is located in an area where the initial deposits below the ground surface are again unconsolidated sediments. They are actual glacial deposits. They contain both coarse grain units like sand and gravel, and also some finer units that contain some glacial silts and clay.

Below that there is bedrock again, and, again, in this area the bedrock is essentially dipping, and here it's dipping to the south, and the bedrock is part of what's referred to as the Passaic Formation. It contains one of the main aquifers that's used for water supply in this part of New Jersey

Q. The next slide, please.

You evaluated receptors. Correct?

A. Yes. As part of our assessment of the regional

background information we identified eight public water supply wells within one mile. Now, only two of those are within what was termed the court delineation area and the others were outside of that area.

We also identified the nearest surface water bodies, including the pond and the brook about 1500 feet to the south of the service station.

Q. Now, there were MTBE detections in some of those receptors. Is that correct?

A. That's correct.

The next slide actually shows some of the detections at the Ridgewood Andover Well, and there was one just one detection back in 1999, and there were also some detections at the additional well we identified. Again, these were historical detections, and there have not been consistent detections particularly in recent years.

Q. Why a "non-detect" followed by a "detect," if you can briefly explain?

A. There are two issues one has to consider here.

The first is, say, for example, at the Ridgewood Andover Well in 1999, the concentration that was detected in July of that year was .7 parts per billion. It was very low. In fact, it was even below the PQL. So non-detect might be very close to that

concentration, but the lab just couldn't see it.
Q. Even if you have consistent detection in the well, when you look at the chemistry data, is it common to have variation in the concentration?
A. Yes. In fact, one would expect that. The sample is never identical each time you take a sample. The old adage is: You never step in the same river twice.
Q. And the chronology for the site, please. You reviewed the historical data and plotted it on a timeline. Is that correct?
A. Yes. You may recall in the standard methodology that we used, Step 3 was to review the site-specific data, and that included developing a very complete and lengthy summary of all of the activities at the site, and then we summarized the key elements on this timeline.
Q. The maximum concentration of the MTBE at the site was what and when?
A. The maximum concentration was 2,500,000 parts per billion. That was detected, I believe, in 1999.
Q. In a monitoring well on the site property?
A. It was MW-5.
Q. Which is an abbreviation for monitoring well No. 5 associated with this station?

A. That's correct.
Q. You also made a note in 2012 on this chronology that the latest maximum MTBE concentration at Kaplan Cleaners was 14,000 parts per billion, listing a monitoring well number. Correct?
A. That is correct.
Q. And that's in 2012 at Kaplan Cleaners Monitoring Well 2-D. And in your 2013 report did you discuss MTBE's occurrence in Kaplan Cleaners wells?
A. I did, yes.
Q. Now, a dry cleaners such as Kaplan Cleaners, MTBE is not something you would expect to be at their site from their activities. Is that correct?
MR. TULLY: Objection; foundation.
THE COURT: It's basically a leading question. So why don't you just ask him the question.
MR. TULLY: It also calls for speculation.
THE COURT: I don't know that it does. The real question is: Do you get MTBEs from dry cleaners from what they do?
MR. TULLY: You do if they have underground storage tanks on premises.
THE COURT: Look, you're testifying for me now. That's your cross-examination. We're talking about from the general use of the dry cleaners. Feel

free to explore this on your questioning. We will eventually get to that.

BY MR. MILLER:

Q. Kaplan Cleaners had monitoring wells of their own for their site. Correct?

A. That is correct, yes.

Q. What was their contaminant of concern or the reason they were doing this monitoring?

A. They were investigating a release of PCE, which is perchloroethylene, and it often goes just by the abbreviation PCE, and that is the solvent used in dry cleaning.

Q. Okay. So is PCE commonly associated with dry cleaning sites that have had releases?

A. Yes. It was historically used as the dry cleaning solvent in nearly all dry cleaning sites.

Q. And when they submitted samples that tested for PCE, is it uncommon to have MTBE results disclosed by the lab?

A. No. Now that the labs include the ether oxygenates as part of the standard analytical package for volatile constituents, the lab reports not only the PCE but the concentration of the ether oxygenates, including MTBE, along with many other constituents.

Q. So when you reviewed a completely separate file

for Kaplan Cleaners, did you find some MTBE data that you used in your 2013 opinion?

A. Yes. As part of the analysis of samples taken at the Kaplan Cleaners during their investigation, they had detected high concentrations of MTBE in the deeper samples that is within the lower intermediate zone in the bedrock.

Q. How did that relate to your 2013 opinions, briefly?

A. Essentially, we had identified that this site was directly down-gradient of the release at the Gulf station, and this site had detected high concentrations of MTBE in the groundwater, particularly deeper groundwater, that clearly were associated with the release at the Gulf station.

Q. Now, if you have a release at the Gulf station in millions of parts per billion, can that create a plume that is long and large?

A. It can, yes, long and large; and in this particular case, also, it dives and goes deep as it migrates to the south.

Q. And the concentration at the dry cleaners of more than 10,000 parts per billion, actually 14, in your mind and in your opinion, is that reasonably explained by migration of an MTBE plume from the gas

station we are talking about, Bakers Waldwick Gulf, to the Kaplan Cleaners site?

A. Yes, that is what's indicated. It is associated with the release at the Gulf site.

Q. Since you were seeing it in 2013 in the tens of thousand of parts per billion, did you expect that if we went back there in 2017 it would all be gone?

A. No.

Q. Why is that?

A. Essentially, the concentrations obviously were very high for an off-site location. There was no active remediation going on for the groundwater in that area; therefore, one would have expected the concentrations to persist not only because they were there previously, but because they would be continuing to migrate in that direction from the Gulf site.

Q. And in forming that opinion, did you consider the nature of remediation activities at the Gulf station?

A. Yes. There had been ongoing remediation at the property itself, the Gulf property.

Q. Could you describe that, briefly.

A. Yes. They had been conducting some multiphase extraction and air sparging. You may recall, I discussed those technologies earlier. Essentially,

they were bubbling air into the aquifer to oxygenate and strip out some of the contamination, and then they were doing multiphase extraction to suck out high levels of contamination in the vadose zone and dissolved in the groundwater directly beneath the site.

Q. And throughout the history of this site, up to your 2017 report, did they have any pump and treat system that was designed to prevent MTBE dissolved in groundwater from moving away from the site?

A. They did not.

Q. And in contrast, the Exxon Livingston station did have that. Correct?

A. The Exxon station did have an on-site pump and treat system which they later expanded to even include pumping off-site.

Q. So, basically, given the nature of the remediation being done at this Gulf station, did you expect that distant contamination such as that at Kaplan Cleaners would continue to occur?

A. Yes, that's a fair statement.

Q. And was that concept expressed in your written reports in both 2013 and 2017?

A. Yes, it was.

Q. And when you were preparing your 2017 report,

were you able to get your hands on updated Kaplan Cleaners data?

A. Between the preparation of the 2013 report and the 2017 report, we had expected that additional samples had been taken at the Kaplan Cleaners site; therefore, we made a request through legal counsel if that information could be obtained. But as of the time of the preparation of my report in 2017, we have not received that data.

Q. Now, if we look at the groundwater contamination data, if we can turn to that slide, please -- I'm sorry, groundwater flow. I inadvertently skipped one.

This is concepts that you had about how groundwater was moving with MTBE in it that were expressed in your opinions. Is that correct? Your reports.

A. Yes. Here we're summarizing the groundwater conditions at and to the south of the Gulf site.

Q. And did the flow directions that you describe here include movement of a plume of MTBE toward the Kaplan Cleaners site?

A. Yes. In general, it's moving to the south.

Q. And you have expressed the opinion that both in bedrock and in the unconsolidated material it's moving at times to the south and then other times to the

southwest; this is the natural variation in flow direction. Is that correct?

A. In the shallow zone. In the intermediate zone, it varies south-southwest to south-southeast; and in the bedrock, generally, it's south-southeast.

Perhaps if we go to the previous slide, it annotates here that cross-section that shows those different zones.

Q. And is that opinion about the direction of the groundwater flow based on hydrogeological data, namely, measurements of water levels in wells?

A. That is correct.

Q. Let's turn to the groundwater contamination summary.

The first detection at the site was 81,000 parts per billion, but the concentration went up two years later to 2,500,000 parts per billion. Why would it go up during that period of time?

A. Well, actually, those were samples taken at two different wells. When it was first detected at the site, they had drilled four wells. So the first detection was in MW-1, Monitoring Well 1.

Subsequently, they installed some additional monitoring wells. And when they sampled MW-5 a couple of years later, that was the well that was closest to

the point of the release, and had the maximum concentrations.

Q. Is that the apparent explanation for the change?

A. Yes. It's simply the location of the well.

Q. I want to go to the remediation plan.

Before I get there, with respect to the feasibility study for Bakers Gulf, did you follow the same procedures you described earlier?

A. Yes. It was the exact same analysis. We did a feasibility analysis or feasibility study that applied for all of the sites, and then we specifically selected the technologies that were appropriate for each individual site, and the feasibility study was contained within my expert report along with the site-specific selection of technologies.

Q. The next slide, please.

This is your site restoration plan. It involves a recommendation for 11 monitoring well clusters and one off-site pump and treat system and monitored natural attenuation for five years after pump and treat. Is that correct?

A. That is correct, yes.

Q. One of the reasons you are recommending a pump and treat system is to date none has ever been done at this site. Is that correct?

A. There had been no pump and treat and there had been no off-site remediation to address the high levels of contaminant present to the south of the Gulf site.

Q. And that's the reason you recommended the pump and treat system?

A. Yes, along with other factors. We obviously considered the hydrogeologic conditions that would make pump and treat the most appropriate technology.

Q. Now, does the Bakers Waldwick Gulf site have as extensive an off-site monitoring network as the Exxon station?

A. I would not say it's as extensive. They do have a significant number of wells, especially when you consider the wells that were installed as part of the Kaplan Cleaners investigation. However, there's still significant data gaps in terms of identifying where the contamination is present to the south of the site.

Q. And is that the reason you recommended the higher level or number of monitoring well clusters?

A. That's correct.

Q. You recommended monitored natural attenuation for five years after pump and treat. Why not during pump and treat?

A. Actually, the monitoring does go on while the

pump and treat is taking place. So the monitoring is done on a quarterly or in some cases semi-annual basis from the time the wells are first installed.

So what we are recommending here is that monitoring should continue for five years after the pump and treat system stops operation.

Q. Basically, after you get down to concentrations 70 parts per billion or lower. Correct?

A. For MTBE, that's correct, yes.

Q. Then you have a site restoration cost estimate, the next one, and you used the same techniques for developing the restoration costs and recommendations for this site, as you described earlier. Is that correct?

A. Yes, the same approach we took to all of the sites.

Q. Now, let's go to the Kaplan data.

MR. TULLY: Your Honor, just so that you can follow along, this is now the data that was in the plaintiffs' possession but not considered at the time of the 2017 report.

THE COURT: Thank you.

BY MR. MILLER:

Q. The Kaplan data involves eight monitoring wells. Is that correct?

A. There are eight monitoring wells at the site, that is correct.
Q. And when you did your 2013 report, you had data from that set of monitoring wells that included MTBE detections. Is that correct?
A. That is correct. We had data collected prior to the preparation of my expert report.
Q. Now, had anything changed between 2013 when you did your original report and 2017 when you did your supplemental report that would cause the natural behavior of MTBE in groundwater to change, in your opinion?
A. Not that I could think of, no, other than the continued migration.
Q. So given the nature of MTBE, you expected it to continue to go into groundwater in the service station area. Correct?
A. Actually, if you look at the on-site remediation that was done at the Gulf site, they had actually removed most of the contamination beneath the Gulf site. So the concentrations on the site had been declining significantly during the period they implemented the on-site remediation program.
Q. Okay.
A. So we were not looking really at a situation

where there was significant new contamination being added to the groundwater. So we had a finite concentration or massive contamination that now was simply migrating further to the south.

Q. And the groundwater was going to continue to move unimpeded away from the site and toward the Kaplan Cleaners, in your opinion?

A. And beyond the Kaplan Cleaners.

Q. And that was your opinion in 2013?

A. It was, yes.

Q. And 2017?

A. Correct.

Q. Now, if you compared all the data associated with the Kaplan Cleaners site to all the data you had for the overall MTBE picture for the Gulf station, could you describe the relative contribution of those data points for me?

A. If I understand the question correctly, if we just took the wells that are being installed by Gulf, which is approximately 32 wells, and they had monitoring data for 19 years collected multiple times a year for all of those locations, we had a very significant data set.

For Kaplan Cleaners they installed eight wells, and I believe at the 2013 timeframe, the wells

had only been sampled once or twice. So a much more limited data set for the Kaplan Cleaners than we had for the wells being installed by Gulf.

Q. So they weren't sampling the wells as frequently. Is that correct?

A. That's correct.

Q. Do you have any understanding why that was?

A. I can't say for certain, but I believe the Kaplan Cleaners was essentially an orphan site. That means there was no responsible party who was implementing the investigation remediation program and therefore was relying on public funds to implement the program.

Q. Have you looked at the Kaplan Cleaners data since 2013 as part of your response to this motion?

A. Yes. You may recall earlier I mentioned that we had assumed there may be some new samples that had been collected at the Kaplan Cleaners between 2012, which is when we had a data set to prepare the report, and 2017 when my updated report was prepared.

We made a request through legal counsel if there was any data, but at the time of the preparation of the 2017 report we had not received that data, but we did receive it subsequent to the preparation of the 2017 report.

Q. And did they find MTBE at lower concentrations later in time?
A. At Kaplan Cleaners?
Q. Yes.
A. No. The concentrations were very similar. In fact, slightly higher.
Q. So the conditions were essentially unchanged in terms of the concentration. Correct?
A. Yes. The new samples essentially confirmed the earlier results.
Q. And did it provide any new information that you didn't have before?
A. It provided new data. But that data simply confirmed the previous data I had that supported the opinions that I presented.
Q. Did you form any new opinions because of getting the additional Kaplan's data after 2013?
A. No.
Q. Are your opinions the same today after reviewing it?
A. Yes.
Q. Would it change the estimate of the cost of dealing with it at all, the contamination?
A. It has not, no.
MR. MILLER: That's all the questions I have

at this time, your Honor. I was trying to finish at 2:00, and I missed.

THE COURT: I think you're close enough.

Livingston is going to go first.

MR. LENDER: Yes, your Honor. Would it be okay if I just take a five-minute break.

THE COURT: Okay.

THE DEPUTY CLERK: All rise.

(Recess.)

* * * * *

(In open court.)

THE DEPUTY CLERK: All rise.

THE COURT: Thank you.

You may proceed.

CROSS-EXAMINATION

BY MR. LENDER:

Q. Mr. Brown, you filed your initial expert report concerning the Livingston site back in November of 2012 and a revised report in January of 2013. Is that correct?

A. That is correct.

Q. And then you issued your most recent report in August of 2017. Right?

A. That is correct.

Q. During that more than four-year period between

your original report and your most recent report, the Livingston site has continued to be cleaned up under the direction of the LSRP. Correct?

A. That's my understanding.

Q. And just so we have it, that's a new term we used for the first time. An LSRP is a licensed site remediation professional who is licensed by the State under the supervision of the Department of Environmental Protection and is responsible for cleaning up sites in New Jersey. Correct?

MR. KAUFMANN: Your Honor, that's a legal issue and that's an incorrect description of what an "LSRP" is. An LSRP is licensed by the State and --

THE COURT: I prefer that you not testify. So if you think it's not accurate, you can rephrase it; or if you know the answer and you would like to correct it, feel free.

What is an "LSRP," as you understand it?

THE WITNESS: An LSRP is a licensed professional within the State of New Jersey. It's hired by the responsible party to direct the investigation and remediation program at a release site.

BY MR. LENDER:

Q. And the LSRP, as you understand, essentially

steps into the shoes of the DEP. Correct?
A. I wouldn't use that phrase. They essentially take over the oversight. They submit their reports to the DEP and the DEP on occasion might audit the report.
Q. During the period of time between your original report and your most recent report, you understand additional monitoring wells have been installed at the Livingston site. Correct?
A. That's correct.
Q. And you also explained during your direct testimony that natural attenuation will be relied upon to further clean up the Livingston site. Correct?
A. Yes. That would be one of the approaches to address the contamination at this site.
Q. Natural attenuation is the process where through biodegradation, dilution and other natural processes contamination gets further reduced. Correct?
A. Yes. Either the contaminant penetrations are essentially diluted or in some areas the concentrations are actually declining as a result of degradation.
Q. And natural attenuation can occur whether you are monitoring the natural attenuation or not. Correct?

A. Yes. Natural attenuation processes are natural processes. However, one only knows if they are occurring if you actually monitor.

Q. To be clear, it's the natural attenuation, not the monitoring that further cleans up the contaminated sites. Right?

A. The processes that actually result in the declining concentration are the natural attenuation processes.

Q. So whether we add more monitoring wells or fewer monitoring wells, natural attenuation still occurs and occurs at the exact same rate. Correct?

A. The processes are still ongoing. We just need to confirm they are ongoing and at what rate.

Q. That's right. It's the natural attenuation, not the monitoring. Correct?

A. The monitoring is confirming it.

Q. So adding more monitoring wells will not clean up the Livingston site any faster. Correct?

A. It will not change the rate. It will allow us to more effectively monitor that the processes are in fact occurring and occurring appropriately.

Q. And adding more monitoring wells, as you have proposed, will not get the Livingston site to pre-discharge conditions any faster, and if we don't

add those monitoring wells. Correct?
A. No. We'll simply understand from the wells whether it is actually occurring in the expected way.
Q. Now, all of the additional investigation and remediation activities that have occurred at the Livingston site since you issued your initial report in 2012 has resulted in significant changes to many of the opinions presented by you in your original report. Correct?
A. That's correct. Quite a few of the opinions I presented in 2013 had to be changed in response to the work performed by ExxonMobil.
Q. And as a result, certain things you proposed in your initial report are now no longer necessary in your opinion. Correct?
A. Either they are no longer necessary or they are being implemented by ExxonMobil.
Q. For example, in your original report you had recommended that active remediation be expanded to the northwest of the Livingston site. Correct?
A. That is correct. We had recommended a system that was just on the west side of Livingston Avenue where historically higher concentrations of MTBE had been detected just on the east side of Livingston Avenue.

Q. And now you no longer believe that is justified based on the conditions at the Livingston site. Correct?

A. That's correct. The subsequent investigation performed by ExxonMobil in that area just west of Livingston Avenue indicated that the concentrations were much lower than expected; therefore, active remediation would not be needed.

Q. So you are no longer seeking any costs for that off-site remediation system. Correct?

A. That is correct.

Q. Now, work has continued to be done to clean up MTBE in connection with the Livingston site even since you issued your report in August of 2017. Correct?

A. That would be my expectation, yes.

Q. And you understand and concede that the dynamic nature of the contamination plume and remediation activities at the Exxon Livingston site means that circumstances at the site are in constant flux. Correct?

A. Yes. That's true for any site. Obviously, there are changing ongoing at any particular release site with respect to the migration of the contamination and obviously in relation to any actual remediation that's ongoing.

Q. So that means assuming you are allowed to testify that the additional steps you have proposed in your August 2017 report might no longer be necessary by the time you testify at trial. Right?
A. I could not say whether they would or not. It would depend on data that has been collected subsequent to the preparation of my 2017 report. Although I would expect the majority of the recommendations would still likely be needed.
Q. And whatever you might say at a trial, for example, might no longer be necessary by the time any appeals run. Correct?
A. It would depend upon site conditions. We don't know at this time what the data might reveal in the future.
Q. For example, it's possible that the LSRP could decide to do some of the things you are recommending in your report. Right?
A. That is correct. Just as some of the things I recommended in 2013 were actually implemented.
Q. And if that happens, ExxonMobil will be required to pay for that work. Right?
A. That would be my understanding, yes.
Q. And if that happens, it could moot some of your opinions. Right?

A. Potentially. I would have to speculate whether it would or not.

Q. In fact, you agree that for a finder of fact to reach accurate conclusions, it needs to be based on the most current conditions at the site. Right?

A. In an ideal situation, yes. Unfortunately, most of the cases I'm involved in, there is essentially a cut-off or else you will be forever updating your report over and over again every time a new piece of data was created. And every time you have a report, then you would have depositions. And by the time you go to trial, there would be more data. So it would just run forever. So usually there is a deadline or a cut-off date imposed.

Q. Well, let's look at some of your specific opinions and see where we go with that.

It's your opinion that ExxonMobil should install additional monitoring wells to assist in the delineation of MTBE and to further evaluate whether additional remediation might be required with respect to Livingston. Correct?

A. Yes, that's correct.

Q. And you are seeking $860,000 for the design and installation of 21 additional wells for that purpose. Correct?

A. Correct, at six discrete cluster locations.
Q. And the reason why you believe these additional monitoring wells should be installed is to further characterize and delineate the extent of the contamination. Correct?
A. Yes.
Q. Now, you understand that remediation falls within the province of the DEP under its LSRP program. Correct?
A. Yes, that's my understanding.
Q. And part of remediation is delineating the extent of the contamination. Correct?
A. Yes. In certain types of projects they refer to that as the "remedial investigation" because they're the components of the overall remedial program.
Q. In fact, adequately delineating a site falls directly within the province of the LSRP. Correct?
A. My understanding is they would be adequately delineating, but to the groundwater quality standards.
Q. And you understand ExxonMobil is not going to be allowed to finish its work at Livingston unless and until the LSRP decides that the site is adequately delineated. Correct?
A. Could you read the question back to me?
Q. You understand that ExxonMobil is not going to

be allowed to finish its work at the Livingston site unless and until the LSRP decides that the site is adequately delineated. Correct?

A. That's my understanding of what the LSRP would be required to do.

Q. And ExxonMobil is not going to be allowed to finish its work at Livingston until it completes all of the required remediation work as directed by the LSRP. Correct?

A. The remediation work, yes, would be directed by the LSRP.

Q. So if the LSRP believes that 21 additional wells are necessary to fully delineate the site, it will require that work be done and ExxonMobil will pay for it. Correct?

A. That would be my assumption, that they would direct the work to be performed and Exxon would pay for it.

Q. Of course, if the LSRP disagrees with your assessment, the work presumably will not be directed to be done at the Livingston site. Correct?

A. Unless Exxon elected to voluntarily do that work.

Q. And, of course, another option is your client, the DEP, could disagree with the LSRP's assessment and

they could require the work to be done. Correct?
A. I believe they have that authority, yes.
Q. So if the DEP, your client, believes 21 additional wells need to be installed to fully delineate the site, it could direct the LSRP to do that work?
MR. KAUFMANN: Objection, your Honor. Now, he is asking questions about DEP policy, and I don't believe that that is the field of Mr. Brown's expertise.
THE COURT: It may not be, but he's asking his understanding because he's come up with the cost estimates of what has to be done and compared remedial issues versus the restoration.
So, if you know.
And I think he's been answering in the way that he thinks he understands.
MR. LENDER: Thank you.
BY MR. LENDER:
Q. If the DEP believes that 21 additional wells need to be installed to fully delineate the site, it is your understanding that it can direct the LSRP to do that work. Correct?
A. I would say I do not understand the full legal authority they have. My understanding would be that

the oversight agency normally would have some authority to demand such work if they felt it necessary.

Q. There is an entire regulatory framework for reviewing sites and determining whether it's adequately delineated and whether additional monitoring wells need to be installed. Correct?

A. There is, and we have been discussing essentially the program within the LSRP.

Q. And, to your knowledge, to date, your client, the DEP, has never directed that these additional wells be installed. Correct?

A. I'm not aware of any such direction.

Q. And you have never spoken to the LSRP about the work you think should be done. Right?

A. I have not.

Q. Now, Mr. Brown, you are aware in March of 2019, so just two months from now, the LSRP overseeing the Livingston site is required to file its remediation investigation report?

A. I wasn't aware of that.

MR. LENDER: Your Honor, if I could just mark just so we can get the timing down as Defendant's Exhibit 1, a document from Kleinfelder, Bates Range XOM-NJDEP-REM-31310-1073785.

(Defendant's Exhibit 1 was marked for identification.)

BY MR. LENDER:

Q. Now, Mr. Brown, Exhibit 1 is a document from Kleinfelder regarding the Livingston site. You can see that on the first page.

If you turn to the third page, do you see where it says that the initial remedial investigation report was due in March 1, 2017, and that the revised date it's now due March 1st, 2019?

A. I see that, yes.

Q. Thank you.

Now, you understand that the remediation investigation report is a report that the LSRP is required to submit to the DEP as part of the State's regulatory framework. Correct?

A. That's my understanding.

Q. And that report will need to set forth the delineation for the site. Correct?

A. It will need to discuss the nature and extent of the contamination. It may not address complete delineation, but it would need to at least comment on the extent.

Q. The report needs to include a detailed description including the dimensions, contamination,

and suspected sources of the contamination. Correct?
A. That's my understanding.
Q. And the report will also propose a classification exception area or a CEA. Correct?
A. I cannot state for certain. I believe that's my understanding.
Q. You know what a CEA is. Right? You mentioned earlier that you've reviewed the regulations?
A. Yes.
Q. And the CEA sets forth the outerbounds of the plume where all chemicals of concern are below the water quality standards. Correct?
A. That is the intent. It's intended to identify an area of the groundwater where concentrations within that area are above the groundwater quality standard.
Q. And the CEA also identifies the locations and identifications of wells and/or sampling points, including those that represent the farthest down-gradient extent of the groundwater contamination. Correct?
A. That's the intent behind the CEA with respect to the groundwater quality water standard, not a pre-discharge standard.
Q. Now, are you aware of whether the LSRP is going to require that additional monitoring wells be

installed as part of the remediation investigation report?

A. I can't say for certain. But I do recall some discussion about ExxonMobil planning to do some additional wells after my 2017 report.

Q. Okay. And if more monitoring wells are installed, you would need to revisit your opinions. Right?

A. That would be true of any investigation. I would need to consider that to see if the new data affected my opinions in any way. So, for example, if a new monitoring well was installed and they found very high concentrations of MTBE because they intercepted a fracture that contained the contamination, that obviously would have an impact on my opinions.

Q. And you would also agree ExxonMobil should not have to pay to do the same work twice. Right?

A. I think that's a reasonable position to take.

Q. Okay. Now, when the remediation investigation report is provided to your client just two months from now, they presumably will read it. Right?

A. I cannot speak for my client.

Q. And if the DEP believes that the Livingston site is not fully delineated or believes that additional

monitoring wells need to be installed, it can reject the report or require that they be installed. Correct?

A. Well, I cannot say for certain. That would be my understanding of part of their authority.

Q. Thank you.

Now, in terms of your proposed 21 additional wells, you are proposing individual casings for those wells. Is that correct?

A. That is correct. They would be cluster wells.

Q. Meaning that for each well you are proposing to drill a new well. Right?

A. That is correct.

Q. So just for an example, for one of the places where maybe you said that there should be five additional depths, your opinion would require the LSRP to drill five separate holes. Correct?

A. That's correct.

Q. And you understand that right now at the Livingston site they are actually using the FLUTe system. Right?

A. I didn't know whether they are using it right now. I understand for the wells installed immediately prior to my 2017 report, they've used the FLUTe system.

Q. And the FLUTe system, I think you mentioned, but let's be clear, it allows you to drill one bore hole but then have multiple sample locations. Correct?
A. That's correct. You drill a large diameter hole and you insert a very complex well construction that allows for depth specific samples to be taken.
Q. Now, during your direct examination you suggested the reason why you didn't recommend using the FLUTe was because of some concerns you had about the FLUTe system. Do you remember that testimony?
A. I wouldn't say I was concerned specifically about the FLUTe system. I have some concerns based on my experience with other similar approaches to doing multiple sample locations within a single bore hole.
Q. Well, to be clear, no one at your company has actually ever installed and used the FLUTe technology in a site investigation that you've conducted. Correct?
A. That's correct.
Q. And you have no experience installing a multi-level system like the Westbay system you mentioned in bedrock. Correct?
A. No. My experience of multi-level sampling in bedrock has always been using cluster wells.
Q. Not the FLUTe wells that we have been talking

about?
A. Correct.
Q. And the truth is, the reason why you recommended installing 21 individual casings in your revised report rather than a FLUTe system was because you had recommended individual casings previously. Right?
A. Partly. We had recommended them previously, and that's how ExxonMobil had initially investigated the contamination.
Q. And that's why you recommended doing it again, because that's what you had recommended before. Right?
A. That's only part of it. I think the existing investigation performed by ExxonMobil, but also my experience doing similar investigations at numerous sites.
Q. Now, using the FLUTe system is absolutely an alternative to installing the individual casings. Correct?
A. Yes.
Q. And there is no question that a FLUTe system is an appropriate technology. Correct?
A. Yes, I think it is an appropriate technology.
Q. You also concede that a FLUTe system would be less expensive. Right?

A. While I do not have the exact numbers, I don't anticipate anticipate that even though you are drilling a larger bore hole and you have multiple complex completions, it would still be somewhat cheaper than individual holes.

Q. Mr. Brown, you did nothing to cost out the FLUTe system or how much less expensive it would be than installing 21 individual casings. Correct?

A. I did not.

Q. In fact, you have never once costed out a FLUTe system in bedrock. Right?

A. That's correct.

Q. And you also did no analysis to determine whether you could even install additional individual casings at the locations you have identified. Right?

THE COURT: I think you want to put that in context as to what you mean by whether he could. Do you mean geographically, geologically, or ownership or otherwise?

MR. LENDER: Fair enough, your Honor.

THE COURT: While you are looking for that --

When did the site go to the FLUTe system?

MR. LENDER: As far as I know, all of the ones that are west of the site are all FLUTes. I don't know the exact date. I can find out.

THE COURT: That's okay. But obviously that was something that was determined by the LSRP and approved by the DEP?

MR. LENDER: Yes, or wasn't objected to by the DEP.

THE COURT: Or not objected to.

MR. LENDER: Not that I'm aware of.

THE COURT: I'm hearing them shake their heads "no," but I don't know what that means.

MR. KAUFMANN: Either out of ignorance or I don't know what, there is a misrepresentation of what the LSRP program does. The DEP,your Honor --

THE COURT: Well, I don't want to get into this now. I'll take it at the end of the hearing if you want.

But I think I need to have some additional information about this because it's now been made clear that the FLUTe system is being utilized off-site to the western part, that it's being done under the auspices of the LSRP, which is under in some manner the supervision of the DEP.

MR. LENDER: Yes.

THE COURT: Well, I see them shaking their head "no," but I doubt the LSRP is acting without any authority.

So I can have that legal discussion with you, but it is one that I think is necessary to some of my consideration.

Okay. Let's move on to your questions.

BY MR. LENDER:

Q. Mr. Brown, you did no analysis to determine whether or not there were any access issues with regard to drilling wells. Correct?

THE COURT: In a location that he has identified?

MR. LENDER: Yes.

A. Actually, we've cited five of the proposed six locations on properties where ExxonMobil had already obtained access to drill existing locations. Only one of the locations would be on a new piece of property, and it may actually be in a public right of way. But the other locations were all on properties where ExxonMobil has already obtained assess.

Q. So let's talk about the one where there are no wells right now.

You did no detailed analysis to access whether there would be any access issues. Correct?

A. I believe that's why we cited it in the public right of way.

Q. And further in places where there are FLUTe

wells already, there you did no detailed analysis either; you just assumed that because there is a well there now, you could drill four or five more. Right?

A. I assumed ExxonMobil had already obtained access to drill the existing location; therefore, drilling adjacent to it they would be able to obtain that access also.

Q. That's an assumption that you made, not a detailed analysis you did. Correct?

A. I would say that's an assumption I made, and it would appear reasonable.

Q. Okay.

MR. LENDER: Now, if I could I would like to mark -- this was a figure put up on the screen, but it's easier to have a copy of it.

So I'm going to mark as Defendant's Exhibit 2 a copy of Figure 2 from his report.

(Defendant's Exhibit 2 was marked for identification.)

THE COURT: Where is that from?

MR. LENDER: This is Figure 2 from his 2017 report, and I believe it was also put in his PowerPoint.

THE COURT: Okay.

///

BY MR. LENDER:

Q. Now, Mr. Brown, you are familiar with Figure 2 that I just placed before you?

A. I am.

Q. This is a figure that comes from your recent August 2017 report?

A. That is correct.

Q. And this is a map that shows the locations of where you are proposing that additional monitoring wells be installed. Correct?

A. That's correct.

Q. And as you mentioned in most of the instances you are proposing that additional monitoring wells be installed at or near the locations where FLUTe monitoring wells already exist. Correct?

A. Some are located adjacent to FLUTe wells and some are located adjacent to existing cluster wells.

Q. Thank you. That's helpful.

And for the FLUTe wells that have been installed, you understand that the LSRP decided on the depths for the sampling. Correct?

A. My understanding would be, yes, that a consultant working on behalf of ExxonMobil selected those depths.

Q. And you are now proposing that additional wells

be installed at different depths than the LSRP has concluded. Right?

A. In some cases, yes. In others, it is different locations than where the current FLUTe well is, or it would be for different depths where there are existing cluster wells. But those cluster wells only monitor two or three different layers in the subsurface.

Q. The LSRP made the judgment to decide that the monitoring should be at a certain depth, and now you are here saying you disagree and they should be monitored at a different depth?

A. I wouldn't say "disagree." I evaluated their data and identified that there are other layers that need to be monitored at one of the FLUTe well locations. FLUTe well location 20-D4, I believe there is a need to collect samples from bedrock layers above where the FLUTe well currently collects samples.

Q. We're going to get to 20-D4 in one minute. I promise you.

But you understand, of course, if the LSRP ultimately agrees with you, that these additional depths are needed to fully delineate the site, it can require that those monitoring wells be installed and make ExxonMobil pay for it. Right?

A. I believe that's the question you posed earlier

and I answered yes.

Q. Okay. Let me ask you to take a look at Exhibit 3, which is Figure 5-B from your expert report, and I believe Mr. Miller also put this up in his presentation.

I'll ask you to take a look at it.

(Defendant's Exhibit 3 was marked for identification.)

BY MR. LENDER:

Q. Now, Mr. Brown, Figure 5B also comes from your latest August 2017 report. Correct?

A. Yes, it does.

Q. And Figure 5B shows the depths that are currently being monitored for each of the monitoring wells that are currently installed at the Livingston site. Correct?

A. That is correct.

Q. And if we look at 19-D4 as an example, the LSRP has installed a FLUTe system --

THE COURT: Show me where that is. Honestly, this print is so small. It's difficult for me.

MR. LENDER: 19-D4 is the most northern site on Livingston Avenue. So this one.

THE COURT: I see it.

Q. For Monitoring Well 19-D4, the LSRP has

installed a FLUTe system where MTBE is being sampled at six different depths. Correct?

A. That is correct. There are six sample ports located within bedrock Zone C and D.

Q. Now, if we go back to Exhibit 2, from your August if 2017 report, you are proposing that five additional wells be installed slightly north of 19-D4. Correct?

A. Correct.

Q. And that's what you refer to as and AQ1. Correct?

A. Yes. That location, AQ1, is the cluster location that would have five new monitoring depths, four of which would be above the depth sample at 19-D4, and one would be below.

Q. And you included the costs of installing these five additional monitoring wells in your cost assessment. Correct?

A. Correct.

Q. And at the time you prepared your supplemental report in August of 2017, no one had told you that the LSRP had already proposed installing additional wells near 19-D4. Correct?

A. That's correct.

Q. And you now know that in fact the LSRP has

already installed additional wells in this exact area. Right?

A. I was aware that additional wells were being installed. I couldn't say for certain whether it was this area, as I sit here today.

Q. Let me see if I can refresh your recollection from the declaration you submitted in connection with the opposition brief in this case.

Mr. Brown, this is the declaration that you submitted in support of plaintiffs' opposition to this Daubert motion?

A. It is, yes.

On page 4 it makes reference in paragraph 12 to new monitoring wells that ExxonMobil plans in the vicinity of 19-D4.

Q. Does this, now looking at this declaration, refresh your recollection that ExxonMobil has in fact installed additional monitoring wells at the proximate location of AQ1, and that they were also designed to collect depth discrete groundwater samples as you recommended in your expert report?

A. Yes. It does appear ExxonMobil at this particular location is implementing a program consistent with the recommendations that I made.

Q. So because new FLUTe wells have already been

installed at this spot, your opinions and the costs associated with them drop out. Correct?

A. I would have to review obviously the data for the completion of the new monitoring wells and evaluate the impact that would have upon my current opinions and my cost estimates for the restoration program.

Q. And since these wells were installed in the last year and a half, no one provided that information to you. Correct?

A. I have not received it, no.

Q. Mr. Brown, isn't the problem with your cost analysis that if the LSRP agrees with you, you will make us do the work and could moot your damages claim. Right?

A. I would not say that's the problem with it. I would have to speculate that they were going to do it. I do not know, as I sit here, whether they would implement all of my recommendations.

THE COURT: Well, I think the question is simply, if in fact they are all undertaken and the work is done, it basically limits your damage calculations. Correct?

THE WITNESS: So, yes. If, for example, the LSRP or ExxonMobil independently elected to go and

install the monitoring locations that I recommended in my 2017 report, and they were in fact installed, then, clearly, the costs to do that work would need to be removed because they have just been done, because ExxonMobil had decided to do something I recommended.

BY MR. LENDER:

Q. And, of course, the flip side of that is, if the LSRP disagrees with you, the work might never be done because the LSRP could just decide it's unnecessary to delineate the site. Right?

A. Well, if the LSRP elected not to do it, or ExxonMobil independently elected not to do it, then based upon the data to date, my recommendations obviously would still stand. Therefore, I would believe that work still needs to be done and the cost associated with that work would still be relevant.

Q. Do you agree that it would be wrong and inconsistent with your opinions for the State to collect money from ExxonMobil to install monitoring wells and then not actually install them?

A. I don't think I'm in a position to speak for what NJDEP might do. Clearly, my recommendation is those wells are needed, and I've developed costs to install those wells, and my understanding is that's what the State of New Jersey is trying to recover.

How the State would use those funds, that's beyond my control. I still would believe the wells are needed.

Q. Is there a scenario in your mind where the State could actually collect damages from ExxonMobil, and then the LSRP requires us to put those same wells in, then we're paying for the same twice?

A. I can't answer that.

THE COURT: We're dealing with his opinions, and the issues you are raising are things I will deal with at some point in time, but they don't go to the validity of his opinions. He's giving opinions of what he thinks are necessary.

MR. LENDER: Fair enough, your Honor. Thank you.

THE COURT: I understand the points you would like to make before me today, but it may not be through this witness.

MR. LENDER: Fair enough. Thank you, your Honor.

BY MR. LENDER:

Q. Let me now move to the next main opinion which is the additional $730,000 you are seeking to sample monitoring wells for the next five years. Okay?

A. Yes. That would be the ongoing monitoring program.

Q. Essentially, your position back in August of 2017, when you issued your revised report was that on-site active remediation should continue you reached asymptotic conditions, and after that you should proceed to MNA for at least five years?

A. Yes. That sounds correct.

Q. And asymptotic conditions are reached when you basically are no longer recovering contaminant at an appreciable amount by using the active remediation system?

A. That is correct. You may recall earlier I said there comes a point where the active remediation is no more effective than allowing monitored natural attenuation to then supplement that work.

Q. At that point what you do is, you shut down the on-site system and just do monitored natural attenuation or MNA. Correct?

A. That is what I'm proposing, yes.

Q. Your opinion is that monitored natural attenuation combined with the ongoing operation of the pump and treat for a short period of time will ultimately achieve pre-discharge conditions and that MNA for a period of five years or slightly longer will be able to demonstrate that. Correct?

MR. MILLER: Objection; compound.

THE COURT: You can break it up.

MR. LENDER: That's actually a direct quote from his deposition. That's how he said it.

THE COURT: If you want to just say, is your opinion still today what it was at your deposition that -- and phrase the question.

MR. LENDER: Okay.

BY MR. LENDER:

Q. Is it your opinion still today, as you said at your deposition, that monitored natural attenuation combined with the ongoing operation of pump and treat for a short period of time will ultimately achieve pre-discharge conditions and that MNA for a period of five years or slightly longer will be able to demonstrate that?

A. Based upon the data that I have reviewed up through the preparation of my expert report, yes, that's what I concluded.

Q. So basically you stopped active remediation when you hit asymptotic conditions, and then you rely on natural attenuation to finish the cleanup and you monitor the natural attenuation. Right?

A. Yes, that's correct.

Q. Now, you know, sitting here today, that the LSRP has approved that the on-site system be turned off

precisely because it was at asymptotic conditions. Correct?

A. I don't recall definitively as I sit here today, but that sounds correct.

Q. Let's see if we can refresh your recollection one more time.

Mr. Brown, I'm handing you a copy of the second declaration you filed in connection with the Daubert motions in this case, and if you could turn to paragraph 17, and let's see if that refreshes your recollection that the pump and treat was turned off because it had reached asymptotic conditions?

A. Yes. I see that now. ExxonMobil planned to shut down the system on August 30, 2017.

Q. And given that, now it's your opinion that MNA should take place for at least five years. Right?

A. That's correct.

Q. It may be a little more than that. But you think five years of MNA is a reasonable timeframe. Correct?

A. I did, yes. You may recall that we did analysis of various rates of degradation and determined that MNA would take between five and seven years. Therefore, we conservatively took the shorter time period.

THE COURT: Would it be that the five years actually began on August 30, 2017?

THE WITNESS: Essentially, yes.

THE COURT: So we're essentially 1 1/2 years in?

THE WITNESS: Yes. Obviously, the program may run longer if the natural attenuation processes are slower.

THE COURT: Right. But you were working with the five years. So it's actually begun.

THE WITNESS: Yes.

BY MR. LENDER:

Q. So it's your opinion we will ultimately achieve pre-discharge conditions and that MNA for five years or slightly longer will be able to demonstrate that. Right?

A. That is my opinion and I think my hope.

Q. And that's the reason why your cost analysis includes five years of monitoring. Correct?

A. As I said, we elected to choose five years based upon the analysis that we did for the likely rates of degradation, and five years would be the minimum time. It may be longer, but I'm hoping not much longer.

Q. At the conclusion of five years of MNA, according to your opinions, ExxonMobil might be done

at the Livingston site. Right?
A. There is a chance of that, yes.
Q. And, again, just so we're all clear, it's the natural attenuation that's going to get us there. Right?
A. It's the natural processes that actually result in the reduction of transportations as confirmed by the monitoring.
Q. In fact, there is no question in your mind that the remediation program at Livingston has helped groundwater to its pre-discharge condition. Correct?
A. There is no question that the work implemented by ExxonMobil, specifically their remediation program, has assisted in reducing the concentrations that hopefully will ultimately achieve a pre-discharge condition.
Q. In your opinion, though, to be clear, the remediation program at the Exxon service site helped restore groundwater to its baseline condition. Correct?
A. Yes, that sounds consistent with what I offered at my deposition testimony.
Q. And "baseline," just so we're clear, you mean pre-discharge conditions. Right?
A. That is what I meant, yes.

Q. Now, you understand that there are currently over 50 monitoring locations in connection with the Livingston site. Correct?

A. That's my understanding. Approximately that number.

Q. And as we discussed, you are proposing to add 21 more screened intervals. Right?

A. Yes. But as we discussed, we know that ExxonMobil has already installed some of those locations near 19-D4.

Q. Right. So your cost estimate is going to have to be adjusted to account for that. Right?

A. That is correct. Once I review that data, if it appears that they have completed a monitoring program that is consistent with my recommendation, then there would be no need to drill an additional cluster well in that location.

Q. Now, the $730,000 you have included in your damages assessment covers the cost not just for monitoring the 21 new wells you are seeking to get installed, but also the existing wells that the LSRP is currently monitoring and sampling. Correct?

A. Correct.

Q. So 70 percent of the cost associated with your $730,000 alleged damages number relates to the

existing monitoring wells. Right?
A. Yes. The ongoing monitoring of those existing wells.
Q. So your $730,000 amount, only around 220,000 is attributed to monitoring the 21 new wells you are proposing to install over the next five years. Right?
A. I don't know the exact number. But that would seem to be a reasonable division of those costs, yes.
Q. And you understand and you understood this when you issued your report that the LSRP has been requiring that existing wells be monitored, and that's being paid for by ExxonMobil. Right?
A. That's my understanding, yes.
Q. So if ExxonMobil would continue to pay for monitoring the existing wells going forward, the 510,000 would actually already be accounted for and should not be included in your damages calculation. Right?
A. If ExxonMobil had somehow legally committed to do that work, then I would not obviously look to recover funds to duplicate work.
Q. And even though you knew that the LSRP was requiring monitoring of the existing wells, you included the full amount of monitoring all the wells in your cost calculation. Right?

A. I did. So all of the costs of the monitoring moving forward irrespective of who might actually do it, I assumed that in the case of the costs it would have to be done.

Q. But for the ongoing cost associated with the pump and treat, until it was turned off, because of asymptotic, you knew ExxonMobil was paying for that but you excluded those costs. Right?

A. Correct. I could see that ExxonMobil was continuing to do that. Therefore, I did not include that.

Q. So you treated the pump and treat costs differently than the monitoring costs?

A. Yes. I understood from my review of the documentation that ExxonMobil was committed to continuing to operate the on-site pump and treat system. And I understood they would be doing some ongoing monitoring, but I did not see anything to confirm for how long they would be doing that.

Q. And as we discussed just a moment ago, the LSRP has already required the installation of monitoring wells north of 19-D4. Right?

A. They have. They made a decision consistent with my recommendation in that area to install additional monitoring points.

Q. And they've required those monitoring wells also be monitored. Right?
A. I cannot say for certain, but I would assume that to be the case.
Q. So those would be additional monitoring costs that should be taken out of your cost estimate. Right?
A. They would be if there was some legal commitment to do that work that I felt confident that it would be done.
Q. And, of course, if the LSRP decides to install additional wells in the future and those are monitored, that too could cut into your monitoring cost assessment. Right?
A. Yes, it could. Obviously, if they, say, for example, elected to install some of the other monitoring wells that I recommended, then, clearly, I would not look to duplicate their work. But I would have to obviously review that work to ensure that the work had actually been done and not just promised.
Q. Mr. Brown, sitting here today, you don't actually know how much of the $730,000 you included for monitoring costs over a five-year period will turn out to be duplicative. Correct?
A. I do not because I do not know for certain

exactly what ExxonMobil plans to do with respect to that number.

Q. Now, Mr. Brown, after the LSRP files its remediation investigation report in March of 2019, you understand that the LSRP will be required to file its remedial action report and seek a remedial action permit from the DEP by March 2024. Correct?

A. I don't recall the specific date, but that does sound reasonable.

Q. And the remediation investigation report may update the CEA based on any new data that the LSRP has. Right?

A. It may.

Q. And the remediation action permit will contain a proposal for future MNA and for how long MNA should continue. Correct?

A. It may.

Q. Okay. It may.

And you understand that the DEP needs to approve the remedial action permit which will identify the wells to be monitored going forward for MNA and at what frequency. Right?

A. I do not know the specific legal approval authorities of DEP with respect to that specific issue as I sit here.

MR. LENDER: Your Honor, we could either submit the regs and show this to you because the regs say what they say or I could go through them with him.

THE COURT: No. I would rather do it after. I'm going to permit everyone to have a, not lengthy, but a final written summation you can give me after this hearing and you could include those kinds of things there. I don't think it's a good use of our time to do that with him.

MR. LENDER: I didn't either. That's why I wanted to check. Thank you.

BY MR. LENDER:

Q. Mr. Brown, you understand that MNA cannot be authorized for use at the site until the contamination is adequately characterized and delineated. Right?

A. Actually, that's not quite true. Monitored natural attenuation is being conducted now and it's even conducted while the remediation system is operating. We are monitoring the groundwater conditions at the site and monitoring natural attenuation.

So it's an ongoing process. It isn't something that only starts at the end of the active remediation, the actual pump and treat. What I'm recommending is five years after it continues.

Q. Your opinion, as the Judge said, starting in August of 2017, we are now in a five-year period of MNA?

A. At this particular site, yes.

Q. But you know that in fact at the site MNA is going to occur for much longer than five years. Right?

A. MNA or natural attenuation itself?

Q. MNA and natural attenuation.

A. Potentially. I do not know what they would recommend within their reports. But there is the potential that it could be recommended to continue for longer than that.

Q. Now, Mr. Brown, the third thing that you had recommended in your latest report is that a system be designed and permitted for Public Water Supply No. 11 in the event that MTBE is detected in that well in the future. Correct?

A. That is one of the recommendations that I made within my report. But my understanding is that claim is being withdrawn.

Q. Yesterday your side abandoned that claim. Correct?

A. My understanding is they withdrew the claim for the $70,000.

Q. And you had mentioned in response to a question from Mr. Miller that there has been no MTBE detected at Public Water Supply No. 11 and I wrote down in the last few years. That's what you said. Right?

A. That's my understanding.

Q. In fact, your understanding is that since 2009 Public Water Supply No. 11 has been sampled 28 times and MTBE has been non-detect in every single one of them. Right?

A. That's my understanding, yes.

Q. So it's not just the last few years; it's almost a decade. Correct?

A. That sounds correct, yes.

Q. And, by the way, for the other two receptors you identified in response to some questions from Mr. Miller, to be clear, your side is not seeking any damages to clean up those receptors. Right?

A. That's correct. I don't believe my client is seeking any damages for those.

Q. The last thing you mentioned is that you are seeking a contingency of $247,000, which now may be a little less, to account for the drop-off of the permit?

A. Correct.

Q. Basically, you added a 15 percent kicker on top

of the cost estimates. Right?
A. I've added the contingency, as I discussed earlier, because of the inherent uncertainties in implementing the type of program I'm recommending.
Q. And nowhere in your report do you provide any calculation of how you came up with that 15 percent number. Right?
A. Actually, I believe we do. For the sites we evaluated we used a contingency based on EPA's calculations of contingency for estimates, such as the ones we prepared. And because of the limited scope of work and the limited amount of remediation that were proposed for Exxon, we actually reduced that percentage, as we felt there was a higher degree of confidence in the cost for the ExxonMobil site.
Q. So your testimony is that in your report I'll find a sheet of paper that calculates, comes up with how you came up with the 15 percent number. That's your testimony?
A. I don't know if there's a piece of paper. There will be an indication as to the percentage.
Q. It said 15 percent. But you said earlier that's calculated based on using EPA guidance.
My question to you is, if I look through your reports, will I see anywhere a document that shows how

you came up with the 15 percent number?
A. The document will show how we came up with a larger percentage. But for this particular site we felt that percentage was too high.
Q. So you think there's a sheet of paper that lays out that calculation in your report?
A. There is a sheet of paper that lays out the calculation for the contingency we applied for sites where we were recommending active remediation that was not being performed by the responsible party.
Q. So not for the Livingston site then?
A. For the Livingston site we actually looked on a site-specific basis and said, Well, we have a much more defined scope here as to what's going to be done, and we're not recommending any active remediation other than ExxonMobil continue to operate their current system. Therefore, we felt the contingency that would apply to other sites didn't need to be as large for this site.
Q. And the reason why you are seeking this contingency in the case is that things cost more than you have proposed. Right?
A. Yes. Obviously, I'm sure you are aware that when you drill a monitoring well, one gets an estimate as to what that well might cost. But in the field

you could come across issues where the bedrock is more confident. Therefore, the drilling takes longer, so the costs are greater.

There are other issues that occur whenever one is doing a remedial investigation or remedial implementation program that requires you to have some contingency for those uncertainties.

Q. And, of course, because a lot of the wells are being drilled in places where there already are wells, it's possible that it might cost what you've proposed or even less than what you've proposed. Right?

A. I would be very surprised if it cost less because we actually obtained fixed prices from the driller, and my experience with drillers is they don't give you a discount if it takes them less. They still charge you their bid. Obviously, if they think conditions have changed, they issue a change order to get more money.

Q. And if the DEP makes us do the work, there will be no need for a contingency. Right?

A. If ExxonMobil elects to do the work, then obviously I would not be seeking to recover the cost to do that work or the related contingency, just as we've removed the 60,000 for the well and treatment system and the contingency associated with that.

MR. LENDER: Your Honor, my colleague said he needed about 30 minutes.

THE COURT: Are you going to need more than 30 minutes?

MR. TULLY: Maybe

THE COURT: I have a suggestion actually because I think I'm going to want to speak with the attorneys when this is all complete. I won't have time to do that today. I'm not trying to press you to do your 30 minutes and be done, particularly if there is anything else we want to cover.

I know we had put aside the days. I would really prefer if you come back tomorrow morning and we spend the morning. We're not going to need more than the morning. You can do your examination then. We could fill in on anything else that we need.

I certainly want to have some discussion with the lawyers about the Livingston site off the record in chambers tomorrow. So I would like that opportunity.

MR. LENDER: Thank you.

THE COURT: You are all planning to be here tomorrow anyway. Right?

MR. MILLER: Yes, your Honor.

MR. TULLY: Will you also entertain brief oral

arguments on the motions?

THE COURT: I may do that. I thought I would let you do it in written form. But I have the time now to do it, if you want to do it tomorrow and you don't have to submit anything else in writing, that's fine too. So if you all want to be ready to do that, not long, that's fine, we can do that and you can prepare for that tonight then for tomorrow.

You can step down. You are excused.

I'll see you tomorrow morning at 10:00.

THE WITNESS: Thank you.

(Witness excused for the day.)

THE COURT: May I see counsel for just one moment off the record.

(Off-the-record discussion.)

(Court adjourned at 3:30 p.m.)

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I N D E X

Witness	Direct	Cross	Redirect	Recross
Anthony Brown				
By Mr. Miller	6	--		
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C E R T I F I C A T E

I, **Vincent Russoniello**, Official United States Court Reporter and Certified Court Reporter of the State of New Jersey, do hereby certify that the foregoing is a true and accurate transcript of the proceedings as taken stenographically by and before me at the time, place and on the date hereinbefore set forth.

I do further certify that I am neither a relative nor employee, nor attorney, nor counsel of any of the parties to this action, and that I am neither a relative nor employee of such attorney or counsel and that I am not financially interested in this action.

S/Vincent Russoniello

Vincent Russoniello, CCR

Certificate No. 675

Q